TRAINING MANUAL

COLOR MONITOR

SyncMaster 17GLsi, 17GLi
15GLi, 15GLe

SAMSUNG ELECTRONICS

CONTENTS

I . PRODUCT CONCEPT

1. Product concept

PCs used in offices constantly require more-diverse applications and ever greater performance, and these new demands have been rapidly expanding to home-use PCs as well. This trend will continue to accelerate with the spreading use and development of multimedia systems. At the same time, computer monitor quality is becoming one of the most important elements of the PC system because users' eyes are directly exposed to the monitor.

The SyncMaster GLi series monitor was designed to incorporate technology with user-friendliness and **ecological-friendliness.**

SyncMaster GLi series
A new point of view

User-friendly
- Ergonomical design
- Protects user's eyes
- Virtually no emissions

Ecologically-friendly
- Advanced power-saving function
- ODC-free
- Recyclable design, materials

Technologically-sophisticated
- New Real Color control
- Improved FOS performance

User-friendly Elements
- Ergonomical principles have been built into the design to maximize user efficiency.
- Harmful electromagnetic emissions have been virtually eliminated, minimizing the possibility of dangerous effects on the human body.
- A special coating on the screen cuts down on eye fatigue.

Ecologically-friendly Elements

- The power-saving function has been improved to minimize users' energy costs.
- The packing has been redesigned to reduce material consumption by at least 30%.

Technological Elements

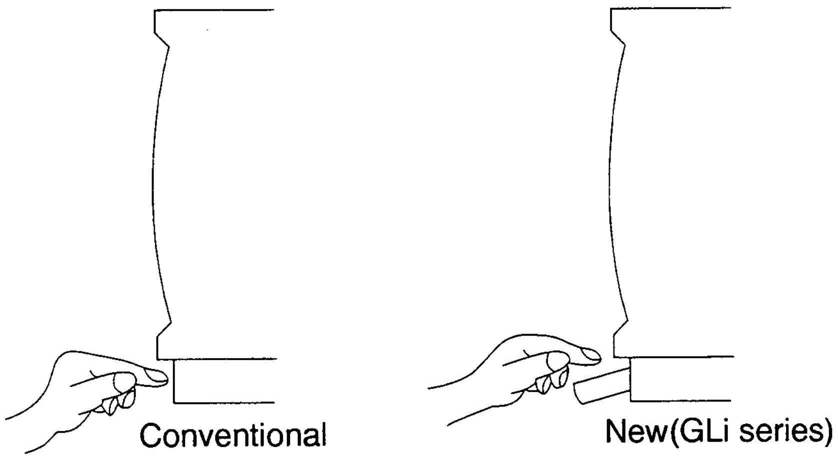
- New technology has been applied to improve screen performance and picture quality.

User Friendliness

As the role of the PC expands, so does the time users must spend at their computers, and this extended exposure can lead to such undesirable side-effects as Video Display Terminal(VDT) Symptoms. "VDT Symptoms" refers to eye fatigue from diffused light, aching wrists from incorrect use of the keyboard, a stiff neck and other problems. Eliminating these adverse effects of constant computer use is a complex task that requires technology from a number of areas to solve. The SyncMaster GLi series is ergonomically designed to minimize VDT symptoms caused by the monitor.

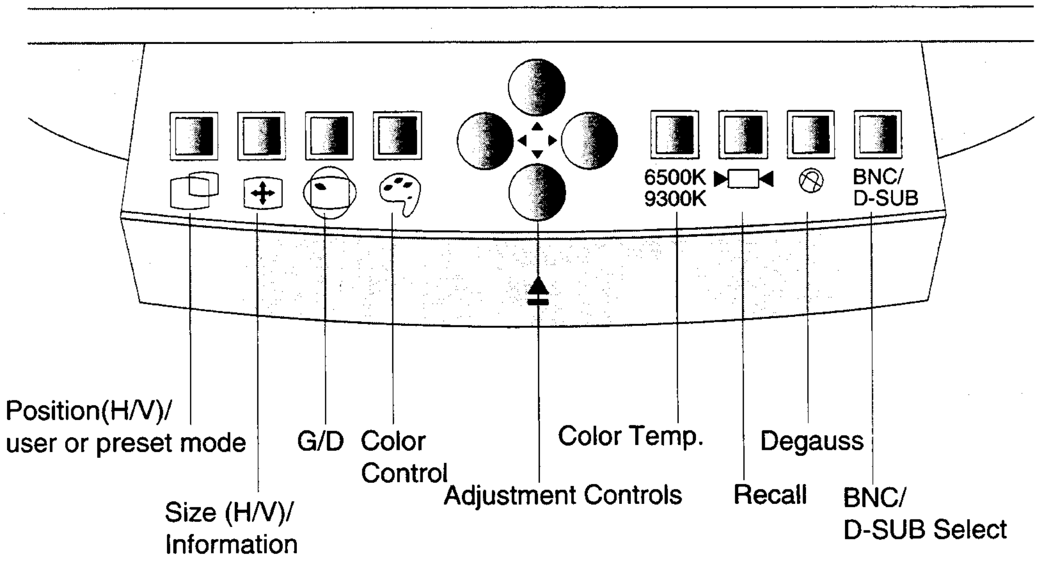
Ergonomic Control Panel

The sliding damper control panel allows the user's wrists to be at their most natural angle when the user presses the control buttons. As shown in the diagram, control buttons on a conventional monitor are arranged toward users,



control Panel

requiring the user to exert pressure on the wrists when pressing them. On the other hand, the damper panel lets the user control the screen effortlessly. Moreover, the Real Time control panel is fast and efficient, while screen control buttons are very easy to learn how to use.



Readability

The UltraClear coating used on the GLi series is a low cost way of getting the same fine readability as provided by a glass filter. Moreover, it solves the problem of weakening contrast that normally results as the screen surface becomes rough by continued exposure to diffused light or ultraviolet rays. The Refresh Rate is also at least 76Hz, eliminating the flicker that can lead to eye strain.

Extremely Low Emissions

The SyncMaster has been designed to emit virtually no potentially harmful electromagnetic waves. The new GLi series meets the extremely low radiation standards set by the TCO in 1992, ensuring complete user safety.

REDUCED
ELECTOMAGNETIC FIELDS
TCO
1992
AUTOMATIC
DISPLAY POWER DOWN

Ecologically-friendly

Protecting the environment is an urgent task that is now the responsibility of all people in all countries to carry out. The SyncMaster was designed specifically with the environment in mind.

Power Saving

An improved power saving function has made the SyncMaster one of the most efficient monitors on the market, saving users a lot of money.

■ Power Consumption Index(120V/60Hz) (Wattage/Recovery time)

Model / Mode	15GLe	15GLi	17GLi	17GLsi
On	68W	78W	81W	91W
Stand-by	42W	47W	66W	61W
Suspend	5W/3	7W/3	9W/4	11W/4
Off	2W/7	3W/7	3W/9	3W/9

* Test Condition : Full White Pattern(Full Screen Size, Max. Resolution)
Brightness/Contrast Max.

ODC Free(Ozone Depleting Chemicals)

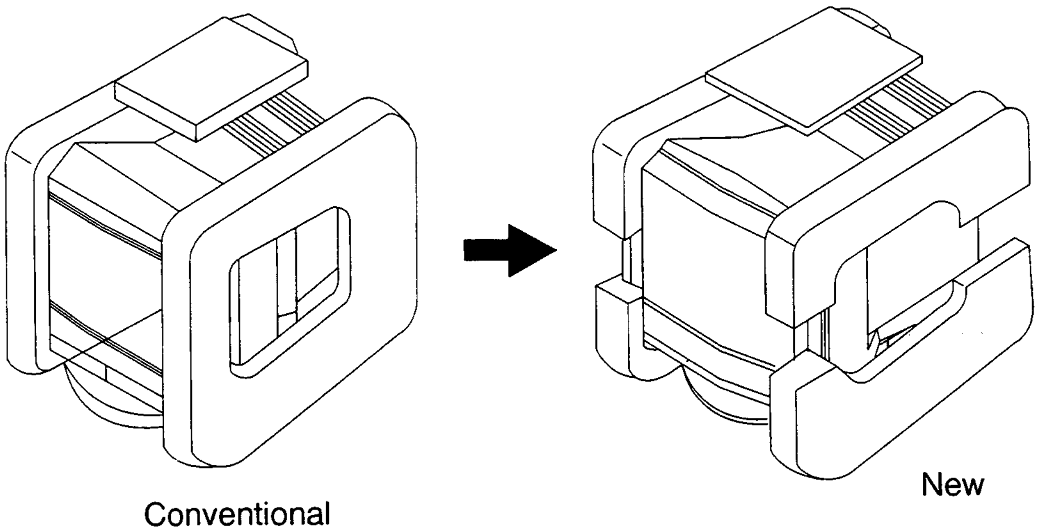
CFCs are known as the primary chemical responsible for the destruction of the ozone layer in the upper atmosphere. With that in mind, CFC use has been completely eliminated throughout the entire production process.

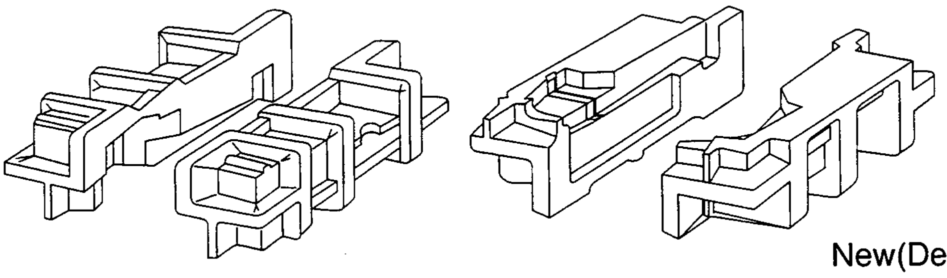
PB/DE-free materials

Poly Brominated/Dipheyl Ether is a known cancer causing material. The compound is normally used when mixing resins. By improving the production process, the use of this compound has been completely eliminated, enhancing user safety.

Recyclable Packing Materials

Styrofoam, the often-used packing material, is very hard to recycle and expensive to dispose of. The SyncMaster GLi series packing has been specially computer designed to reduce the amount of material needed by 30% compared to conventional packing methods.





New(Detail)

Technologically-sophisticated

Plug & Play

PCs and their peripherals continue to become more sophisticated, making their operation more and more complicated. "Ease of operation" has already become an important part of boosting sales in the consumer electronics industry, and the trend has spread to the PC industry. This demand by consumers has necessitated the Plug & Play function, which means that all the user has to do is turn on the power switch and the PC will set up all other operations on its own. Therefore, the PC industry has devised a solution to this problem by coming up with the Data Display Channel, or DDC. The DDC allows the PC to communicate with the monitor and other peripherals, and the SyncMaster has a DDC built in for the added user friendliness that it provides the user.

Easy Installation

For a number of years now, a monitor's display capability has been determined by individual, multisync display modes. Most operators today are unable to make optimum use of their PC system because they cannot take full advantage of what the Flicker-free Mode, Resolution, etc. have to offer. The DDC optimizes the system's display capabilities for users.

The SyncMaster uses a Display Data Channel(DDC) that allows for two-way interaction between the monitor and the PC for added user convenience.

What is "DDC"?

The DDC uses a conventional VGA connector and cable to establish a two-way channel that links the PC to its peripherals. This channel can be used to exchange the data needed to adjust screen configurations. The DDC is divided into DDC1, DDC2B and DDC2AB types.

a. DDC1

Preset monitor instructions such as Timing, Color Gain and DPMS are permanently stored in the monitor memory with EEPROM chips. As the PC is booting up, the (host) PC can refer to this information, and the user can press a button to send, from the computer to the monitor, the same display signals as those already stored in the monitor.

At the most basic level, DDC1, the stored EEPROM data, cannot be altered, which limits the DDC's usefulness.

b. DDC2 and DDC2AB

The DDC1 level is a uni-directional flow of information, from the monitor to the PC only. However, the more advanced DDC2B and DDC2AB levels allow for bi-directional communications between the PC and the monitor

i. DDC2B : I^2C-type data communication takes place between the monitor and PC.

ii. DDC2AB : Data communication between the PC and all peripherals is done through an interface protocol access bus. In this case, the keyboard is connected to the monitor. With a special monitor connector, the keyboard can be separated from the PC altogether.

Impact on Monitor Industry

a. Single-mode monitors can be made with such restricted, standardized modes as:

640 × 480 @80Hz at 48KHz
800 × 600 @72Hz at 48KHz
1024 × 768 @60Hz at 48KHz

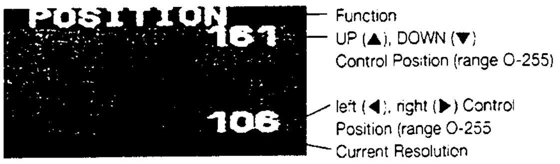
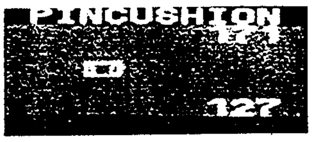
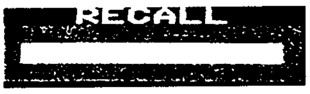
b. Function keys are simplified.

The power switch can be included in the keyboard.
The screen control key can be eliminated.
The color control key can be eliminated.

The Latest On-screen Display Menu

The initial SyncMaster GL series was praised for its easy-to-use On-screen display (OSD) controls. The new GLi series has an even better OSD menu. Not just a simple display (as found on other monitors), the innovative GL series OSD menu corresponds 1:1 with the control panel, for added user convenience.

Examples of OSD

Function Button	On-screen Display
• Position • Size	
• **Color Temperature**	
• Pincushion • G/D	
• Recall	

New Real Color Control

The original GL series SyncMaster features a unique color control system, and the GLi series has used a very simple technique to improve on it for even better screen color quality. That is, the OSD control menu has a single-function key selection to adjust color saturation or hue. A special control panel mechanism makes operation even easier so that even beginners can become instantly familiar with how to operate the system.

Mac Compatibility

A single adapter makes the Syncmaster monitor compatible with any Macintosh PC model, unlike most monitors, which require separate adapters for each Mac model. This single adapter means greater user convenience and cost savings.

Ⅱ . PRODUCT GENERAL DESCRIPTION

1. What is the Green Monitor?

As we approach the end of the 20th century, environmental protection and energy efficiency are becoming more and more important. The world is experiencing the "greenhouse effect", the destruction of the ozone layer in the upper atmosphere, and the destruction of the Amazon rain forest, one of the world's last natural sources of oxygen. This is due, in large part, to the widespread use of fossil fuels. **Increased energy consumption is threatening the environment** by depleting the Earth's natural resources. If we don't do more to protect the environment, mankind itself is in danger.

Countries and organizations around the world are concentrating on environmental protection and implementing innovative new programs. The US Environmental Protection Agency's (EPA) Energy Star Computer Program focuses on the reduction of energy required for computers. Grune Punkt (Green Point) is one of Germany's many environmental programs which help to **encourage clean earth.**

Industrial corporations around the world are increasingly striving to eliminate waste and use materials that do not damage the environment. They have recognized that it is in their own interest to do so. Among the world's businesses, the electronics industry can provide the most significant impact in energy reduction.

Computer equipment consumes more energy than almost any other electronic product. Computers account for more than five percent of all energy consumed, and by the year 2000, that number is expected to exceed 10 percent. According to one survey, nearly 40 percent of office computers remain on over night, resulting in a tremendous waste of energy relative to other consumer electronics. Samsung Electronics Company is doing its part to help alleviate this problem.

SEC's SyncMaster Green Monitors provides up to a 95 percent reduction in energy consumption compared to conventional monitors. This is accomplished with circuits that turn the monitor off when not used for a specified period of time. In addition, CFCs, which are largely responsible for the destruction of the ozone layer, have been eliminated from the production process. Poly-Brominated Diphenyl Ether (PBDE), both known carcinogens and often used in electronics products, are not used either. SEC is committed to manufacturing products that are not harmful to man and are environmentally friendly.

SyncMaster Green Series

SyncMaster monitors utilize energy consumption reduction features that: reduce monitor energy consumption, which accounts for 60 to 70 percent of a computer system's total energy needs save enough electricity to contribute to reduced power plant operations, which helps prevent air pollution and depletion of valuable natural resources cut down on operating costs of air conditioners used to reduce heat generated by monitors almost completely **eliminating dangerous electromagnetic waves and extending monitor life.**

The SyncMaster series monitors use recyclable materials that allow for easy sorting and recycling when the monitors are disassembled.

2. Ecology

Power Management

Discussions about power management began when people started to realize that excessive power consumption was destroying the environment. Increases in power consumption inevitably cause an increase in power generation. This, in turn, causes severe problems, such as the depletion of natural resources and increased air pollution, through the excessive use of fossil fuels.

According to the EPA, power plants are responsible for 35 percent of the world's output of carbon dioxide, a major cause of the greenhouse effect and perhaps the main reason for a recent series of climate changes. The EPA also reports that power plants put out 75 percent of the world's sulfur dioxide, the leading cause of acid rain, and 35 percent of the nitrogen oxide present in the atmosphere.

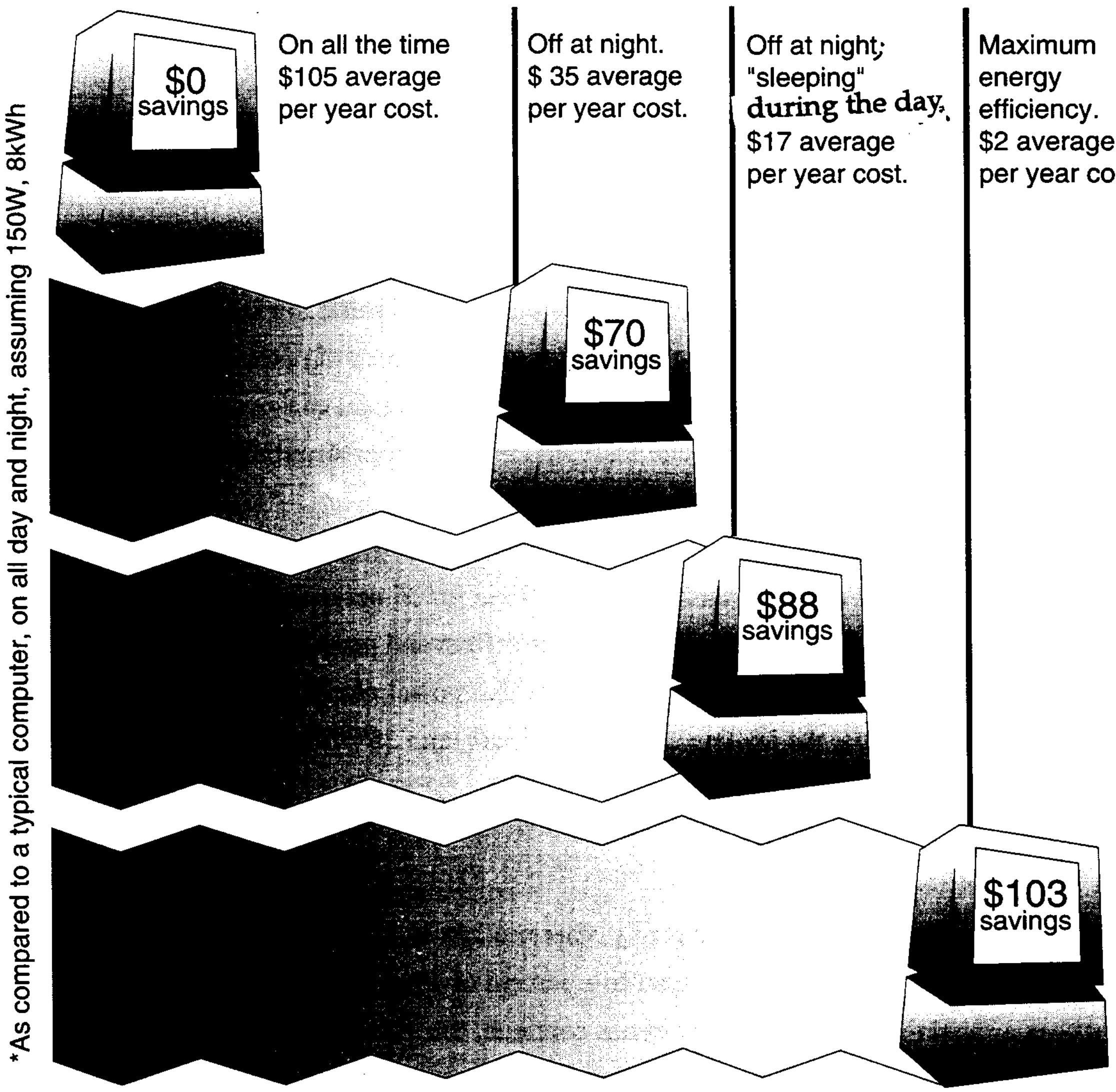
Why Focus on the Monitor?

Computers use more electricity than any other product in the business world. According to the EPA, computer systems use more than five percent of all energy consumed in industry and offices around the world. If current trends continue, this figure is expected to increase to more than 10 percent before the end of this century.

Computers and peripherals account for 74 percent of all the energy used by office equipment. Of that 74 percent, PCs and monitors account for 49 percent and printers 25 percent, A 14-inch monitor uses more than 60 percent of the energy consumed by a computer system, and a 17-inch monitor uses more than 65 percent.

These figures only include the computer and monitor. If the figures included the air conditioning necessary to reduce the heat generated by computer systems, those figures would increase considerably.

How Much Can I Save?



The EPA(Environmental Protection Agency)

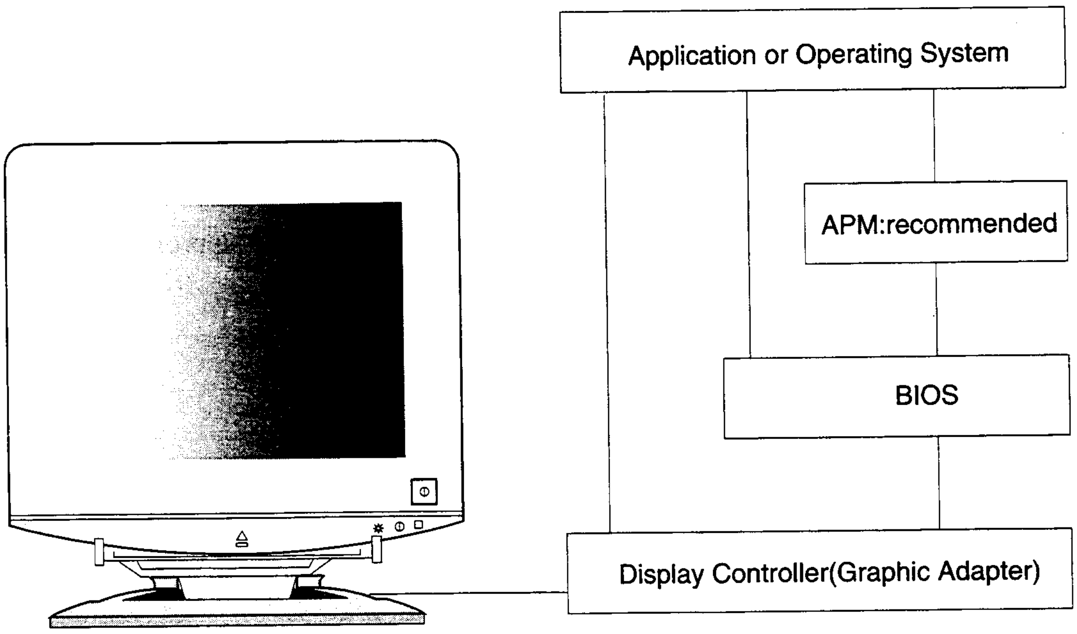
EPA POLLUTION PREVENTER

1994 Outstanding Partner

* SyncMaster has been awarded EPA's 1st Annual Award as a "1994 Outstanding Partner."

The EPA considers reducing the power consumption of computer-related equipment to be one of its most important goals. The Energy Star Computer Program is designed to do exactly that. When the US government purchases computer-related equipment, it purchases only that equipment which meets the program's power management guidelines.

The Video Electronics Standards Association (VESA) has adopted a display power management system (DPMS) standard that covers in four operational states through a host system signal methodology.



How Does SyncMaster Manage Power?

The SyncMaster Green Series utilizes a DPMS control device that receives the signal from the PC and modulates the signal through four states:

On(Normal Operation): When the computer is in the "on" mode, it is operating normally, i. e., no image control signal is being transmitted from the DPMS to the monitor. In this mode, energy consumption is dictated by the characteristics of the computer system.

Standby: When there is no horizontal sync coming from the computer or graphics adapter, but the vertical sync is being relayed normally, the monitor converts to a video mute, or "standby" mode. The internal components of the monitor remain in a normal state, and by maintaining the lowest levels of contrast and brightness, only the monitor image is affected. Touching any key or clicking the mouse returns the monitor to normal operations. Power consumption in the standby mode is 80 percent that of the "on" mode.

Suspend: In the "suspend" mode there is a horizontal sync coming from the computer or graphics adapter, but no vertical sync. In the "suspend" state, the monitor's internal high-voltage components along with the horizontal and vertical deflection yokes are disabled. When the computer receives a recover signal, the monitor image returns to normal within a specified period of time, normally three seconds. Power consumption in the suspend state is 30 percent that of normal.

Off: The "off" mode, of course, provides maximum power consumption savings. In this state the horizontal and vertical sync of the computer or graphics adapter are disabled, and all internal components except the microprocessor are turned off. Power consumption in the "off" state is 95 percent that of normal operations. Recovery time from the "off" state is approximately five seconds.

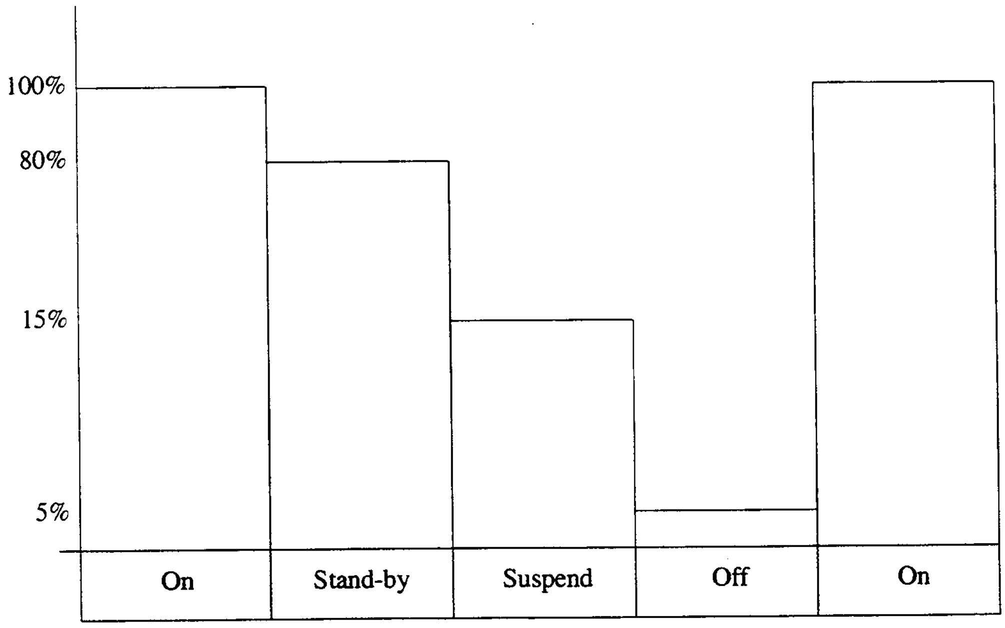
Power Consumption

- 120V/60Hz (Watt)

Mode	SyncMaster 15GLe	SyncMaster 15GLi	SyncMaster 17GLi	SyncMaster 17GLsi
On	68	78	81	91
Stand-by	42	47	66	61
Suspend	5	7	9	11
Off	2	3	3	3

- 240V/50Hz (Watt)

Mode	SyncMaster 15GLe	SyncMaster 15GLi	SyncMaster 17GLi	SyncMaster 17GLsi
On	68	78	81	95
Stand-by	42	50	67	65
Suspend	7	8	13	13
Off	4	4	4	4



Power Consumption Level

Power Management System

States	Signals			Recovery Time	Enabled Parts	Disabled Parts
	Verti.	Horiz.	Video			
On	Y	Y	Y	-	All	NA
Stand-by	Y	N	N	Real time	DY, Video, High Voltage, MCU	Video mute
Suspend	N	Y	N		Semi-power Video, MCU	High voltage DY
Off	N	N	N		MCU	Main Power DY, Video, High voltage

* MCU : Microprocessor Control Unit.

Comparison between EPA and NUTEK

	EPA	NUTEK
Logo	Energy Star	NUTEK
Available	June 1993	September 1994
Mode	On	Normal
	Stand-by	
	Suspend	Position A1
	Off	Position A2
Operating Time	NA	A1 : 5min~1Hr A2 : 5min~70min
Recovery Time	NA	A1 : 3sec A2 : Similar to Power on Status
Power consumption	Suspend under 30W	A1 : under 30W(Desired less than 15W) A2 : under `8W(Desired less than `5W)
Indicator	NO	Recommended

The Recycling Issue

The issue of recycling the Earth's limited natural resources is fast becoming one of man's most pressing issues, in conjunction with curtailing power consumption. The recycling issue is considered extremely important from the viewpoint of trash and waste disposal as well.

The SyncMaster series monitors are manufactured with the maximum amount of recyclable materials possible. In addition, the adoption of Germany's Grune Punkt labeling system also helps in waste disposal and recycling. All components are marked with a distinctive code, which makes sorting of materials for recycling easier after disposal. SyncMaster monitors are manufactured with recycling in mind from the planning and design stage to the finished product.

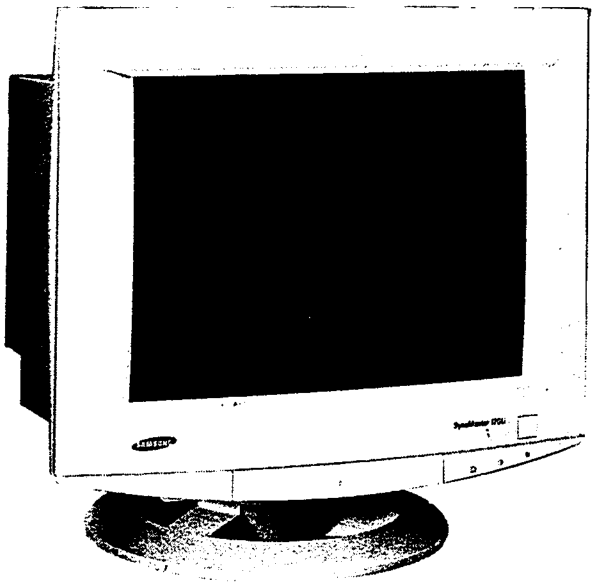
Plastic Code

SPI, USA	DIN,Germany	
1 PETE	01 PET	Polyester
2 HDPE	02 PE-HD	High Density Polyester
3 V	03 PVC	Polyvinyl Chloride
4 LDPE	04 PE-LD	Low Density Polyester
5 PP	05 PP	Polyproylen
6 PS	06 PS	Polystyrene
7 OTHER	07 O	Other Plastics

3. Ergonomic Features

Contemporary Design

The SyncMaster monitor allows the user to maximize the use of available space. The compact design of the monitor allows it to be placed almost anywhere in an office. The monitor is well-suited for the office of today's forward-looking businessman.

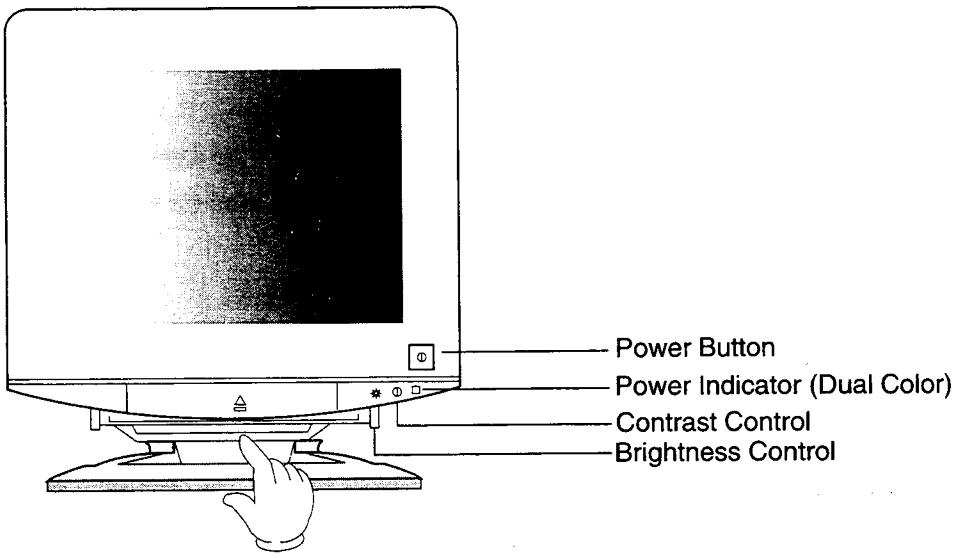


Up-front, easy-to-use control panel

The SyncMaster control panel is located on the front of the monitor. The design of the panel reduces the number of operations the user must perform to adjust the monitor's image. Each screen control function has an individual button. The panel was built with one-touch access to maximize user-friendliness.

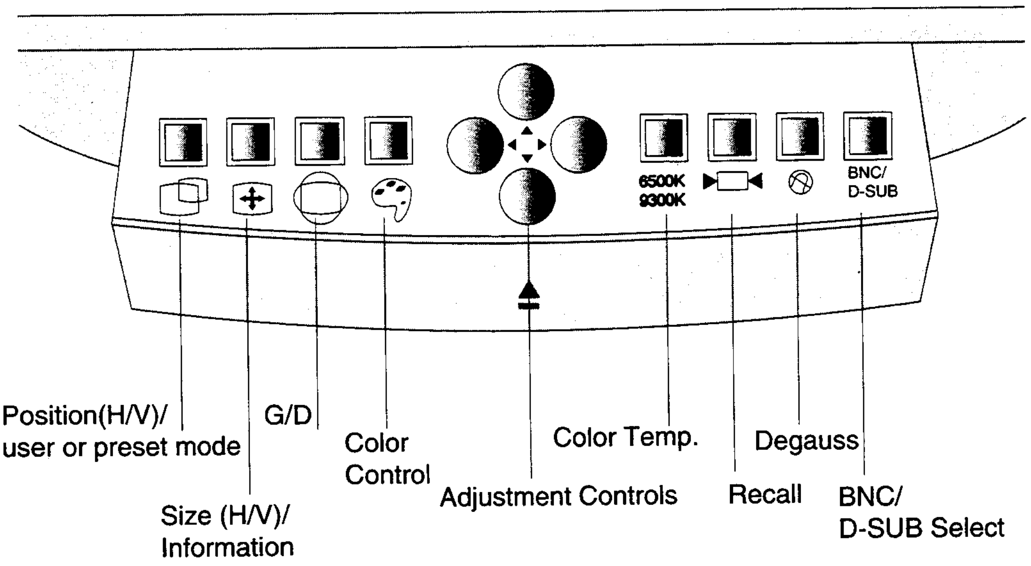
Conventional monitors utilize digital, press-type controls. Whereas the SyncMaster takes advantage of a variable adjustment control.

By simplifying the adjustment process, the SyncMaster monitor allows the user to perform fine tuning quickly and easily.



Control Panel

Press the center of the control panel to gain access to these controls



The control panel also has a button for each function to adjust the screen image. These adjustments are accomplished through a variable adjustment control, located on the bottom of the screen. The panel provides maximum efficiency by providing screen adjustments through only two steps: the one-touch function buttons in the panel and the variable adjustment control.

Intelligent Monitor

With the SyncMaster GLi and GLsi series, the monitor is no longer simply a passive product. The age of the "intelligent monitor" has dawned with automatic screen adjustments, which can save the user valuable operating time.

A computer system monitor is one of the two pieces of the computer's equipment, the printer being the other, that can display inputted information. The monitor displays information through a video board. Each signal sent from among the numerous video boards available has a distinct signal. The format displayed on the screen is unique according to the boards' differences in frequency and resolution, among other factors.

For example, when a conventional monitor is receiving an 800 × 600, 35.5KHz signal, it adjusts the image accordingly. During use, if the signal changes to 1024 × 768, 48KHz, the video board or the graphic user interface must also be changed to the new signal. This causes a change in the vertical image size or a shift in the horizontal position. With the SyncMaster monitor, the user doesn's have to manually readjust the image, it's done automatically. This feature is one of many that significantly improve user-friendliness.

SyncMaster monitors overcome this signal-switching problem through the development of an 8-bit microprocessor chip in a joint project with Intel of the US. SEC studied the most common video cards in use and selected the one with vertical/horizontal frequencies and resolution ratio best suited to improving user-friendliness. The monitors are shipped from the factory already pre-set.

The SyncMaster also has 11 programmable settings that allow the user to "customize" the monitor to his or her specific needs. The monitor automatically searches for the signal coming from the PC video board and adjusts the image accordingly.

Model	Preset modes	User Modes
SyncMaster 15GLe	11	11
SyncMaster 17GLi	11	11
SyncMaster 17GLsi	11	11
SyncMaster 20GLs	12	11

The microprocessor automatically memorizes user image adjustments in three seconds according to the video signal characteristics. These adjustments are then saved to an empty setting among the 11 available. When there are no empty settings, the adjustment is automatically saved on the first available one.

If the adjusted images by users are no longer needed, or there is a need to return to the preset mode, by simply pressing the recall button, the image will automatically return to the preset mode within three seconds. The relatively slow recall lead-time of three seconds gives the user time to reconsider the decision to eliminate the current image adjustments.

Pressing the recall button affects only the current screen adjustments; it has no effect on other modes. By pressing the recall button, the image returns to the preset mode that is most similar to the image characteristics the user was originally using.

As a result, the user doesn't have to perform any image adjustments after monitor installation and a few preliminary adjustments. This eliminates wasted time, provides peace of mind, and facilitates efficient operations.

*** Signal Identification Flowchart: Refer to Appendix II.**

Free of Eyestrain

When selecting a monitor, one of the most important considerations should be, "How safe is it?"

The computing environment we first became accustomed to has changed dramatically. It is no longer simply a matter of working only with text. The use of complex applications involving computer simulations, graphics, and multimedia has exploded. At the same time, fortunately, there has also been extensive research into the harmful potential effects of prolonged personal computer (PC) use.

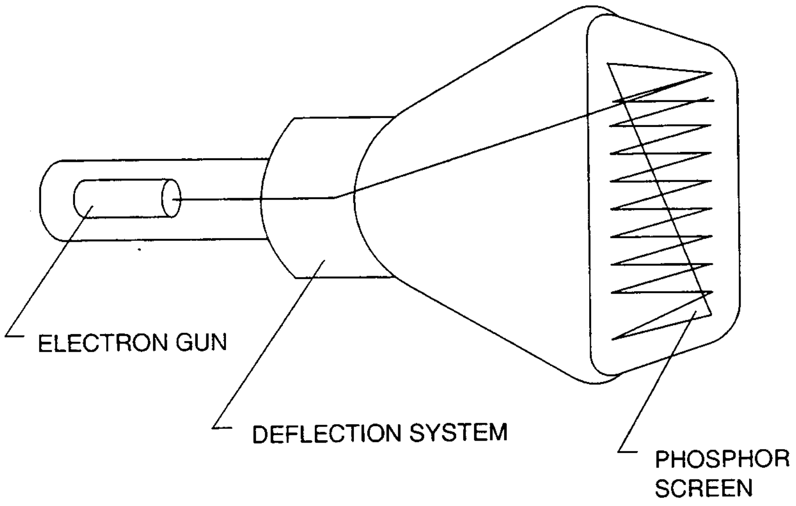
Of all the equipment that makes up a PC system, including input and output devices, monitors are the only devices directly exposed to the user's eyes. Accordingly, developing safer display devices has become a high priority. A result of this research has led to the now available SyncMaster Green Series monitors, which effectively eliminate much of the influence harmful side effects can pose for the user.

There are some challenges that all users must overcome when working with computers. Primary among them is the extreme eye fatigue that accompanies long hours, and sometimes even short periods, of working with a monitor. The main cause of this fatigue is the inconvenience brought on by the way monitors display data. Additional contributors to eye strain include diffused (ambient) reflections, light variations in the work environment, and poor focusing of the display monitor.

Flicker-free

In the movies, the impression of moving pictures is produced by presenting a series of still frames on a film in rapid succession. Since the human eye cannot discern the interval between the frames, the image appears to be continuous.The display on a monitor works in much the same way.

Behind the monitor's cathode ray tube (CRT) is an electron gun, which emits a beam of electrons that are rapidly scanned onto specified landing points on the screen. As these points are repeatedly scanned, text and/or graphic images are produced.



The scanning speed is measured in terms of hertz(Hz), a unit of frequency equal to one cycle per second. The monitor screen is scanned in a sequence from the upper left corner down to the lower right corner. A scanning speed of one hertz signifies one scanning pass per second. Correspondingly, a scanning speed of 60Hz signifies 60 passes per second.

In actuality, the images scanned onto a monitor do not remain on the screen for long. Rather the images are constantly being reproduced according to the scanning speed, or hertz, of the monitor.

Although there are other factors to consider such as light fluctuations, light source, and viewing angle, most people can detect some flickering of the display image at speeds of around 60Hz. At more than 70Hz, almost no flickering is discernible.

Flickering can cause acute eye fatigue. With a scanning speed of 60Hz, most people will experience watering eyes along with headaches and blurred vision after about one hour of continuous work. Recent clinical research in Japan showed some irregularities in the cornea of the eye after 4 hours of continuous computer work at 60Hz.

To protect the health of the eye, a ten-minute rest every 50 minutes is absolutely necessary, in addition to the use of a flicker-free monitor. All SyncMaster Green Series monitors operate at up to 120Hz, offering true flicker-free display under almost all circumstances. Any flicker that may exist is practically indiscernible by the user.

No diffused reflections

Because a CRT screen is made of glass, it reflects the image of objects and lights that surround it. This can make it harder to read the display and contribute significantly to eye fatigue. In other words, the main difference between glare and non-glare monitors is their effect on eye fatigue.

Non-glare image processing -

1. Etching -

   Etching the surface of the screen is the most economical way to reduce glare. This is not among the best methods, however, because the permeability to light, or the amount of light from the display that is able to come through, is reduced.

2. Silica Coating -

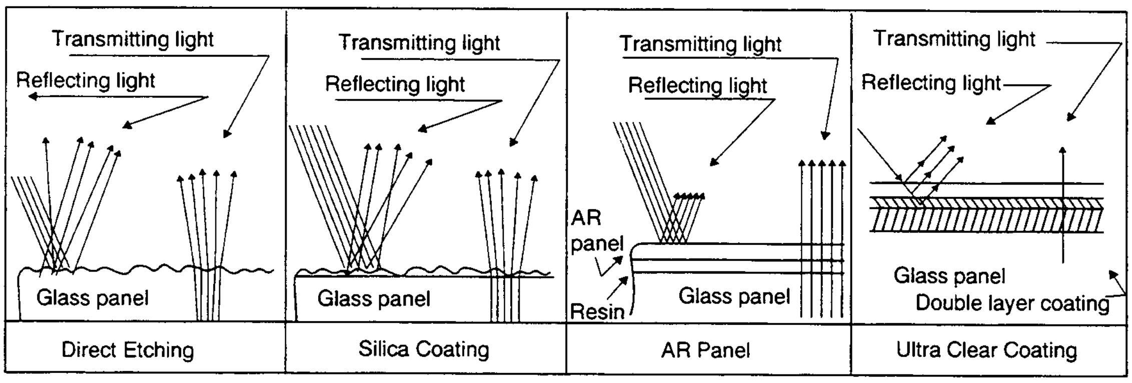
   Coating the screen with silicon is an improvement over etching. Nonetheless, the picture quality is still not as good as it could be.

3. Anti-reflection (AR) Panel -

   An anti-reflection panel is the most effective way to reduce glare. The per tube cost of about **$80, however, makes it difficult to standardize the use of AR panels.**

4. Innovative Ultra Clear Coating™ -

   SyncMaster 17GLi, 17GLsi and 20GLs monitors use Ultra Clear Coating that is both economically viable and delivers performance second only to an actual AR panel.



Direct Etching	Silica Coating	AR Panel	Ultra Clear Coating

Item	Etching	Silica	AR Panel	Ultra Clear Coating
Contrast	B	B	AAA	AAA
Resolution	A	A	AAA	AAA
Reflectivity	B	B	AA	A
Reflected Image	AAA	AAA	A	AAA
Sparkling	B	B	AAA	AA
Cost	AAA	AAA	B	AA
Mechanical Strength	AAA	A	AA	AA

- Comparison of Surface Treatment of Tube

AAA : Excellent AA : Very Good A : Good B : Acceptable

Emission

As computer use continues to grow very rapidly, typical users are spending between 200 and 2,000 hours a year working in front of a monitor. With the increased time, the electromagnetic waves emanating from the monitor can well be doing significant damage to users' eyesight. Even though there may be a lack of hard evidence directly correlating monitor emissions with certain illnesses, the statistics hint some link.

If there is even the possibility of some correlation, it is important to be concerned about being in proximity with high-voltage lines and also about the electromagnetic radiation being emitted from computer monitors.

Electrostatic Fields(ESF)

We are all familiar with the electric shock or spark that occurs when we touch a TV screen. Yet in all the years of research, there is still no proof that there is any real danger involved. Still, we seek to eliminate the danger involved with the pain that is inflicted on our fingers. As well, the dirt and dust that the static charge attracts reduces screen clarity.

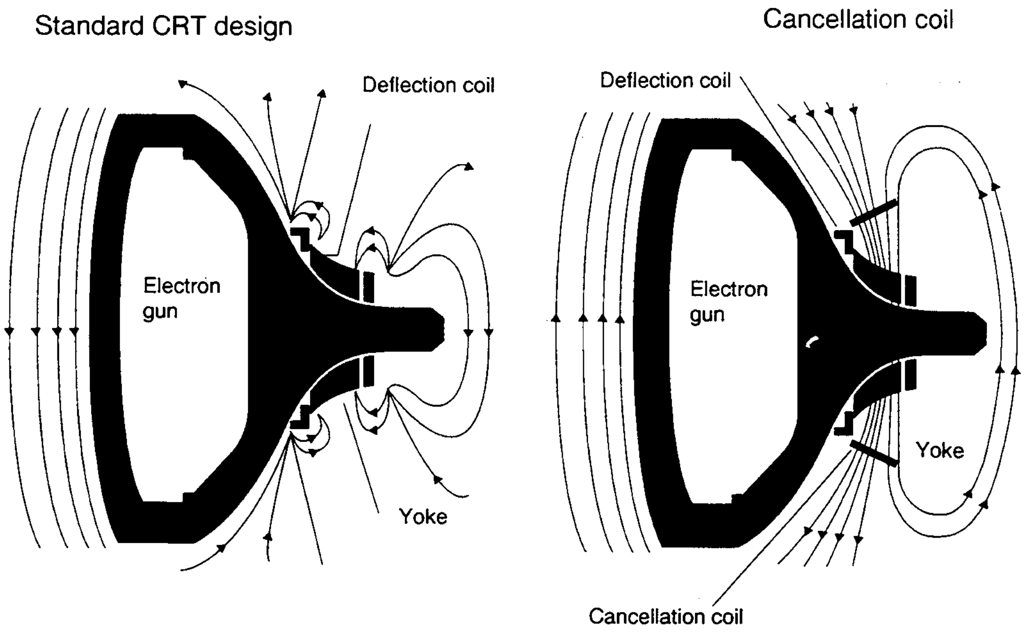
SyncMaster monitors have a coat of film applied to the surface of the screen to help reduce the strength of the electrostatic field. This thin film is known as ESF coating.

Electromagnetic Fields

Almost all electronic products, from TVs, toasters, and monitors, to printers and electric blankets, generate an electromagnetic field.

- Extremely Low Frequency (ELF) : 20 - 2,000Hz
- Very Low Frequency (VLF) : 2,000 - 400,000Hz

Monitors emit a VLF horizontal frequency generally around 15,000 - 85,000Hz (or 15 - 85KHz) and an ELF of around 50 - 90Hz. A particular problem with monitors is that the user is usually much closer to the screen than with a TV set, and may work in front of the monitor for much longer periods of time.
(Standard CRT design - Low-emission CRT design)



The color or brightness level does not influence the profusion of electrostatic fields that emanate from the monitors.

Although there may be some confusion caused by the number of research reports that fail to show a conclusive link between emissions and possible harmful side effects, it is always better to **be on the side of caution.**

Samsung's "green" monitors use an emission canceling coil mounted on the deflection yoke to significantly reduce the electromagnetic fields.

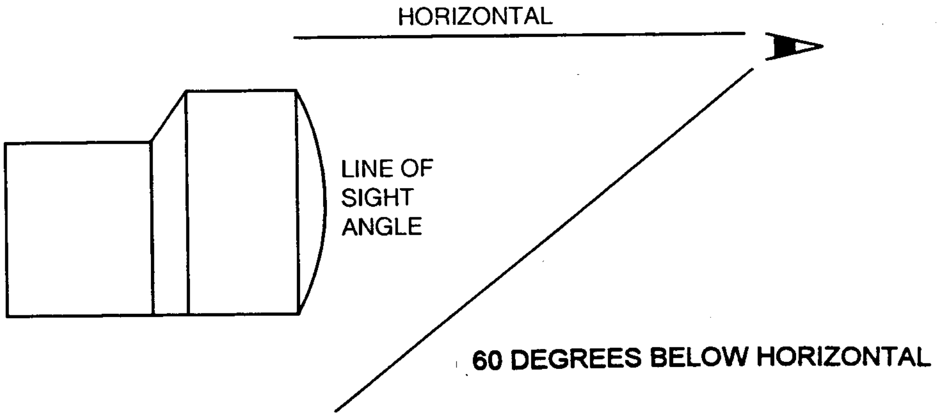
Special glass panels can also be installed; however, they adversely affect the brightness and contrast. Improperly manufactured panels may also cause reflections in the screen images. Of these three potential problems, the most important consideration is cost, which is why the panels are hardly ever used.

ISO 9241 Analysis

Specifications that can make the information on a visual display terminal (VDT, or monitor) easier for the user to read.

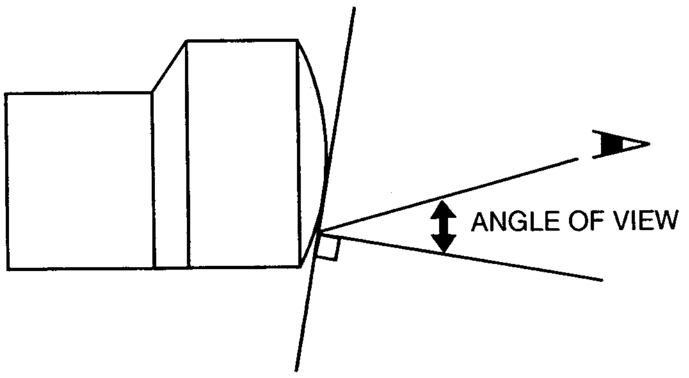
1) Line of sight Angle

The user must be able to see the entire display screen without having to change **his/her line of** sight. That means that the display must be within sixty degrees below the operator's line of horizontal vision.



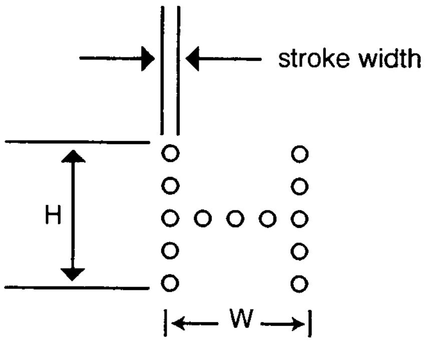
2) Viewing Angle

The user must be able to read the all characters on the screen at a 40 degree angle perpendicular to the lower edge of the screen.



3) Characters (letters)

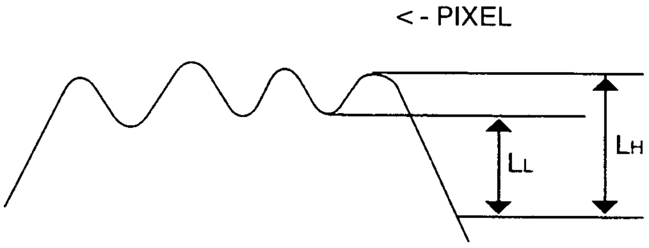
- Height : letter height
- Stroke Width : stroke width should be within 1/6~1/12 of a character height.



- Ratio : the ratio of height to width of the letter should be between 1:0.7 to 1:0.9

4) Raster Modulation

Characters on a screen are made up of a series of pixels. Raster modulation is the degree of variance in the luminance between the pixels that make up the characters. That level of luminance should not exceed:



$$Cm = \frac{(LH-LL)}{(LH+LL)}$$

Cm = 0.4 for monochrome and Cm = 0.7 for color monitors.
Level of luminance

5) Character Uniformity

For the characters to be considered uniform in display, the variance in the height and width of characters cannot exceed 5 percent.

6) Character Spacing

The interval between characters must be at least one stroke width and wider than a single pixel.

7) Line Spacing

The distance between the characters on two adjacent lines must be at least one pixel-width apart. This width must be maintained for special characters as well.

8) Linearity

Two methods are used to measure linearity.

The distance between two rows or columns cannot exceed 2 percent.

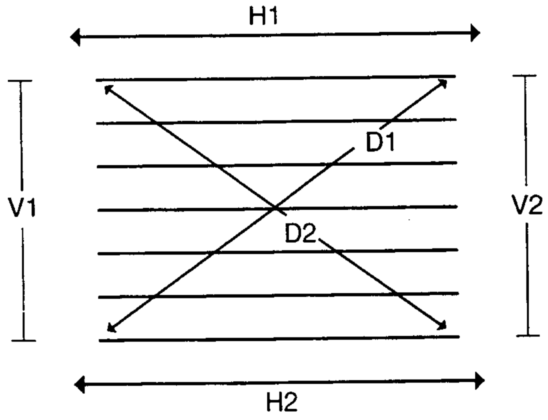
When measuring the characters:

For characters displayed horizontally, there cannot be more than a 5 percent variance in the width between the top and the bottom of characters on different lines.

For characters displayed vertically, there cannot be more than a 5 percent variance in the width between the left and right sides of different characters.

9) Orthogonality

Must satisfy the following conditions:



HORIZONTAL : $\dfrac{(H1-H2)}{1/2\ (H1+H2)}\ \text{X}\ 100 \leqq 2\%$

VERTICAL : $\dfrac{(V1-V2)}{1/2\ (V1+V2)}\ \text{X}\ 100 \leqq 2\%$

DIAGONAL : $\dfrac{(V1-V2)}{1/2\ (V1+V2)}\ \text{X}\ 100 \leqq 4\%$

10) Display Luminance

The luminance of the display must be at least 35cd/m^2. (i. e. the brightness of a display character against a black background)

11) Luminance Contrast

The luminance contrast ration must exceed 3:1. (i. e. the contrast between a character and a black background)

12) Luminance Uniformity

For the luminance to be considered uniform, the variance between the center of the display and the extreme edges cannot exceed 1.7:1.

13) Flicker

There can be no discernible flicker.

14) Jitter

There can be no discernible jitter.

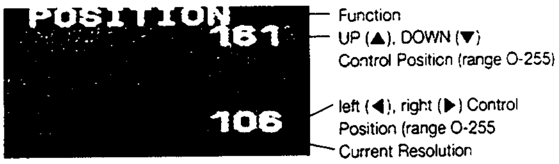
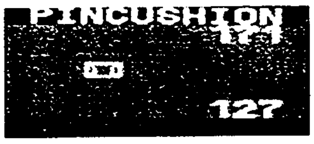
4. Functional Features

On-screen Display

As the computer has become more and more sophisticated, so has its main output device, the monitor, grown more versatile and functional. Accordingly, it has become more important to have ready access to even the most obscure video-generating signals and data.

Access to video display data first came in the form of simple LED indicator lights. Next came liquid crystal display (LCD) panels to provide more comprehensive access to user data.

Examples of OSD

<table>
<tr><th>Function Button</th><th>On-screen Display</th></tr>
<tr><td>• Position
• Size</td><td>
</td></tr>
<tr><td>• Color Temperature</td><td>
</td></tr>
<tr><td>• Pincushion
• G/D</td><td>
</td></tr>
</table>

Yet without even addressing the older LEDs, the usefulness of LCD panels is quite limited as they can only handle limited amounts of data in a small display panel.

Today, the on-screen displays that are widely used with TVs and VCRs can also be used to facilitate user interface with monitors. A variety of control data, including the PC signal, can be displayed directly on-screen, enabling the user to adjust everything, including true color levels. Quick and accurate adjustments to whatever display the user desires is now possible. Productivity increases since the work environment is easily adjusted for each individual employee.

RealColor Control System (Innovative Color Control)

The recent trend in computer systems development shows an acceleration in the development of high-speed color applications. Software is multiplying rapidly for Windows and other graphic user interfaces commonly known as GUI environments, along with business presentation, graphics design, and, of course, multi-media applications that require quality color displays.

The significance goes beyond accounting for the color preferences of individual users. Different types of computer equipment generate different colors. For instance, the image displayed on the monitor that originated from a color scanner may show colors significantly different from the original hard copy. Moreover, when the color images on the monitor are output into a color printer, the printed image can easily be very different in color from the image on the monitor.

Some separate calibration systems have been designed to compensate for and correct the errors that arise from this kind of color mismatching. However, the high cost of such a system does not make it practical for the average user.

To overcome this problem, Samsung developed in-house screen control technology called the "RealColor Control System" for use in the company's latest line of SyncMaster monitors. The SyncMaster RealColor Control System is a vast improvement over the complicated process of directly altering the three basic colors - red, green and blue (RGB) - a common practice with many of today's graphics applications. That process, functionally called the hus and saturation system, is standard in Windows®, AppleTalk, and most other graphics programs.

The hue and saturation system is an adjustment technique that involves the direct modification of the three basic RGB colors to obtain the desired color mix. For example, to accentuate the color red involves independently raising the "R" value. Obtaining the precisely desired color scheme desired using this technique is extremely difficult and can be very time-consuming.

However, the RealColor Control System used in the SyncMaster monitors allows the user to precisely adjust the color using only two variables: hue and color (saturation). Since the RealColor system is similar to the basic principles used in conventional color adjustment software, it is easy to understand, making it much easier to use. Coupled with the use of on-screen display (OSD), adjusting color levels to what the user is looking for is very simple.

The user-friendliness of SyncMaster's RealColor Control System is outlined below.

SyncMaster's Hue & Saturation(color) Technique

SyncMaster's hue and color saturation adjustment represents a significant improvement over the mixing and revising of the three RGB colors employed by the competition for popular Windows Apple Talk, and other GUI environments. These conventional systems make it very difficult to adjust and modify the three colors to obtain the precise color scheme desired. The RealColor Control System takes advantage of the same hue and saturation operational principle that most people are familiar with; however, it simplifies the process by using only two adjustment variables.

OSD and RealColor Make it Easy

The SyncMaster's RealColor Control System uses the on-screen display (OSD) to change the display color. Changing the hue and color saturation values through the OSD makes it even easier to obtain the precise true color the user is looking for.

Understanding the Color Palette(the function of RealColor)

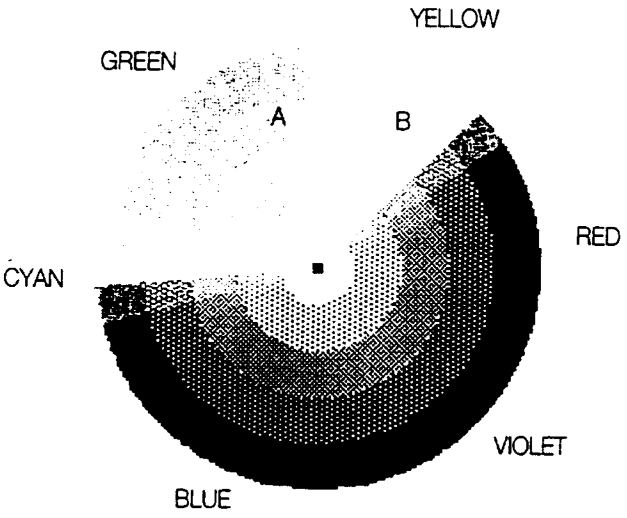
The color table shown to the lower left is that used by conventional applications. The one to the lower right is the table shown in the OSD for The SyncMaster's RealColor Control Center.

The SyncMaster's hue color table on the right corresponds to the 6 basic colors that change along the perimeter of the color table shown to the left. The saturation color table value on the right corresponds to the variations in color along the radius from the center of the color table to the perimeter.

Similarly, the color values in the table on the left are shown as digital RGB values in the hue and color saturation table on the right. In the color table on the left, the hue varies as the selected color spot is moved in an arc to the left or right, not radially. In other words, as the angle from the center point to the original color spot changes with the movement of the selected color sport, so changes the hue. Conversely, the color saturation varies as **the selected color spot is moved** from the center of the table radially, out toward the perimeter.

To make the RealColor System more convenient, the table is divided into 64 "clock" segments. This is how by simply adjusting only two variables-hue and color saturation-any color of the spectrum may be obtained.

If the color at position "A" is desired, first adjust to hue around toward the green section of the table. Then the saturation should be adjusted from the center of the table out to about halfway to the perimeter.



Color Table

Then if the color at position "B" is desired, the hue (or the angle formed from the center of the table) must be moved back toward the yellow section of the table.

Now we'll offer another example of the RealColor Control System to help further familiarize you with the process.

There are basically two ways to make the adjustment.

The first involves changing the display color to what **the individual user would like or what a** particular application requires. This is generally referred to as color coordination and adjustment of the white balance. In most cases, the screen should be adjusted for white balance, before making any color adjustments.

For example, some users prefer a little more red in their displays, while some programs look better if there is a little more blue. Whatever the situation, the color adjustment is now simpler.

First, open the RealColor Control Center through the OSD. **Push color button once to adjust the** color hue and saturation. Then, use the left (◀) and right (▶) buttons to access the color saturation and use the up (▲) and down (▼) button to access the hue function.

- Saturation (radius) is the distance away from the reference white value (preset at the factory and not a user control) in the direction of a primary color or color combination. Increasing saturation (radius) results in changing the color away from white and towards vivid concentrations of a color (hue).

- Hue is the term used to define color. Adjusting the hue (angle) determines the color that displays. By adjusting the hue, the color can be changed from blue to bluishgreen to green and so on.

  Note : If the color saturation is not increased to a sufficient level, then hue adjustments may not be visible. Please make sure that color saturation is increased in order to see your hue adjustments.

Color Reference Diagram

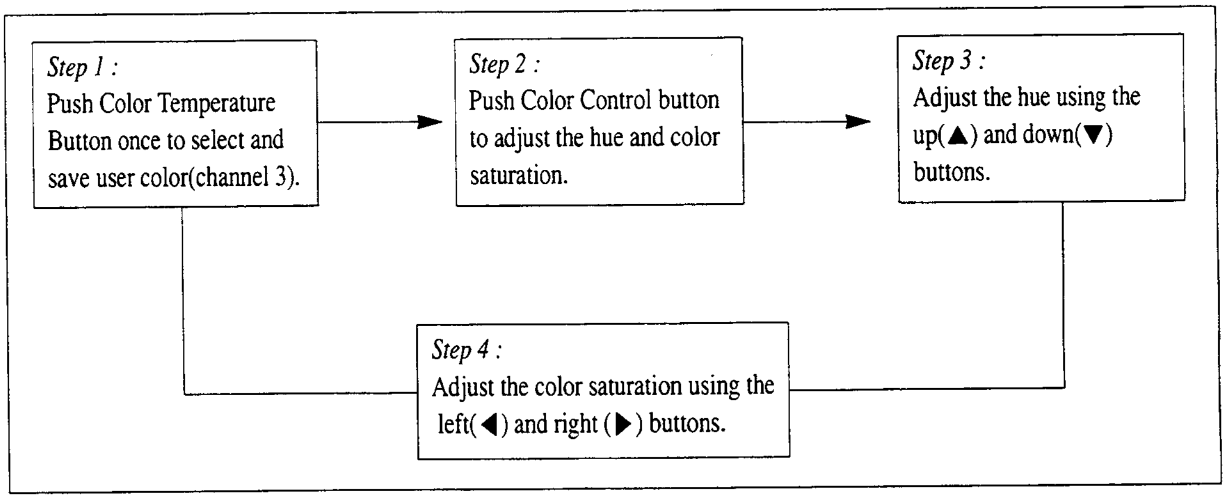
What is the Hue?

Hue is the property associated with the color family (e.g., red, yellow, blue, etc.). It is specified as an angle and ranges from 0° to 359°, with red at 0° by convention.

What is Saturation?

Saturation describes the vividness of a color or its variation from white to the most vibrant hue. It ranges from 0° to 120°.

Changing User/Color Setting



Step 1 : Push Color Temperature Button once to select and save user color(channel 3).

Step 2 : Push Color Control button to adjust the hue and color saturation.

Step 3 : Adjust the hue using the up(▲) and down(▼) buttons.

Step 4 : Adjust the color saturation using the left(◀) and right (▶) buttons.

When the color has been adjusted the first time, compare it with the original image. If additional adjustment is necessary, activate the hue key and adjust the hue while referring to the color table provided.

Depending on the circumstances, it may not be possible to obtain the exact color desired. If that is the case, adjusting the color modification functions on the input or output equipment should bring the color closer to an exact match.

Full Screen Technology

Graphic user interface first appeared with Macintosh computer systems. Today, as Windows applications and multimedia use grows, so does the usefulness of GUI environments on non-Macintosh computers.

Because of the demands involved with GUI environments, the viewing area on conventional 14-inch monitors may be too small. Characters and icons can be too small, particularly in the corners, making them difficult to read.

Unfortunately, if a user needs a larger screen and/or higher resolution, it can be very expensive, especially for the largest monitors.

Size

Model	Normal	Full Screen
15"	267 × 200	280 × 210
17"	306 × 230	320 × 240
20"	367 × 275	380 × 290

The SyncMaster Green Series takes advantage of "full screen" technology to economically resolve these problems.

With a 14-inch monitor, full screen technology can increase the viewing area by 20 percent, without incurring the cost of a larger monitor. That makes the viewing area of a 15-inch monitor only 13 percent smaller than a conventional 17-inch monitor.

Proper, not always higher, resolution is the key

Techniques to increase the display size, coupled with higher resolution allow the screen to show more characters and icons. This means the number of characters that can be displayed properly on a screen with 1024 × 768 resolution greatly outnumber those than can fit on a 640 × 480 screen.

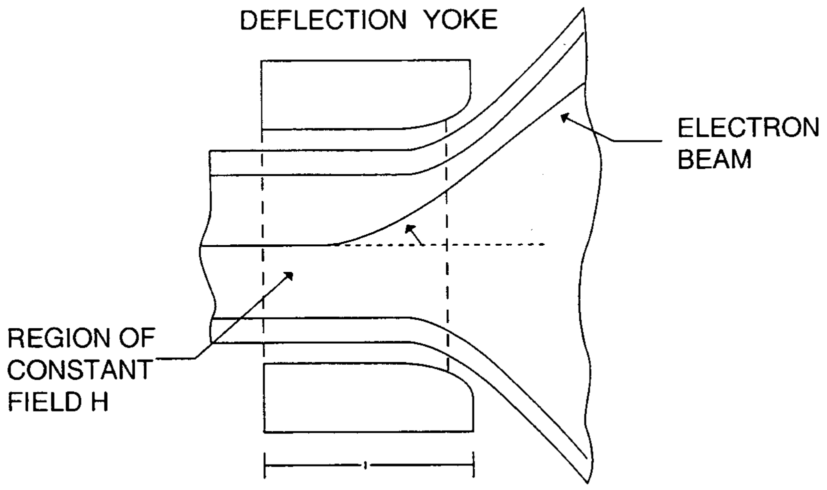
Since characters that are too small are difficult to read, the following table suggests the optimum resolution for each size monitor.

- 14-inch - 640 × 480(max. 800 × 600) VGA (Super VGA)
- 15-inch - 800 × 600 Super VGA
- **17-inch - 1024 x 768 Extended VGA**

Simply boosting the resolution to avoid the expense of a larger monitor is, at best, a short-term solution. Nonetheless, full screen technology is one good way to significantly increase the size of the display, without added expense.

Degaussing

A monitor's display is generated by a beam of electrons that come from an electron gun located behind the CRT. Positive and negative fields are used to both attract and repel the beams, and direct them toward the screen. More specifically, a deflection yoke is used to generate the positive and negative fields that direct the beam to the appropriate phosphors, or landing points, on the screen. This process occurs very quickly, which makes modifications difficult. The ability of the deflection yoke to regulate the beams is the biggest factor in the ability of the CRT to focus properly.



As you probably are aware, the earth generates a huge magnetic field. That magnetic field can influence a deflection yoke making it difficult for the electron beam to hit the correct landing point on the face of the screen. Focus and color uniformity are adversely affected.

One method to minimize the effects of the magnetic field is to physically set up the monitor screen so that it faces toward the east. Another way is to limit the harmful gaussing associated with larger screen monitors to ensure the finest display quality.

The 15-inch, 17-inch SyncMaster monitors is equipped with a one-touch degauss button in the front control box area that makes degaussing simple.

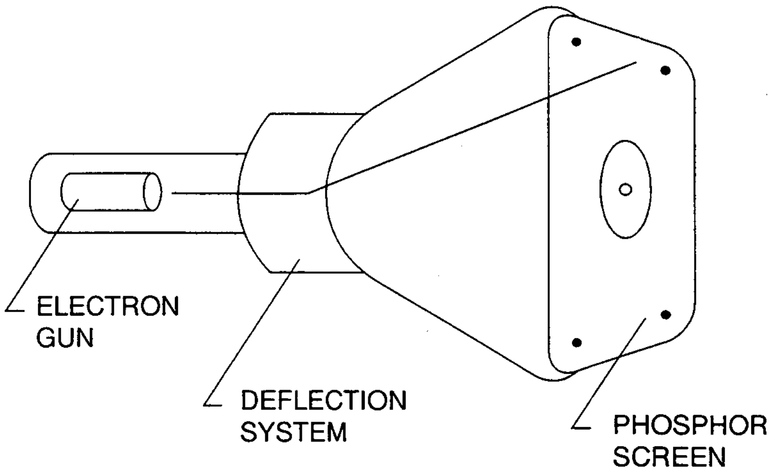
5. Top display Quality-Legibility

Dynamic Focus

Focusing is one of the most important factors in determining display quality. As the monitor increases in size, focusing at the corners becomes increasingly difficult.

High voltage, anode electricity is necessary to shoot the electron beam from the electron gun to the screen. The level of the voltage determines the time it takes the electrons to reach the screen.

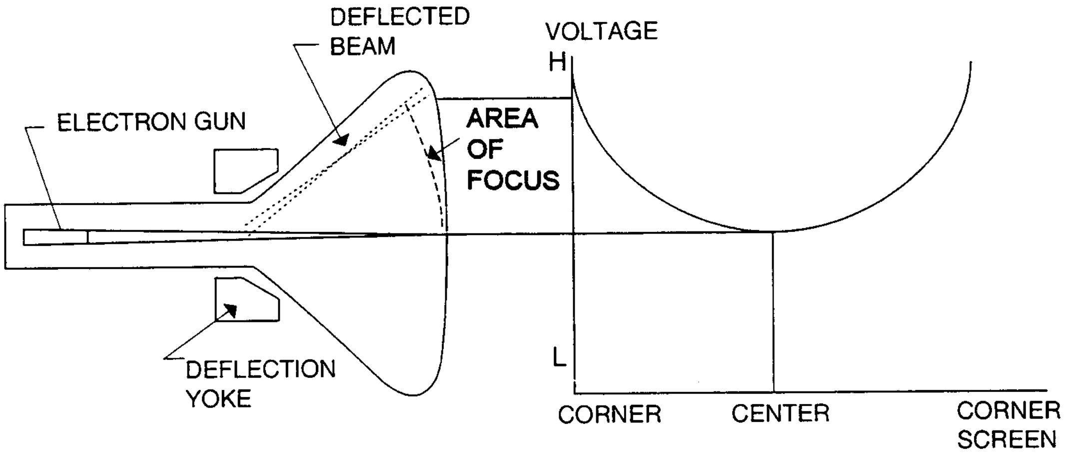
As mentioned above, the text and images displayed on the monitor are not static. They are actually formed by electrons quickly turning colors on and off. If there is improper variation in the timing of the beam, the result is a blurry image.



Dynamic Focus

To minimize this, conventional monitors simply regulate the level of voltage. This reduces the variation in the time it takes the electrons to reach the center and corners of the display. This helps maintain an even focus across the display. Although this system does help maintain uniformity, it does not offer the most precise focusing.

The dynamic focusing system was developed to offer viewers a voltage regulator that also delivers precise focusing. Dynamic focusing uses controlled variance in the voltage, employing a circuit that emits parabolic-waved voltage. By varying the voltage levels between the center and the corners of the display, a nearly perfectly focused picture is achieved.



In actuality, a lower voltage is used for the center landing positions and a higher voltage is used for the corners. This system virtually eliminates the gaps in scanning times, offering the viewer uniformity and crisp, clear focusing.

High Contrast, Glare CRTs

The concern for high contrast and brightness have escalated with the increase in the use of graphics in the 1990s. A high contrast monitor has a number of advantages, including:

- easier to read
- crisper icons and graphic elements
- better color fidelity
- better environment for Windows and other GUIs
- better color contrast better viewing that can lead to more productivity and fewer errors.

To Glare or Not to Glare

When selecting a color monitor, one important consideration is whether or not to obtain a glare or non-glare CRT. A glare CRT has the advantage of offering higher contrast.

A non-glare CRT eliminates much of the glare and reflected ambient light, which reduces eye fatigue. Although it is safer when used for longer periods of time, the display is darker than that of a glare CRT. The relative brightness and vivid colors of a glare CRT may disturb a user's vision. When used for shorter periods of time, a glare CRT is not harmful.

Nonetheless, the color of the display is usually not the most important factor to the user. When working for longer periods of time, using a non-glare CRT is better for the health and safety of the user.

Shadow mask

A shadow mask is quite effective in avoiding misconvergence, which occurs when the electron beam strikes the wrong position on the screen. However, the electron beam energy that is absorbed by the mask can lead to poor focusing. The mask material heats up and expands, resulting in a doming effect and unclear focusing.
The invar mask was developed to overcome this problem. The metal expansion is reduced through the use of a iron/nickel alloy.

Flat screen

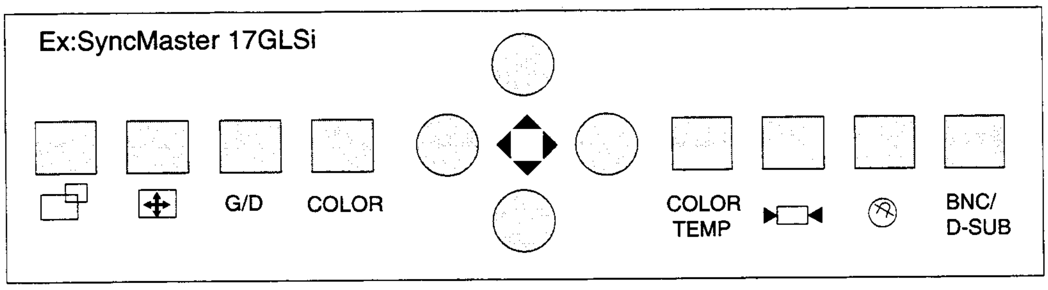
There are three basic types of picture tubes used for CRTs.
First, the spherical tube installed in many 14-inch monitors is the most widely used. All four corners of the monitors are curved. Focusing is a real problem, since there is a great deal of difference in the focal length from the user's eyes to the center and the corners of the display. However, this type of type is the most economically priced.
Second, the flat square tube is almost completely flat and is more common in 15-, 17- and 21-inch models. This type of tube is popular because of its relatively good focusing and reasonable pricing, Flat screens are highly compatible with full screen technology.

Generally speaking, the flat square tubes are the best choice.

If realistic color is the main consideration, however, the Trinitron models are best.

Ⅲ SPECIFICATION

1. User Control Panel



User Control	SM15GLe	SM15GLi	SM17GLi	SM17GLsi
# of Controls (Function/Adjustment)	8/2	6/4	6/4	8/4
Position	One Touch	1st Touch	1st Touch	1st Touch
Size	One Touch	1st Touch	1st Touch	1st Touch
Pin and Barrel	One Touch	1st Touch	1st Touch	1st Touch
Trapezoid	One Touch	1st Touch	1st Touch	1st Touch
Parallelogram	Two Button	2nd Touch	2nd Touch	2nd Touch
Pin Balance	Two Button	2nd Touch	Two Button	Two Button
Rotation(Tilt)	N/A	N/A	2nd Touch	2nd Touch
Dual Color	N/A	One Touch	One Touch	One Touch
Color Control	N/A	N/A	N/A	One Touch
BNC/D-SUB	N/A	N/A	N/A	One Touch
Manual Degaussing	One Touch	One Touch	One Touch	One Touch
Recall	Long Push	Long Push	Long Push	Long Push
Mode Information	N/A	2nd Touch	2nd Touch	2nd Touch

Compatibility Chart(Continued)

Graphics Board Manufacturer	SyncMaster15GLe H-Freq.:30-50KHz V-Freq.:50-120Hz	SyncMaster15GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLsi H-Freq.:30-85KHz V-Freq.:50-120Hz
Apple PowerMac7100/8100 Built-in board	640 × 480@67Hz 800 × 600@75Hz 1024 × 768@60Hz	640 × 480@67Hz 800 × 600@75Hz 1024 × 768@75Hz	640 × 480@67Hz 800 × 600@75Hz 1024 × 768@75Hz	640 × 480@67Hz 800 × 600@75Hz 1024 × 768@75Hz 1152 × 870@75Hz
Apple LC/LC Ⅱ / Ⅱ vx,vi Built-in board	640 × 480@60Hz 640 × 480@67Hz	640 × 480@60Hz 640 × 480@67Hz	640 × 480@60Hz 640 × 480@67Hz	640 × 480@60Hz 640 × 480@67Hz
Apple LC Ⅲ /Performa450 Built-in board	640 × 480@60Hz 640 × 480@67Hz 832 × 624@75Hz	640 × 480@60Hz 640 × 480@67Hz 832 × 624@75Hz	640 × 480@60Hz 640 × 480@67Hz 832 × 624@75Hz	640 × 480@60Hz 640 × 480@67Hz 832 × 624@75Hz
Apple Quadra 700/900 Built-in board	640 × 480@67Hz 832 × 624@75Hz	640 × 480@67Hz 832 × 624@75Hz	640 × 480@67Hz 832 × 624@75Hz	640 × 480@67Hz 832 × 624@75Hz 1152 × 870@75Hz
Apple Quadra800/840AV/950 Centris610/650/660 Built-in board	640 × 480@67Hz 832 × 624@75Hz	640 × 480@67Hz 832 × 624@75Hz 1024 × 768@75Hz	640 × 480@67Hz 832 × 624@75Hz 1024 × 768@75Hz	640 × 480@67Hz 832 × 624@75Hz 1024 × 768@75Hz 1152 × 870@75Hz
Apple Power Book Series Built-in board	640 × 480@67Hz 832 × 624@75Hz	640 × 480@67Hz 832 × 624@75Hz	640 × 480@67Hz 832 × 624@75Hz	640 × 480@67Hz 832 × 624@75Hz
Radius Video Vision/ PrecisionColor24xK	640 × 480@67Hz 830 × 624@75Hz	640 × 480@67Hz 832 × 624@75Hz 1024 × 768@75Hz	640 × 480@67Hz 832 × 624@75Hz 1024 × 768@75Hz	640 × 480@67Hz 832 × 624@75Hz 1024 × 768@75Hz 1152 × 870@75Hz
Radius Precision Color Pro 24xp	640 × 480@67Hz 800 × 600@75Hz	640 × 480@67Hz 800 × 600@75Hz	640 × 480@67Hz 800 × 600@75Hz	640 × 480@67Hz 800 × 600@75Hz
SuperMac Thunder/24	640 × 480@67Hz 800 × 600@75Hz 1024 × 768@60Hz	640 × 480@67Hz 800 × 600@75Hz 1024 × 768@75Hz	640 × 480@67Hz 800 × 600@75Hz 1024 × 768@75Hz	640 × 480@67Hz 800 × 600@75Hz 1024 × 768@75Hz 1152 × 870@75Hz
Raster Ops 8XL/24XLi	640 × 480@67Hz 832 × 624@75Hz	640 × 480@67Hz 832 × 624@75Hz 1024 × 768@75Hz	640 × 480@67Hz 832 × 624@75Hz 1024 × 768@75Hz	640 × 480@67Hz 832 × 624@75Hz 1024 × 768@75Hz 1152 × 870@75Hz

2. Key Features

Model No. / Item	SM15GLe	SM15GLi	SM17GLi	SM17GLsi
CRT Size	15-inch	15-inch	17-inch	17-inch
Dot Pitch	0.28mm	0.28mm	0.28mm	0.26mm
Horizontal Freq.	30-50kHz	30-65kHz	30-65kHz	30-85kHz
Vertical Freq.	50-120Hz	50-120Hz	50-120Hz	50-120Hz
Max. Resolution	1024×768@60	1280×1024@60Hz	1280×1024@60Hz	1280×1024@75Hz
Signal Type	Sep/Comp	Sep/Comp	Sep/Comp/SOG	Sep/Comp/SOG
Signal Connector	D-sub(15pin)	D-sub(15pin)	D-sub(15pin)	D-sub/5BNC
Signal Cable Length	1.8MT/Det.	1.8MT/Det.	1.8MT/Att.	1.8MT/Det.
Display Size(normal)	267×200mm	267×200mm	306×230mm	306×230mm
Display Size(max)	280×210mm	280×210mm	320×240mm	320×240mm
Power Consumption	85W(Max)	90W(Max)	100W(Max)	120W(Max)
OSD	No	Yes	Yes	Yes
Color Temperature	No	Dual	Dual	Dual
Color Control	No	No	No	Yes
Plug & Play	Yes	Yes	Yes	Yes
TCO '92	Option	Option	Option	Option
Factory Modes	11	11	11	11
User Mode	11	11	11	11
User Control	Door	Snap-in Door	Snap-in Door	Snap-in Door
Dimension(W×D×H)	373×400×393.5	373×400×393.5	428×439×420	428×439×420
Weight	13.5kg	13.5kg	17kg	18kg
Loading Q'ty(20/40FT)	275/575	275/575	160/352	160/352

Compatibility Chart(Continued)

Graphics Board Manufacturer	SyncMaster15GLe H-Freq.:30-50KHz V-Freq.:50-120Hz	SyncMaster15GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLsi H-Freq.:30-85KHz V-Freq.:50-120Hz
Spider Tarantula 64	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@75Hz 1600 x 1200@60Hz
STB System Pewergraph Pro	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@75Hz 1600 x 1200@60Hz
STB Ergo VGA	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@70Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@70Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@70Hz
Sigma Legend GX	640 x 480@72Hz 800 x 600@70Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@70Hz 1024 x 768@80Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@70Hz 1024 x 768@80Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@105Hz 1024 x 768@84Hz 1280 x 1024@60Hz
Sigma Winstorm	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@70Hz 1280 x 1024@87iHz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@70Hz 1280 x 1024@87Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@70Hz 1280 x 1024@87iHz
Tseng Labs Mega VGA/1024	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@70Hz 1280 x 1024@87iHz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@70Hz 1280 x 1024@87iHz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@70Hz 1280 x 1024@87iHz
Western Digital Windows Accelerator	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@87iHz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@87iHz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@87iHz
Western Digital Paradise	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@87iHz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@87iHz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@87iHz

3. Supporting Display Modes

Mode	Resolution	Refresh	SM15GLe	SM15GLi	SM17GLi	SM17GLsi
VGA	640 × 350	at 70Hz	●	●	●	●
	720 × 400	at 70Hz	●	●	●	●
	640 × 480	at 60Hz	●	●	●	●
	640 × 480	at 72Hz	●	●	●	●
	640 × 480	at 75Hz	●	●	●	●
	640 × 480	at 120Hz	○	●	●	●
SVGA	800 × 600	at 56Hz	●	●	●	●
	800 × 600	at 60Hz	●	●	●	●
	800 × 600	at 72Hz	●	●	●	●
	800 × 600	at 75Hz	●	●	●	●
	800 × 600	at 120Hz	○	○	○	●
XGA	1024 × 768	at 87(i)Hz	●	●	●	●
	1024 × 768	at 60Hz	●	●	●	●
	1024 × 768	at 70Hz	○	●	●	●
	1024 × 768	at 72Hz	○	●	●	●
	1024 × 768	at 75Hz	○	●	●	●
	1024 × 768	at 100Hz	○	○	○	●
CAD/CAM	1280 × 1024	at 60Hz	○	●	●	●
	1280 × 1024	at 72Hz	○	○	○	●
	1280 × 1024	at 75Hz	○	○	○	●
	1152 × 900	at 76Hz	○	○	○	●
	1600 × 1200	at 60Hz	○	○	○	●
	1600 × 1200	at 66Hz	○	○	○	●
MACINTOSH	640 × 480	at 67Hz	●	●	●	●
	832 × 624	at 75Hz	●	●	●	●
	1024 × 768	at 75Hz	○	●	●	●
	1152 × 870	at 75Hz	○	○	○	●

※ ○:Not Supported, ●:Supported

Compatibility Chart(Continued)

Graphics Board Manufacturer	SyncMaster15GLe H-Freq.:30-50KHz V-Freq.:50-120Hz	SyncMaster15GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLsi H-Freq.:30-85KHz V-Freq.:50-120Hz
Miro Crystal 40SV	640 × 480@75Hz 800 × 600@75Hz 1024 × 768@60Hz	640 × 480@115Hz 800 × 600@75Hz 1024 × 768@75Hz 1280 × 1024@60Hz	640 × 480@115Hz 800 × 600@75Hz 1024 × 768@75Hz 1280 × 1024@60Hz	640 × 480@115Hz 800 × 600@75Hz 1024 × 768@75Hz 1280 × 1024@75Hz 1408 × 1024@70Hz
Metheus Premier 928	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@70Hz 1280 × 1024@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@70Hz 1280 × 1024@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@70Hz 1280 × 1024@70Hz
Number Nine #9GXi	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@72Hz 1280 × 1024@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@72Hz 1280 × 1024@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@72Hz 1280 × 1024@75Hz
Number Nine #9GXi	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@72Hz 1152 × 870@60Hz 1280 × 1024@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@72Hz 1152 × 870@60Hz 1280 × 1024@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@72Hz 1152 × 870@72Hz 1280 × 1024@72Hz
Orchid Prodesigner IIs	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@60Hz
Orchid Celsius VLB	640 × 480@90Hz 800 × 600@70Hz 1024 × 768@60Hz	640 × 480@90Hz 800 × 600@90Hz 1024 × 768@75Hz 1152 × 900@56Hz 1280 × 1024@56Hz	640 × 480@90Hz 800 × 600@90Hz 1024 × 768@75Hz 1152 × 900@56Hz 1280 × 1024@56Hz	640 × 480@90Hz 800 × 600@90Hz 1024 × 768@75Hz 1152 × 900@56Hz 1280 × 1024@56Hz
Orchid P9000VLB	640 × 480@90Hz 800 × 600@70Hz 1024 × 768@60Hz	640 × 480@90Hz 800 × 600@90Hz 1024 × 768@75Hz 1280 × 1024@87iHz	640 × 480@90Hz 800 × 600@90Hz 1024 × 768@75Hz 1280 × 1024@87iHz	640 × 480@90Hz 800 × 600@90Hz 1024 × 768@75Hz 1280 × 1024@87iHz
Orchid Kevin 64	640 × 480@75Hz 800 × 600@75Hz 1024 × 768@60Hz	640 × 480@75Hz 800 × 600@75Hz 1024 × 768@70Hz 1280 × 1024@60Hz	640 × 480@75Hz 800 × 600@75Hz 1024 × 768@70Hz 1280 × 1024@60Hz	640 × 480@75Hz 800 × 600@75Hz 1024 × 768@70Hz 1280 × 1024@60Hz

4. Compatibility Chart

∗ *Note :* All refresh rates below the rate status in this chart, but currently supported by these graphics boards, are also supported by the Samsung Monitors Listed in this chart.

Graphics Board Manufacturer	SyncMaster15GLe H-Freq.:30-50KHz V-Freq.:50-120Hz	SyncMaster15GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLsi H-Freq.:30-85KHz V-Freq.:50-120Hz
Artist Winsprint900	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz
Artist Winsprint1000i	1024 x 768@60Hz	1024 x 768@75Hz 1152 x 870@70Hz 1280 x 1024@60Hz	1024 x 768@75Hz 1152 x 870@70Hz 1280 x 1024@60Hz	1024 x 768@75Hz 1152 x 870@70Hz 1280 x 1024@75Hz
Artist XJ1000	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@75Hz
Artist XJS(4BNC)				1280 x 1024@51Hz 1280 x 1024@70Hz
ATI Ultra Pro	640 x 480@72Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@74Hz
ATI Xpression	640 x 480@90Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@100Hz 800 x 600@100Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@100Hz 800 x 600@100Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@100Hz 800 x 600@100Hz 1024 x 768@100Hz 1280 x 1024@75Hz
ATI Pro Turbo	640 x 480@90Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@100Hz 800 x 600@100Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@100Hz 800 x 600@100Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@100Hz 800 x 600@100Hz 1024 x 768@100Hz 1280 x 1024@75Hz
Boca Super VGA	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz

Compatibility Chart(Continued)

Graphics Board Manufacturer	SyncMaster15GLe H-Freq.:30-50KHz V-Freq.:50-120Hz	SyncMaster15GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLsi H-Freq.:30-85KHz V-Freq.:50-120Hz
Hercules Stingray	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@72Hz 1280 x 1024@88iHz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@72Hz 1280 x 1024@88iHz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@72Hz 1280 x 1024@88iHz
Hercules Graphite Pro	640 x 480@90Hz 800 x 600@76Hz 1024 x 768@60Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@80Hz 1152 x 864@67Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@80Hz 1152 x 864@67Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@90Hz 1152 x 864@80Hz 1280 x 1024@75Hz
Hercules Graphite Pro HG420	640 x 480@90Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@90Hz 800 x 600@100Hz 1024 x 768@80Hz 1152 x 900@68Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@100Hz 1024 x 768@80Hz 1152 x 900@68Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@100Hz 1024 x 768@90Hz 1152 x 900@80Hz 1280 x 1024@75Hz
Hercules Superstation XP	640 x 480@90Hz 800 x 600@77Hz 1024 x 768@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@72Hz 1152 x 900@62Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@72Hz 1152 x 900@62Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@91Hz 1152 x 900@85Hz 1280 x 1024@60Hz
Matrox MGA Impression Plus	640 x 480@90Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@75Hz 1152 x 882@72Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@75Hz 1152 x 882@72Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@120Hz 1024 x 768@90Hz 1152 x 882@75Hz 1280 x 1024@75Hz
Matrox MGA Ultima	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@72Hz
Matrox Ultima Plus VLB	640 x 480@90Hz 800 x 600@75Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@120Hz 1024 x 768@100Hz 1280 x 1024@75Hz 1600 x 1200@66Hz
Media Vision Pro Graphics 1280	640 x 480@90Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@60Hz

Compatibility Chart(Continued)

Graphics Board Manufacturer	SyncMaster15GLe H-Freq.:30-50KHz V-Freq.:50-120Hz	SyncMaster15GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLsi H-Freq.:30-85KHz V-Freq.:50-120Hz
Cardinal VGA732/1MB	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz
Diamond Viper VLB	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@80Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@80Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@80Hz 1280 x 1024@75Hz
Diamond Viper Pro	640 x 480@90Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@120Hz 800 x 600@90Hz 1024 x 768@80Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@90Hz 1024 x 768@80Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@120Hz 1024 x 768@100Hz 1280 x 1024@75Hz
Diamond Stealth Pro	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@72Hz
Diamond Stealth 64	640 x 480@90Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@80Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@80Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@100Hz 1280 x 1024@75Hz
Diamond Speedstar Pro	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@87iHz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@87iHz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@87iHz
Diamond Stealth VRAM	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz
Diamond Stealth 24	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz
Diamond Stealth 32	640 x 480@90Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@60Hz

Compatibility Chart(Continued)

Graphics Board Manufacturer	SyncMaster15GLe H-Freq.:30-50KHz V-Freq.:50-120Hz	SyncMaster15GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLsi H-Freq.:30-85KHz V-Freq.:50-120Hz
Diamond Speedstar 64	640 x 480@90Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@60Hz
ELSA Gemini 200-5	640 x 480@90Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@90Hz 800 x 600@100Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@100Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@100Hz 1024 x 768@75Hz 1280 x 1024@75Hz
ELSA Winner 1280	640 x 480@90Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@90Hz 800 x 600@100Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@100Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@100Hz 1024 x 768@100Hz 1280 x 1024@75Hz
ELSA Winner 2000 Pro	640 x 480@100Hz 800 x 600@78Hz 1024 x 768@62Hz	640 x 480@120Hz 800 x 600@102Hz 1024 x 768@81Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@102Hz 1024 x 768@81Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@120Hz 1024 x 768@105Hz 1280 x 1024@80Hz 1600 x 1200@66Hz
Genoa Phantom 32i 8900VL	640 x 480@92Hz 800 x 600@67Hz 1024 x 768@60Hz	640 x 480@116Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@116Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@116Hz 800 x 600@90Hz 1024 x 768@84Hz 1280 x 1024@70Hz
Genoa 8500VL	640 x 480@92Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@114Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@87iHz	640 x 480@114Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@87iHz	640 x 480@114Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@87iHz
Genoa VGA7900	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@70Hz 1280 x 1024@87iHz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@70Hz 1280 x 1024@87iHz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@70Hz 1280 x 1024@87iHz
Hercules Dynamite	640 x 480@90Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@72Hz 1280 x 1024@70Hz

Compatibility Chart(Continued)

Graphics Board Manufacturer	SyncMaster15GLe H-Freq.:30-50KHz V-Freq.:50-120Hz	SyncMaster15GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLsi H-Freq.:30-85KHz V-Freq.:50-120Hz
Hercules Stingray	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@72Hz 1280 x 1024@88iHz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@72Hz 1280 x 1024@88iHz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@72Hz 1280 x 1024@88iHz
Hercules Graphite Pro	640 x 480@90Hz 800 x 600@76Hz 1024 x 768@60Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@80Hz 1152 x 864@67Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@80Hz 1152 x 864@67Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@90Hz 1152 x 864@80Hz 1280 x 1024@75Hz
Hercules Graphite Pro HG420	640 x 480@90Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@90Hz 800 x 600@100Hz 1024 x 768@80Hz 1152 x 900@68Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@100Hz 1024 x 768@80Hz 1152 x 900@68Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@100Hz 1024 x 768@90Hz 1152 x 900@80Hz 1280 x 1024@75Hz
Hercules Superstation XP	640 x 480@90Hz 800 x 600@77Hz 1024 x 768@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@72Hz 1152 x 900@62Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@72Hz 1152 x 900@62Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@91Hz 1152 x 900@85Hz 1280 x 1024@60Hz
Matrox MGA Impression Plus	640 x 480@90Hz. 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@75Hz 1152 x 882@72Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@75Hz 1152 x 882@72Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@120Hz 1024 x 768@90Hz 1152 x 882@75Hz 1280 x 1024@75Hz
Matrox MGA Ultima	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@72Hz
Matrox Ultima Plus VLB	640 x 480@90Hz 800 x 600@75Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@100Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@120Hz 800 x 600@120Hz 1024 x 768@100Hz 1280 x 1024@75Hz 1600 x 1200@66Hz
Media Vision Pro Graphics 1280	640 x 480@90Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@60Hz

Compatibility Chart(Continued)

Graphics Board Manufacturer	SyncMaster15GLe H-Freq.:30-50KHz V-Freq.:50-120Hz	SyncMaster15GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLsi H-Freq.:30-85KHz V-Freq.:50-120Hz
Miro Crystal 40SV	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@115Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@115Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@60Hz	640 x 480@115Hz 800 x 600@75Hz 1024 x 768@75Hz 1280 x 1024@75Hz 1408 x 1024@70Hz
Metheus Premier 928	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@70Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@70Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@70Hz 1280 x 1024@70Hz
Number Nine #9GXi	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1280 x 1024@75Hz
Number Nine #9GXi	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1152 x 870@60Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1152 x 870@60Hz 1280 x 1024@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@72Hz 1152 x 870@72Hz 1280 x 1024@72Hz
Orchid Prodesigner IIs	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz	640 x 480@72Hz 800 x 600@72Hz 1024 x 768@60Hz
Orchid Celsius VLB	640 x 480@90Hz 800 x 600@70Hz 1024 x 768@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1152 x 900@56Hz 1280 x 1024@56Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1152 x 900@56Hz 1280 x 1024@56Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1152 x 900@56Hz 1280 x 1024@56Hz
Orchid P9000VLB	640 x 480@90Hz 800 x 600@70Hz 1024 x 768@60Hz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@87iHz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@87iHz	640 x 480@90Hz 800 x 600@90Hz 1024 x 768@75Hz 1280 x 1024@87iHz
Orchid Kevin 64	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@70Hz 1280 x 1024@60Hz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@70Hz 1280 x 1024@60Hz	640 x 480@75Hz 800 x 600@75Hz 1024 x 768@70Hz 1280 x 1024@60Hz

Compatibility Chart(Continued)

Graphics Board Manufacturer	SyncMaster15GLe H-Freq.:30-50KHz V-Freq.:50-120Hz	SyncMaster15GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLsi H-Freq.:30-85KHz V-Freq.:50-120Hz
Spider Tarantula 64	640 × 480@75Hz 800 × 600@75Hz 1024 × 768@60Hz	640 × 480@75Hz 800 × 600@75Hz 1024 × 768@75Hz 1280 × 1024@60Hz	640 × 480@75Hz 800 × 600@75Hz 1024 × 768@75Hz 1280 × 1024@60Hz	640 × 480@75Hz 800 × 600@75Hz 1024 × 768@75Hz 1280 × 1024@75Hz 1600 × 1200@60Hz
STB System Pewergraph Pro	640 × 480@75Hz 800 × 600@75Hz 1024 × 768@60Hz	640 × 480@75Hz 800 × 600@75Hz 1024 × 768@75Hz 1280 × 1024@60Hz	640 × 480@75Hz 800 × 600@75Hz 1024 × 768@75Hz 1280 × 1024@60Hz	640 × 480@75Hz 800 × 600@75Hz 1024 × 768@75Hz 1280 × 1024@75Hz 1600 × 1200@60Hz
STB Ergo VGA	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@70Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@70Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@70Hz
Sigma Legend GX	640 × 480@72Hz 800 × 600@70Hz 1024 × 768@60Hz	640 × 480@72Hz 800 × 600@70Hz 1024 × 768@80Hz 1280 × 1024@60Hz	640 × 480@72Hz 800 × 600@70Hz 1024 × 768@80Hz 1280 × 1024@60Hz	640 × 480@72Hz 800 × 600@105Hz 1024 × 768@84Hz 1280 × 1024@60Hz
Sigma Winstorm	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@70Hz 1280 × 1024@87iHz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@70Hz 1280 × 1024@87Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@70Hz 1280 × 1024@87iHz
Tseng Labs Mega VGA/1024	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@70Hz 1280 × 1024@87iHz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@70Hz 1280 × 1024@87iHz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@70Hz 1280 × 1024@87iHz
Western Digital Windows Accelerator	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@72Hz 1280 × 1024@87iHz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@72Hz 1280 × 1024@87iHz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@72Hz 1280 × 1024@87iHz
Western Digital Paradise	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@60Hz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@72Hz 1280 × 1024@87iHz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@72Hz 1280 × 1024@87iHz	640 × 480@72Hz 800 × 600@72Hz 1024 × 768@72Hz 1280 × 1024@87iHz

Compatibility Chart(Continued)

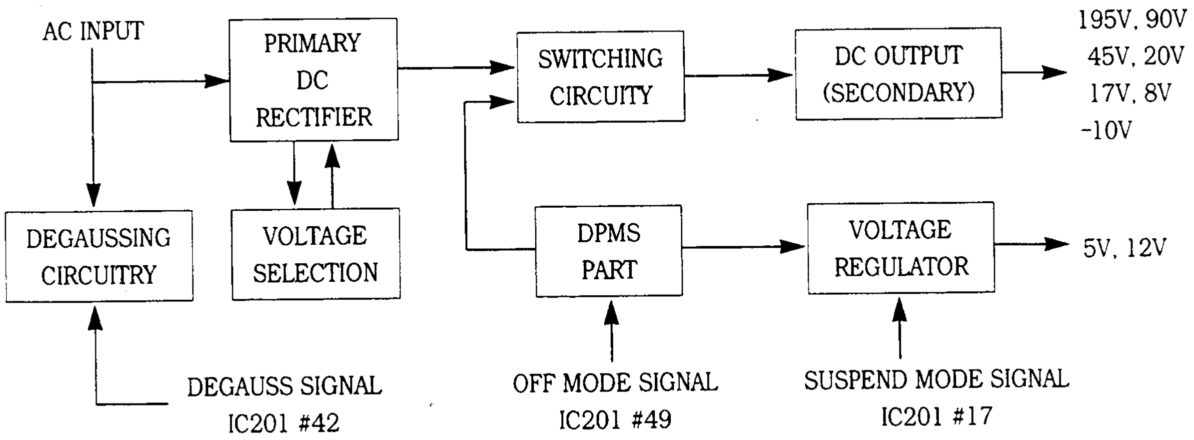
Graphics Board Manufacturer	SyncMaster15GLe H-Freq.:30-50KHz V-Freq.:50-120Hz	SyncMaster15GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLi H-Freq.:30-65KHz V-Freq.:50-120Hz	SyncMaster17GLsi H-Freq.:30-85KHz V-Freq.:50-120Hz
Apple PowerMac7100/8100 Built-in board	640 x 480@67Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@67Hz 800 x 600@75Hz 1024 x 768@75Hz	640 x 480@67Hz 800 x 600@75Hz 1024 x 768@75Hz	640 x 480@67Hz 800 x 600@75Hz 1024 x 768@75Hz 1152 x 870@75Hz
Apple LC/LC Ⅱ / Ⅱ vx,vi Built-in board	640 x 480@60Hz 640 x 480@67Hz	640 x 480@60Hz 640 x 480@67Hz	640 x 480@60Hz 640 x 480@67Hz	640 x 480@60Hz 640 x 480@67Hz
Apple LC Ⅲ /Performa450 Built-in board	640 x 480@60Hz 640 x 480@67Hz 832 x 624@75Hz	640 x 480@60Hz 640 x 480@67Hz 832 x 624@75Hz	640 x 480@60Hz 640 x 480@67Hz 832 x 624@75Hz	640 x 480@60Hz 640 x 480@67Hz 832 x 624@75Hz
Apple Quadra 700/900 Built-in board	640 x 480@67Hz 832 x 624@75Hz	640 x 480@67Hz 832 x 624@75Hz	640 x 480@67Hz 832 x 624@75Hz	640 x 480@67Hz 832 x 624@75Hz 1152 x 870@75Hz
Apple Quadra800/840AV/950 Centris610/650/660 Built-in board	640 x 480@67Hz 832 x 624@75Hz	640 x 480@67Hz 832 x 624@75Hz 1024 x 768@75Hz	640 x 480@67Hz 832 x 624@75Hz 1024 x 768@75Hz	640 x 480@67Hz 832 x 624@75Hz 1024 x 768@75Hz 1152 x 870@75Hz
Apple Power Book Series Built-in board	640 x 480@67Hz 832 x 624@75Hz	640 x 480@67Hz 832 x 624@75Hz	640 x 480@67Hz 832 x 624@75Hz	640 x 480@67Hz 832 x 624@75Hz
Radius Video Vision/ PrecisionColor24xK	640 x 480@67Hz 830 x 624@75Hz	640 x 480@67Hz 832 x 624@75Hz 1024 x 768@75Hz	640 x 480@67Hz 832 x 624@75Hz 1024 x 768@75Hz	640 x 480@67Hz 832 x 624@75Hz 1024 x 768@75Hz 1152 x 870@75Hz
Radius Precision Color Pro 24xp	640 x 480@67Hz 800 x 600@75Hz	640 x 480@67Hz 800 x 600@75Hz	640 x 480@67Hz 800 x 600@75Hz	640 x 480@67Hz 800 x 600@75Hz
SuperMac Thunder/24	640 x 480@67Hz 800 x 600@75Hz 1024 x 768@60Hz	640 x 480@67Hz 800 x 600@75Hz 1024 x 768@75Hz	640 x 480@67Hz 800 x 600@75Hz 1024 x 768@75Hz	640 x 480@67Hz 800 x 600@75Hz 1024 x 768@75Hz 1152 x 870@75Hz
Raster Ops 8XL/24XLi	640 x 480@67Hz 832 x 624@75Hz	640 x 480@67Hz 832 x 624@75Hz 1024 x 768@75Hz	640 x 480@67Hz 832 x 624@75Hz 1024 x 768@75Hz	640 x 480@67Hz 832 x 624@75Hz 1024 x 768@75Hz 1152 x 870@75Hz

Ⅳ. OPERATION THEORY

1. SyncMaster 17GLsi (CMH7379L) Circuit Description

1) Power Supply

The switch mode power supply for the CMH chassis is capable of automatically sensing 110 or 220 AC voltage input. It also operates with reduced power consumption by implementing the VESA Display Power Management System off and suspend modes which is microprocessor controlled. The manual degaussing circuit is also controlled by the microprocessor.



Block Diagram

Line Filtering

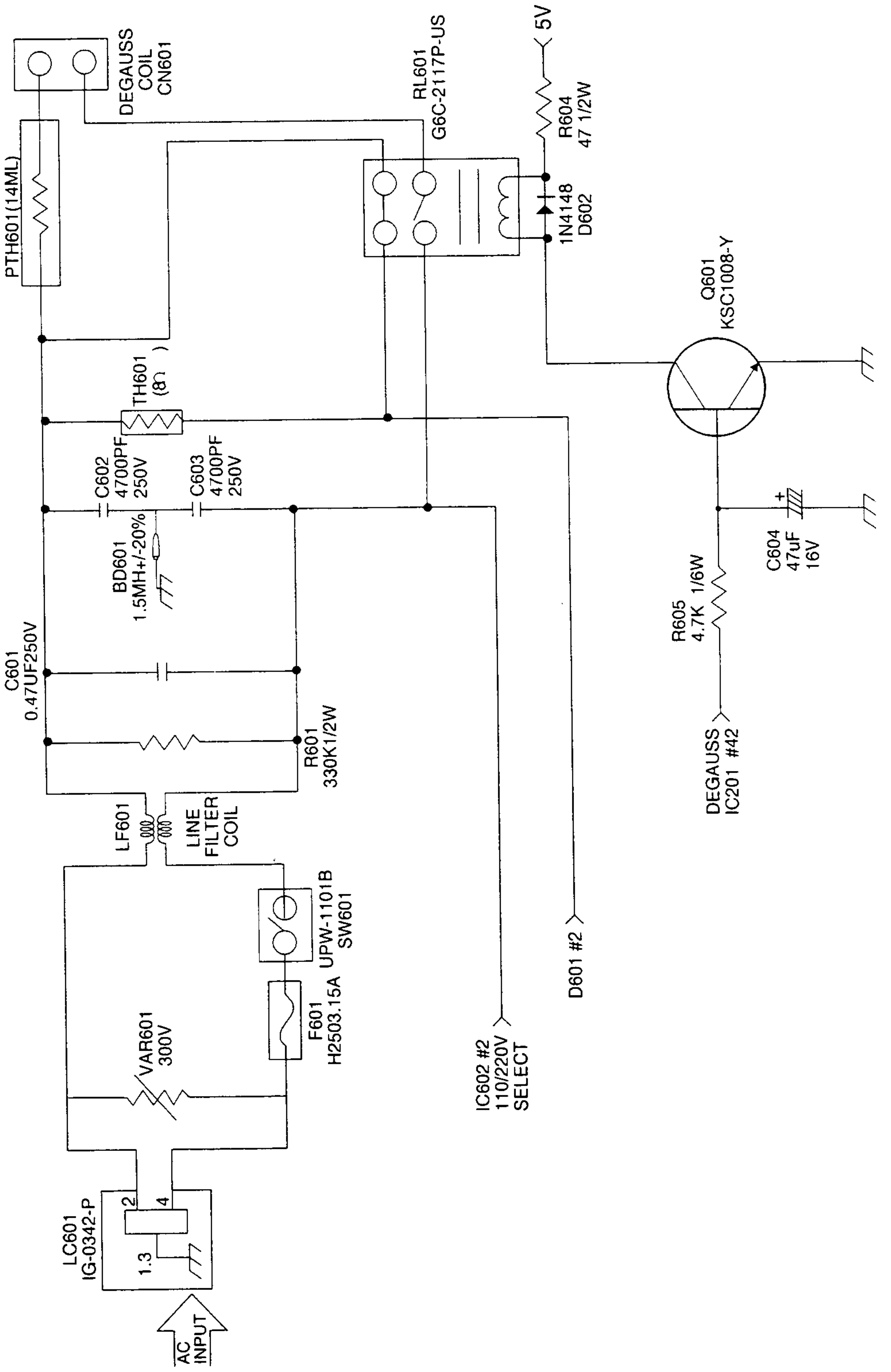
The AC input is enabled by the power switch SW602. AC line noise is filtered by LF601, R601, C601, C602, C603, and BD601.

Degaussing

The degaussing coil measures 10 ohms in resistance and it's purpose is to demagnetize the CRT during power up and when the manual degauss switch on the front control panel is pressed by the user. This is necessary since the CRT can become magnetized by the earth's magnetic field and force a beam shift, causing color impurities on the face of the picture tube.

During power up, current is applied to posistor PTH601. PTH601 when cold has a low resistance. As the current heats up PTH601, it's resistance will increase to infinity. This will cause current to stop flowing to the degaussing coil. This will culminate in the degaussing coil being taken out of the circuit. This is the completion of auto degaussing.

Manual degaussing can be performed as well by the user, in case impurities occur to the monitor after power is on. In normal operation, RL601 has the switch from pin 3 to 2 closed while 5 to 4 is in an open state, due to transistor Q601 being turned on by 5 vdc. from IC201 pin #42. This will put pin 1 of RL601 at zero volts potential. When the user presses the degauss switch on the front panel, IC102 pin #42 will output a low for approximately 3 seconds, turning Q601 off. When Q601 is at cutoff, switch 3 to 2 opens and switch 5 to 4 closes due to 5 vdc. potential on pin 1 of RL601. AC can now flow through the switched on relay. After a 3 second period, Pin #42 goes high again, turning on Q601 and cutting out the degaussing coil from the circuit.



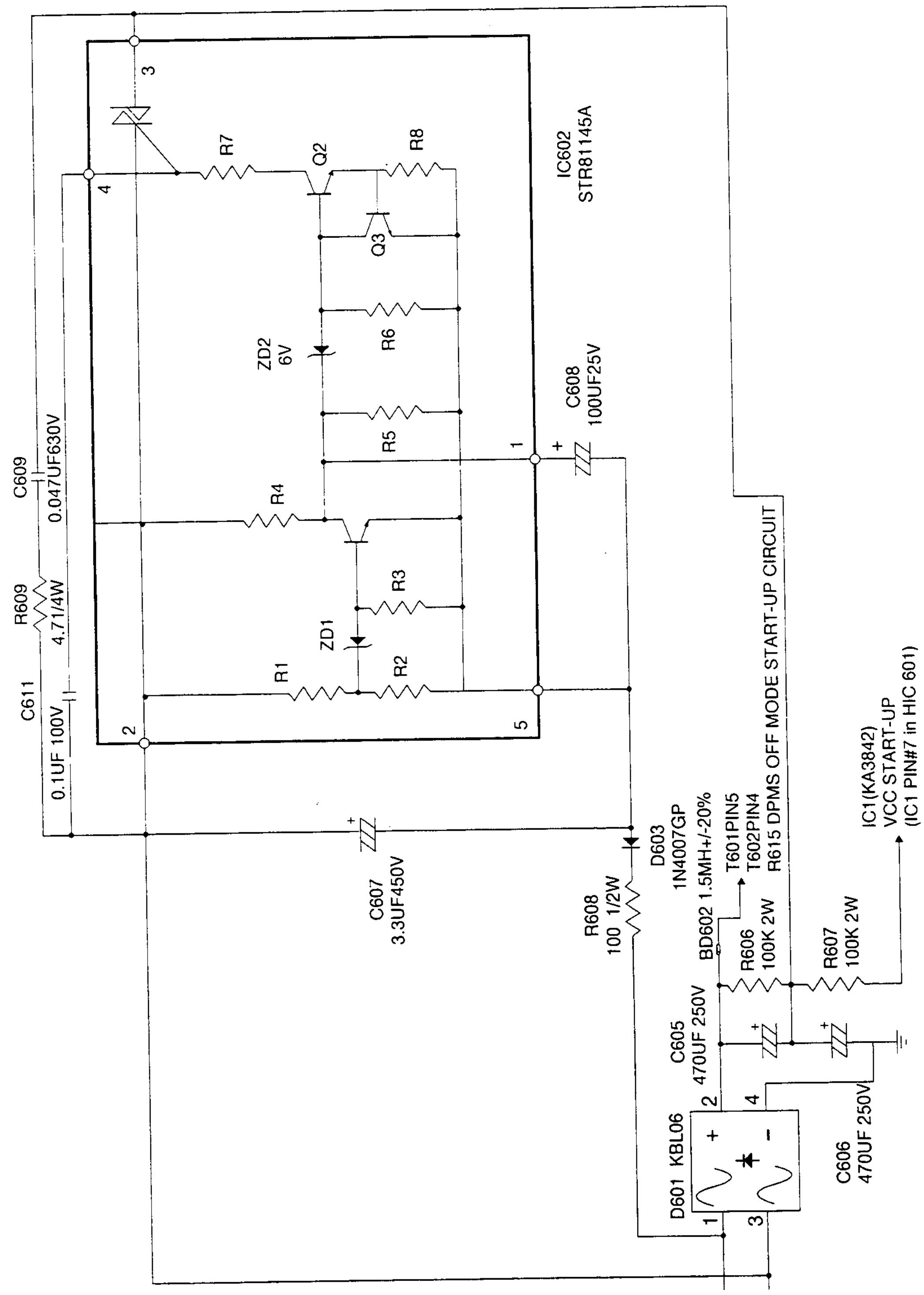
Degaussing & Line Fiter

Voltage Selector

The CMH 73*9L power supply auto senses 110 and 220 AC line input and makes the necessary compensation. The voltage sensing is performed by IC602 (STR81145A). AC input is sensed by pin #2 of IC602. High 220 VAC will cause ZD1 to conduct, turning on Q1. Emitter to collector current will flow, causing Q2 to cutoff. The triac will turn off, enabling the full wave rectifier C605 and C606. Pin #2 senses low 110 VAC. Q2 will operate at saturation turning on the triac. The doubler will now be inactive and the full bridge capabilities will be enabled.

IC602 Voltage:

	110VAC	**220VAC**
Pin 1	7.1 vdc	0 vdc
Pin 2	144 vdc	288 vdc
Pin 3	144 vdc	296.6 vdc
Pin 4	144.3 vdc	288 vdc
Pin 5	0 vdc	0 vdc

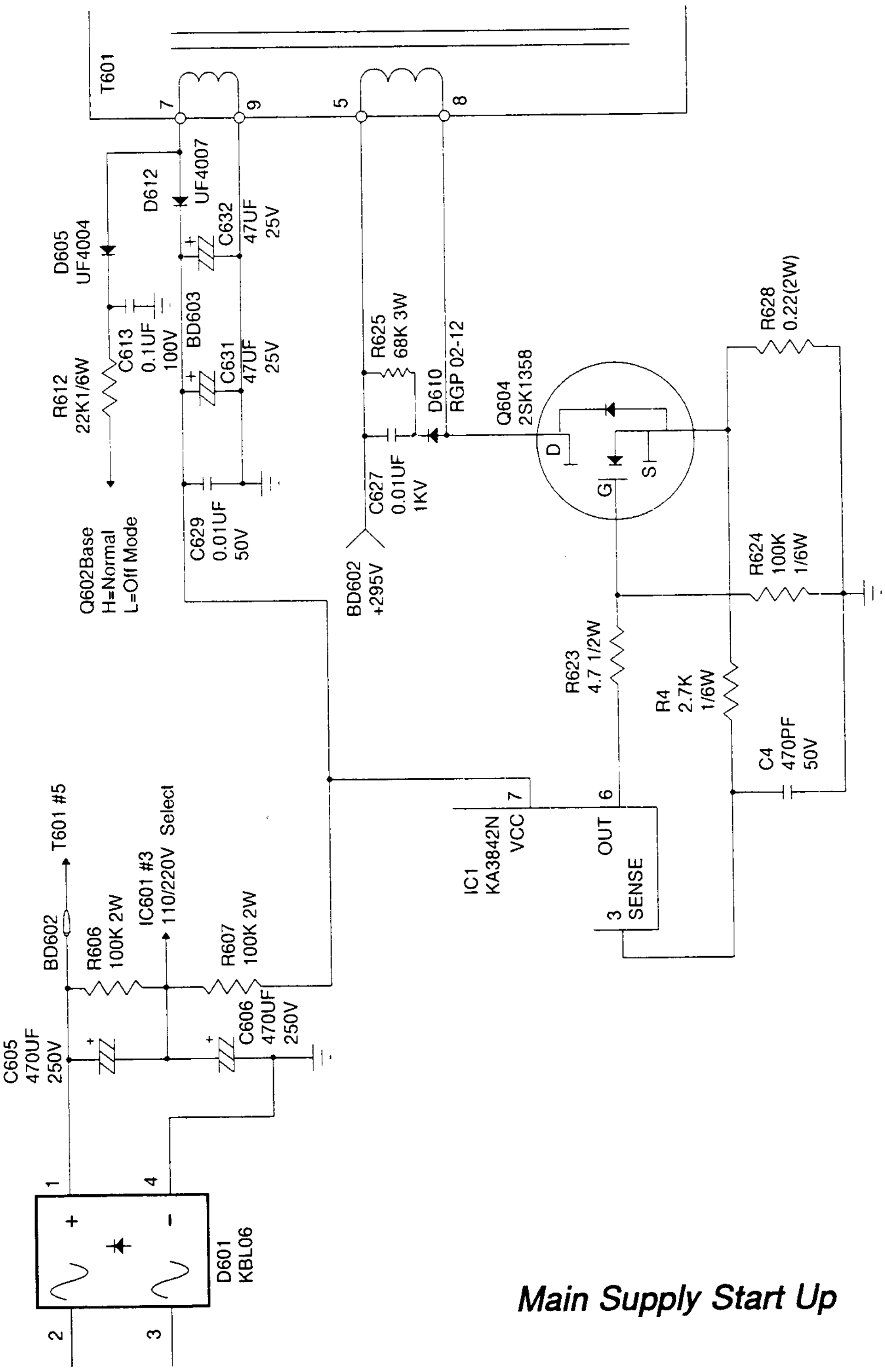


Voltage Selector

Start Up

Initially, when the power switch is turned on, the microprocessor's off mode power supply receives a start up voltage. The start up voltage is supplied from the bridge rectifier D601, which produces 295 vdc, through BD602. Starter resistors R614 and R615 will step down the voltage and supply a dc voltage to pin 2 of IC603 (STR17006). This will start the initial switching on the output pin 3 and will be sensed by T602, driving the winding on pin 2. Pin 2 of T602 will provide feedback to IC603 pin 2 to start the cycle by cycle switching. D607 and R618 provide negative feedback to pin 1 for current sensing in order to maintain and regulate the output. If active signals with vertical and horizontal sync are detected by the microprocessor, the main supply will start up and cutoff the voltage at pin 2 of IC603, the DPMS Off mode supply. The Off mode supply will run for approximately 2 seconds if powered on with sync applied.

Start up voltage to the main power supply is supplied to pin 7 of IC1 in HIC601 from R606 and R607. A starter voltage of 16 vdc is needed to initialize the first switching cycle out of pin 6, which will drive Q603(2SK1358) FET and **subsequently** drive T601 pin 8. Before the voltage at VCC drops below 10 vdc, pin 7 of T601, from the induced voltage applied to pin 8, will output the next cycle and will be rectified by D612, charging C632 and C631 to 16 volt VCC. A 5 volt reference output from pin 8, derived from the VCC, will free run the oscillator cycle by cycle, until the T603 supplies H-Sync to lock in the IC1 oscillator for continued regulated power.



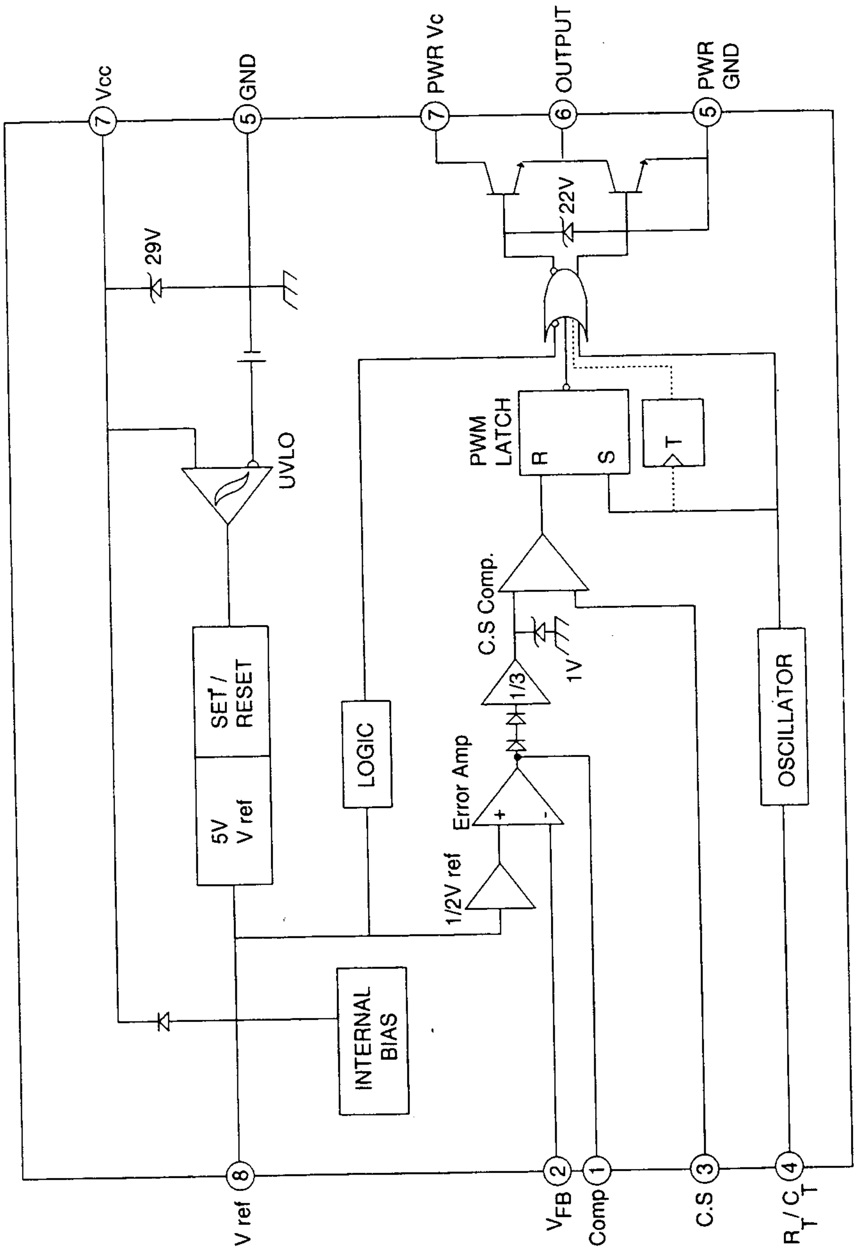
Main Supply Start Up

Output Amplifier

Q603 source to drain current amplifies with the PWM output from pin 3 of IC1, in order to drive T601 cycle by cycle. Pin 3 of IC1 monitors source current through R628. Compensation is done by an internal comparator with a 1 volt reference. D610, R625 and C627 snub Q603 switching positive peaks.

Pulse Width Modulation

IC1 (KA3842N) is a pulse width modulation integrated circuit. IC1 generates a pulse width duty cycle from a VCC derived 5 Vref., current sensing compensation, error amp, and a RC time constant oscillation. Each is monitored by an internal PWM latch and gate. An output switcher outputs the corrected pulse width duty cycle.

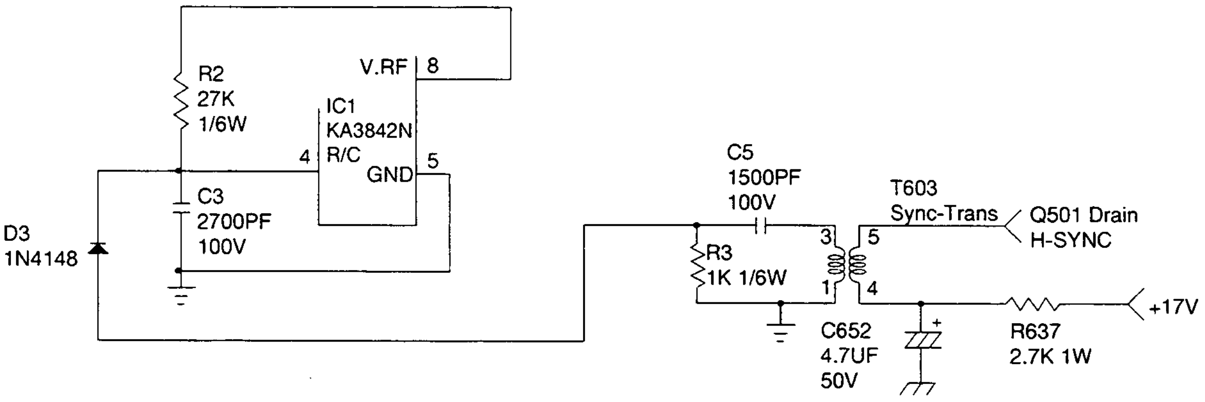


KA3842N Block Diagram

R/C Timing

Pin 8 of IC1 outputs a 5 vdc reference voltage to bias the oscillator circuit. C3 and R2 provide the time constant to develop an **ongoing duty cycle. Due to fluctuations in load from the** different horizontal scan frequencies, the oscillator must be compensated for. The main deflection pcb supplies a **pulse** from the horizontal driver Q501. Sync is supplied to T603 primary winding.

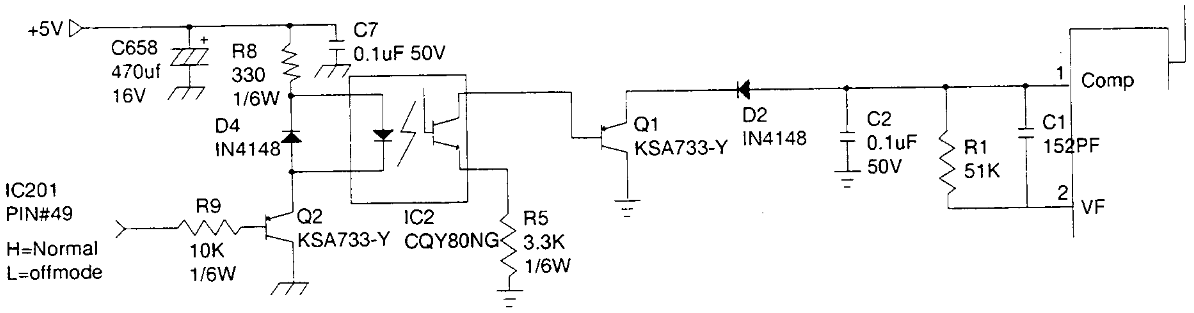
The secondary supplies sync to the anode of D3. D3 cathode signal charges and discharges C3 at the horizontal rate in order to control the oscillation and Q603 gate switching duty cycle.



R/C Timing

Flyback and Compensation

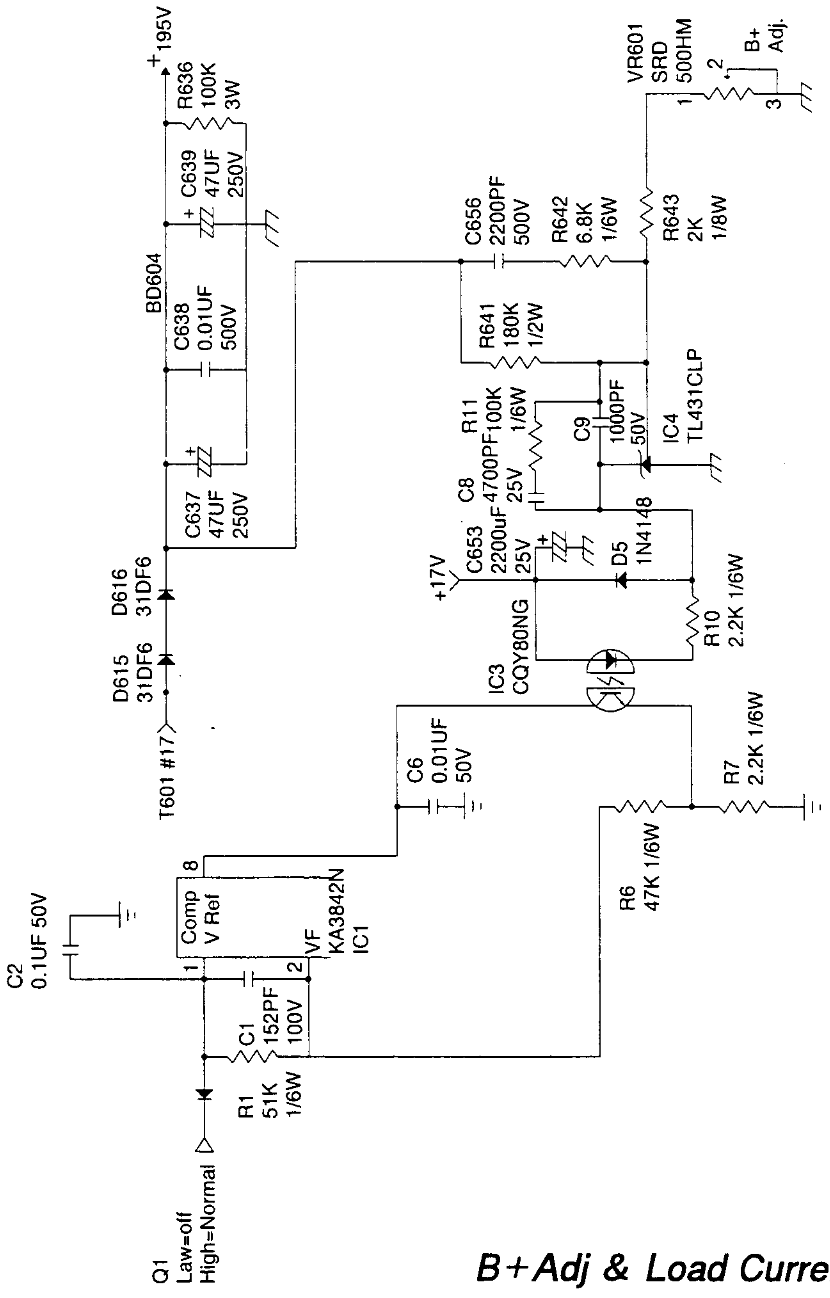
Pins 1 and 2 provide error amp detection by a feedback voltage from comp output pin 1 to inverting error amp input pin 2 to compensate for any errors in reference voltage. Also, pin 1, the error amp output, will be cutoff in the DPMS off mode by the micom command, causing D2 to turn on and force pins 1 and 2 low. **The flyback and compensation circuit also** monitors the load current from the output 195 volt line.



Flyback & Compensation

B+Adjust and Load Current Sensing

In order to adjust the output supply voltage as well as **regulating** the output due to a change in the load, which will affect the output voltage, the 195V line is monitored through IC4 (TL431CLP), opto-coupler IC3 (CQY80NG), and pin 2 of IC1. The output at pin 6 of IC1 will have the corrected duty cycle driving Q603.



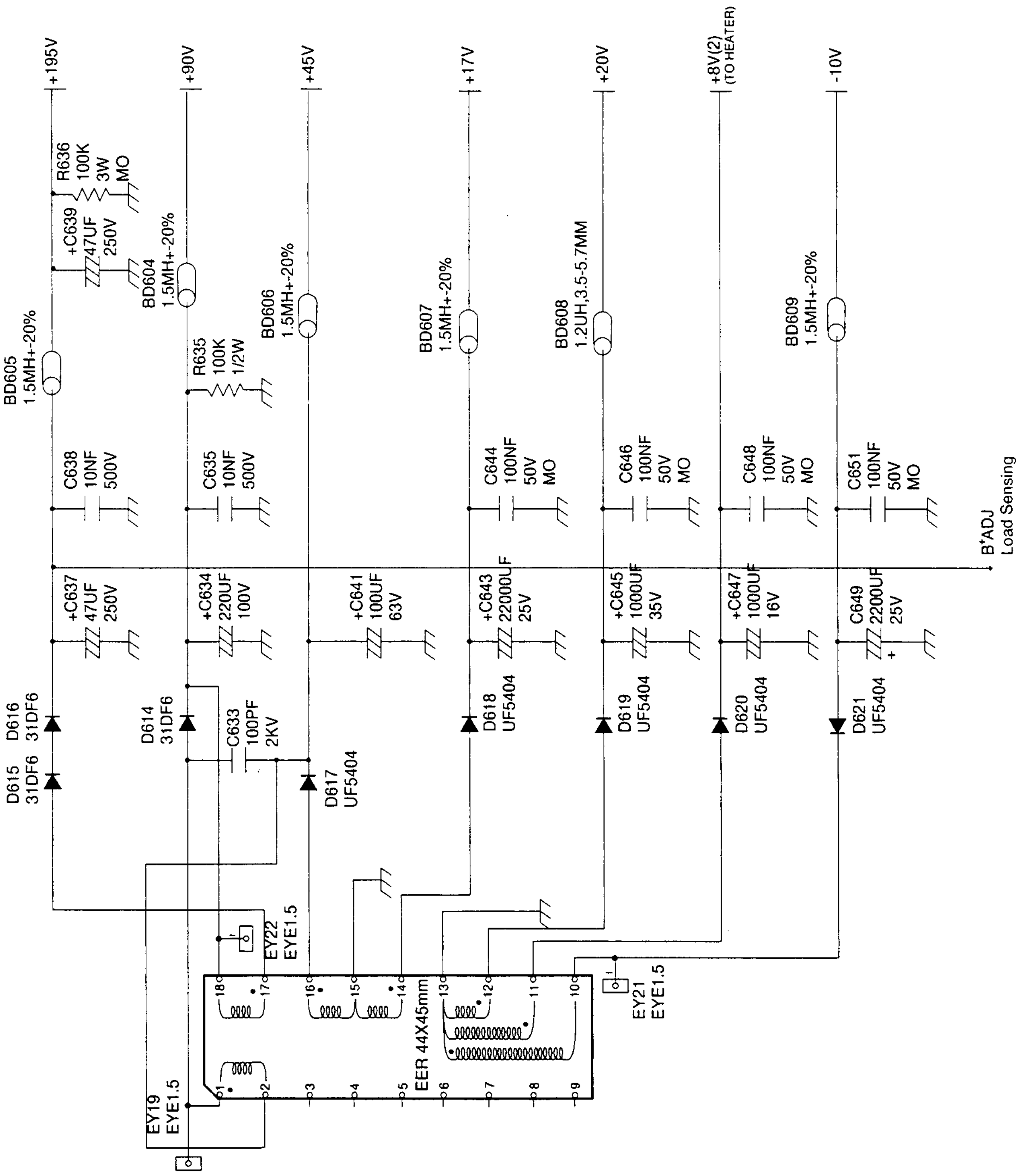
B+Adj & Load Current Sensing

SMPS Output Voltages

The switch mode transformer T601 outputs seven different peak to peak levels.
The outputs will be rectified to produce seven dc voltage lines. Pin 17 900 vpp is rectified by D615 and D616 and AC filtered to produce +195vdc. Pin 1 of T601 outputs a 680 vpp signal which is rectified by D614 and filtered to produce 90vdc. Pin 16 of T601 outputs a vpp signal which is rectified by D617 to produce 45vdc. Pin 14 of T601 outputs a signal which is rectified by D618 to produce 17vdc. Pin 12 outputs a signal witch is rectified by D619 to produce 20vdc.
Pin 11 outputs a 56vpp signal which is rectified by D620 to produce 8vdc.
Pin 10 outputs a Vpp signal which is rectified by D621 to produce -10 vdc.

Circuit Supplies

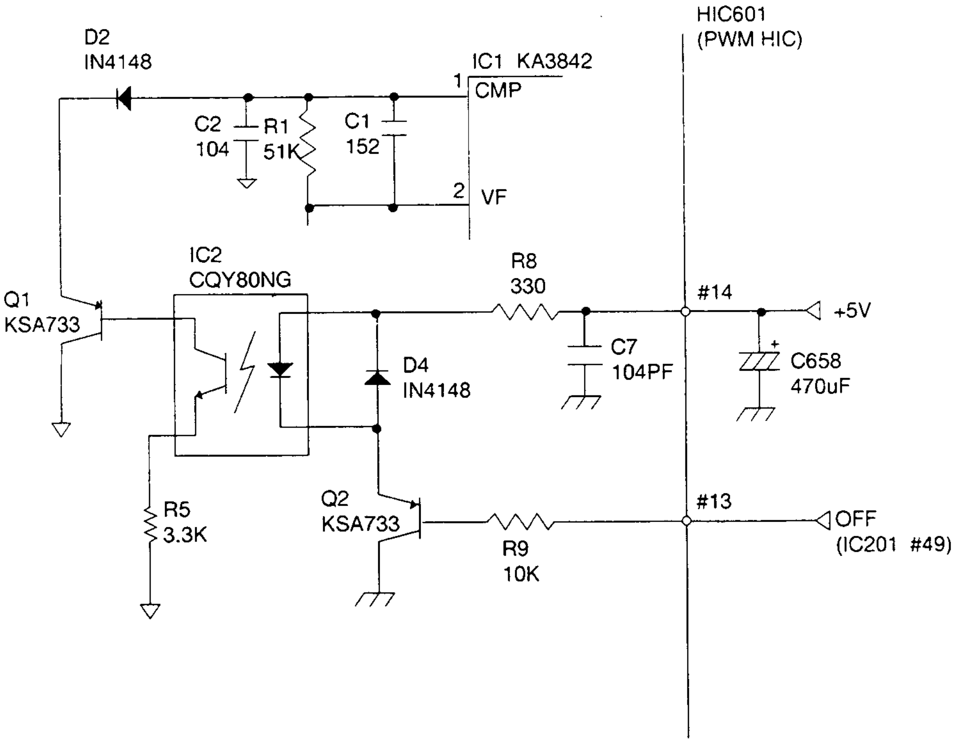
195V	Video cutoff, H-deflection, High Voltage, Dynamic focus.
90V	Video
45V	H-Deflection start
20V	High Voltage Drive, H-deflection drive
17V	V-Deflection, LED-Bias. SMPS Sync. SMPS Load sensing. IC601(12V, 5V Regulator)
8V	CRT Heater
-10V	V-Deflection



SMPS Output Voltage

Power Supply DPMS Off Mode Sensing

The power off mode is a command from the microprocessor when no sync input is detected from the signal source to the monitor. This is part of the VESA DPMS standard to conserve energy. The power saving circuit is used to maintain micom Vcc when the main supply is inactive. In the off mode, the micom detects missing horizontal and vertical sync. Once detected, the micom, IC201, outputs a low from pin 49. The low is sent to the base of Q2 turning on the transistor. This will turn on opto-coupler IC2, causing the emitter to go Low, thus turning on Q1. Once Q1 conducts, the collector goes low turning on D2 and driving pin 1 low on IC1. This will cutoff the output duty cycle at pin 6 of IC1, cutting off the drive to Q602. This will deenergize T601 forcing no output from pin 7 of the transformer. This will cause VCC to pin 7 of IC1 to be reduced to approximately 2.1 vdc., while causing Q602 to turn off, due to a lack of rectified voltage at the cathode of D605.

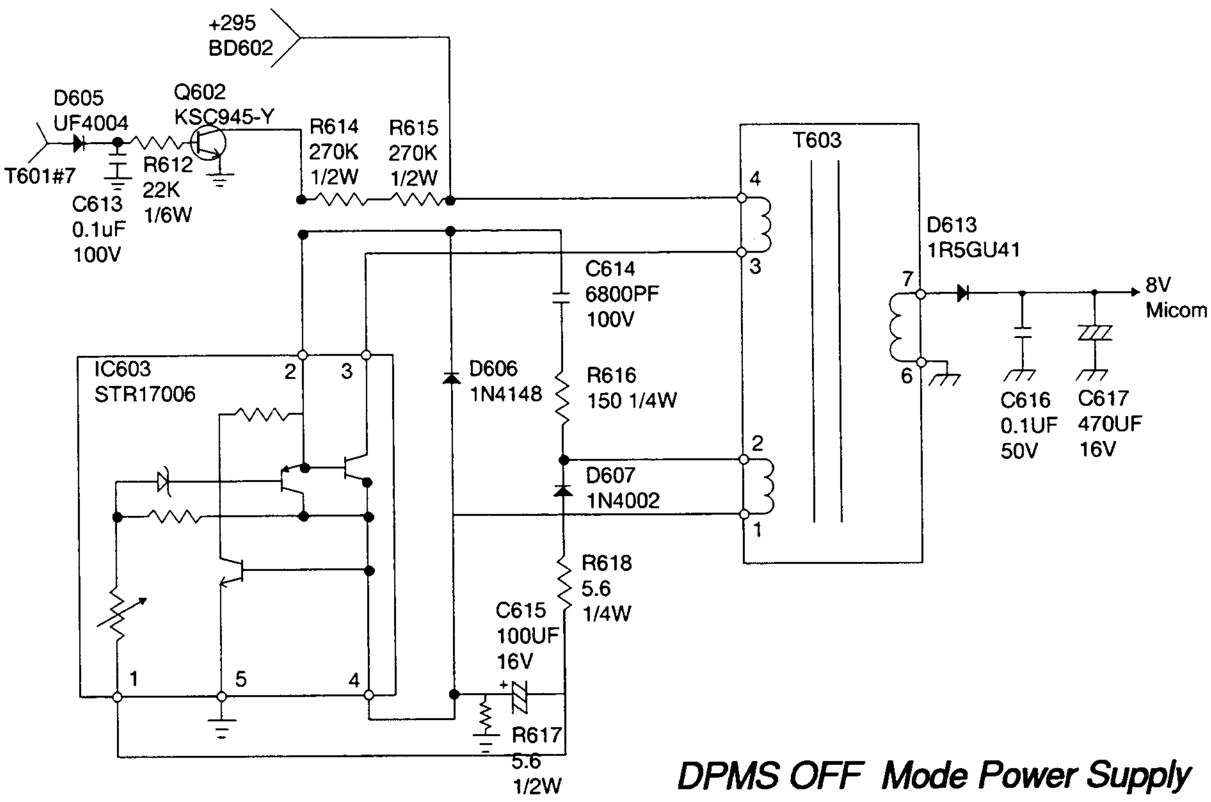


DPMS OFF Mode Sensing

DPMS Off Mode Power Supply

The power saving circuit can now be activated. With no output at pin 7 of T601, D605 will not rectify, causing Q602 to turn off, allowing starter voltage to be supplied to pin 2 of IC603. With 295vdc as collector voltage, the output at pin 3 will be driven low. This change will drive T602 to induce a voltage into the pin 2 winding.
A feedback from the transformer will be sensed at pin 2 of IC603 through R616 and C614, changing the state of the output again at pin 3. This will continue cycle by cycle. Pin 3 of IC603 outputs a 640 vpp duty cycle, driving T602 pin 3. T603 steps down the output at pin 7 to 24 vpp. D613 rectifies the 24 vpp waveform to 8 vdc for the microprocessor's VCC.

When the power switch is initially turned on, the power supply's Off mode power saving circuit operates for approximately 2 seconds (if active sync is already applied to the monitor). Otherwise the micom will wait till sync is applied again. Once the main supply gets up and running the output from T601 pin 7 is rectified by D605 (UF4004) to 18.8vdc and filtered by C613.
This turns on Q602, forcing pin 2 low on IC603 and cuts off the starter and feedback to the power saving circuit. The power saving circuit is now disabled.



DPMS OFF Mode Power Supply

2) Sync Interface

Connector Interface

The 17GLsi "M series" monitor is interfaced with BNC and 15 pin D-Type input connectors.

BNC Inputs	Signal
R	Red Video
B	Blue Video
G	Green Video or Sync on Green
H/V	Separate Horizontal Sync or Composite Sync
V	Vertical Sync

D-Type Input	Signal
Pin 1	Red Video
Pin 2	Green Video or Sync on Green
Pin 3	Blue Video
Pin 4	GND
Pin 5	DDC Return
Pin 6	Red Ground
Pin 7	Green Ground
Pin 8	Blue Ground
Pin 9	Reserved
Pin 10	GND-Sync/Self-Raster
Pin 11	GND
Pin 12	DDC Data
Pin 13	H-Sync
Pin 14	V-Sync
Pin 15	DDC Clock

Sync Interface

BNC and D type video inputs are selected by the micom control switch. Default is the D type when powered up with both signals supplied. Otherwise, it will select the active signal when powered up initially. If signal is detected missing while powered up, it will operate in the power saving mode.

The micom of he 17 GLsi has the sync processing circuit internally. This micom performs sync separation of composite TTL Sync, and **generates the positive horizontal and vertical sync.**

BNC and D-Sub Input Select

As mentioned, the input control switch on the front panel tells the micom to select BNC inputs or D-sub inputs. The micom will output from pin 21 5 volts for BNC or 0 volts for D-sub selection. This will be present on connector CN104 pin 7 and applied to IC102.

IC102 is a buffer IC with output enable control QE.
IC output is enabled when QE port is low.
BNC or D-sub Sync signal is input to IC102.
For the D-sub Sync selection, **selection signal from IC201 Pin #21 is input directly, but for the** BNC sync selection, reversed selection signal by Q106 is input to IC102.

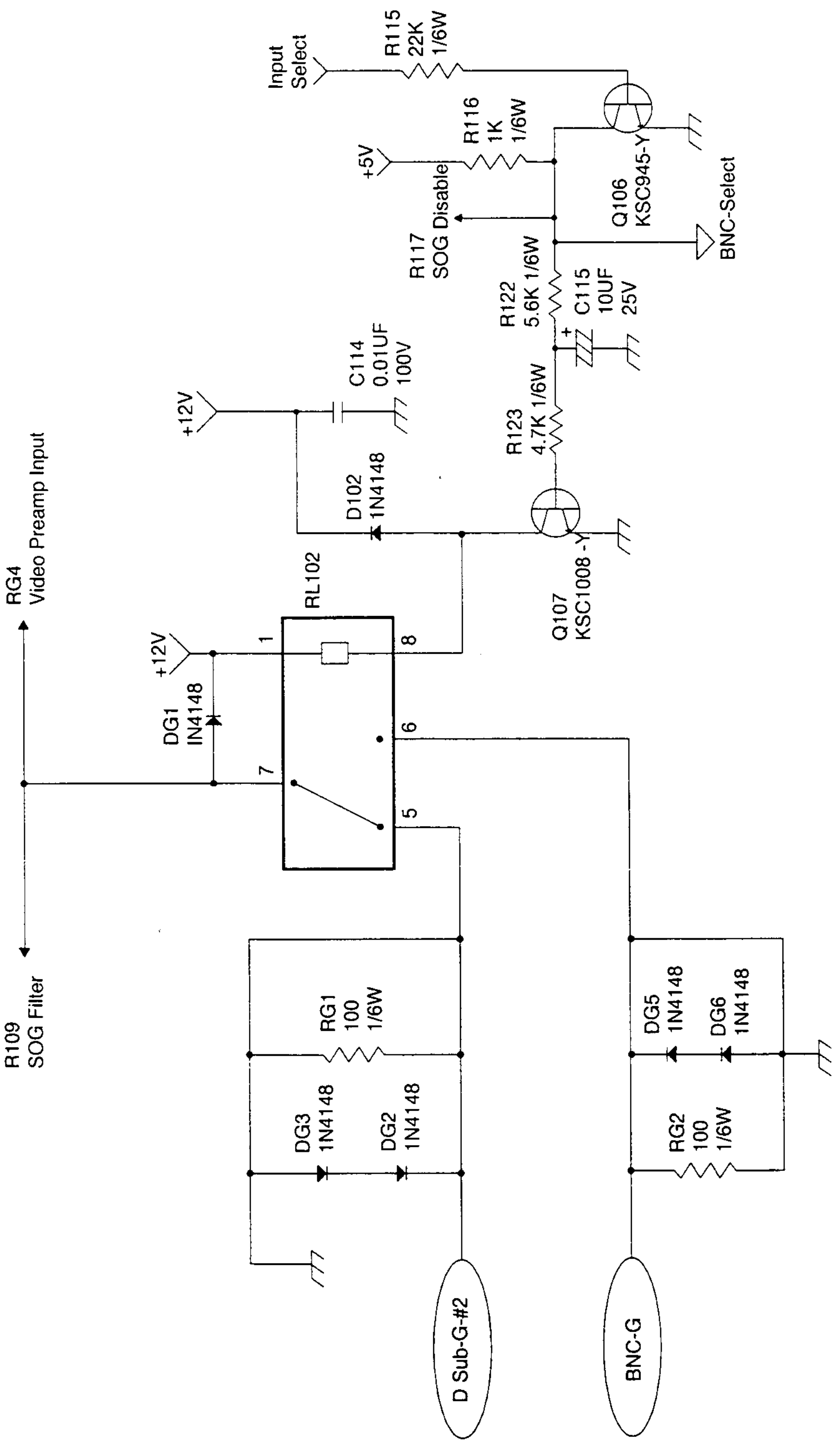
Sync On Green Interfacing

When using sync on green from the green video inputs, the video must be filtered and the analog sync must be brought to a 5 volt peak to peak level. The green signal with analog sync is input from the signal source either by means of the BNC or D-type connector.

In the case of the D-type connector, the sync mixed with green video is input from pin 2 and applied to pin 5 of relay RL102.

In case of the BNC green input, the video mixed with sync is applied to pin 6 of relay RL102.

Pin 8 of RL102 selects what pin is selected to be output on pin 7 of the relay. The micom, IC201, selects the input that is to be interfaced by the logic level output from it's own pin. The output from the micom will be interfaced to the Video/Interface pcb from connector CN202 pin 7 to connector CN104 pin 7. A low output will select the D-Sub inputs and a high will select the BNC inputs. When IC201 pin 21 outputs a low, Q106 turns off and Q107 turns on.
Pin 8 of RL102 will be forced low, selecting the sync on green D-Sub input.
When IC201 pin 21 outputs a high, Q106 turns on and Q107 turns off, forcing Pin 8 of RL102 to 12Vdc. The BNC green input is now selected.

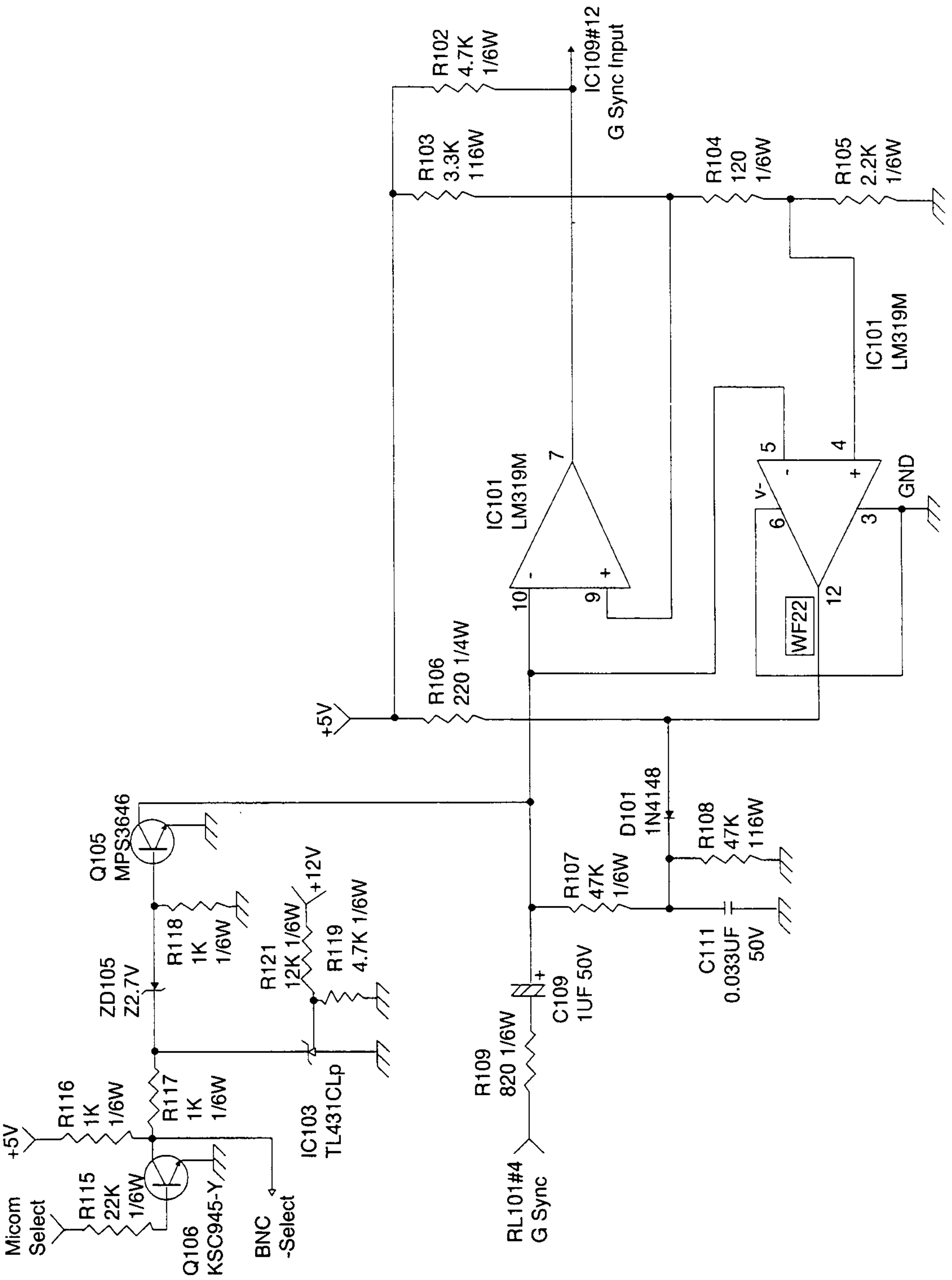


Sync On Green Interfacing

Sync On Green Filtering

Once the video line is selected, pin 7 of RL102 will output the composite green signal. The green signal with sync is sent to R109 to have the green video filtered out by the IC101 circuitry. C109 AC couples the SOG signal to inverting input pin 10 of IC101. A dc level of 2 volts for pin 10 is set up from the 5 volt source applied to D101 and voltage divider R107 and R108. This will give the SOG signal a 2 volt dc reference level and place the sync portion below the 2 vdc level. The non-inverting input on pin 9 also has a 2 vdc reference level. This voltage is setup by the 5 vdc source and the voltage divider which is comprised of R103, R104, and R105. The result will be a 5 vpp positive polarity composite sync output from pin 7, which will be sent to IC109 pin 2. In order to maintain the proper dc level at pin 10, pin 4 of IC101 is biased at 2 vdc, while pin 5 has the SOG signal. Pin 12 will output the positive composite sync, charging and discharging C111.

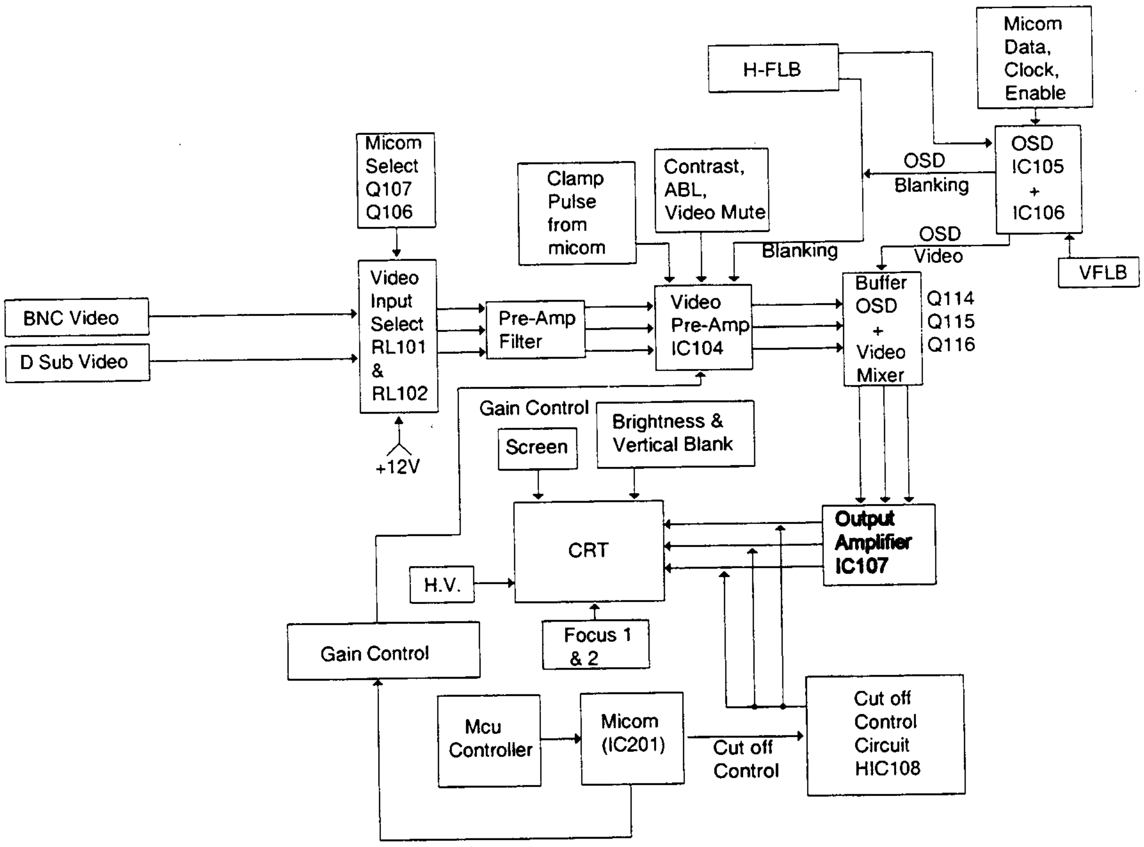
In order to prevent the SOG circuit from triggering a noise spike during off and suspend modes, Q105 goes into it's on state. This will ground out pin 10 of IC101.



Sync On Green Filtering

3) Video

The CMH chassis can accept either video from BNC or the D-Sub connectors.
The input selection is microprocessor controlled through the use of relays. The selected video is applied to a pre-amp, where amplitude is contrast controlled along with ABL and video mute. Gain is controlled by MCU controller as well as the user's color control. Horizontal and OSD blanking is applied to the pre-amp. The next stage buffers and mixes the video with the OSD video to be amplified by the output amplifier. The output amplifier, IC107, amplifies the video with the OSD video. The output dc level for cutoff is controlled by MCU controller.

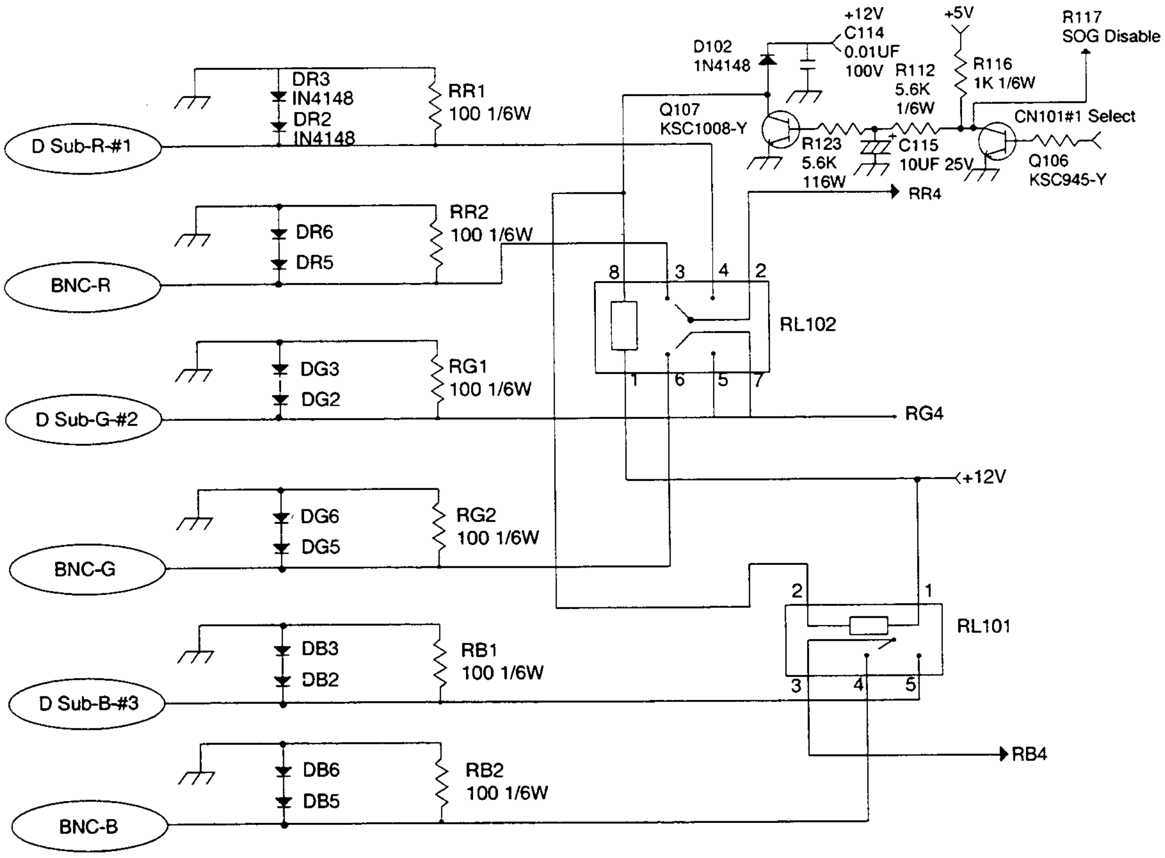


Video Block Diagram

Video Interface

RGB video is interfaced from BNC connector or the 15 pin D-type connector.

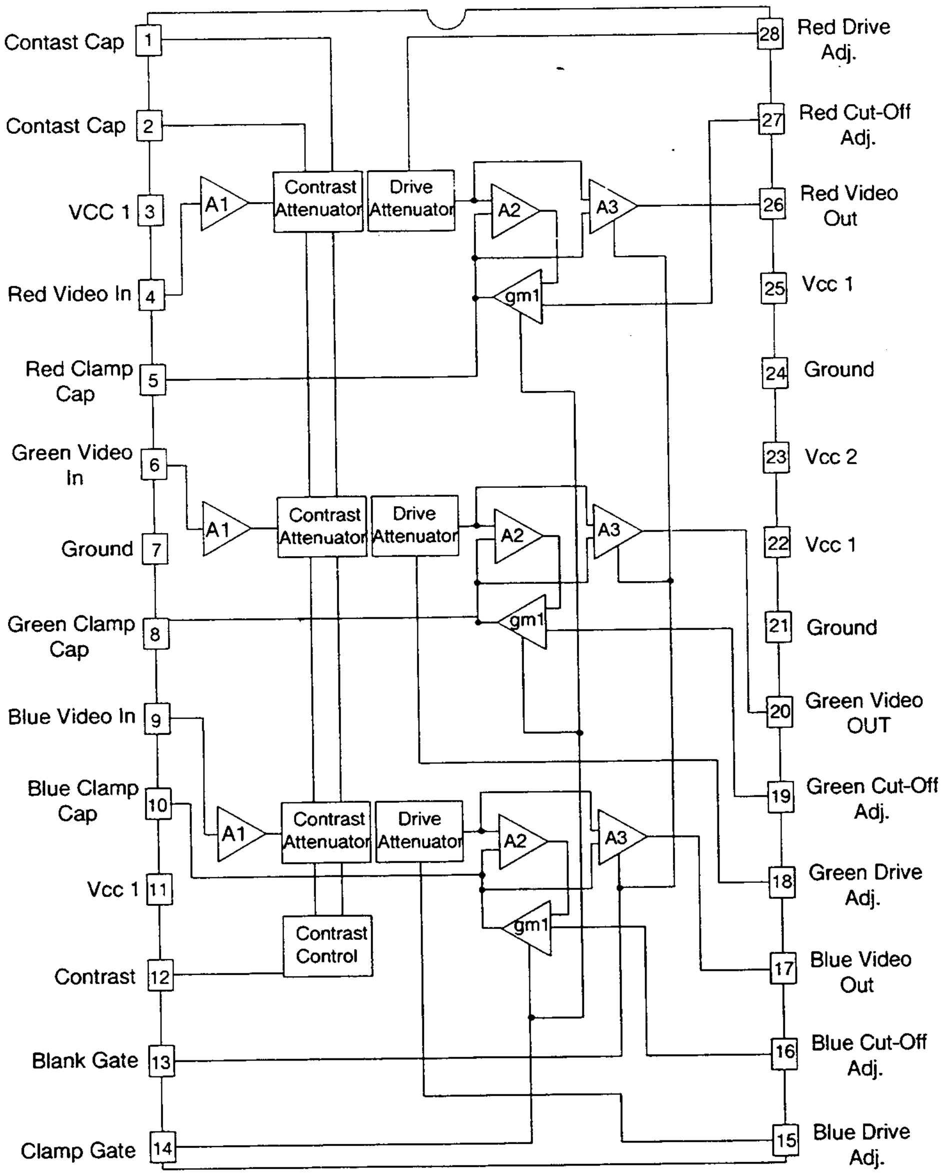
These video inputs are selected through relays RL101 and RL102 and are controlled by the microprocessor. IC201 will output a high from pin 21 for BNC RGB inputs and a low for the D-type RGB inputs. The logic level will turn on Q106 for BNC and turn off Q106 for the D-sub selection. By turning on Q106; Q107 will be turned off, selecting the BNC relay inputs. By turning off Q106, Q107 will be turned on, selecting the D-type relay inputs.



Video Interface

Video Preamplifier

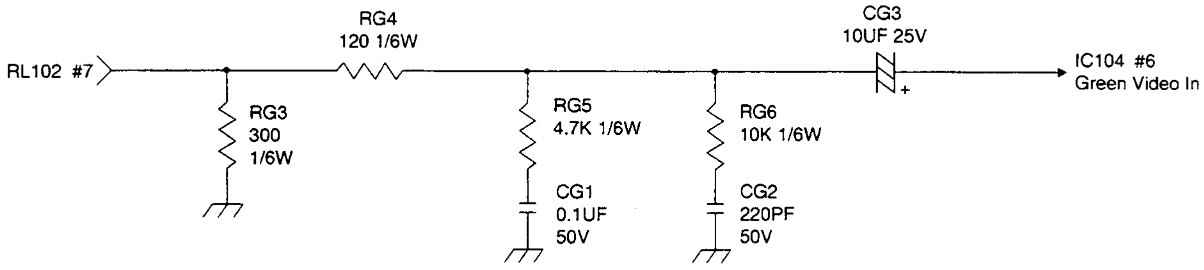
The video **preamplifier** that is used is a LM1205. The LM1205 has 3 wideband 130 Mhz amplifiers for red, green, and blue video. The output amplitude is controlled by external contrast and gain controls. Also, horizontal blanking is applied to the IC along with a clamp gate pulse to control the internal dc level and an external dc voltage to set the black cutoff level.



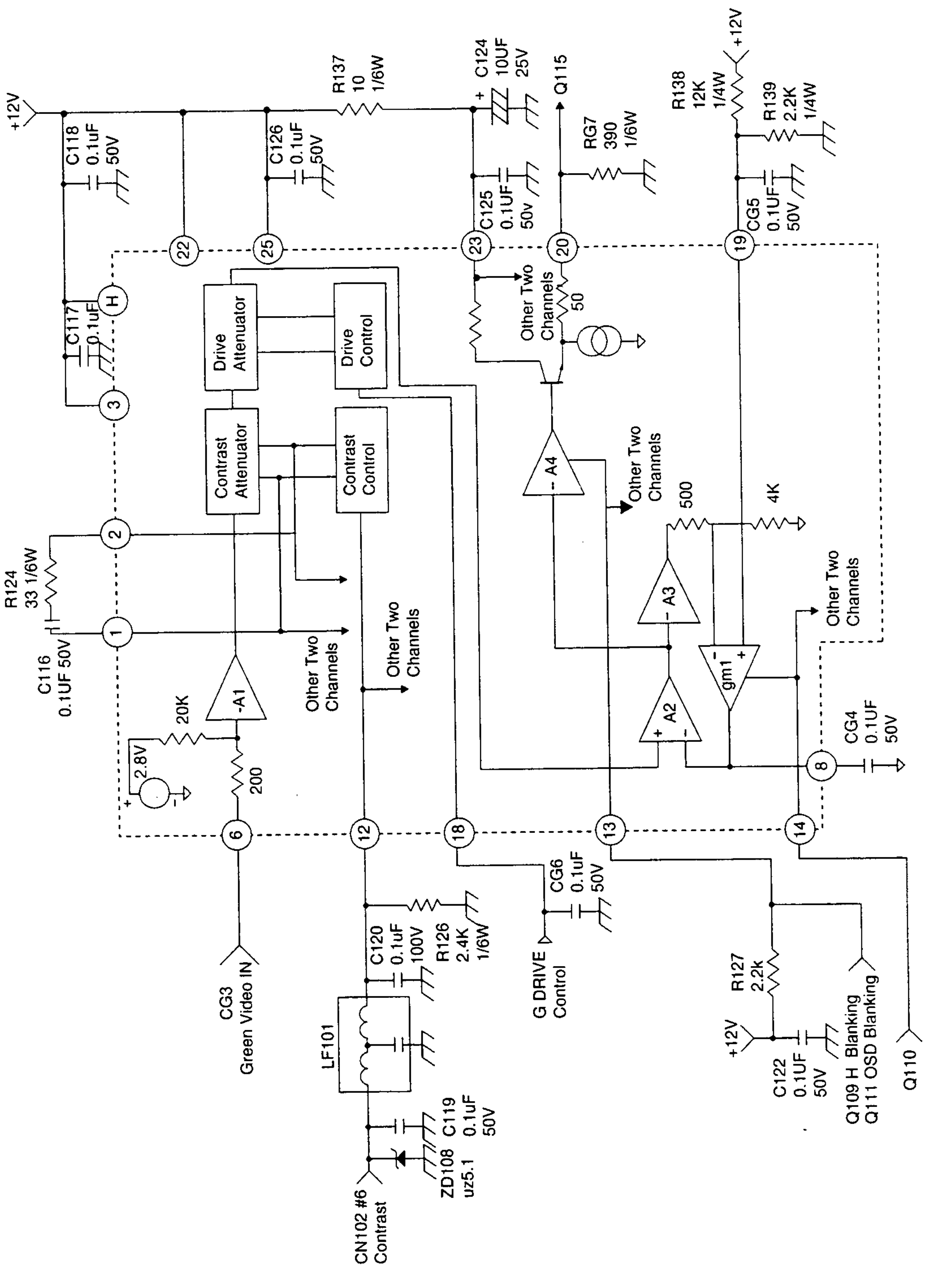
LM1205N Block Diagram

Green Video Input

For the purpose of simplicity, the green video will be discussed. Should either the BNC or D-type be selected, the green video will be output from relay RL102, pin 7. RG3, RG4, RG5, CG2, RG6, and CG2 at the input of IC104 pin 6, green video in, are used to limit the amplitude against surges above VCC and below chassis ground level. CG3 provides AC coupling of the video signal. IC104 (LM1205) will restore the dc level at the input internally. The dc restoration level is approximately 2.8vdc.



Green Video Input



Video Preamp

LM1205 Contrast Control

Internally, the video is amplified and controlled by the user's color control, and the servicer's gain controls. Green video is input at pin 6. The 200 ohm resistor is used for ESD protection and current limiting during surges. The signal is buffered and inverted by A1. A1 is composed of a buffer and inverter. The inverter will drive the contrast attenuator. The contrast attenuator is a differential amplifier. The video is applied to the emitters of the amplifier. The contrast control is a dc voltage, operating the base of both transistors in a differential pair. The voltage applied to the base of either transistor will change the amplitude level on the output. The change in contrast voltage is dependent on 4 items.

1. Automatic Contrast Limiting
2. User's contrast control
3. Video Mute

Contrast Input Operating Voltage

The contrast operating voltage is controlled at pin 12 of the LM1205 video preamp IC. Pins 1 and 2 are the final control voltage to this stage. The operating voltage range of pin 12 is from 0 to 2 volts dc. Using a full white pattern at 1024×768 resolution and 75Hz vertical frequency, contrast control, video mute, and ABL ranges are depicted below.

Control Status	Pin 12 Voltage
Contrast Minimum	.576
Contrast Maximum	1.674
Video Mute	17.8mv

Contrast Input ABL Range

Below is the range of ABL with the contrast and brightness controls set to maximum when different patterns and colors are displayed on the CRT.

Color and Pattern	Pin 12 Voltage
Full White Pattern	1.674
Full Yellow Pattern	1.741
Full Magenta Pattern	1.780
Full Cyan Pattern	1.802
Full Red Pattern	1.906
Full Green Pattern	1.952
Full Blue Pattern	1.979
50mm Box White	1.994

Contrast Attenuator

Pin 1 of the contrast attenuator is held constant at approximately 5.43 vdc. Pin 2 of the attenuator is the variable to control the output video level. Using the full white pattern at 1024×768 75Hz by setting the contrast control to minimum, the voltage is set to 5.49 vdc. Set the control to maximum, the voltage increases to 5.54 vdc. Using the 50mm box with the ABL at cutoff and the contrast set to maximum, the voltage decreases to 5.43 vdc. This gives us a 110mv swing in voltage, with the contrast set to minimum and maximum with the ABL at cutoff. C116, a 0.1uf 50V capacitor, is in the circuit to cutout crosstalk, while R124 33 ohm 1/6 watt is there to increase stability. Contrast variation at this point will vary the video out approximately 150mv peak to peak.

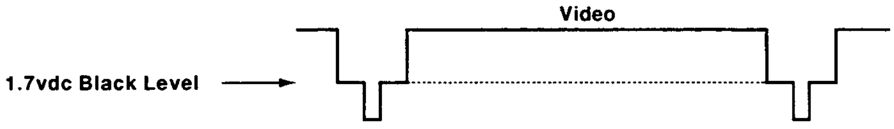
Drive Attenuator

Continuing with the green video that is output from the contrast attenuator, the video is input to the drive attenuator made up from another differential pair. The drive control is controlled by VCC and the voltage applied to pin 18 of the LM1205. The voltage on pin 18 is controlled by MCU controller. Variation of this control will range the voltage from 0 vdc at minimum gain, to 4.22 vdc at maximum gain. The nominal voltage at this pin is about 2.871 vdc. The signal derived from the drive attenuator will be applied to differential pair. The output from the differential pair's black level will be controlled by a clamp comparator.

Clamp Comparator

CG4 of pin 8 is used as a filter to clamp the dc level going to the video amplifier output stage. The clamp comparator receives a 5vpp negative polarity clamp gate pulse at pin 14 of the LM1205. Pin 19 receives a 1.7 vdc developed from the voltage drop across R138 and R139 and is fed by the 12 volt VCC source. This will be referenced to during the duty of the clamp gate pulse. By increasing the voltage at pin 19, the black level point will increase, causing a brighter raster. Decreasing the voltage will cause a decrease in raster brightness. The output of gm1 will charge and discharge CG4, leaving a pure dc for the video dc voltage level applied to the inverting input of A2.

During the back porch of the video signal, the clamp gate pulse is applied to gm1, turning on the comparator. During this period, the video out is compared to the voltage on pin 19 to set the black level.



Amplifier A3 is used to restore the dc level to the video signal. A4 is a high gain current amplifier 10 times the output of A3. A blanking pulse is applied to pin 13 and applied to A4. This will drive the output on pin 20 to less than 0.1 vdc during the period when video is inactive. This will blank the video during horizontal retrace of the CRT deflection yoke.

The final stage of A4 buffers out the video signal. In order to match the loading of the feedback section, RG7(390 ohm) is tied to the output of pin 20 and ground. Vcc2 at pin 23 supplies the output stage with collector voltage. Vcc1 supplied to pins 3, 22, and 25 provides bias voltage to the main functions of the LM1205N.

Video Output

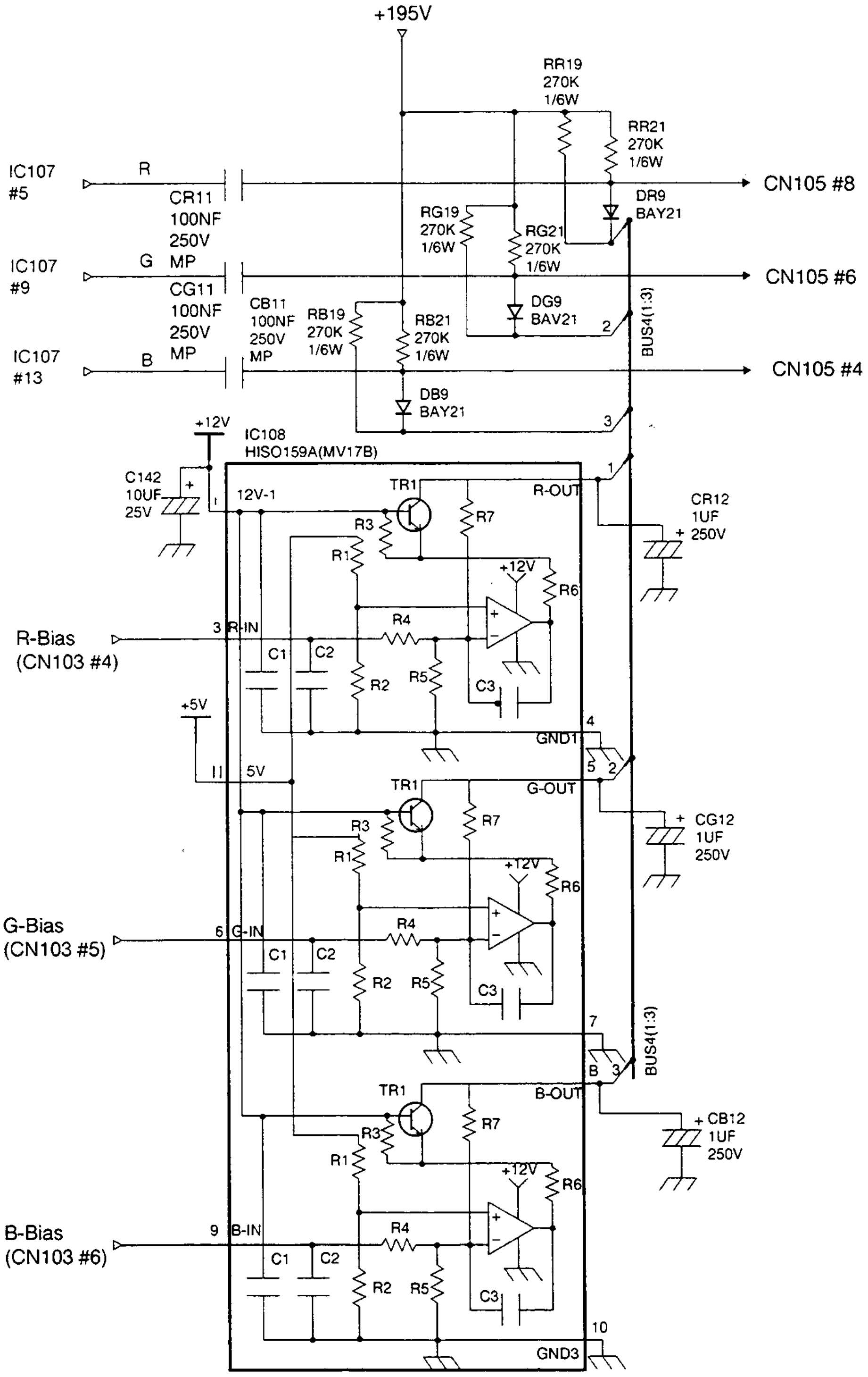
The video output from pin 20 of IC104 is applied to the base of Q115(2N5770) and buffered to the emitter, where it will be mixed with the On Screen Display video when activated by the user. The signal is applied through RG 17 to pin 7 input of IC107 (VPS10) and amplified to a 40vpp level including blanking.

The video output from pin 9 of IC107 is filtered of positive peaks by DG8 (BAV 21) and AC coupled by CG11. The CRT dc cutoff voltage is provided by the 195vdc source. The amount of dc is variable controlled by the 12vdc source providing bias for TR1 (MPSA42) and LM324 in the cutoff hybrid IC (HIC108). The approximate dc voltage range for the CRT cutoff control is listed below.

80 vdc for CRT cathode saturation.
130 vdc for CRT cathode cutoff.
110 vdc is the nominal CRT cathode voltage.

Cutoff Control

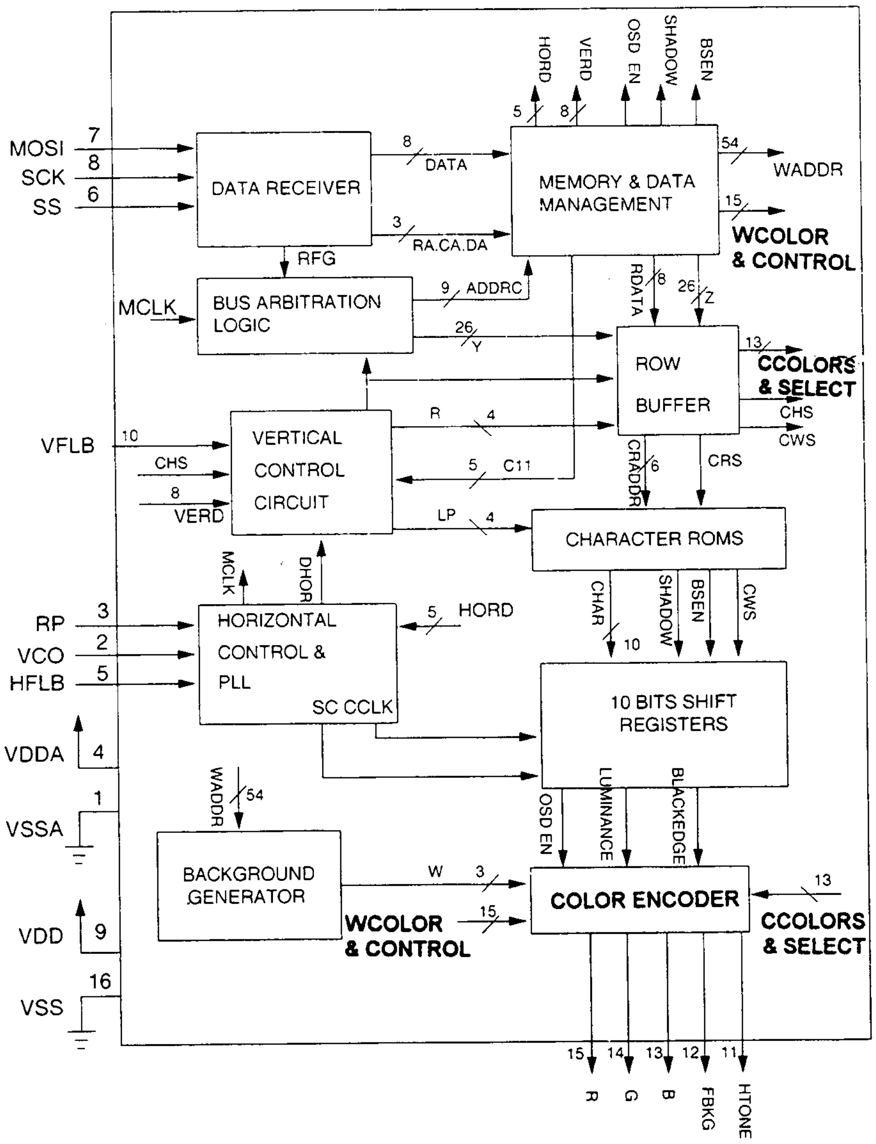
G-Cutoff adjustment by MCU controller creates a voltage drop across R5, which will apply the voltage to pin 6 of LM324. When increasing the voltage drop across R5, the adjustment will cause an decrease in voltage on pin 7. That causes TR1 to operate in saturation and decrease the collector voltage driving the CRT cathode towards saturation. Decreasing the voltage, with adjustment, at pin 6 of LM324 will increase the voltage at pin 7 and operate TR1 in cutoff. This will increase the CRT cathode voltage, operating it in cutoff. Pin 5 of the op amp has about 2.8 Vdc reference level.
This Voltage is setup by the 5 Vdc source and Voltage divider which is comprised of R1 and R2.



Video Output & Bias Control

On Screen Display

The CMH7379 uses a MC4320P OSD character plus background generator and a QM74HC125PS non inverting buffer in it's OSD circuit. The MC4320P located at IC105 operates off of commands from the micom. When a key is pressed, except for the manual degauss key, the micom sends an Enable, Data, and Clock to IC105 pins 6, 7, and 8. The OSD will remain active on the screen for approximately 8 seconds before and after user adjustments are made, or until that particular function key is pressed through it's cycle.



MC4320

System Block Diagram

MC4320 Pin Outs

Pin 1-VSSA

It provides the signal ground to the PLL circuitry. Analog ground for PLL is separated from digital ground for optimal performance.

Pin 2-VOLTAGE CONTROL OSCILLATOR INPUT(VCO)

A DC control voltage input to regulate an internal oscillator frequency. See figure 10 for the application values used.

Pin 3-RESISTOR(RP)

An external RC network is used to bias an internal VCO to resonate at **a specific dot frequency**. The value of the resistor for this pin should be adjusted in order to set the pin voltage to around half VDD. See Figure 10 for the application values used.

Pin 4-VDDA

A positive 5V DC supply for PLL circuitry. Analog power for PLL is separated from digital power for optimal performance.

Pin 5-HORIZONTAL FLYBACK(HFLB)

This pin inputs a negative polarity Horizontal Synchronize signal pulse from a host monitor to phase lock into an internal system clock generated by the on-chip VCO circuit.

Pin 6-SLAVE SELECT(SS)

This input pin is part of the SPI system. An active low signal generated by the master device enables this slave device to accept data. Pull high to terminate the SPI communication.

Pin 7-SERIAL DATA INPUT(MOSI)

Data and control message are being transmitted to this chip from a host MCU via this wire which is configurated as an uni-directional data line. (Detailed description will be discussed in the SPI section).

Pin 8-SERIAL CLOCK INPUT(SCK)

A separate synchronizing clock input from the transmitter is required. Data is read at the rising edge of each clock signal.

Pin 9-VDD

This is the power pin for the digital logic of the chip.

Pin 10-VERTICAL FLYBACK(VFLB)

Similar to pin 5, this pin inputs a negative polarity of Vertical Synchronize signal from the monitor set to synchronize the vertical control circuit.

Pin 11-HTONE

This pin outputs a logic high during windowing except when graphics or character is being displayed. It is used to lower the external R, G, B amplifiers gain to achieve a transparent windowing effect.

Pin 12-FAST BLANKING(FBKG)

This pin will output a logic high while displaying characters or windows when FBKGC bit in frame control register is 0, and output a logic high only during displaying characters when FBKGC bit is 1. It is defaulted to high impedance state after Power on or when there is no output. An external 10K Ohm resistor pull low is recommended to avoid level toggling caused by hand effect when there is no output.

Pin 13, 14, 15-BLUE, GREEN, RED(B.G.R)

OSD color output in TTL el to the host monitor. These three signals active high output pins are in high impedance state when OSD is disabled.

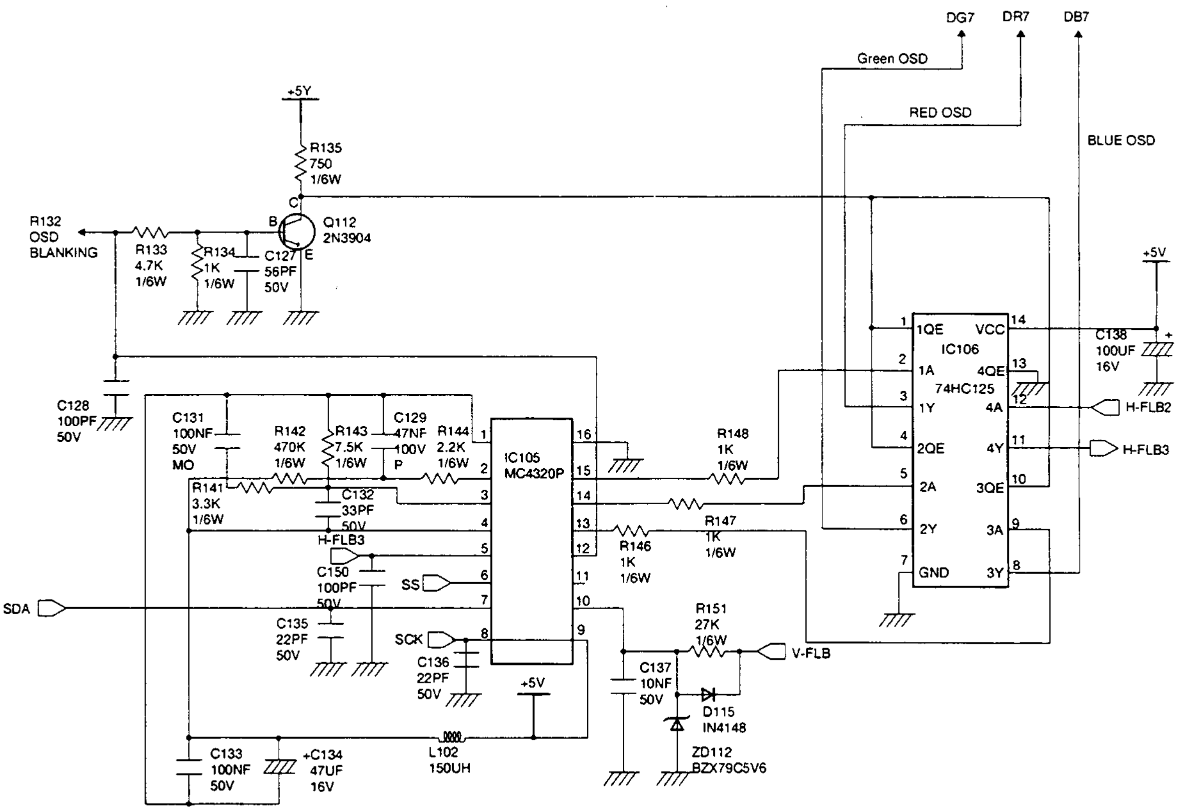
Pin 16-VSS

This is the ground pin for the digital logic of the chip.

On Screen Display Buffer

The OSD video is buffered through IC106(QM74HC125P5). Blue OSD is input at pin 9. Green OSD is input at pin 5. Red OSD is input at pin 2. The outputs are enabled by the blanking output from the OSD generator IC105. Pin 12 of IC105 outputs a positive polarity blanking pulse. The pulse is applied to the base of Q112, while R133 and R134 bias the base emitter junction of Q112. The signal will invert and amplify to a 5vpp level. The pulse will then be applied to IC106 pins 1, 4, and 10. An active low at these pins will enable the buffer OSD outputs on pins 3, 6, and 8 red, green, and blue respectively.

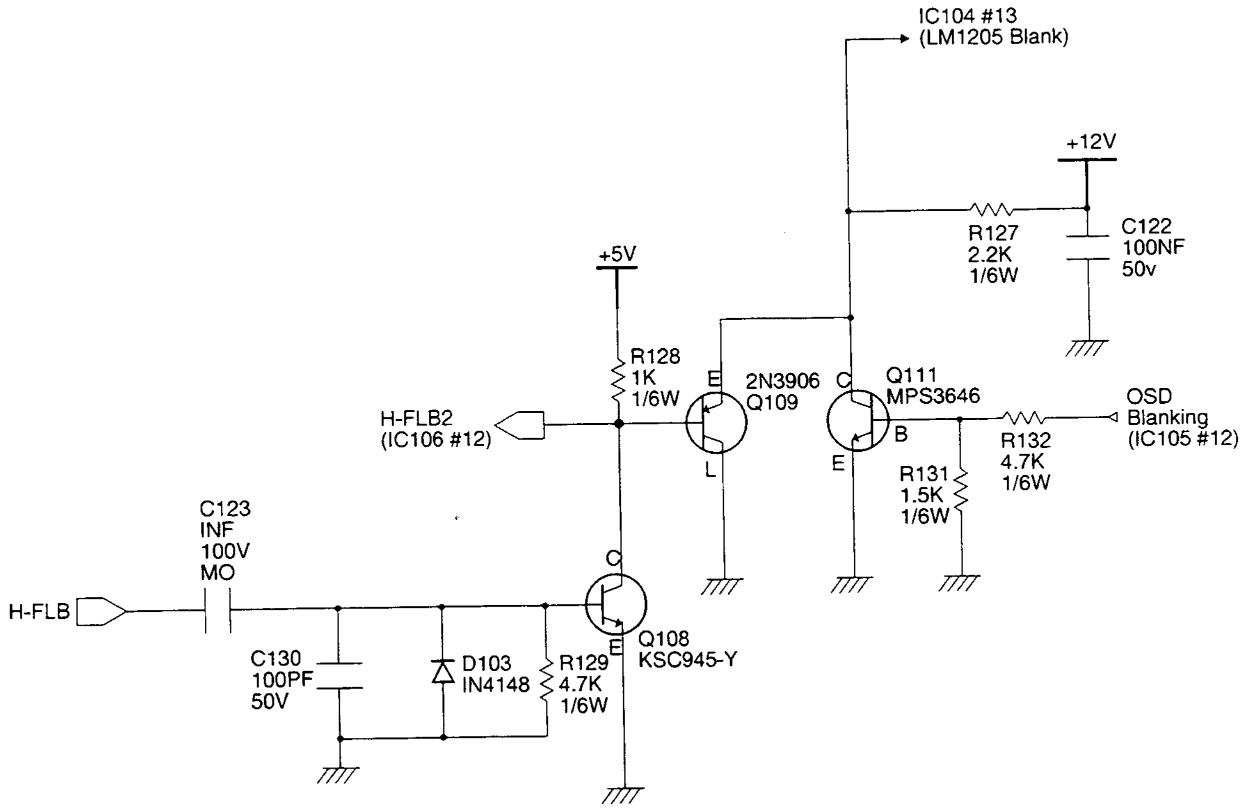
The red, green and blue OSD video will be applied to the anodes of diodes DR7, DG7, and DB7 respectively. The diodes will buffer through the OSD video to the cathodes where they will mix with the video from IC104 at the emitters of Q114, Q115, and Q116. The OSD video can now be amplified, along with the RGB video, by IC107(VPS10).



OSD Circuit

LM1205 Horizontal Blanking

The horizontal blanking circuit receives a H-flyback pulse from the main pcb horizontal deflection circuit via CN602 pin 2. This is a 20 vpp pulse which will connect to CN102 pin 2 on the video pcb. C123 will AC couple the H-FLB pulse to the base of Q108. D103, C130, and R129 bias the base emitter junction of Q108. Q108 will amplify the H-FLB to a negative polarity 5vpp pulse. At this point H-FLB will be supplied to pin 5 of the OSD IC105 and also buffered by Q109 to pin 13 of IC104.



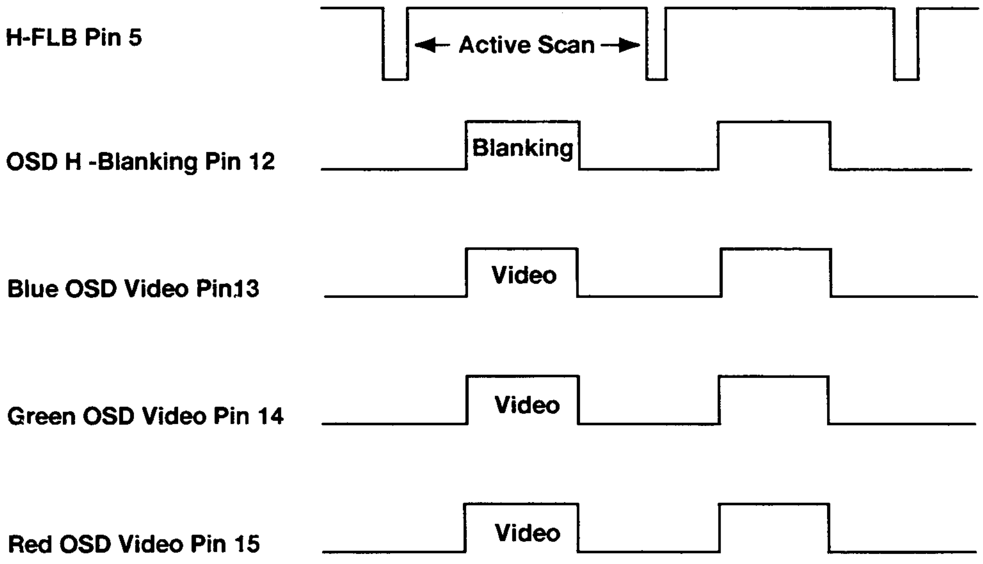
Horizontal Blanking Circuit

OSD Blanking

The OSD blanking is generated out of IC105 pin 12 as a positive polarity and will be applied to the base of Q111. R132 and R131 set the biasing for the base emitter circuit. Q111 will amplify and invert the blanking signal to a negative polarity 5 vpp signal at the collector and apply it to IC104 pin 13 during OSD function.

OSD Timing

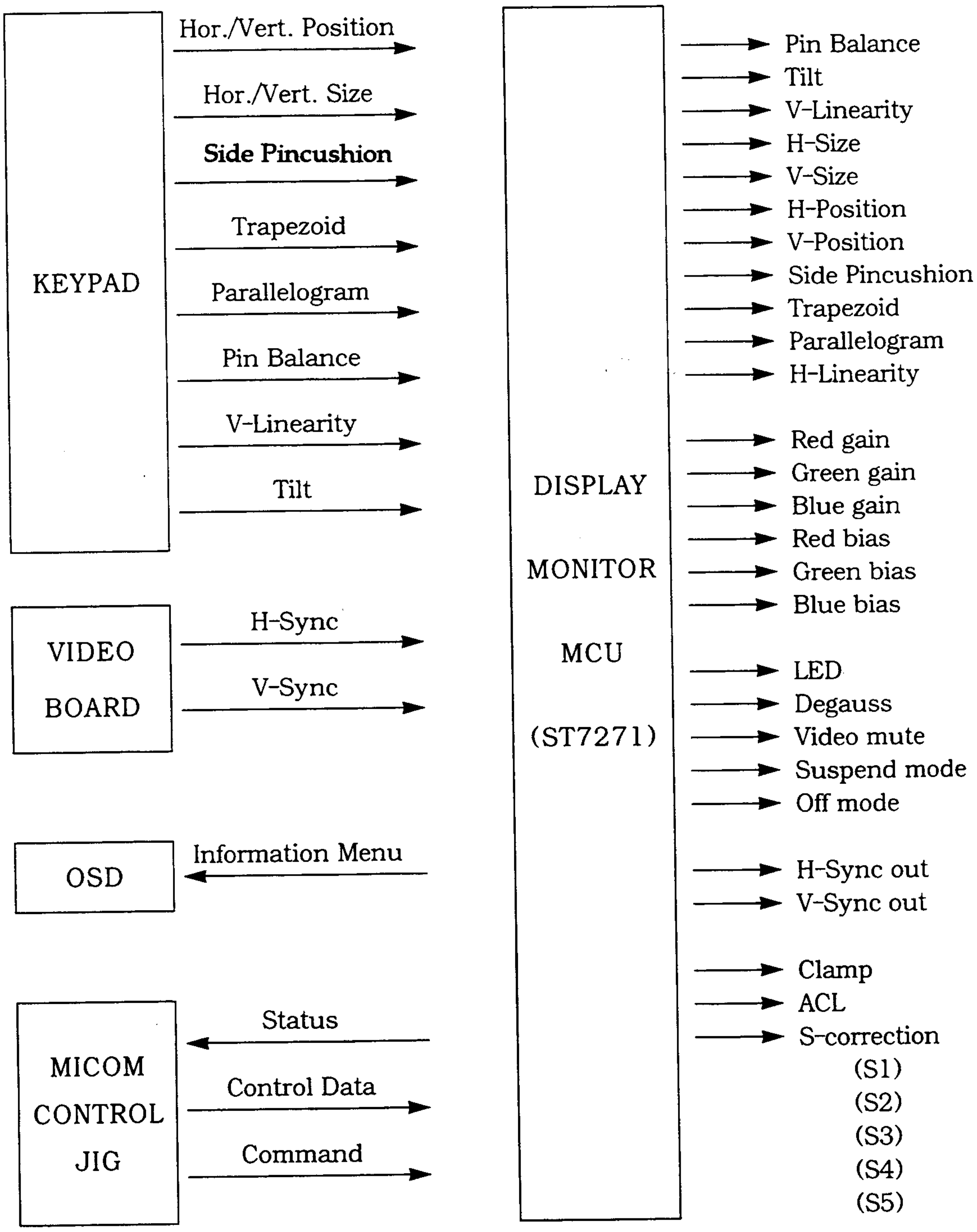
Below is the timing relationship between the OSD video and blanking output from IC105(MC43209) and the horizontal scan rate as it is input to pin 5 of IC105.



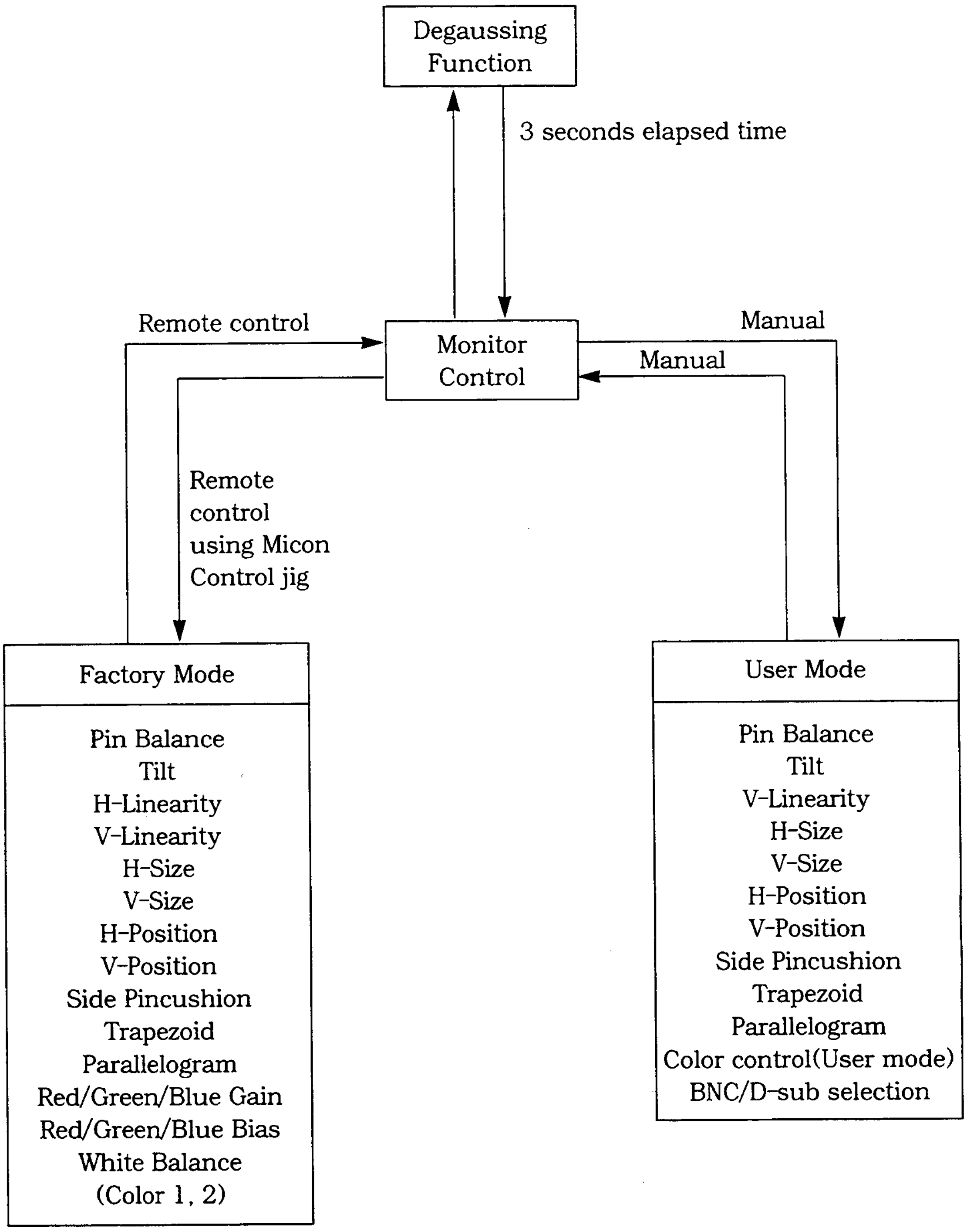
4) Microprocessor Unit

(1) Specification of Monitor control software

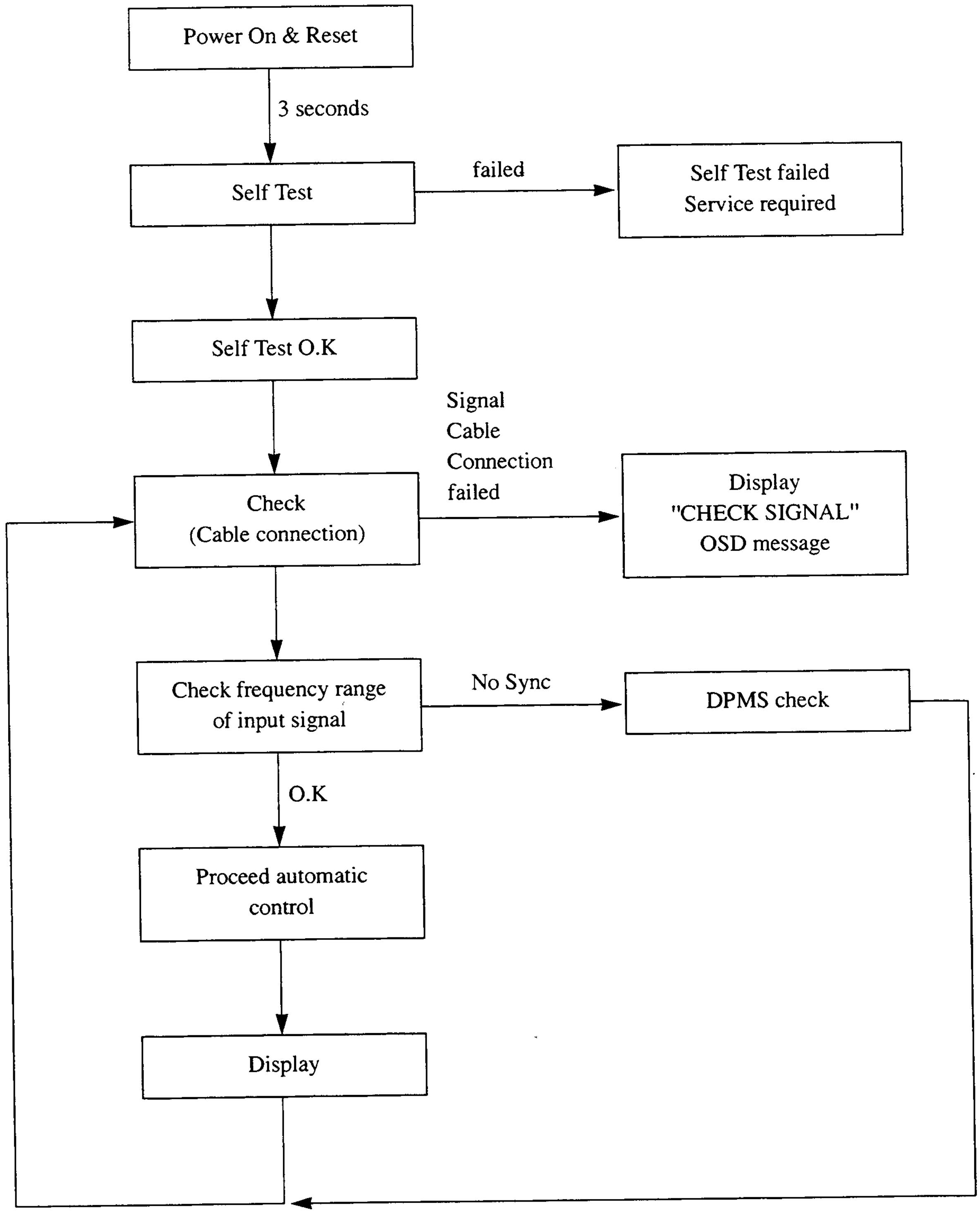
(1-1) Context Diagram



(1-2) Monitor Control Menu Tree

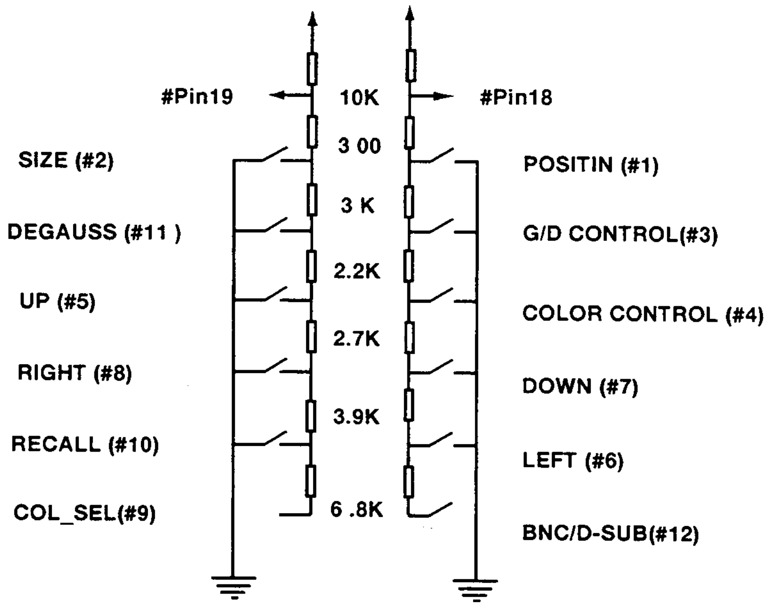


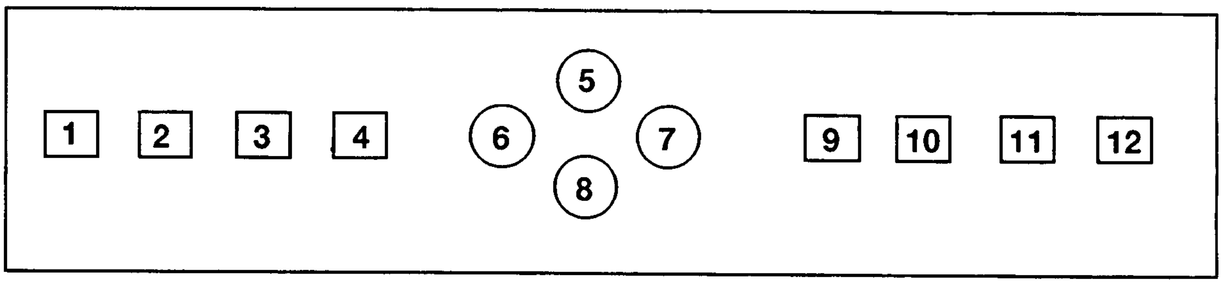
(1-3) Flow Chart of Operation



(2) Description of MCU Pin Configuration

(2-1) Input Key Pad Definition

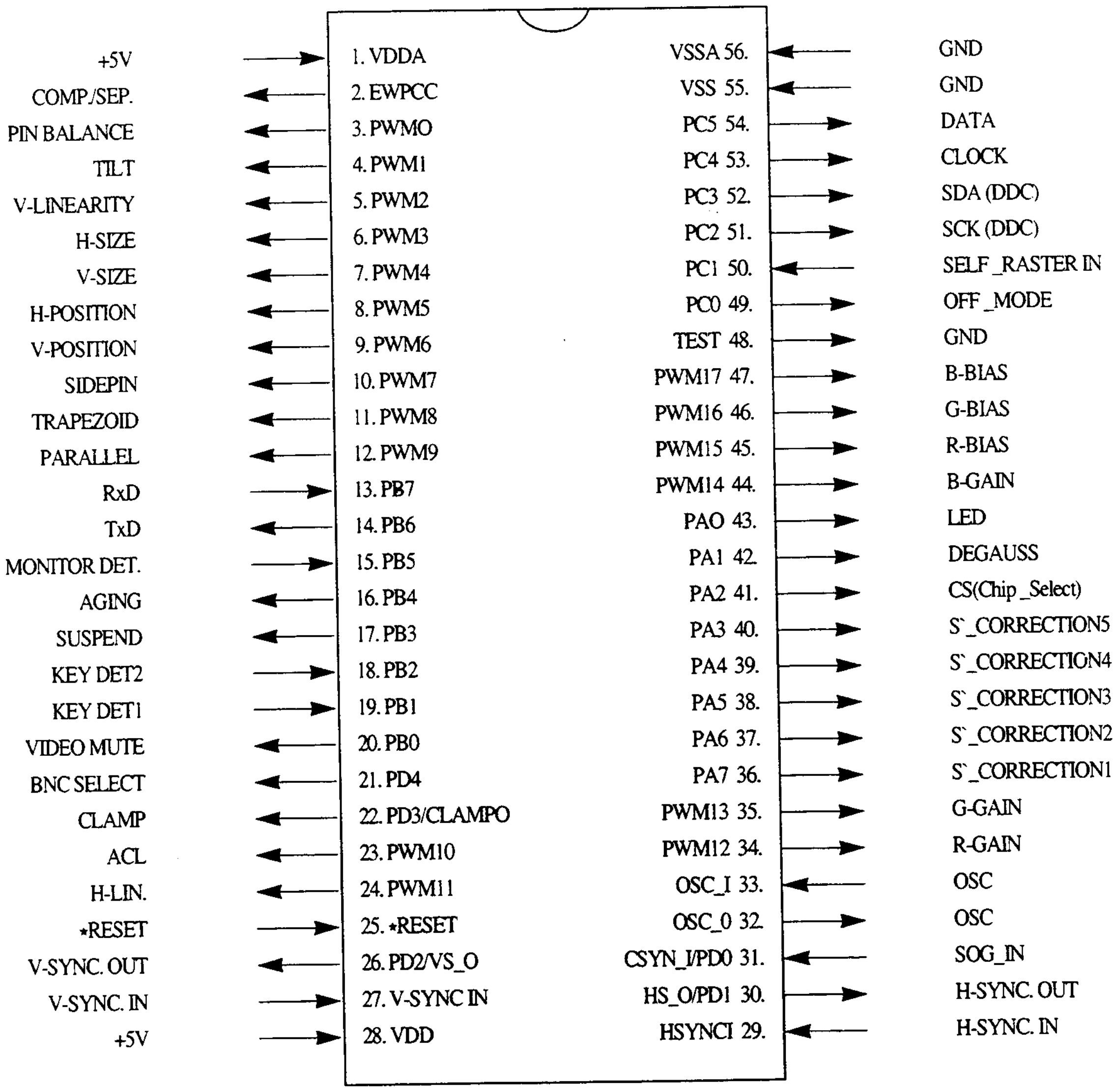




(2-2) MCU Port Configuration

- Pin 1(VDDA) : Power supply port for driving Pin 2(EWPCC)
- Pin 2(EWPCC) : Power input from pin 1 and composite/separate sync signal output to correct V-sync(to solve **interchangeability problem of special signal** source)

- Pin 3~12(PWM 0~PWM 9) : DAC output port to get DC voltage by filtering output of PWM system. Controls tilt, V-Linearity M-size, V-size, M-position.
  V-position, trapezoid, parallelogram along with horizontal, vertical oscillation and **deflection circuits.**
  - ○ Composite sync input : Low
  - ○ Separate sync input : High
- Pin 13~14(PB6, PB7) : Transmission, Reception port. The communication line of micom control JIG and monitor



- Pin 15(PB5) : Input port sensing monitor model
  - Low : Samsung basic model
  - High : Private model
- Pin 16(PB4) : Set aging port. No sync : High
- Pin 17(PB3) : Suspend mode signal output
  - Enable : Low
  - Disable : High
- Pin 18~19(PB1, PB2) : Key input port
- Pin 20(PB0) : Video mute signal output
- Pin 21(PD4) : Select input signal
  - BNC Input : High
  - D-sub input : Low
- Pin 22(PD3) : Clamp signal output port
- Pin 23~24(PWM10, PWM11) : AS 7DAC output, ACL level and H-Linearity control signal output.
- Pin 25(*Reset) Reset port Low Active
- Pin 26(PD2) : V-Sync output port
- Pin 27(V-SYNC IN) : V-Sync input port
- Pin 28(VDD) : B^+
- Pin 29(H-SYNC IN) : H-Sync input port
- Pin 30(PD1) : H-Sync input port
- Pin 31(PD0) : Sync on Green signal input

	S1(PA7)	S2(PA6)	S3(PA5)	S4(PA4)	S5(PA3)
30~33KHz	HIGH	HIGH	HIGH	HIGH	HIGH
33~40KHz	HIGH	HIGH	HIGH	HIGH	LOW
40~53KHz	HIGH	HIGH	HIGH	LOW	LOW
53~65KHz	HIGH	HIGH	LOW	LOW	LOW
65~72KHz	HIGH	LOW	LOW	LOW	LOW
Over 72KHz	LOW	LOW	LOW	LOW	LOW

- Pin 32~33(OSC_0, OSC_1) : Oscillation port
- Pin 34~35(PWM12, PWM13) : ASDAC output, Red, Green Gain output port
- Pin 36~40(PA3~PA7) : S-correction output port

- Pin 41(PA2) : Chip Select port
- Pin 42(PA1) : Degaussing signal output port
  - Enable : Low(3 seconds)
  - Disable : High
- Pin 43(PA0) : LED Signal output
  - High : Orange color
  - Low : Green color
- Pin 44~47(PWM4~PWM17) : ASDAC output Blue Gain, Red, Green, Blue bias output port
- Pin 48(TEST) : Test port, Connected to the ground
- Pin 49(PC0) : Off mode signal output port
  - Enable : Low
  - Disable : High
- Pin 50(PC1) : Cable connection sensing port to output self raster output.
  - Low input : Connection
  - High input : No connection
- Pin 51~52(PC2, PC3) : DDC Data, DDC Clock port
- Pin 53(PC4) : Clock line
- Pin 54(PC5) : Serial Data Line
- Pin 55~56(VSS, VSSA) : Ground Path

3) Deflection

(1) Deflection Processor

OPERATING DESCRIPTION

Power Supply

The typical value of the power supply voltage Vcc is 12V. Perfect operation is obtained if Vcc is maintained in the limits : 10.8V → 13.2V.

In order to avoid erratic operation of the circuit during the transient phase of Vcc switching on or switching off, the value of Vcc is monitored and the outputs of the circuit are inhibited if it is too low.

In order to have a very good power supply rejection, the circuit is internally powered by several internal voltage references (The unique typical value of which is 8V). Two of these voltage references are externally accessible, one for the vertical part and one for the horizontal part. These voltage references can be used for the DC control voltages applied on the concerned pins by the way of potentiometers or digital to analog converters(DAC's).

DC Control Adjustments

The circuit has 10 adjustment capabilities : 3 for the horizontal part, 1 for the SMPS part, 2 for the E/W correction, 4 for the vertical part.

The corresponding inputs of the circuit **have to be driven with a DC voltage typically comprised** between 2 and 6V for a value of the internal voltage reference of 8V.

The input currents of the DC control inputs are typically very low (about a few μA).

Depending on the internal structure of the inputs, the input currents can be positive or negative (sink or source).

HORIZONTAL PART

Input section

The horizontal input is designed to be sensitive to TTL signals typically comprised between 0 and 5V. The typical threshold of this input is 1.6V. This input stage uses an NPN differential stage and the input current is very low.

Concerning the duty cycle of the input signal, the following signals may be applied to the circuit.

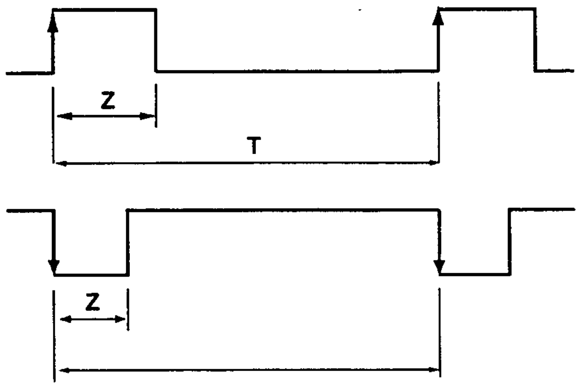


Figure 1

Using internal integration, both signals are recognized on condition that $Z/T \leq 25\%$. Synchronisation occurs on the leading edge of the rectified signal. The minimum value of Z is 1μs.

PLL1

The PLL1 is composed of a phase comparator, an external filter and a Voltage Controlled Oscillator(VCO).

The phase comparator is a "phase frequency" type, designed in CMOS technology. This kind of phase detector avoids locking on false frequencies. It is followed by a "charge pump", composed of 2 current sources sink and source (1=1mA type.)

The dynamic **behavior** of the PLL is fixed by an external filter which integrates the current of the charge pump. A "CRC" filter is generally used.

PLL1 is inhibited by applying a high level on Pin 35 (PLLinhib) which is a TTL compatible input. The inhibition results from the opening of a switch located between the charge pump and the filter.

The VCO uses an external RC network. It delivers a linear sawtooth obtained by charge and discharge of the capacitor, by a current proportionnal to the current in the resistor. Typical thresholds of sawtooth are 1.6V and 6.4V.

The control voltage of the VCO is typically comprised between 1.6V and 6V. The theoretical frequency range of this VCO is in the ratio 1 → 3.75, but due to spread and thermal drift of external components and the circuit itself, the effective frequency range has to be smaller (e.g. 30kHz → 85kHz). In the absence of **synchronization** signal the control voltage is equal to 1.6V type. and the VCO oscillates on its lowest frequency (free frequency).

The synchro frequency has to be always higher than the free frequency and a margin has to be taken. As an example, for a synchro range from 30kHz to 85kHz, the suggested free frequency is 27kHz. To compensate for the spread of external components and of the circuit itself, the free frequency may be adjusted by a DC voltage on Pin 14 (Fmin adjust).

The PLL1 ensures the coincidence between the leading edge of the synchro signal and a phase reference obtained by comparison between the sawtooth of the VCO and an internal DC voltage adjustable between 2.4V and 4V (by Pin 15). So a ±45° phase adjustment is possible.

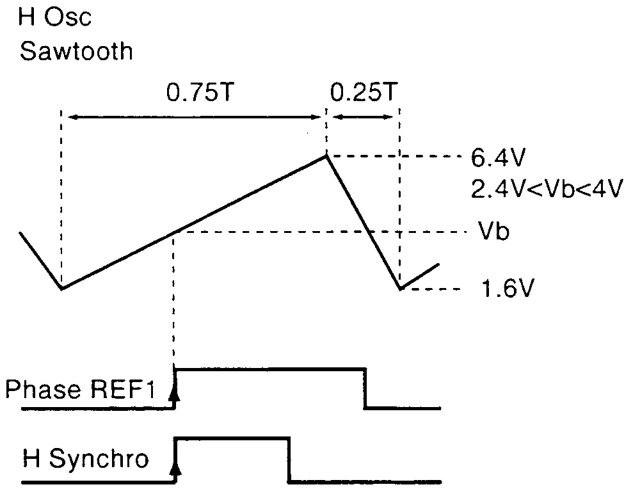


Figure 2 PLL1 Timing Diagram

Phase REF1 is obtained by comparison between the sawtooth and a DC voltage adjustable between 2.4V and 4V. The PLL1 ensures the exact coincidence between the signals phase REF and HSYNS. A±45° phase adjustment is possible.

(2) PLL 2

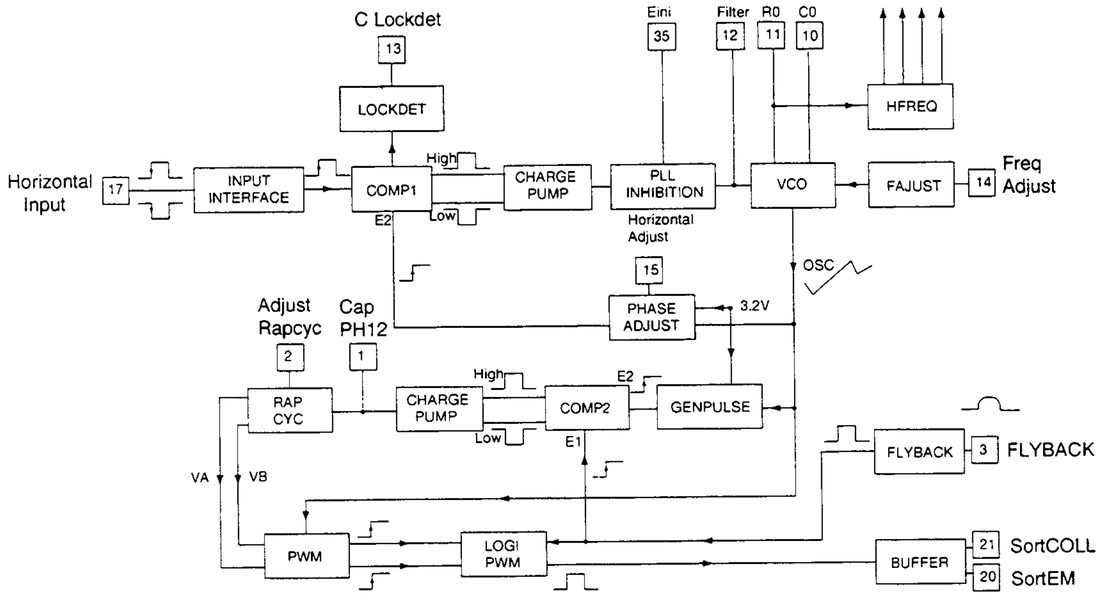


Figure 3 Dual PLL Block Diagram

The PLL2 ensures the coincidence between the leading edge of the shaped flyback signal and a phase reference signal obtained by comparison of the sawtooth of the VCO and a constant DC voltage (3.2V) (see Figure 4).

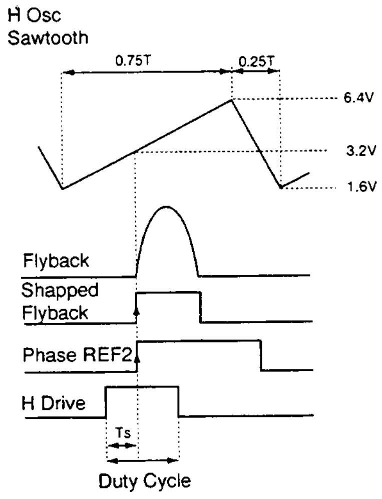


Figure 4 PLL2 Timing Diagram

Phase REF2 is obtained by comparison between the sawtooth and a 3.2V (constant). the PLL2 ensures the exact coincidence between the signals phase REF2 and the flyback signal. The duty cycle of H-drive is adjustable between 30% and 50%.

The phase comparator of PLL2 is similar to the one of PLL1, it is followed by a charge pump with a ±0.5mA(typ.) output current.
The flyback input is composed of an NPN transistor.
This input has to be current driven. The maximum **recommended** input current is 2mA.

Output Section

The H-drive signal is transmitted to the output through a shaping block ensuring a duty cycle adjustable from 30% to 50%.

The output stage is composed of a Darlington NPN bipolar transistor. Both the collector and the emitter are accessible.

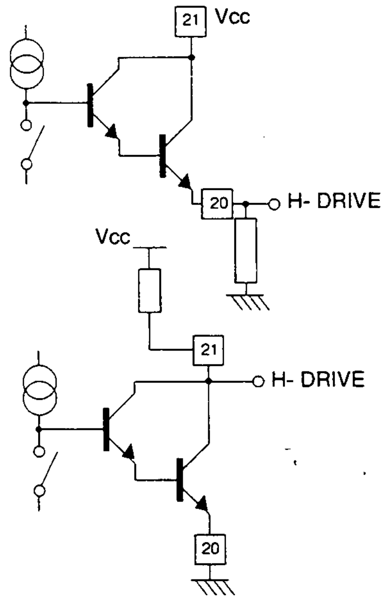


Figure 5 Output stage simplified diagram, showing the two possibilities of connection

The output Darlington is in off-state when the power scanning transistor is also in off-state.
The maximum output current is 20mA, and the corresponding voltage drop of the output darlington is 1.1V typically.
It is evident that the power scanning transistor cannot be directly driven by the integrated circuit.
An interface has to be designed between the circuit and the power transistor which can be of bipolar or MOS type.

PARABOLA GENERATION FOR EAST-WEST CORRECTION(see Figure 6)

Starting from the vertical ramp a parabola is generated for E/W correction.
The core of the parabola generator is an analog multiplier which generates a current in the form:

$$I = k\,(V_{RAMP} - V_{MID})^2$$

Where V_{RAMP} is the vertical ramp, typically comprised between 2 and 5V, V_{MID} is a DC voltage with a nominal value of 3.5V, but adjustable in the range 3.2V → 3.8V in order to generate a dissymmetric parabola if required (keystone adjustment).

The current is converted into voltage through a variable gain transresistance amplifier. The gain, controlled by the voltage on Pin 37 (E/W-AMP) can be adjusted in the ratio 3/1.

The parabola is available on Pin 36 by the way of an emitter follower which has to be biased by an external resistor(10kΩ). It must be AC coupled with external circuitry.

The typical parabola amplitude (AC), with the DC control voltages V_{37} and V_{38} set to 4V, is 2V. It is important to note that the parasitic parabola during the discharge of the vertical oscillator capacitor is suppressed.

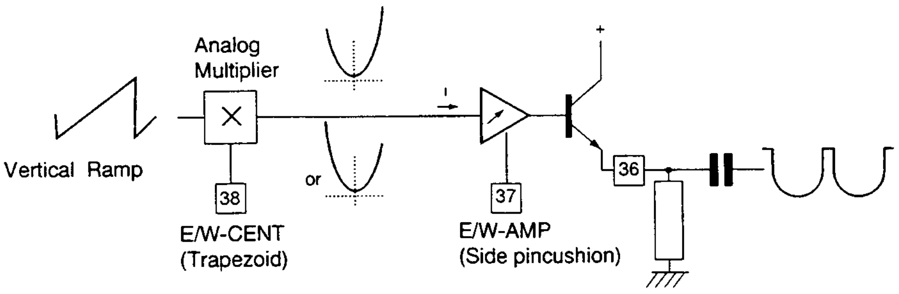


Figure 6 Parabola Generation Principle

VERTICAL PART (see Figure 8)

The vertical part generates a fixed amplitude ramp which can be affected by a S correction shape. Then, the amplitude of this ramp is adjusted to drive an external power stage.

The internal reference voltage used for the vertical part is available between Pin 26 and Pin 24. It can be used as voltage reference for any DC adjustment to ensure high accuracy.

Its typical value is :

$$V_{26} = V_{REF} = 8V.$$

The charge of the external capacitor on Pin 27 (V_{CAP}) generates a fixed amplitude ramp between the internal voltages, $V_L(V_L = V_{REF}/4)$ and V_H ($V_H = 5/8 \cdot V_{REF}$).

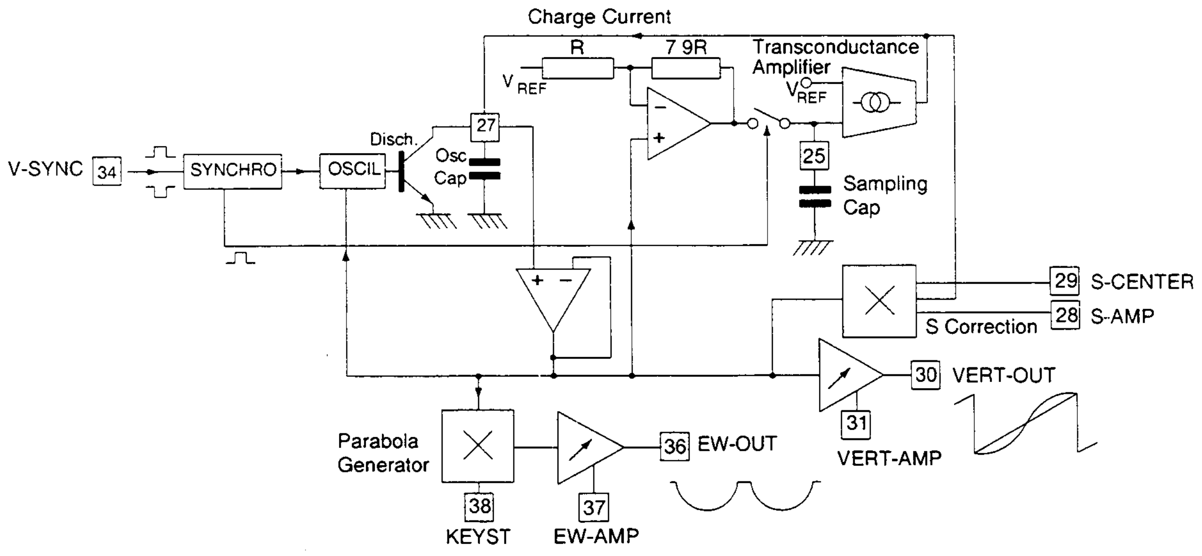


Figure 8 Vertical Part Block Diagram

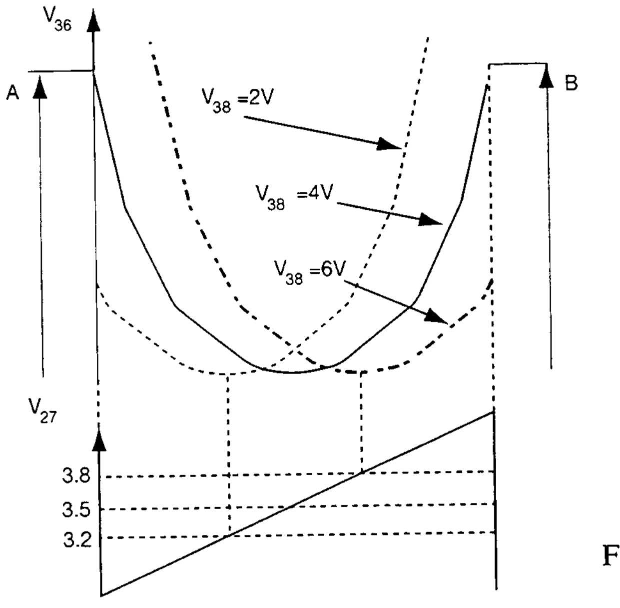


Figure 7 Trapezoid Adjustment

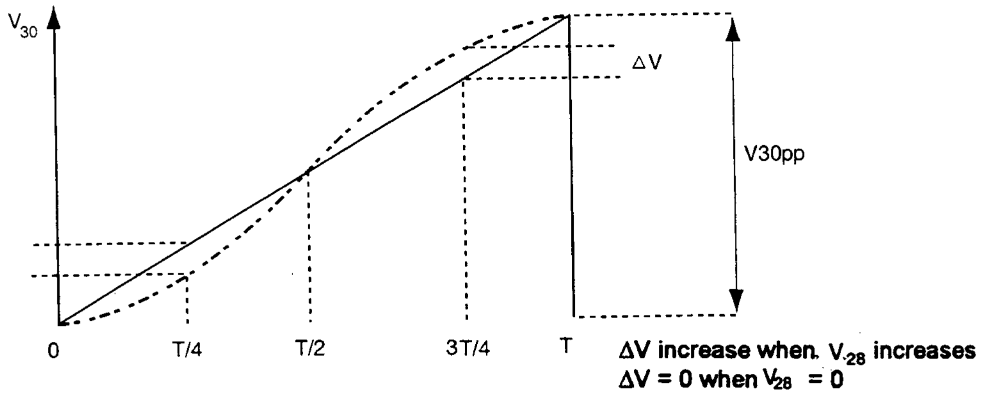


Figure 9 S Amplitude Adjustment

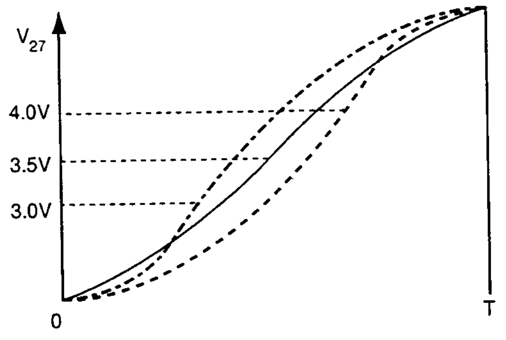


Figure 10 C Correction Adjustment

Function

When the **synchronization** pulse is not present, an internal current source sets the free running frequency. For an external capacitor. Cosc = 220nF, the typical free running frequency is 68Hz.
Typical free running frequency can be calculated by :

$$f_0(Hz) = 1.5 \cdot 10^{-5} \cdot \frac{1}{Cosc(nF)}$$

A negative or positive TTL level pulse applied on Pin 34 (VSYNC) can **synchronize** the ramp in the frequency range [fmin, fmax]. This frequency range depends on the external capacitor connected on Pin 27. A capacitor in the range [150nF, 220nF] is **recommended** for application in the following range : 50Hz to 120Hz.
Typical maximum and minimum frequency, at 25℃ and without any correction (S correction or C correction), can be calculated by :

$$f_{max} = 2.5 \cdot f_0$$

$$f_{min} = 0.33 \cdot f_0$$

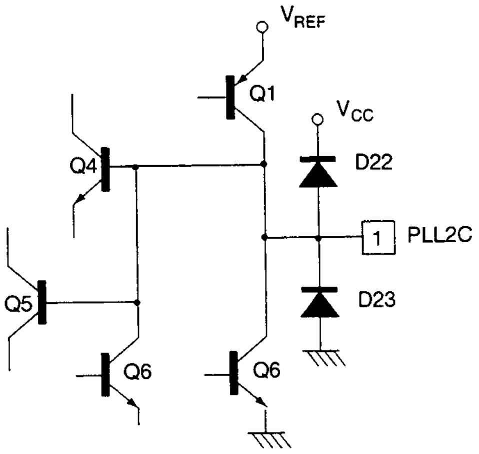
If S or C corrections are applied, these values are slighty affected.
If an external **synchronization** pulse is applied, the internal oscillator is **automatically** caught but the amplitude is no more constant. An internal correction is activated to adjust it in less than half a second : the highest voltage of the ramp on Pin 27 is sampled on the sampling capacitor connected on Pin 25 (VAGCCAP) at each clock pulse and a transconductance amplifier generates the charge current of the capacitor. The ramp amplitude becomes again constant.
It is **recommended** to use a AGC capacitor with low leakage current. A value lower than 100nA is mandatory.

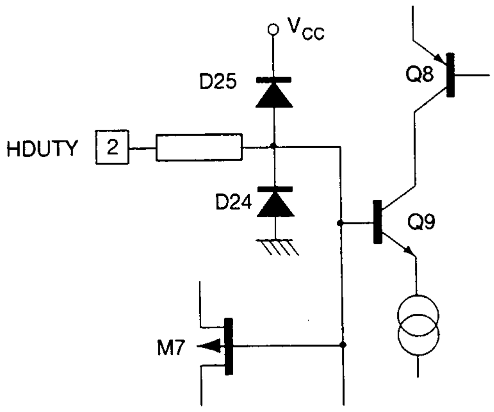
DC Control Adjustments

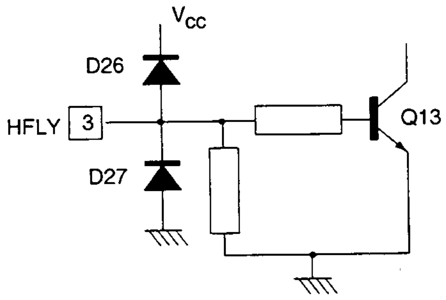
An S correction shape can be added to this ramp. This frequency in dependent S correction is generated internally; its amplitude is DC adjustable on Pin 28 (V_{SAMP}) and it can be centered to generate C correction, according to the voltage applied on Pin 29 (V_{SCENT}).
The amplitude of this S corrected ramp can be adjusted by the voltage applied on Pin 31 (V_{AMP}).
The adjusted ramp is available on Pin 30 (V_{OUT}) to drive an external power stage.
A DC voltage is available on Pin 32 (V_{DCOUT}). It is driven by the voltage applied on Pin 33 (V_{POS}).

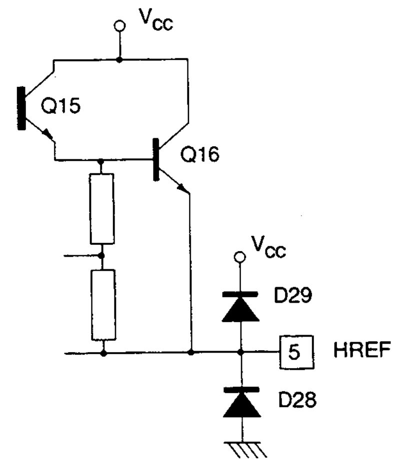
$$V_{DCOUT} = 7/16 \cdot V_{REF} \pm 300mV.$$

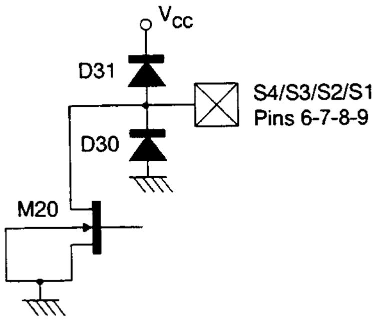
So, the V_{DCOUT} voltage is correlated with DC value of V_{OUT}. It increases the accuracy when temperature varies.

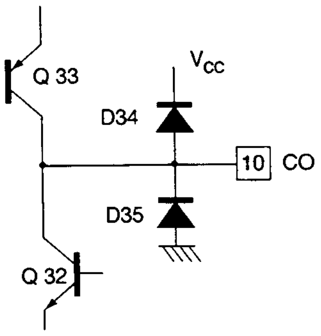

V_{REF}
Q1
V_{CC}
Q4
D22
1
PLL2C
Q5
D23
Q6
Q6


V_{CC}
Q8
D25
HDUTY
2
D24
Q9
M7

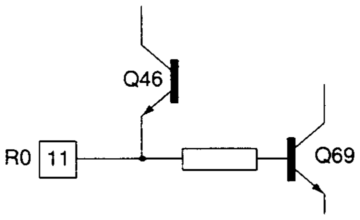

V_{CC}
D26
HFLY
3
Q13
D27


V_{CC}
Q15
Q16
V_{CC}
D29
5
HREF
D28


V_{CC}
D31
S4/S3/S2/S1
Pins 6-7-8-9
D30
M20


Q 33
V_{CC}
D34
10
CO
D35
Q 32

INTERNAL SCHEMATICS



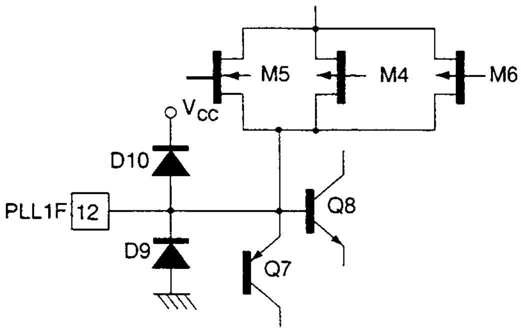


Figure 11

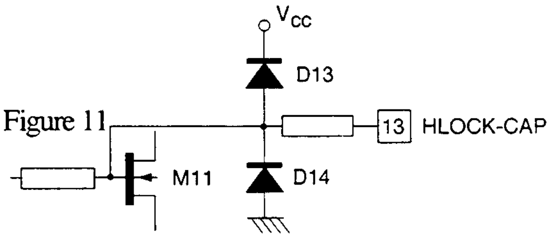
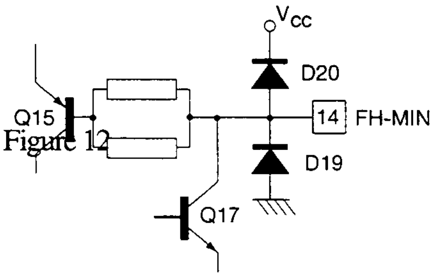


Figure 12



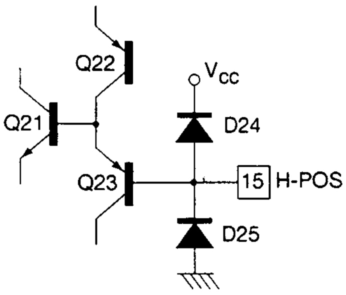


Figure 13

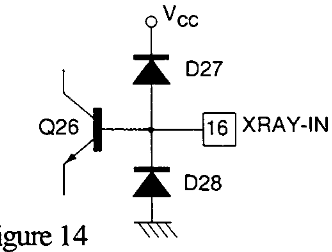


Figure 14

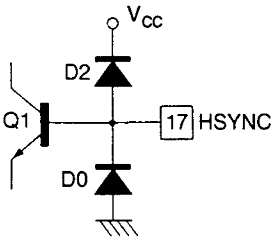


Figure 15

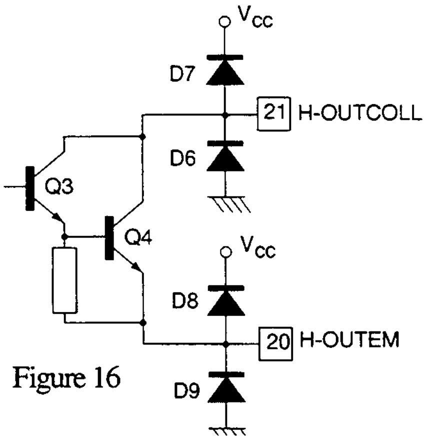


Figure 16

INTERNAL SCHEMATICS (continued)

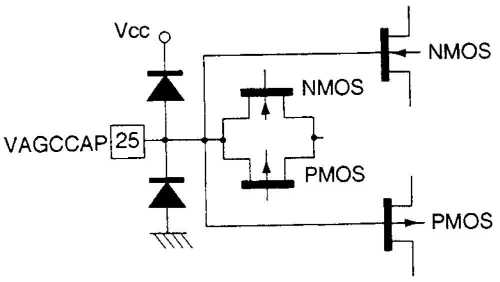


Figure 17

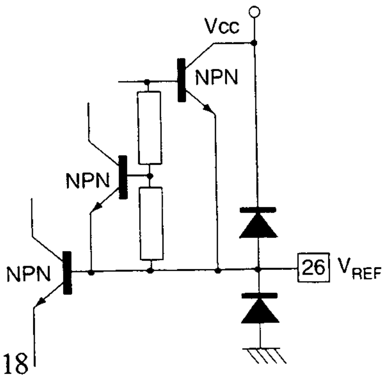


Figure 18

Figure 19

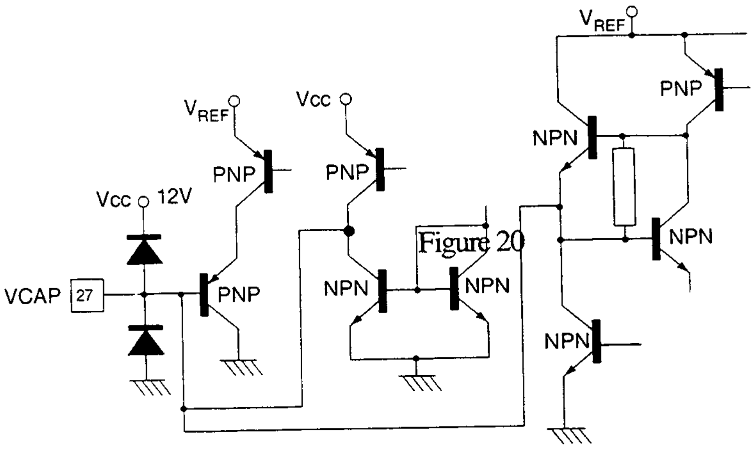


Figure 20

Figure 21

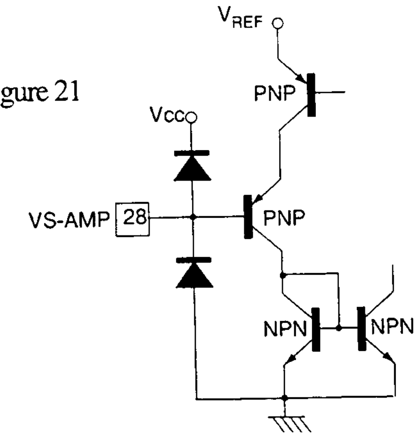


Figure 22

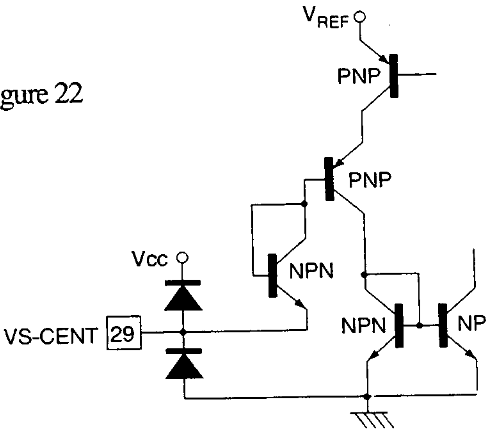
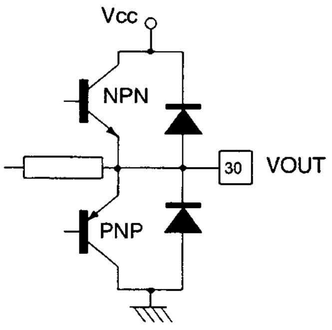


Figure 23

Figure 24

INTERNAL SCHEMATICS (continued)



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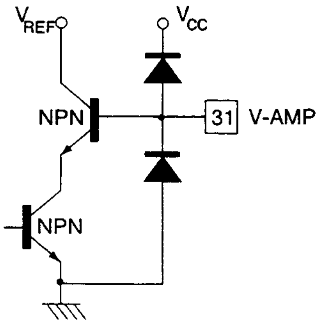
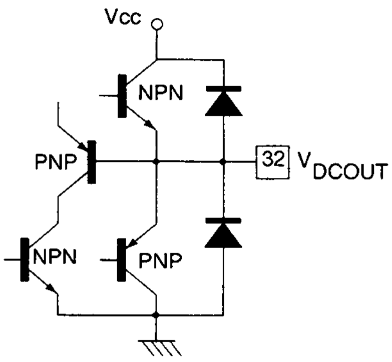


Figure 26



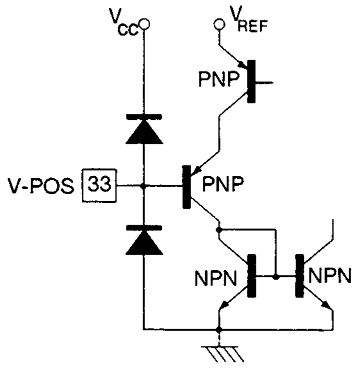


Figure 27

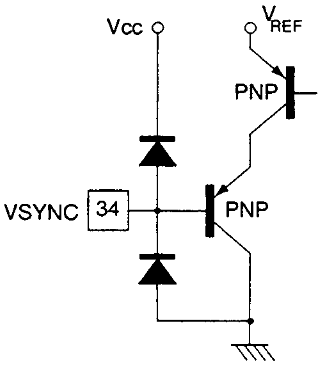


Figure 28

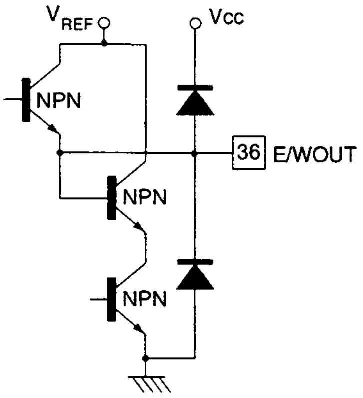


Figure 29

INTERNAL SCHEMATICS (continued)

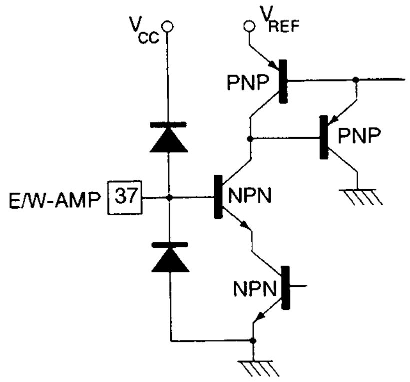


Figure 30

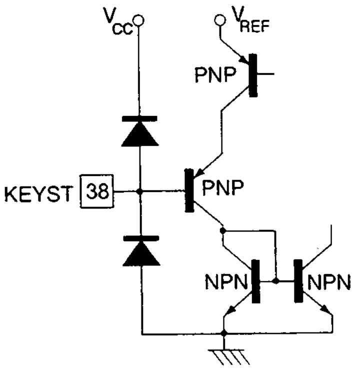


Figure 31

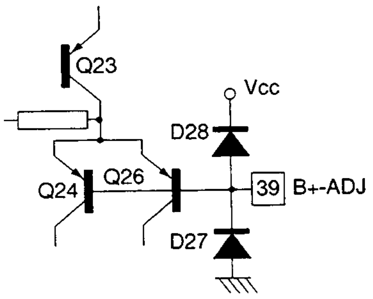


Figure 32

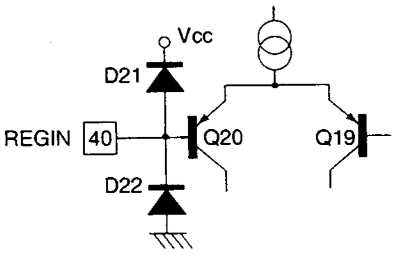


Figure 33

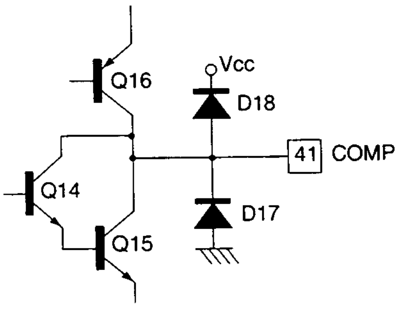


Figure 34

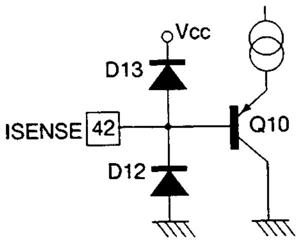
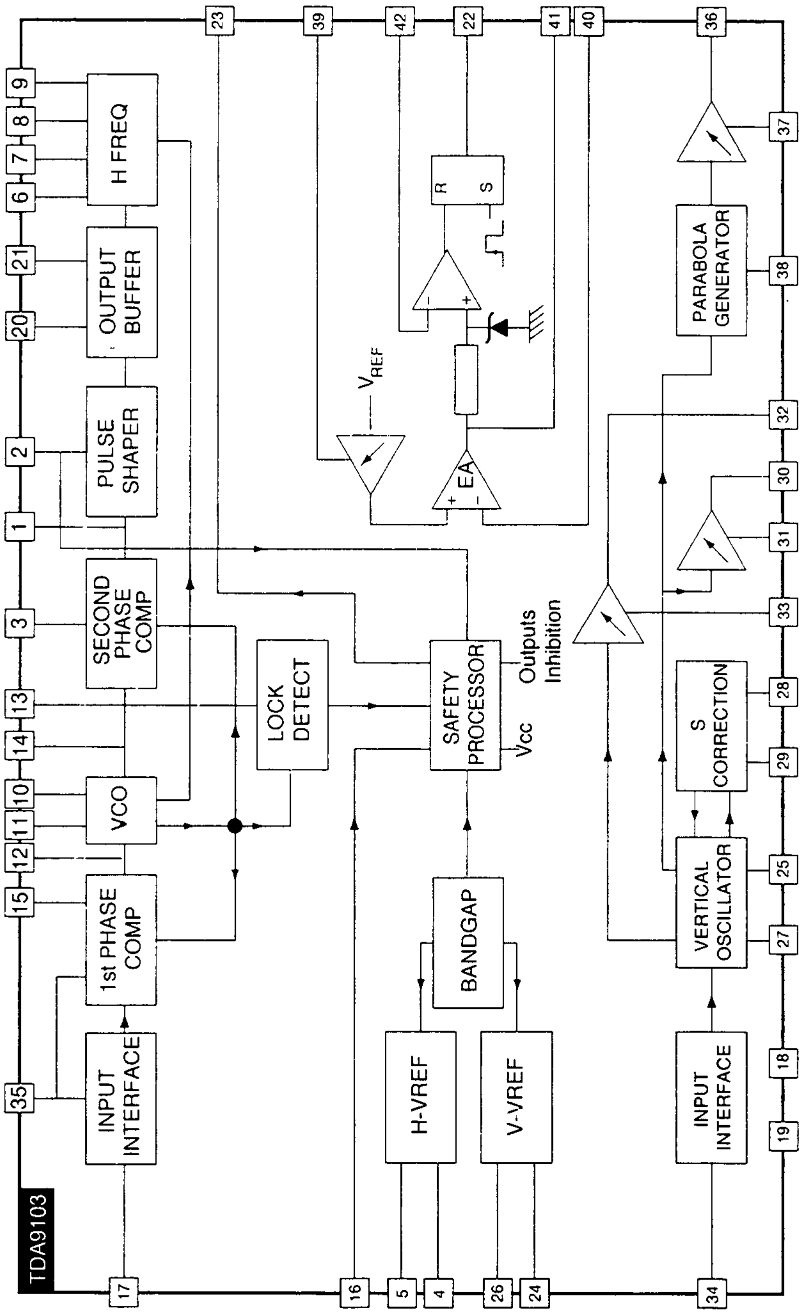


Figure 35

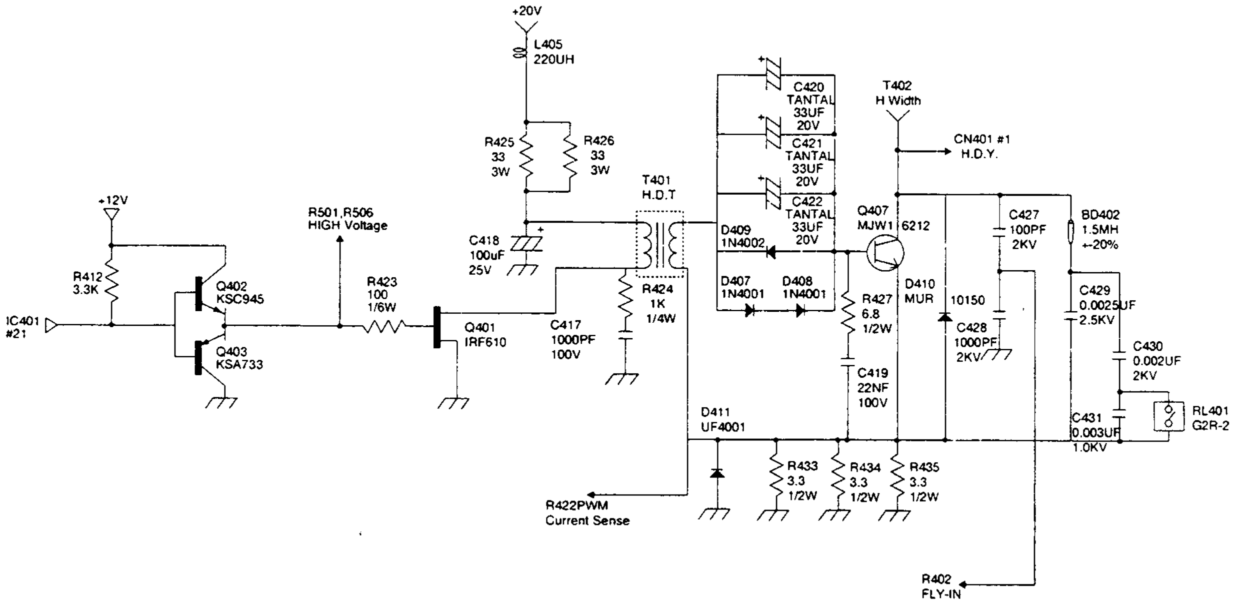
INTERNAL SCHEMATICS (continued)



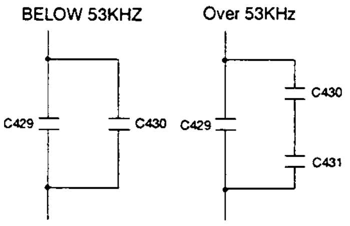
Pin N°	Name	Function
1	PLL2C	Second PLL Loop Filter
2	H-DUTY	DC Control of Horizontal Drive Output Pulse Duty-cycle. If this pin is grounded, the horizontal and vertical outputs are inhibited. By connecting a capacitor on this pin, a soft-start function may be realized on h-drive output.
3	H-FLY	Horizontal Flyback Input **(positive Polarity)**
4	H-GND	Horizontal Section Ground. Must be connected only to components related to H blocks.
5	H-REF	Horizontal Section Reference Voltage. Must be filtered by capacitor to Pin 4
6	S4	Hor S-CAP Switching
7	S3	Hor S-CaP Switching
8	S2	Hor S-CAP Switching
9	S1	Hor S-CAP Switching
10	C0	Horizontal Oscillator Capacitor. To be connected to Pin 4.
11	R0	Horizontal Oscillator Resistor. To be connected to Pin 4.
12	PLL1F	First PLL Loop Filter. To be connected to Pin 4.
13	HLOCK-CAP	First PLL Lock/Unlock time Constant Capacitor. Capacitor filtering the frequency change detected on Pin 13. When frequency is changing, a blanking pulse is generated on Pin 23, the duration of this pulse is proportionnal to the capacitor on Pin 13. To be connected to Pin 4.
14	FH-MIN	DC Control for Free Running Frequency Setting. Comming from DAC output or DC voltage generated by a resistor bridge connected between Pin 5 and 4.
15	H-POS	DC Control for Horizontal Centering
16	XRAY-IN	X-RAY Protection Input (with internal latch function)
17	H-SYNC	TTL Horizontal Sync Input
18	Vcc	Supply Voltage (12V Typical)
19	GND	Ground
20	H-OUTEM	Horizontal Drive Output (emiter of internal transistor). See description on pages 15-16.
21	H-OUTCOL	Horizontal Drive Output (open collector of internal transistor). See description on pages 15-16.
22	B_+ OUT	B_+ PWM Regulator Output
23	SBLK OUT	Safety Blanking Output. Activated during frequency changes, when X-RAY input is triggered or when VS is too low.
24	VGND	Vertical Section Signal Ground
25	VAGCCAP	Memory Capacitor for Automatic Gain Control Loop in Vertical Ramp Generator
26	V_{REF}	Vertical Section Reference Voltage
27	VCAP	Vertical Sawtooth Generator Capacitor
28	VS-AMP	DC Control of Vertical S Shape Amplitude
29	VS-CENT	DC Control of Vertical S Centering
30	VOUT	Vertical Ramp Output (with frequency independant amplitude and S-correction)
31	V-AMP	DC Control of Vertical Amplitude Adjustment
32	V_{DCOUT}	Vertical Position Reference Voltage Output Temperature Matched with V-AMP Output
33	V-POS	DC Control of Vertical Position Adjustment
34	VSYNC	Vertical TTL Sync Input
35	PLL1INHIB	TTL Input for PLL1 Output Current Inhibition (To be used in case of comp sync input signal)
36	E/WOUT	East/West Pincushion Correction Parabola Output
37	E/W-AMP	DC Control of East/West Pincushion Correction Amplitude
38	KEYST	DC Control of Keystone Correction
39	B_+ADJ	DC Control of B+ Adjustment
40	REGIN	Regulation Input of B_+ Control Loop
41	COMP	B+ Error Amplifier Output for Frequency Compensation and Gain Setting
42	I_{SENSE}	Sensing of External B_+ Switching Transistor **Emitter Current**

(3) Horizontal Drive

IC401 drives the gate of Q401 (IRF610). Q401 amplifies and inverts the signal at the drain. The drain drives T401. The horizontal drive transformer (T401) produces an impedance matched drive signal for the base of the horizontal output Q407 (MJW16212). The drive signal is amplified to a 1,230 vpp output signal. Emitter current is supplied by R433, R434, and R435. The collector DC voltage will decide the horizontal raster size. An increase in collector voltage will increase the size while a decrease in collector voltage will decrease the raster size.



Horizontal Drive

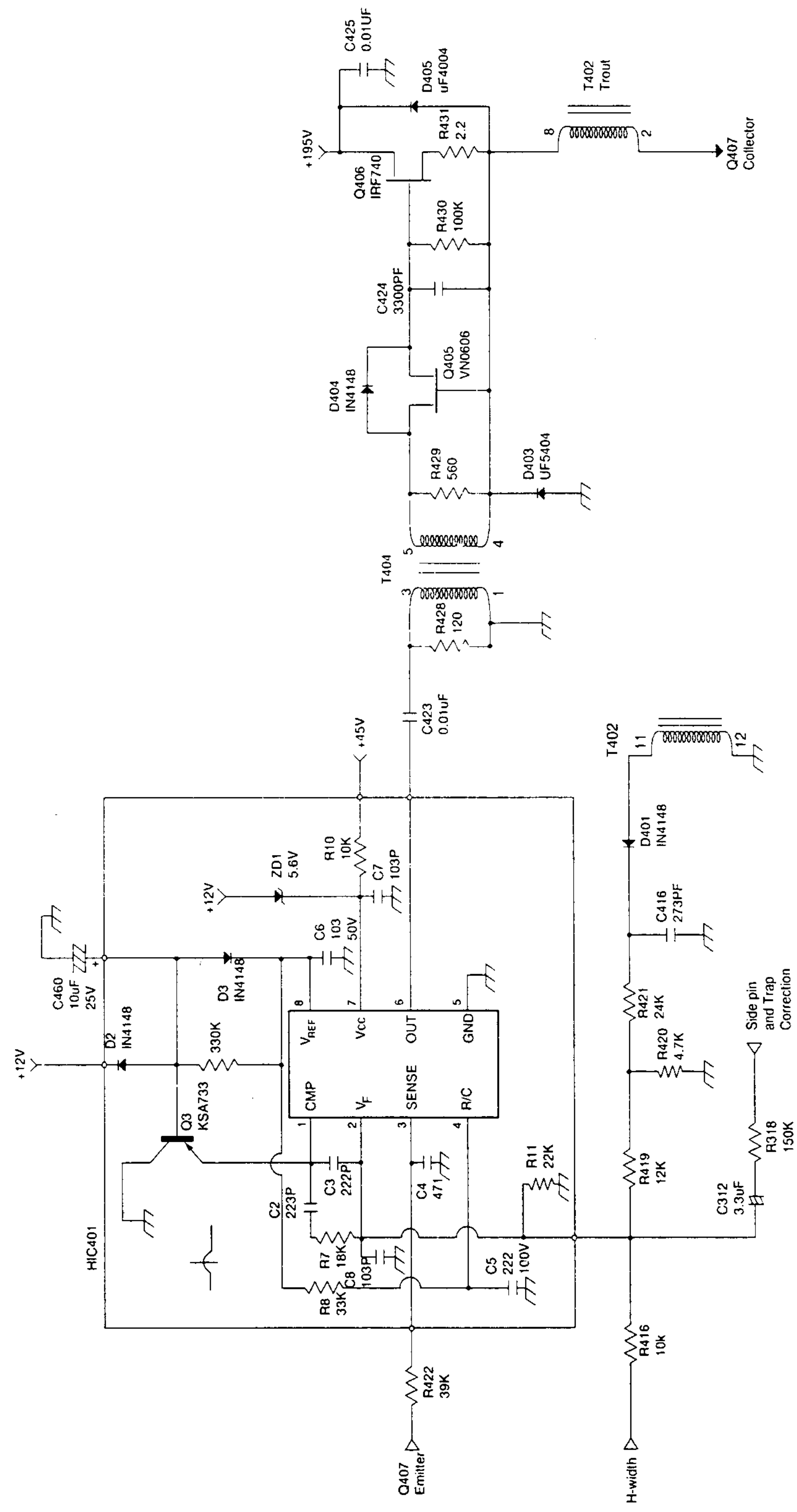


OVER 53 KHz → Switch off

(4) Horizontal Width Control

IC1 in the hybrid IC MIC401 operates in the same manner as the KA3842 in the power supply. The collector voltage on the horizontal output is controlled by pulse width modulation. The PWM is controlled by IC1 (KA3842N). VCC is supplied to pin 7 of IC1. The VCC is supplied by the 45vdc source through resistor R10 (1.0K 1/2W) and regulated by ZD1, whose anode is tied to the 12 vdc source. This will regulate the VCC to a 12vdc level. During Suspend mode, the 12vdc source drops to 1.1 vdc,thus regulating the VCC to IC1 at 6.7vdc level.

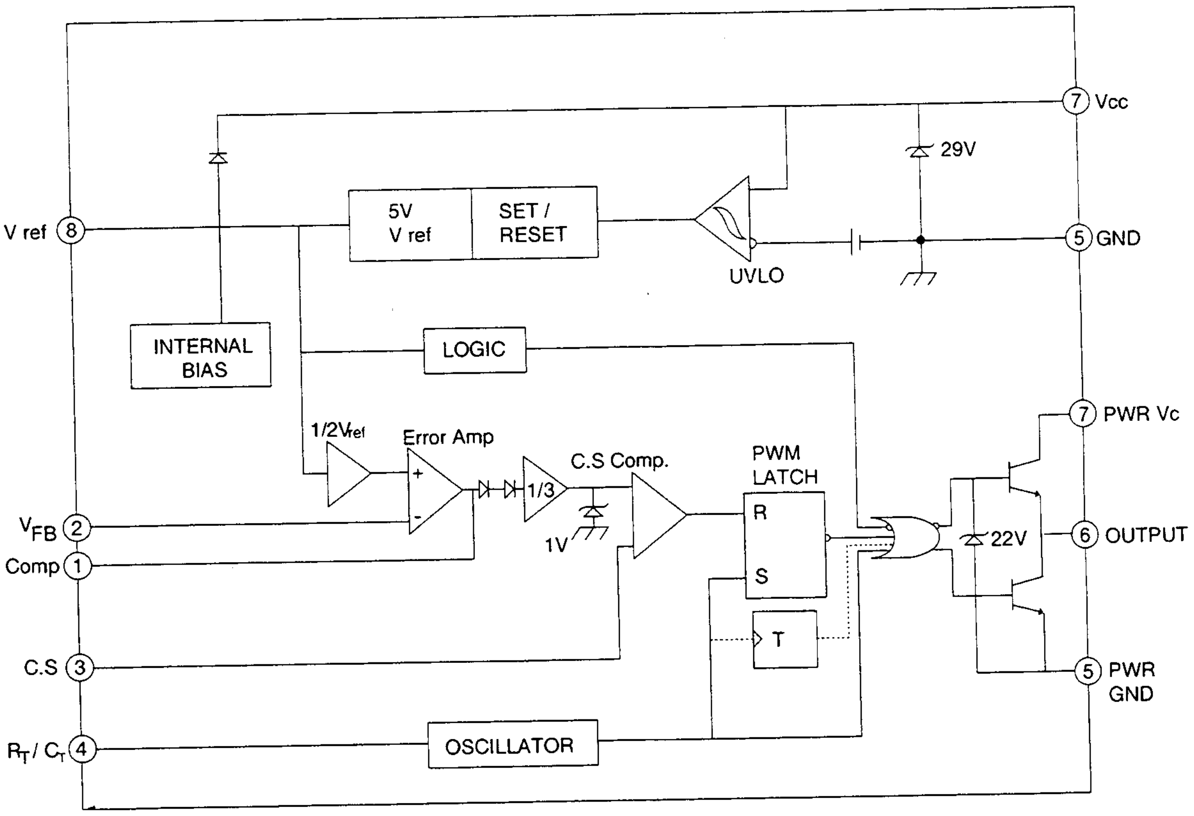
The output pulse width is micom controlled by the D/A voltage for horizontal width. Other main factors are to regulate the PWM voltage feedback, current sensing, mode select S-Correction, and the H-FLB triggered oscillator. The output of pin 6 is sent to C423 (0.01uf 100V). C423 passes the high frequency leading and trailing edges of the PWM output. The gate driver T404 reshapes the signal to a pulse width. Q405 (VN0606M) gates through the pulse width to the gate of Q406 (IRF740). The drain of Q406 is tied to the 195 vdc source. By controlling the pulse width and frequency at the gate,the collector voltage of the horizontal output can be controlled. An increase in pulse width and frequency will increase the collector voltage to the horizontal output. Following are the pin outs and voltage effect on the horizontal width.



Horzontal Width

(5) KA3842 Pin outs

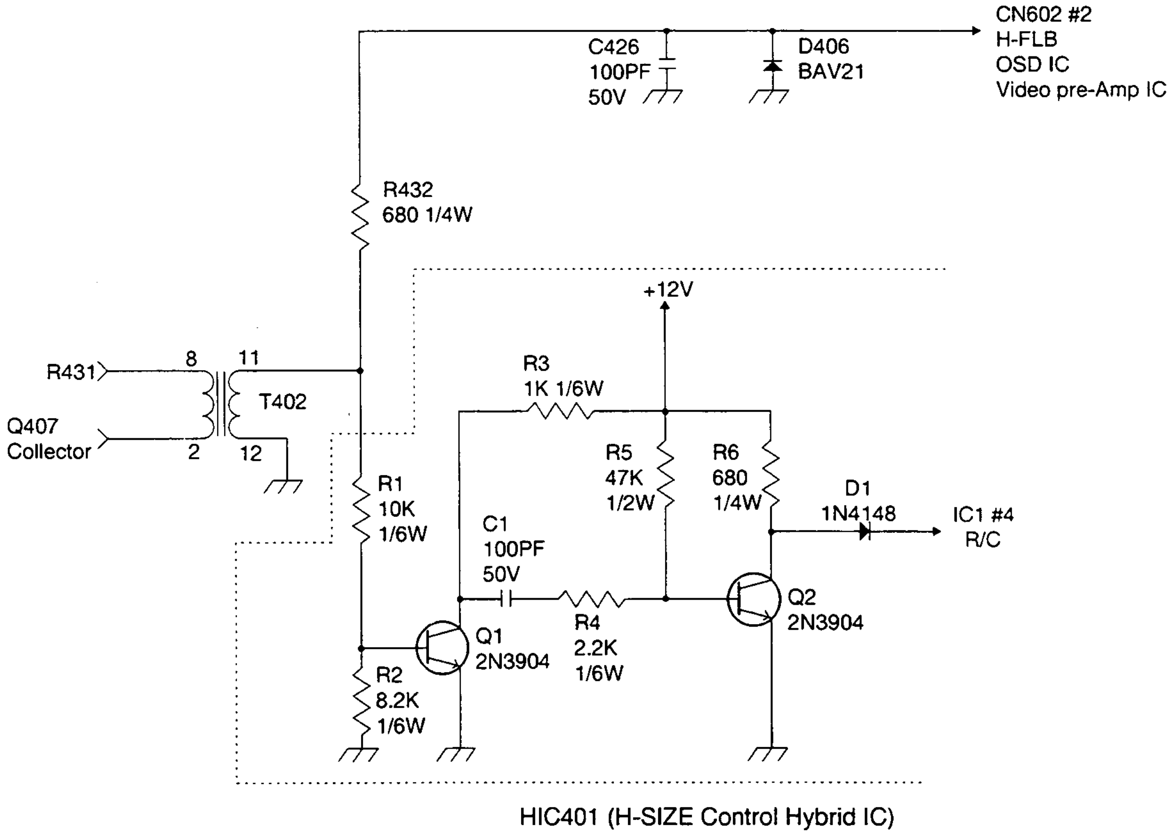
Pin No.	Description
1.	Comp-Output which supplies feedback to pin 2
2.	VFB-Voltage feedback for side pincushion correction, trapezoid correction, micom s-correction control, and H-Deflection return sensing.
3.	C.S.-Current sensing monitored from the horizontal out-put emitter current.
4.	R/C-The time constant to operate the PWM oscillator. A flyback pulse from the H-Deflection circuit is monitored to adjust the charge and discharge rate of C5.
5.	GND-common reference point
6.	Output-The PWM output controlling horizontal output collector voltage.
7.	VCC-Voltage needed to operate the IC.
8.	Vref-Voltage needed to operate the oscillator.



KA3842N Block Diagram

(6) Horizontal Flyback

The horizontal output energizes T402, pin 2, to provide a secondary flyback pulse (H-FLB) at pin 11. The H-FLB will be used for horizontal centering of the OSD and video blanking. H-FLB is also used for feedback to the oscillator of IC1 to lock in the frequency. The H-FLB is applied to the base of Q1. Q1 will amplify the pulse to a negative polarity 12vpp level. C1 will pass the high frequency edge, while R4 and R5 set the bias level to the base of Q2. Q2 will recreate a positive polarity at the collector and apply it to the Anode of D1. D1 will pass a positive peak of the pulse while charging and discharging C5 at the horizontal frequency rate. This will produce a locked in pulse width at pin 6 of IC1.



Horizontal Flyback

(7) Sensing

T402 windings pin 11 and pin 12 induce the flyback waveform of the H-D.Y. D401 (1N4148) rectifies the voltage to 3.5 vdc. The voltage will be monitored by IC401 pin 2 in order to regulate the horizontal width by maintaining a 29% duty cycle. Without sensing, an unregulated pulse width will occur.

(8) S-Correction

S-Correction is a side and linearity distortion correction between horizontal scan frequencies. Due to the variety of scan frequencies compensation must be done to correct for the linearity in the horizontal yoke circuit. Correction is performed by FET switches. Capacitors C437, C438, C439, C440, C441 will be switched into the circuit by FETs Q409, Q410, Q411, Q412, and Q413.

(9) Horizontal Centering

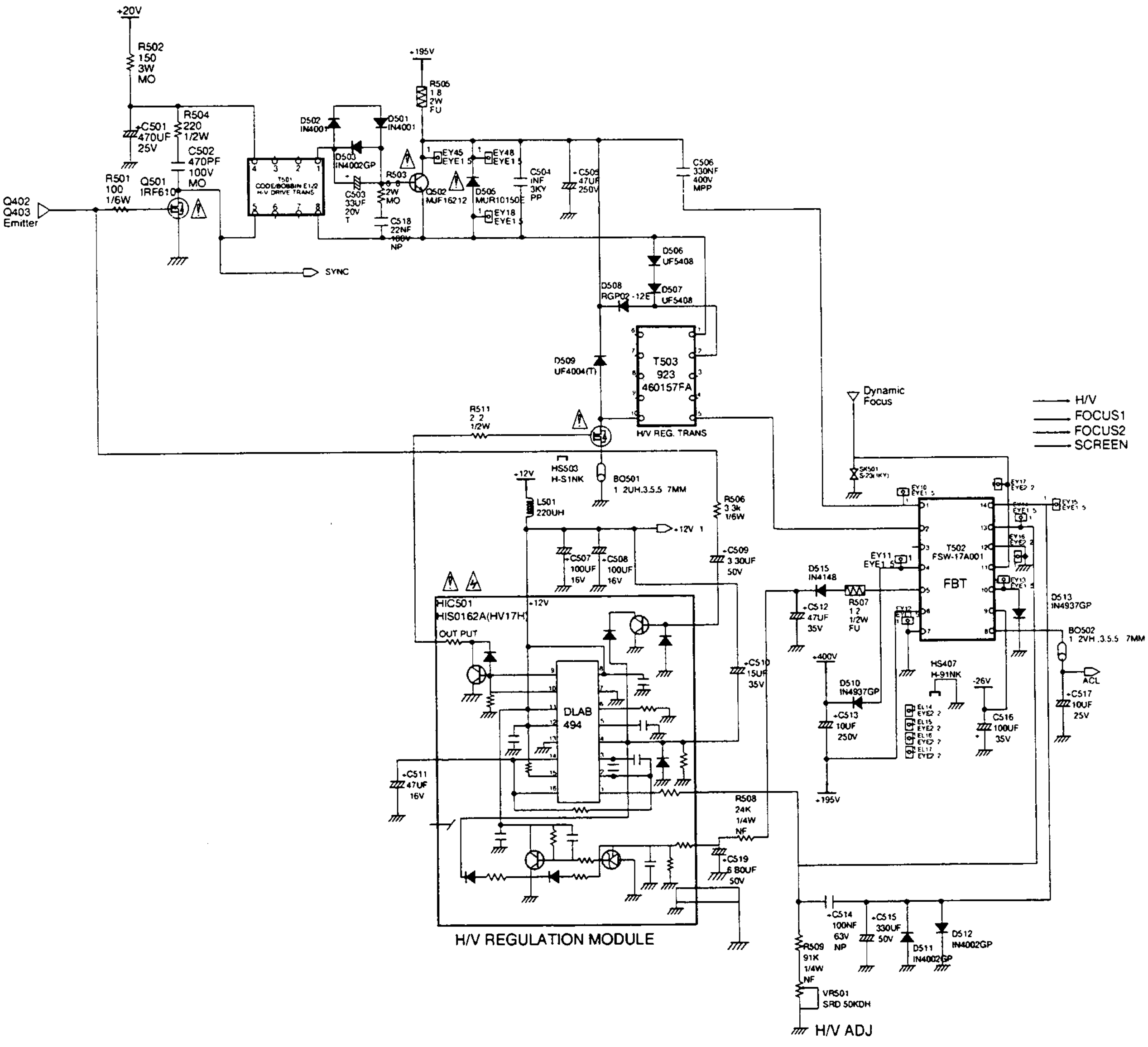
Horizontal centering switch SW401 is a 3 position switch that can position the raster on the face of the CRT, by changing the point where scan starts and retrace points. In order to position the raster towards the left, SW401 will have to switch D413 into the H-D.Y. circuit while switching D413 out of the circuit. Center position will switch D412 and D413 out of the circuit. In order to shift the deflection point of the raster to the right, SW401 must switch D412 into the circuit while switching D413 out of the circuit.

(10) High Voltage

The main purpose of the high voltage circuit is to develop the voltage and supply the voltage to the CRT. The voltages developed are control grid, screen grid, focus 1, focus 2, and CRT anode voltage. These voltages will aid in the beam current flow to the phosphors and illuminate the CRT. The high voltage circuit uses the same drive as the horizontal deflection circuit does. The rest of the circuit is independent of the deflection circuit. The high voltage is regulated by monitoring the drive frequency and feedback from the flyback transformer. If the high voltage exceeds normal ratings, or there is a problem with the circuit, a high voltage protect circuit is used to shutdown the DLAB494 output.

(11) High Voltage Drive

The high voltage circuit uses the same drive pulse as the horizontal deflection circuit does from IC401 pin 21.Pin 21 supplies the 12vpp drive signal to Q501 gate. Q501 has a drain supply voltage of 20vdc and will amplify the signal to a 32vpp level. T501 couples the HV drive signal to Q502. Q502 amplifies the signal to to be applied to flyback transformer T502.

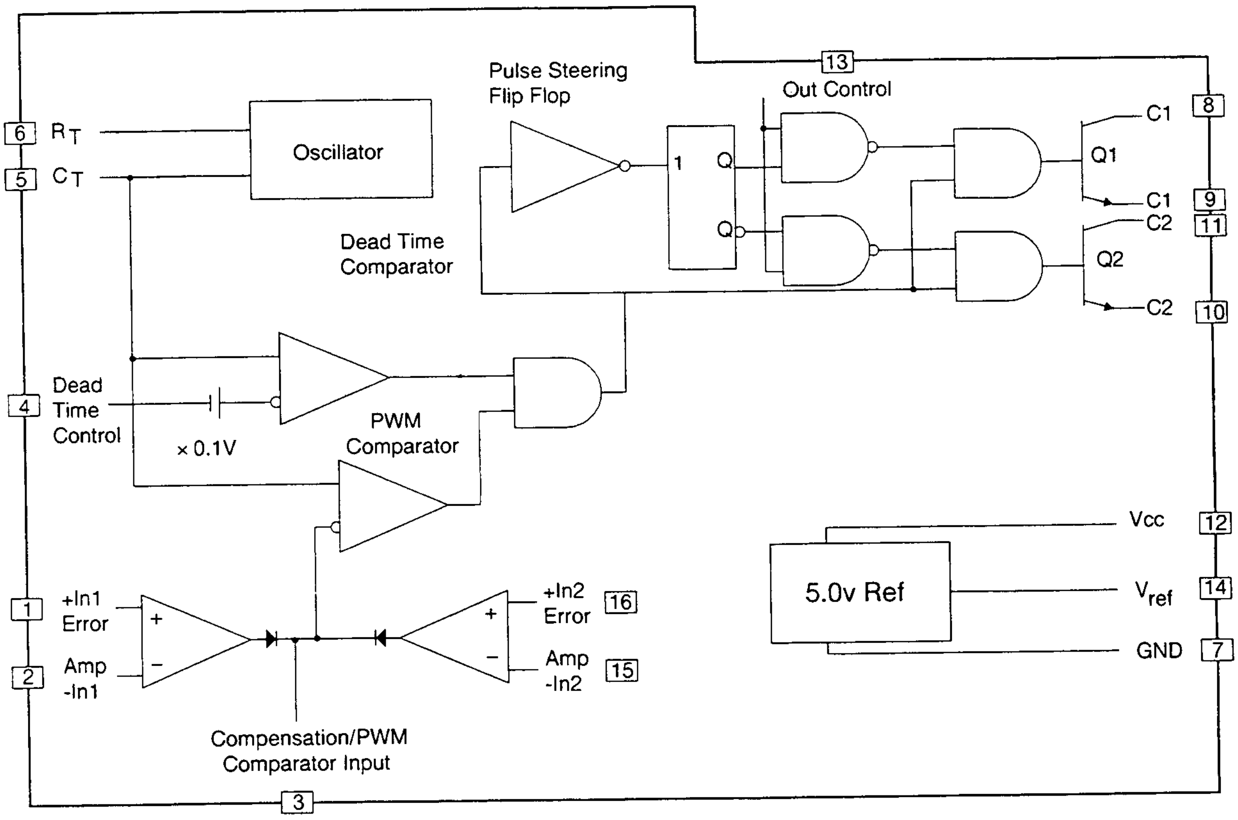


High Voltage Circuit

(12) High Voltage Regulation

The high voltage is maintained by a PWM IC1 (DLAB494) in HIC501. IC1 achieves an oscillator frequency by the RC time constant of R4 and C3. C3 is charged and discharged by the H-drive applied to R506, C509, D3, Q2, and D2. 12 vdc is supplied to VCC pin 12 in which a Vref is developed. Vref will be used for comparison of Error amp 1 & 2. Error amp 1 at pin 1 monitors the change in voltage drop across VR501 and R509. As the voltage drop increases; the pulse width output decreases,causing a decrease in high voltage at the anode lead. A decrease in voltage drop will increase the pulse width and increase the high voltage.

A positive polarity pulse width at the horizontal rate from pin 9 is buffered through Q1. Q503 on/off transition time drives T503; maintaining constant anode voltage with each change in scan frequency.



DLAB494 Block Diagram

(13) Over Voltage Protection

Over voltage is monitored from pin 5 of T502 (FBT). D515 rectifies a 30vpp flyback pulse to a 11.45 dc voltage. C512 **smooths** the dc and IC2 (TL431CLP) monitors the voltage drop across R11. The nominal value is 2 vdc. Under these circumstances IC2 will not conduct anode to cathode. Q3 base voltage from the 12 vdc source will be at cutoff. D4 will be turned off.

If the high voltage increases, pin 5 peak to peak increases, causing a large voltage drop across R11. IC2 needs 2.5 vdc at R to cause it to conduct. This will turn on Q3. Q4 will conduct. And 12 vdc is applied to IC1 #4. This will disable the Q503 drain voltage and cause a collapse in the high voltage.

(14) Flyback Transformer

T502(FSW-17A001) develops a 300 vpp F.B. pulse at pin 4, while pin 6 is referenced with a 195 vdc. D510 rectifies the F.B. pulse while C513 charges to 385 vdc. The 385 vdc is developed for the Dynamic Focus biasing. D513 tied to pin 10 develops -26 vdc at pin 9. C516 filters the FB pulse. The -26 vdc will be used for G1 biasing of the CRT, via the brightness control. Pin 8 controls the ACL (Auto Contrast Limiter) Screen voltage is supplied to G2 of the CRT. The voltage varies between 400-800 vdc. Focus 1 red wire supplies focus voltage to two grids in the CRT. Focus 2 white wire supplies the focus voltage to single grid in the CRT. Anode voltage should be 26kv

(15) Dynamic Focus

The vertical deflection yoke return produces a parabolic waveform. R307 integrates a 2 vpp sawtooth to R464. R464 supplies the sawtooth to IC402 (TL431). This will charge and discharge C453 to reproduce a parabolic. Q415 amplifies the parabolic at the collector to a 150 Vpp level, and mixes the vertical with the horizontal parabola produced by the H-D.Y. return.

The H-D.Y. supplies a 50 vpp parabola to C451. C451 passes the signal to R455 supplying it to T405 (Dynamic Focus Transformer). T405 is referenced with 195 vdc at pin 4 and amplifies the parabola to 350 vpp. C452 passes the AC while blocking the dc. The mixed signal is supplied to D.F. of the F.B.T. The signal will be AC coupled inside the F.B.T. and output at F1. The focus range is between 5720V - 7020V.

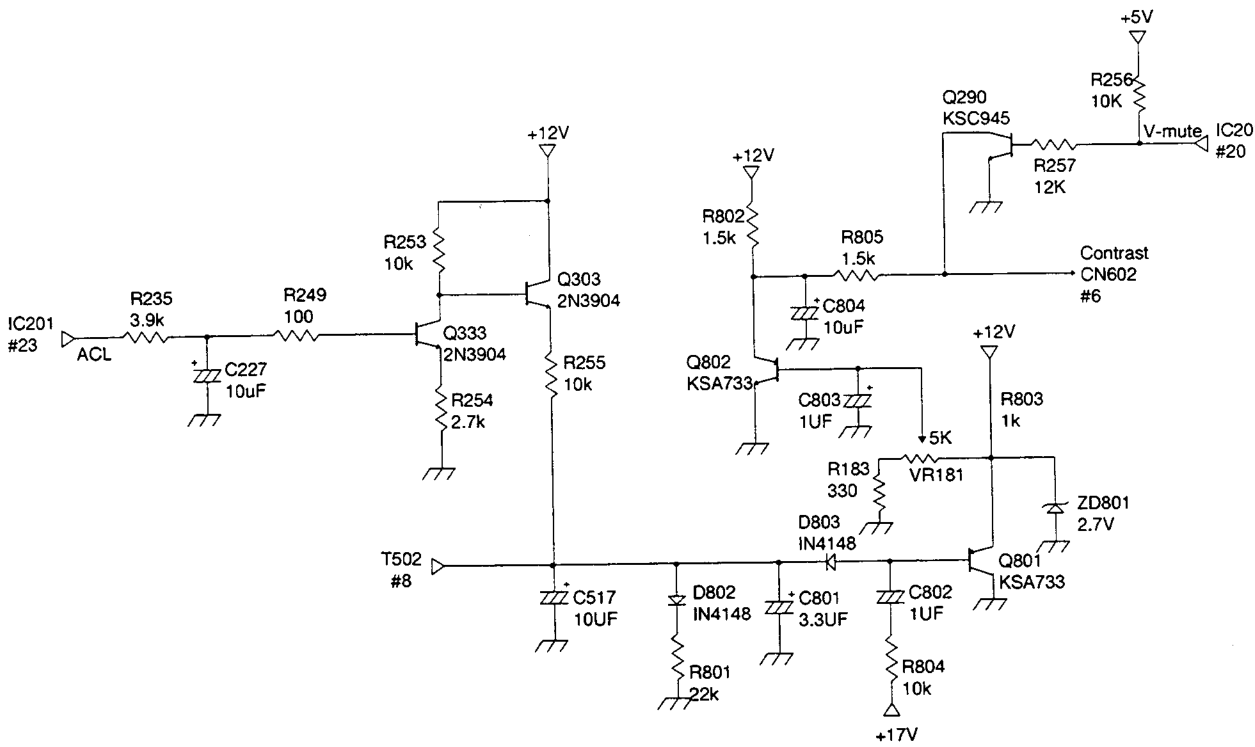
(16) ACL, Contrast, Video Mute, and Brightness Control

The F.B.T. monitors the beam current generated by the C.R.T. from pin 8. Through this connection with the ACL circuit, high intensity to low intensity video levels can be maintained.

(17) ACL Adjustment

ACL Adjustment can be performed by micom control voltage. The voltage range (using 1024× 768 60hz) resolution from flat white to the ACL being cutoff ranges between .942 vdc to 2.865 vdc. With a decrease in voltage, D803 starts to conduct, causing Q801 to start conducting from collector to emitter. This will cause a decrease in emitter voltage. A decrease in emitter voltage will cause Q802 to conduct C to E causing a decrease in contrast voltage.

With an increase in ACL voltage applied to the monitor, D803 will not conduct causing Q801 to cutoff and increase the emitter voltage. Q802 will also operate in cutoff increasing emitter voltage thus increasing the contrast voltage. ZD801 limits the operating voltage applied to Q802 base at 2.7 vdc.



Contrast & ACL

(18) Contrast Control

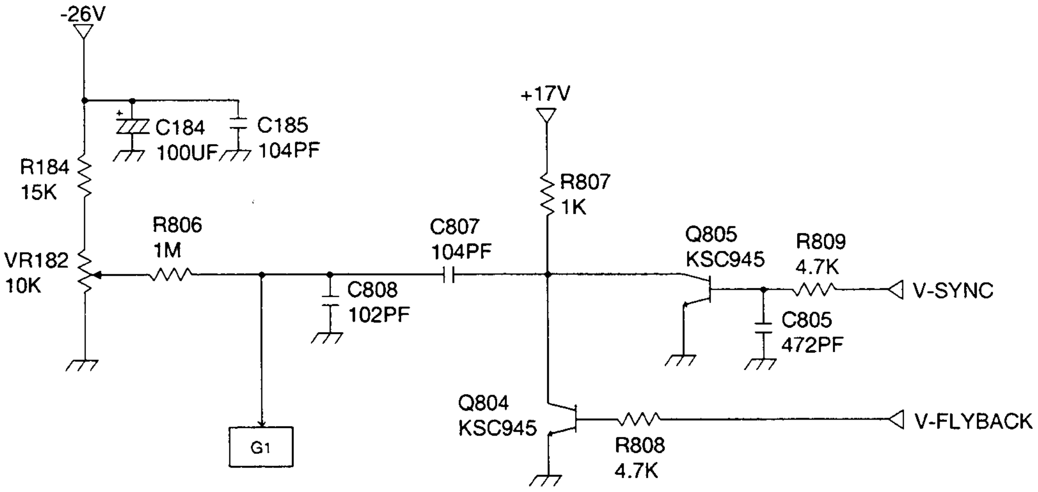
The user's contrast control, VR181, also controls current through Q802. The variation at the emitter is .920 vdc - 2.66 vdc.

Video Mute

In cases of a power saving function and mode change, Video mute is activated by the micom on pin 20. This will cause zero voltage at CN602 pin 6, and this will cutoff the video output of pre-amp IC.

(19) Brightness Control

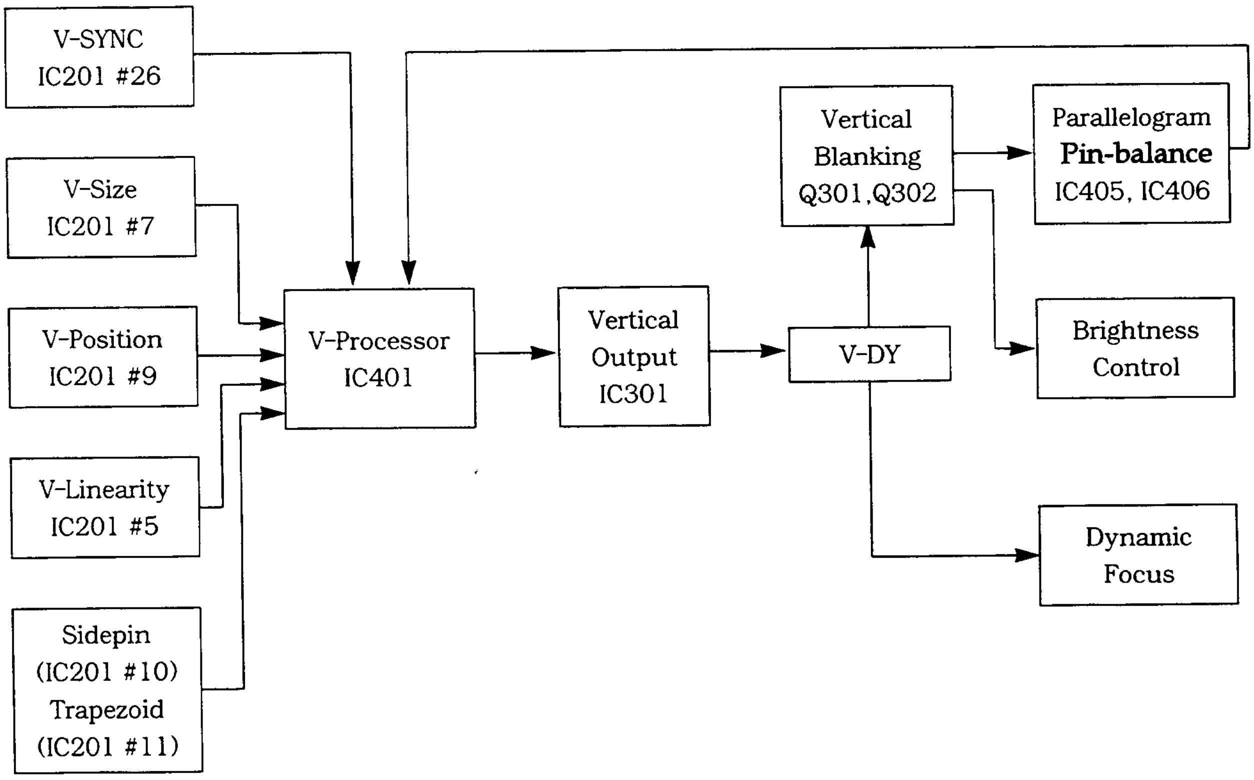
The user's brightness control VR182 (10k ohm) controls the G1 voltage applied to the C.R.T. through R806 (1M, 1/6W). The voltage variation ranges from 0 for maximum brightness to -10.4 for minimum brightness.



Brightness Control

(20) Vertical Deflection

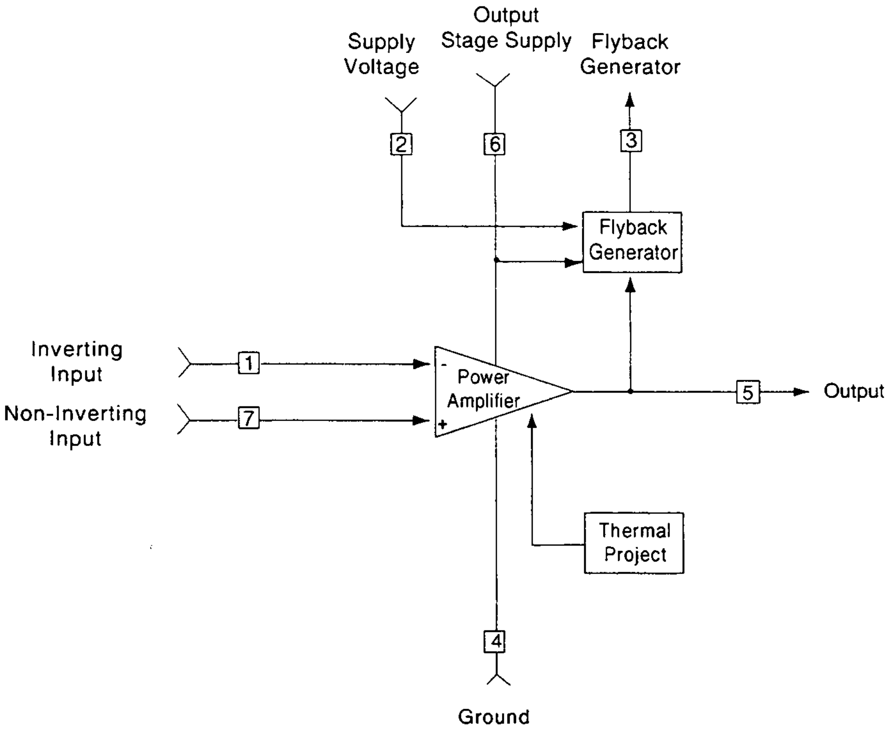
The vertical deflection circuit is used to scan from top to bottom of the display. IC401 provides oscillation, size correction, and linearity correction. The **preceeding are** controlled by the micom D/A convertor voltage applied to the vertical processor. The processor drives the output to create the deflection signal for the V-D.Y. Also, a blanking pulse is produced by the output to produce parallelogram and pin-balance correction signals, as well as blanking out the raster during vertical retrace. The micom D/A also controls the vertical positioning of the raster while the return end of the yoke produces the vertical dynamic focus signal.



Vertical Block Diagram

(21) Vertical Output

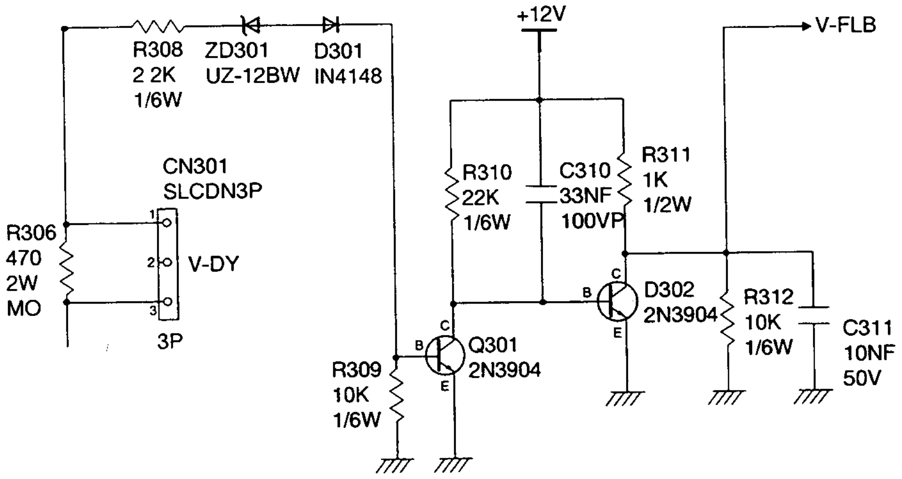
IC301 (TDA1872) receives the ramp signal from IC401 pin 30 through R304. Pin 1 input triggers a power amplifier driving the flyback generator. The flyback generator is biased by the +17V and -12vdc source. **and** D302. C317 will charge and discharge to develop a 25vpp positive polarity flyback pulse. This pulse will be used for retracing the CRT electron beam from bottom to top. Pin 5 will drive the V-D.y. with the flyback pulse and ramp for scanning from top to bottom.



TDA8172 Block Diagram

(22) Vertical Flyback Pulse

The vertical flyback pulse (V-FLB) will be used for blanking of the G1 grid during vertical retrace and creating, parallelogram, and pin-balance correction waveforms.

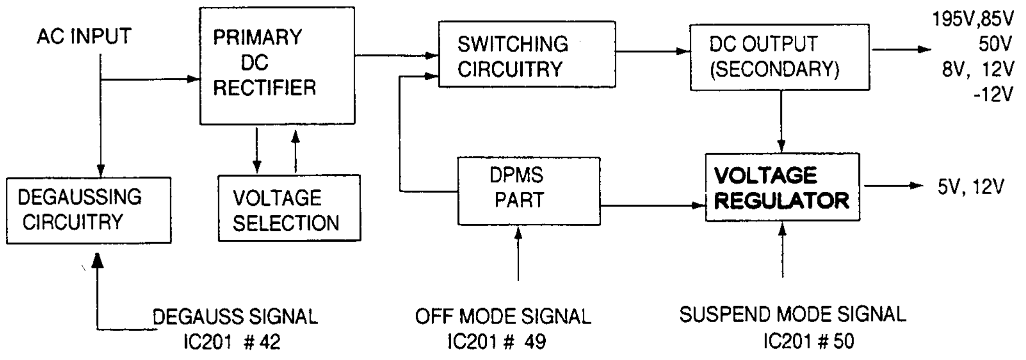


V-flyback pulse generation Circuit

2. SyncMaster 15GLi(CMB5477L) Circuit Description

1) Power Supply

The switch mode power supply for the CMB chassis is capable of automatically sensing 110 or 220 AC voltage input. It also operates with reduced power consumption by implementing the VESA Display Power Management System off and suspend modes which is microprocessor controlled. The manual degaussing circuit is also controlled by the microprocessor.



Block Diagram

Line Filtering

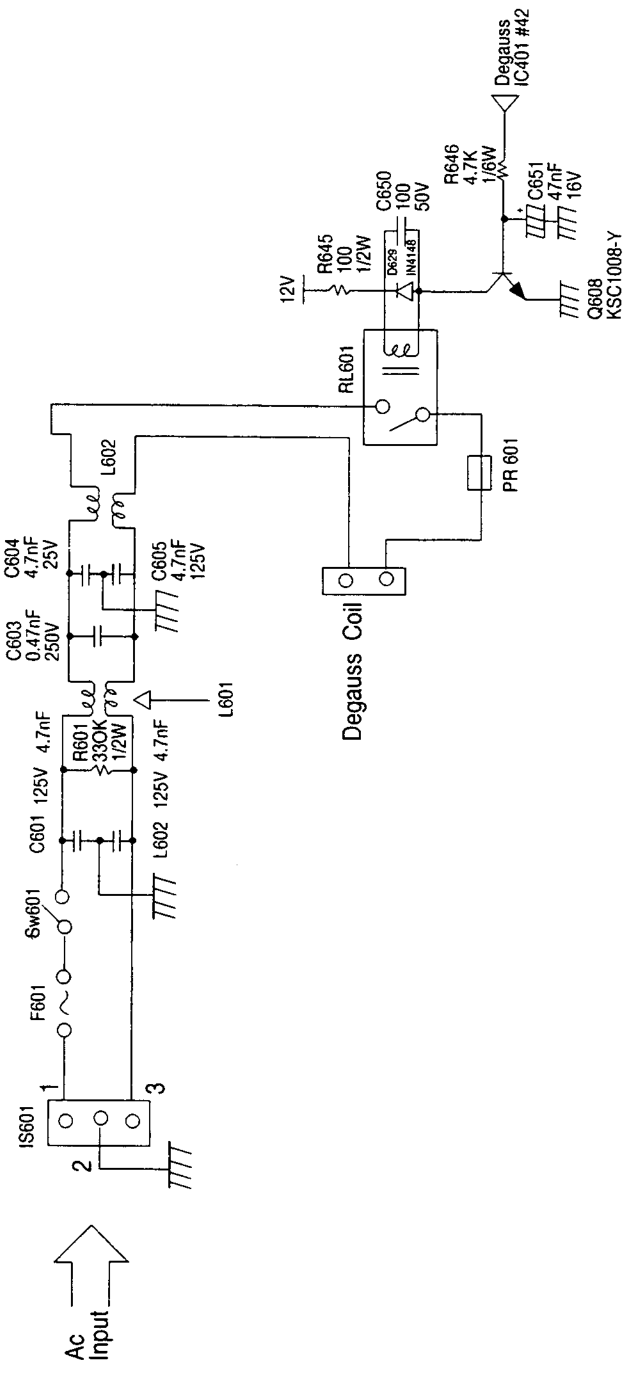
The AC input is enabled by the power switch SW602. AC line noise is filtered by L601, L602, R601, C601, C602, C603, C604, and C605.

Degaussing

The degaussing coil measures 10 ohms in resistance and it's purpose is to demagnetize the CRT during power up and when the manual degauss swich on the front control panel is pressed by the user. This is necessary since the CRT can become magnetized by the earth's magnetic field and force a beam shift, causing color impurities on the face of the picture tube.

During power up, current is applied to posistor PR601. PR601 when cold has a low resistance. As the current heats up, **PR601 resistance will increase to infinity.** This will cause current to stop flowing to the degaussing coil, **culminating in the degaussing coil being taken out of the** circuit. This is the completion of auto degaussing.

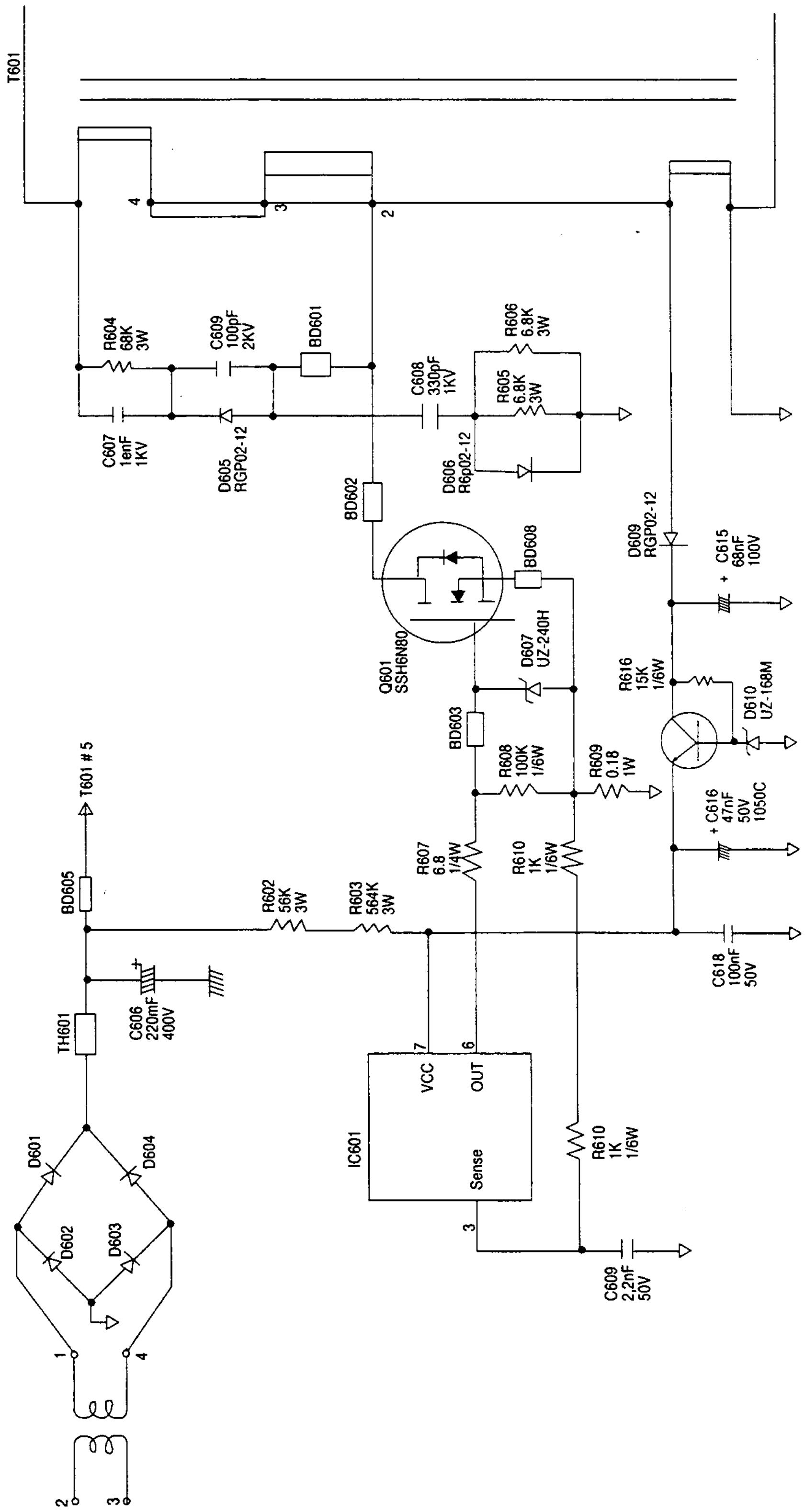
Manual degaussing can be performed as well by the user, in case impurities occur to the monitor after power is on. In normal operation, RL601 has the switch from pin 2 to 1 closed while 3 to 4 is in an open state, due to transistor Q608 being turned **on by IC201 pin #42. This will put pin 3 of** RL601 at zero volts potential. When the user presses the degauss switch on the front panel, IC102 pin #42 will output a high for approximately 3 seconds turning Q608 on. When Q601 is turned on, switch 3 to 4 closes. AC can now flow through the switched on relay. After a 3 second period, Pin #42 goes low again, turning off Q601 and cutting out the degaussing coil from the circuit.


Degauss
IC401 #42
R646
4.7K
1/6W
C650
100
50V
C651
47nF
16V
12V
R645
100
1/2W
D629
IN4148
Q608
KSC1008-Y
RL601
PR 601
L602
C604
4.7nF
25V
C605
4.7nF
125V
C603
0.47nF
250V
Degauss Coil
R601
330K
1/2W
L601
C601 125V 4.7nF
L602 125V 4.7nF
Sw601
F601
IS601
1
2
3
Ac
Input

Degaussing

Start Up

Start up voltage is supplied to pin 7 of IC601 from R602 and R603. A starter voltage is needed to initialize the first switching cycle out of pin 6, which will drive Q601(6N80) FET and subsequently drive T601 pin 2. Before the voltage at VCC drops below 10 vdc, pin 7 of T601, from the induced voltage applied to pin 2 will output the next cycle and will be rectified by D609, **charging**C615 and **regulating** R616, Q602 and D610 to 16Volt VCC. A 5 volt reference output (Pin 8 of IC601) derived from the VCC will free run the oscillator cycle by cycle until the T602 supplies H-Sync to lock in the IC601 oscillator for continued regulated power.


T601
4
3
2
R604
68K
3W
C609
100pF
2KV
BD601
C607
1enF
1KV
D605
RGP02-12
C608
330pF
1KV
R606
6.8K
3W
R605
6.8K
3W
D606
R6p02-12
BD602
BD608
Q601
SSH6N80
D607
UZ-240H
D609
RGP02-12
C615
68nF
100V
R616
15K
1/6W
D610
UZ-168M
BD603
R608
100K
1/6W
R609
0.18
1W
C616
47nF
50V
1050C
T601 # 5
BD605
R607
6.8
1/4W
R610
1K
1/6W
R602
56K
3W
R603
564K
3W
C618
100nF
50V
TH601
C606
220mF
400V
7
6
VCC
OUT
IC601
Sense
3
R610
1K
1/6W
C609
2,2nF
50V
D601
D604
D602
D603
1
4
2
3

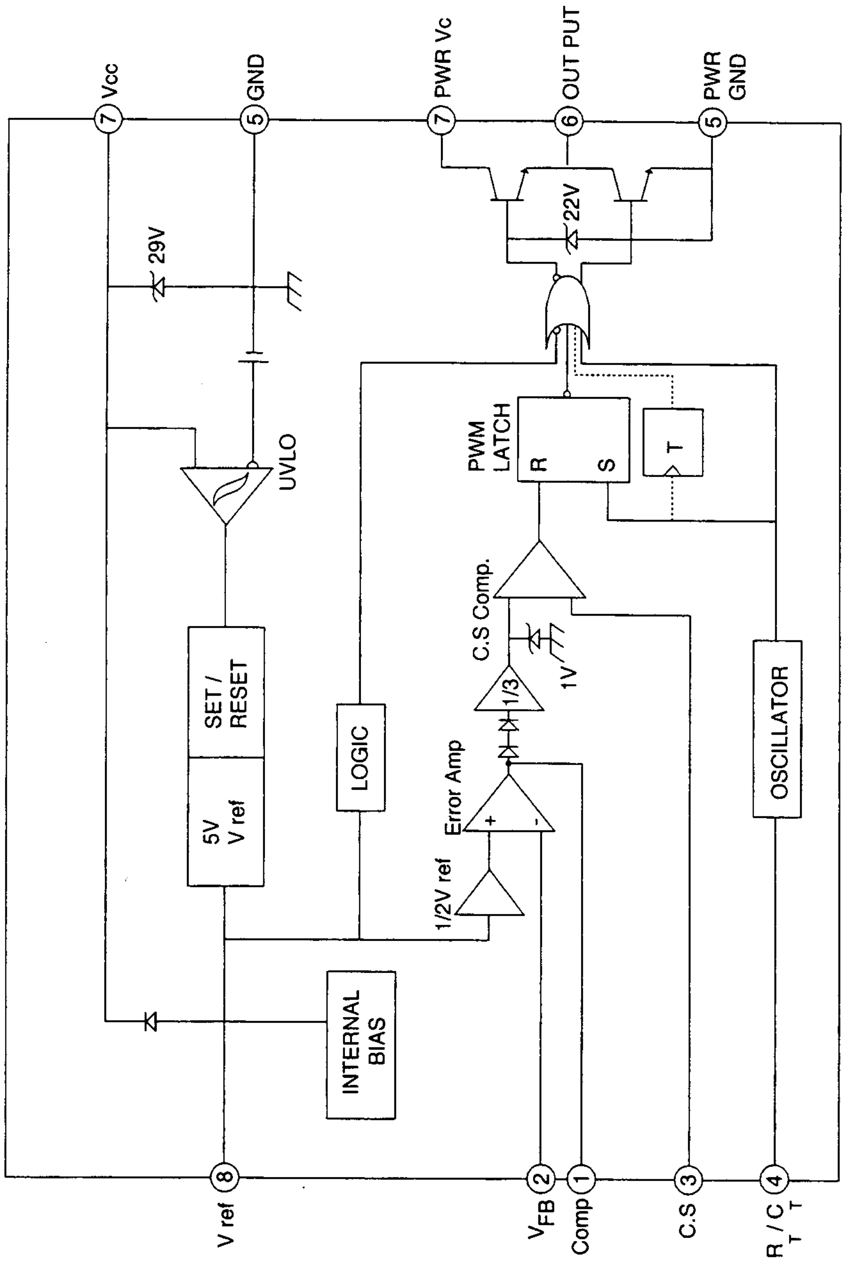
Output Amplifier

Q601 source to drain current amplifies with the PWM output from pin 3 of IC601 in order to drive T601 cycle by cycle. Pin 3 of IC601 monitors source current through R609. Compensation is done by an internal comparator with a 1 volt reference. D605, R604 C607 and C619 snub Q601 switching positive peaks.

D606, R605, R606, and C608 snub negative peaks.

Pulse Width Modulation

IC601 (KA3882) is a pulse width modulation integrated circuit. IC601 generates a pulse width duty cycle from a VCC derive 5 Vref., current sensing compensation, error amp, and a RC time constant oscillation. Each is monitored by an internal PWM latch and gate. An output **switcher** outputs the corrected pulse width duty cycle.

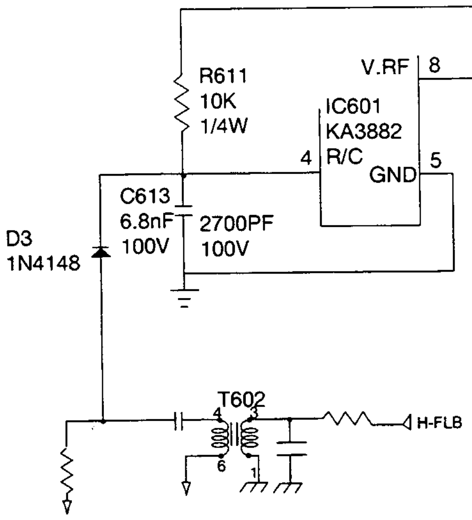


KA3882N Block Diagram

R/C Timing

Pin 8 of IC601 outputs a 5 vdc reference voltage to bias the oscillator circuit. C613 and R611 provide the time constant to develop on going duty cycle. Due to **fluctutations** in load from the different horizontal scan frequencies, the oscillator must be compensated for. Sync is supplied to T602 primary winding.

The secondary supplies sync to the anode of D608. D608 cathode signal charges and discharges C613 at the horizontal rate in order to control the oscillation and Q601 gate switching duty cycle.



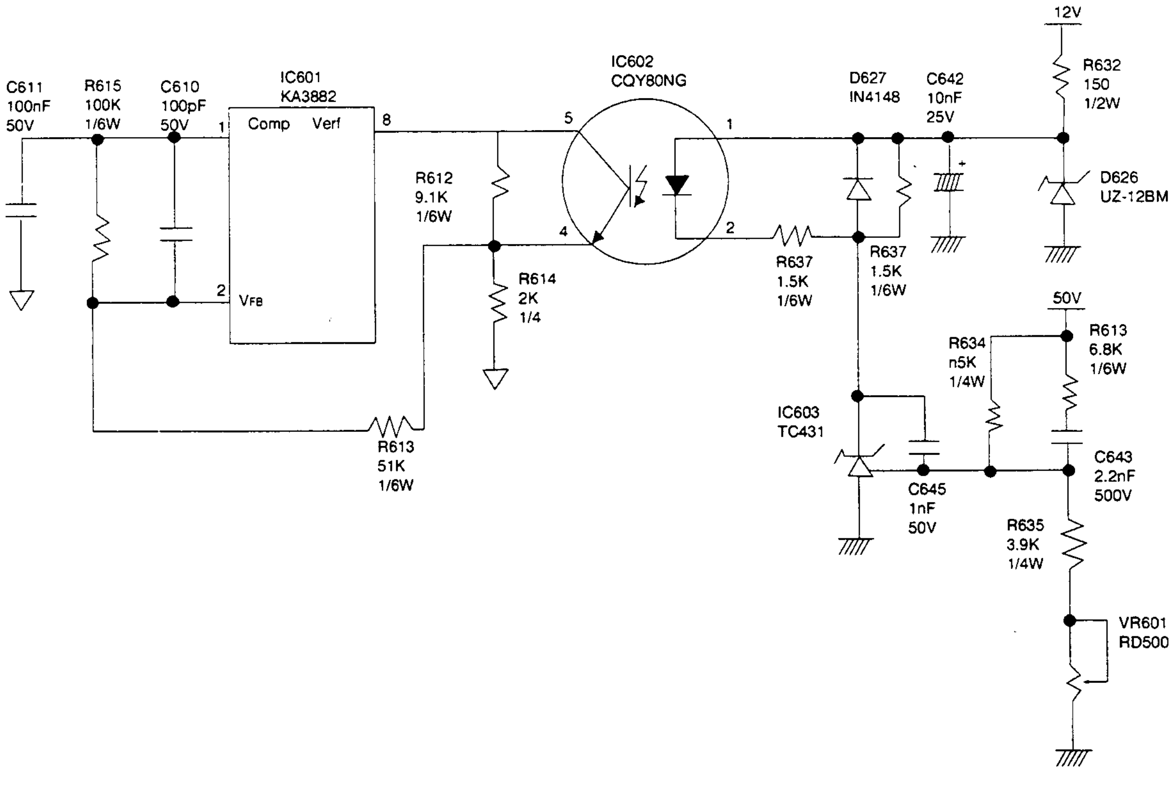
R/C Timing

Flyback and Compensation

Pins 1 and 2 provide error amp detection by a feedback voltage from comp output pin 1 to inverting error amp input pin 2 to compensate for any errors in reference voltage.

Bt adjust and Load Current Sensing

In order to adjust the output supply voltage as well as regulating the output due to a change in the load, which will affect the output voltage, the 50v line is monitored through IC603(TL431CLP), opto-coupler IC602(CQY80NG), and pin 2 of IC601. The output at pin 6 of IC 601 will have the corrected duty cycle driving Q601.

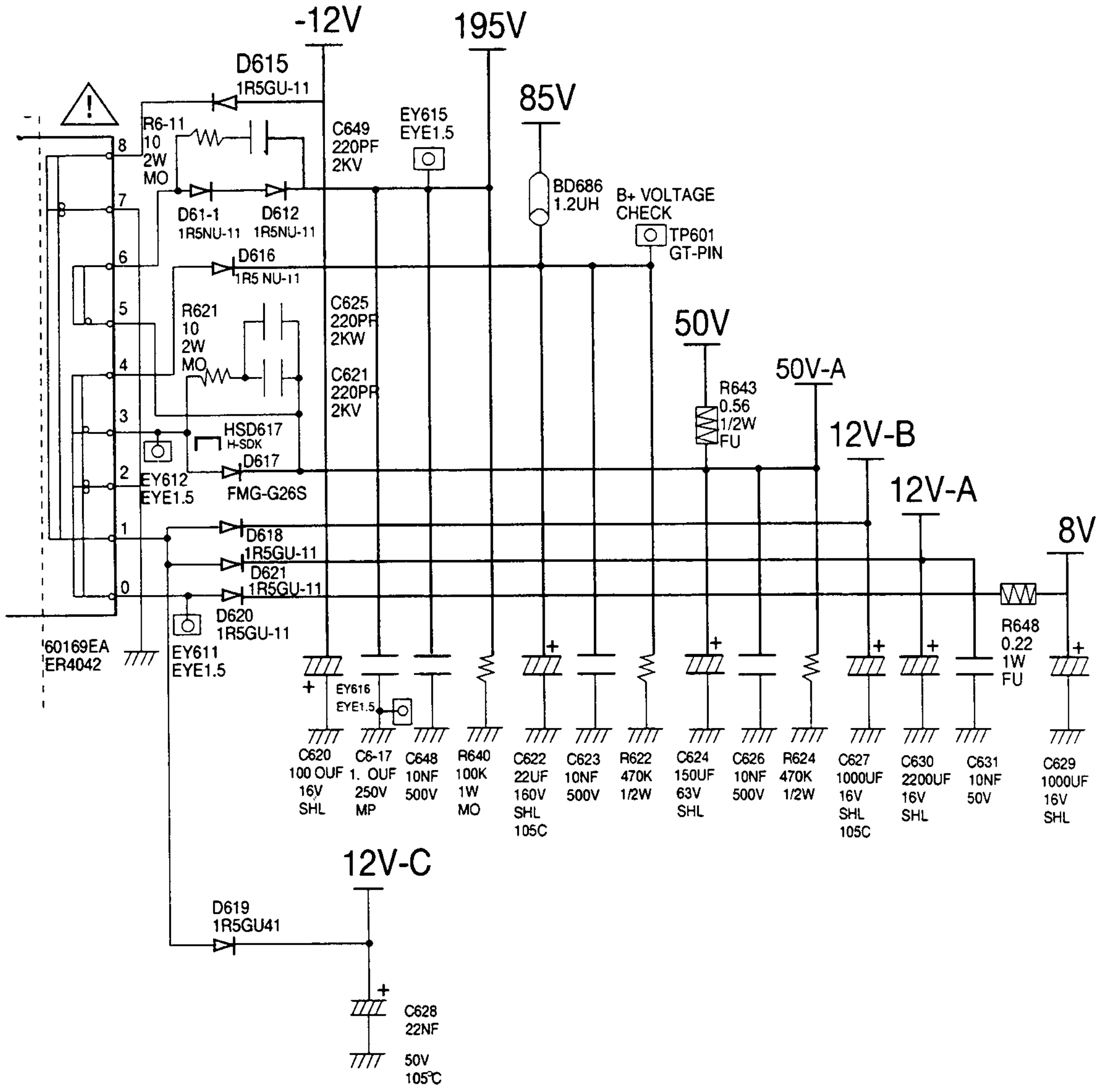


SMPS Output Voltages

The switch mode transformer T601 outputs six different peak to peak levels. The outputs will be rectified to produce six dc voltage lines. Pin 16 900 Vpp is rectified by D614 and D615 and AC filtered to produce +195Vdc. Pin 14 of T601 outputs a ____ Vpp signal which is rectified by D616 and filtered to produce 85vdc. Pin 13 of T601 outputs a ____ Vpp signal which is rectified by D617 to produce 47vdc. Pin 11 of T601 outputs a ____ Vpp signal which is rectified by D618 or D619 or D621 to produce 13vdc. Pin 10 of T601 outputs a ____ Vpp signal **which**is rectified by D620 to produce 8vdc. Pin 18 of T601 outputs a ____ Vpp signal which is rectified by D615 to produce -12vdc.

Circuit Supplies

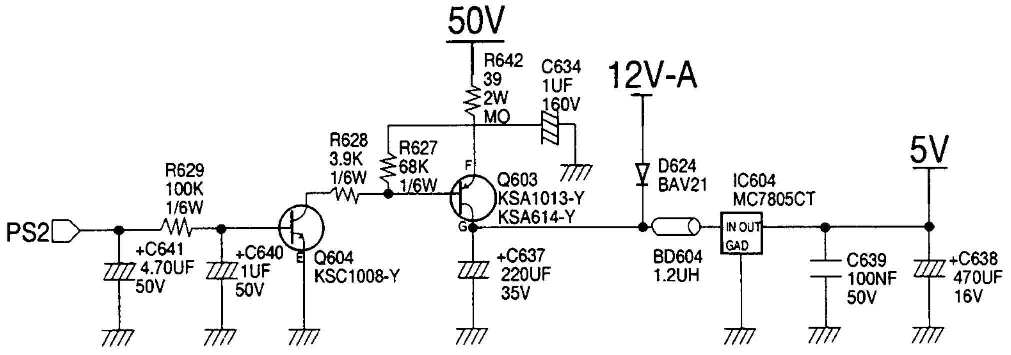
195V	High Voltage
85V	H-Deflection, Video cutoff
47V	H-Deflection start, SMPS Loading Sense(DPMS off mode) IC605(12V Regulator, DPMS off mode)
13V	SMPS Loading Sense, IC605(12V Regulator) IC604(5V Regulator), V-deflection LED-Bias, RL401(S-correction), RL601(Deguass Switch)
8V	CRT Heater
-13V	V-Deflection


-12V
195V
85V
D615
1R5GU-11
R6-11
10
2W
MO
C649
220PF
2KV
EY615
EYE1.5
BD686
1.2UH
B+ VOLTAGE
CHECK
TP601
GT-PIN
D61-1
1R5NU-11
D612
1R5NU-11
D616
1R5 NU-11
R621
10
2W
MO
C625
220PF
2KW
C621
220PF
2KV
50V
R643
0.56
1/2W
FU
50V-A
12V-B
12V-A
8V
HSD617
H-SDK
D617
FMG-G26S
EY612
EYE1.5
D618
1R5GU-11
D621
1R5GU-11
D620
1R5GU-11
EY611
EYE1.5
60169EA
ER4042
8
7
6
5
4
3
2
1
0
R648
0.22
1W
FU
EY616
EYE1.5
C620
100 OUF
16V
SHL
C6-17
1. OUF
250V
MP
C648
10NF
500V
R640
100K
1W
MO
C622
22UF
160V
SHL
105C
C623
10NF
500V
R622
470K
1/2W
C624
150UF
63V
SHL
C626
10NF
500V
R624
470K
1/2W
C627
1000UF
16V
SHL
105C
C630
2200UF
16V
SHL
C631
10NF
50V
C629
1000UF
16V
SHL
12V-C
D619
1R5GU41
C628
22NF
50V
105℃

DPMS OFF Mode Power Supply

The power off mode is a command from the microprocessor when no sync input is detected from the signal source to the monitor. This is part of the VESA DPMS standard to conserve energy.
In the off mode the micom detects missing horizontal and vertical sync. Once detected, the micom, IC201, outputs a high from pin 49. The high is sent to the base of Q607 turning on the transistor.
At that time, the current flowing **to IC602 pin 1 to pin 2 increases, and the voltage of IC602 pin 4 increases** from 2.5V to 3V. Then the output pulse duty of pin 6 is reduced to usec, and the secondary Voltage of T601 is reduced %.

MICON VCC ON DPMS OFF MODE



The IC 604 input connected to 12V line **supplies** Vcc +5V to the Micom through IC 604 (7805) on normal operation mode.

The IC 201 pin 49**registers**high to turn on Q604 on the Power off mode.Then, the Q603 is turned on and the 50V line is connected to the IC 604 input.

The 12V line registers ____ on the power off mode and the 50V line register ____ . The 50V line drives IC604 which supplies Vcc +5V to the micon.

2) Sync Interface

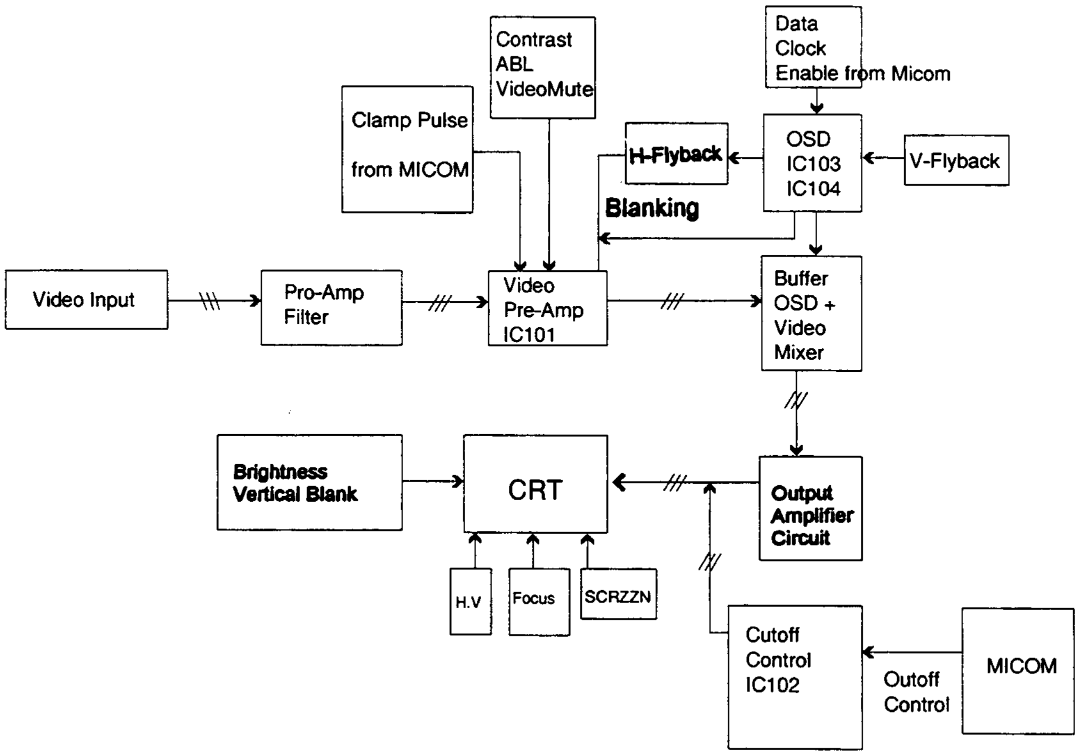
Connector Interface

The 15GLi "M series" monitor is interfaced with 15 pin D-Type input connectors.

D-Type Input	Signal
Pin 1	Red Video
Pin 2	Green Video or Sync on Green
Pin 3	Blue Video
Pin 4	GND
Pin 5	DDC Return
Pin 6	Red Ground
Pin 7	Green Ground
Pin 8	Blue Ground
Pin 9	Reserved
Pin 10	GND-Sync/Self-Raster
Pin 11	GND
Pin 12	DDC Data
Pin 13	H-Sync
Pin 14	V-Sync
Pin 15	DDC Clock

3) Video

The video is applied to a pre-amp, where amplitude is contrast controlled along with ABL and video mute. Gain is controlled by MCU controller. Horizontal and OSD blanking is applied to the pre-amp. The next stage buffers and mixes the video with the OSD video to be amplified by the output amplifier. The output amplifier, IC107, amplifies the video with the OSD video. The output Amplifier consists of QR, QG, QB01, QR, QG, QB11, QR, QG, QB12, QR, QG, QB13 and QR, QG, QB14. The output dc level for cutoff is controlled by MCU controller.



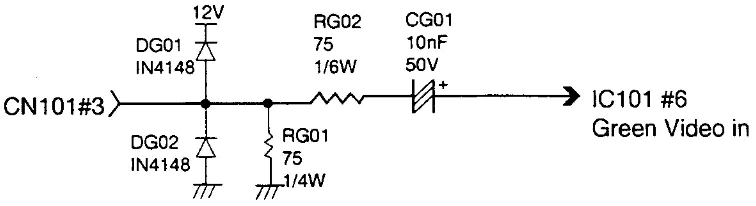
Video Block Diagram

Video Pre Amplifier

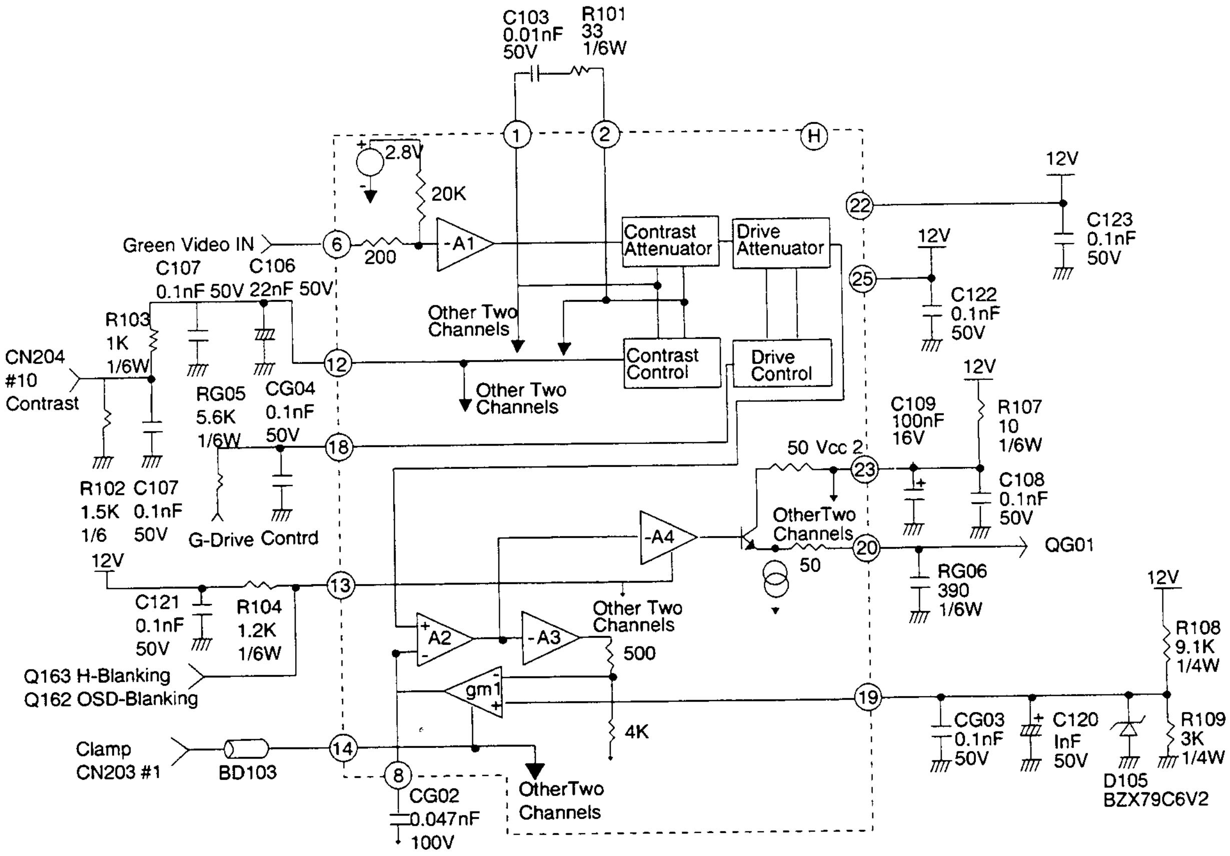
The video pre amplifier that is used is a LM1207. The LM1207 has 3 wideband 85 Mhz amplifiers for red, green, and blue video. The output amplitude is controlled by external contrast, and gain controls. Also horizontal blanking is applied to the IC along with a clamp gate pulse to control the internal dc level and an external dc voltage to set the black cutoff level.

Green Video Input

For the purpose of simplicity, the green video will be discussed. DG01, DG02, RG01, RG02 and CG01 at the input of IC101 pin 6, green video in, are used to limit the amplitude against surges above VCC and below chassis ground level. CG01 provides AC coupling of the video signal. IC101 (LM1207) will restore the dc level at the input internally. The dc restoration level is approximately 2.8vdc.



Green Video Input



Video Preamp

LM1207 Contrast Control

Internally, the video is amplified and controlled by MICOM controller . Green video is input at pin 6. The 200 ohm resistor is used for ESD protection and current limiting during surges. The signal is buffered and inverted by A1. A1 is composed of a buffer and inverter. The inverter will drive the contrast attenuator. The contrast attenuator is a differential amplifier. The video is applied to the emitters of the amplifier. The contrast control is dc voltage, operating the base of both transistors in a differential pair. The voltage applied to the base of either transistor will change the amplitude level on the output. The change in contrast voltage is dependent on 3 items.

1. Automatic Contrast Limiting
2. User's contrast control
3. Video Mute

Contrast Input Operating Voltage

The contrast operating voltage is controlled at pin 12 of the LM1207 video preamp IC. Pins 1 and 2 are the final control voltage to this stage. The operating voltage range of pin 12 is from 0 to 2 volts dc. Using a full white pattern at 1024 × 768 resolution and 75Hz vertical frequency, contrast control, video mute, and ABL ranges are depicted below.

Control Status	Pin 12 Voltage
Contrast Minimum	.576
Contrast Maximum	1.674
Video Mute	17.8mv

Contrast Input ABL Range

Below is the range of ABL with the contrast and brightness controls set to maximum when different patterns and colors are displayed on the CRT.

Color and Pattern	Pin 12 Voltage
Full White Pattern	1.674
Full Yellow Pattern	1.741
Full Magenta Pattern	1.780
Full Cyan Pattern	1.802
Full Red Pattern	1.906
Full Green Pattern	1.952
Full Blue Pattern	1.979
50mm Box White	1.994

Contrast Attenuator

Pin 1 of the contrast attenuator is held constant at approximately 5.43 vdc. Pin 2 of the attenuator is the variable to control the output video level. Using the full white pattern at 1024×768 75Hz by setting the contrast control to minimum, the voltage is set to 5.49 vdc. Set the control to maximum the voltage increases to 5.54 vdc. Using the 50mm box with the ABL at cutoff and the contrast set to maximum, the voltage decreases to 5.43 vdc. This gives us a 110mv swing in voltage, with the contrast set to minimum and maximum with the ABL at cutoff. C103, a 0.01nF 50V capacitor, is in the circuit to cutout crosstalk, while R101 33 ohm 1/6 watt is there to increase stability. Contrast variation at this point will vary the video out approximately 150mv peak to peak.

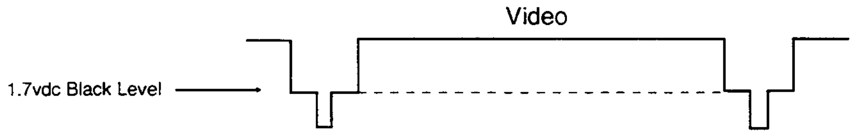
Drive Attenuator

Continuing with the green video that is output from the contrast attenuator, the video is input to the drive attenuator made up from another differential pair. The drive control is controlled by VCC and the voltage applied to pin 18 of the LM1207. The voltage on pin 18 is controlled by MCU controller. Variation of this control will range the voltage from 0 vdc at minimum gain, to 4.22 vdc at maximum gain. The nominal voltage at this pin is about 2.871 vdc. The signal derived from the drive attenuator will be applied to differential pair. The output from the differential pair's black level will be controlled by a clamp comparator.

Clamp Comparator

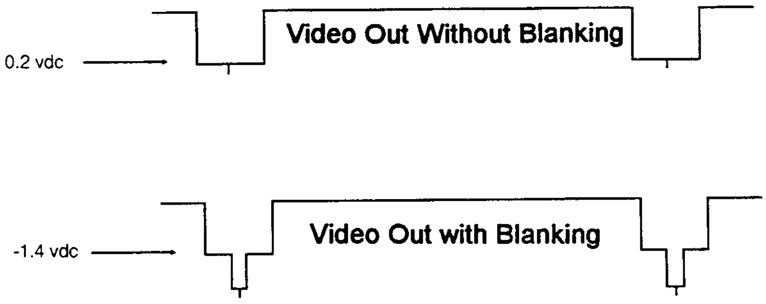
CG02 of pin 8 is used as a filter to clamp the dc level going to the video amplifier output stage. The clamp comparator receives a 5vpp negative polarity clamp gate pulse at pin 14 of the LM1207. Pin 19 receives a 1.7 vdc developed from the voltage drop across R108 and R109 fed by the 12 volt VCC source. This will be referenced to during the duty of the clamp gate pulse. By increasing the voltage at pin 19, the black level point will increase, causing a brighter raster. Decreasing the voltage will cause a decrease in raster brightness. The output of gm1 will charge and discharge CG4, leaving a pure dc for the video dc voltage level applied to the inverting input of A2.

During the back porch of the video signal, the clamp gate pulse is applied to gm1, turning on the comparator. During this period, the video out is compared to the voltage on pin 19 to set the black level.



VIDEO

Amplifier A3 is used to restore the dc level to the video signal. A4 is a high gain current amplifier 10 times the output of A3. A blanking pulse is applied to pin 13 and applied to A4. This will drive the output on pin 20 to less than 0.1 vdc during the period when video is inactive. This will blank the video during horizontal retrace of the CRT deflection yoke.



The final stage of A4 buffers out the video signal. In order to match the loading of the feedback section RG06(390 ohm) is tied to the output of pin 20 and ground. Vcc2 at pin 23 supplies the output stage with collector voltage. Vcc1 supplied to pins 3,11, 22, and 25 provides bias voltage to the main functions of the LM1205N.

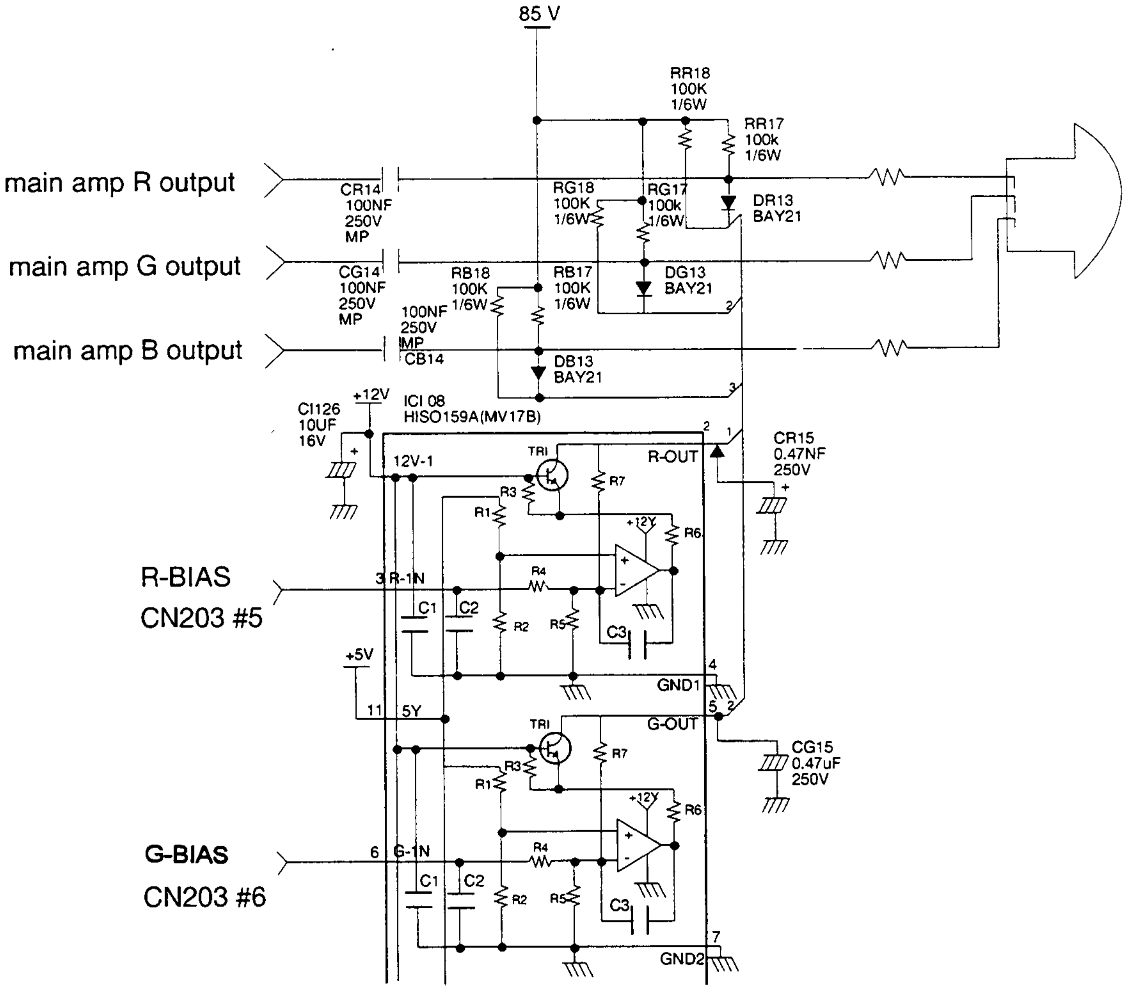
Video Output

The video output from pin 20 of IC101 is applied to the base of QG01(2N5770) and buffered to the emitter, where it will be mixed with the On Screen Display video when activated by the user. Video **signal** mixed with OSD video at QG01 goes to the main Amp composed of cascode citcuit(QG11, QG12). This signal is amplifed to 40 Vpp including blanking, and goes to the DC compling capacitor, (G14 through the output complementary **emitter** follower (QG13, QG14).

Cutoff Control

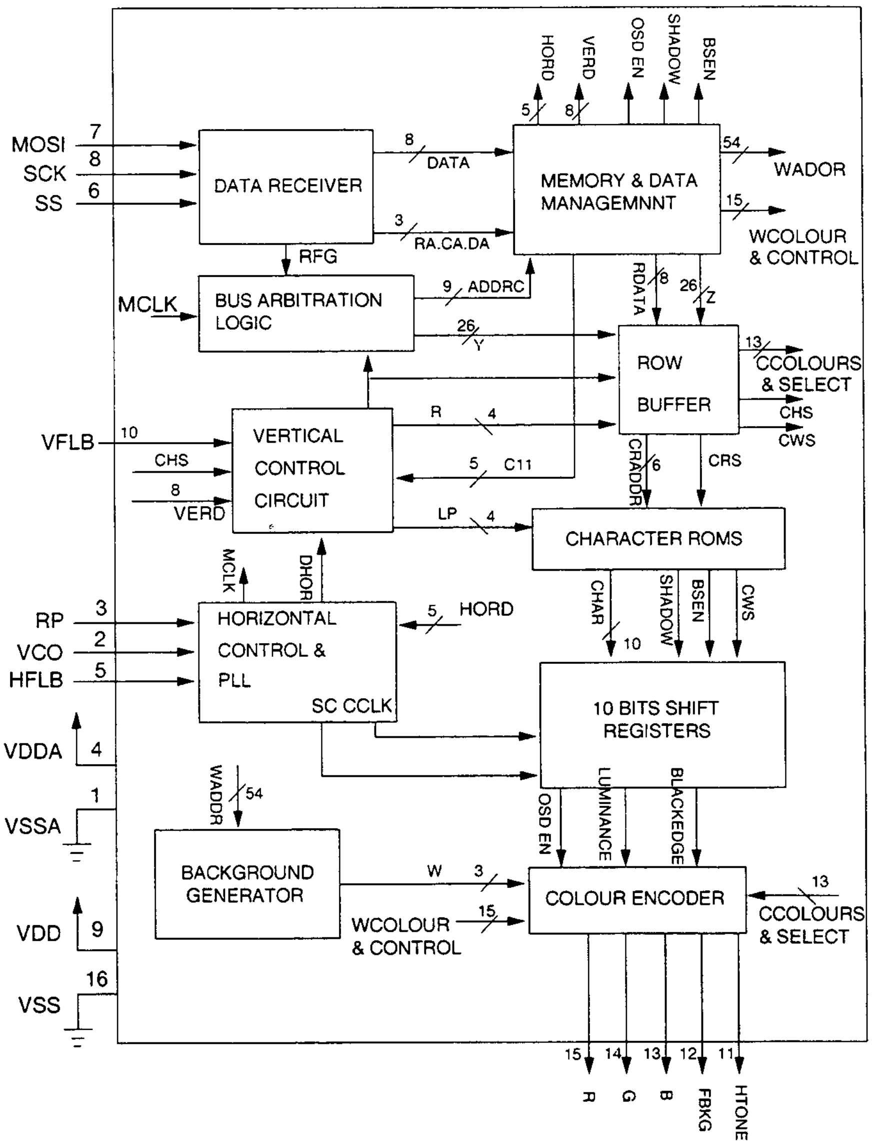
G-Cutoff adjustment by MCU controller creates a voltage drop across R5, which will apply the voltage to pin 6 of LM324. When increasing the voltage drop across R5, the adjustment will cause an decrease in voltage on pin 7. That causes TR1 to operate in saturation and decrease the collector voltage driving the CRT cathode towards saturation. Decreasing the voltage, with adjustment, at pin 6 of LM324 will increase the voltage at pin 7 and operate TR1 in cutoff. This will increase the CRT cathode voltage, operating it in cutoff. Pin 5 of the op amp has about 2^8 Vdc reference level.

This voltage is setup by the 5 Vdc source and voltage divider which is comprised of R1 and R2.



On Screen Display

The CMB5477L uses a MC4320P OSD character plus background generator and a QM74HC125PS non inverting buffer in it s OSD circuit. The MC4320P located at IC103 operates off of commands from the micom. When a key is pressed, except for the manual degauss key, the micom sends an Enable, Data, and Clock to IC103 pins 6, 7, and 8. The OSD will remain active on the screen for approximately 8 seconds before and after user adjustments are made, or until that particular function key is pressed through it's cycle.



MC4320 System Block Duagram

MC4320 Pin Outs

Pin 1-VSSA

It provides the signal ground to the PLL circuitry. Analog ground for PLL is separated from digital ground for optimal performance.

Pin 2-VOLTAGE CONTROL OSCILLATOR INPUT(VCO)

A DC control voltage input to regulate an internal oscillator frequency. See figure 10 for the application values used.

Pin 3-RESISTOR(RP)

An external RC network is used to bias an internal VCO to resonate at specific dot frequency. The value of the resistor for this pin should be adjusted in order to set the pin voltage to around half VDD. See Figure 10 for the application values used.

Pin 4-VDDA

A positive 5V DC supply for PLL circuitry. Analog power for PLL is separated from digital power for optimal performance.

Pin 5-HORIZONTAL FLYBACK(HFLB)

This pin inputs a negative polarity Horizontal Synchronize signal pulse from a host monitor to phase lock into an internal system clock generated by the on-chip VCO circuit.

Pin 6-SLAVE SELECT(SS)

This input pin is part of the SPI system. An active low signal generated by the master device enables this slave device to accept data. Pull high to terminate the SPI communication.

Pin 7-SERIAL DATA INPUT(MOSI)

Data and control message are being transmitted to this chip from a host MCU via this wire which is configurated as an uni-directional data line. (Detailed description will be discussed in the SPI section).

Pin 8-SERIAL CLOCK INPUT(SCK)

A separate synchronizing clock input from the transmitter is required. Data is read at the rising edge of each clock signal.

Pin 9-VDD

This is the power pin for the digital logic of the chip.

Pin 10-VERTICAL FLYBACK(VFLB)

Similar to pin 5, this pin inputs a negative polarity of Vertical Synchronize signal from the monitor set to synchronize the vertical control circuit.

Pin 11-HTONE

This pin outputs a logic high during windowing except when graphics or character is being displayed. It is used to lower the external R, G, B amplifiers gain to achieve a transparent windowing effect.

Pin 12-FAST BLANKING(FBKG)

This pin will output a logic high while displaying characters or windows when FBKGC bit in frame control register is 0, and output a logic high only during displaying characters when FBKGC bit is 1. It is defaulted to high impedance state after Power on or when there is no output. An external 10K Ohm resistor pull low is recommended to avoid level toggling caused by hand effect when there is no output.

Pin 13, 14, 15-BLUE, GREEN, RED(B.G.R)

OSD color output in TTL el to the host monitor. These three signals active high output pins are in high impedance state when OSD is disabled.

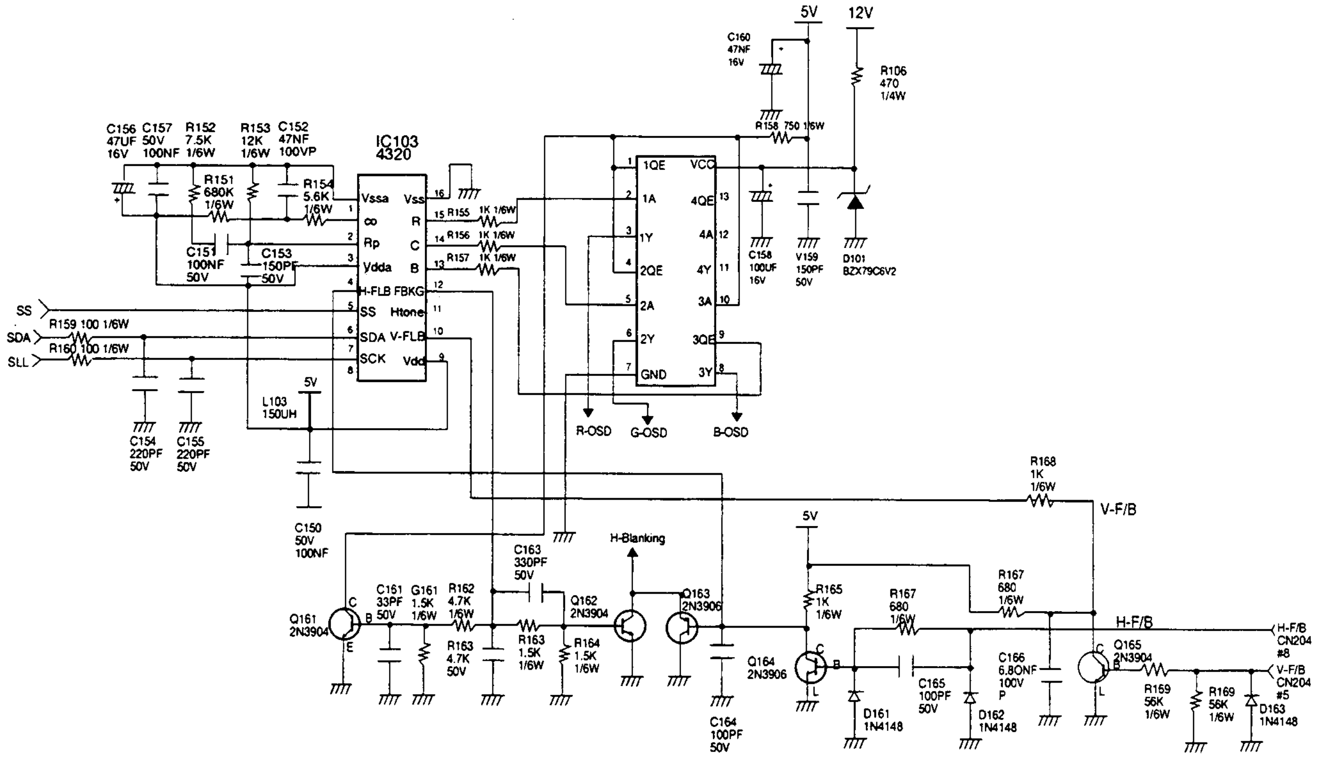
Pin 16-VSS

This is the ground pin for the digital **logic** of the chip.

On Screen Display Buffer

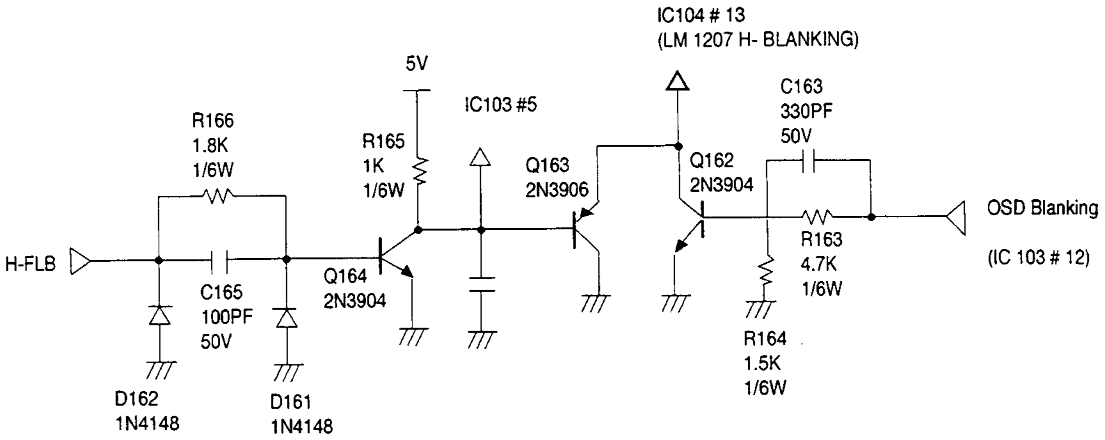
The OSD video is buffered through IC104(QM74HC125P5). Blue OSD is input at pin 9. Green OSD is input at pin 5. Red OSD is input at pin 2. The outputs are enabled by the blanking output from the OSD generator IC103. Pin 12 of IC103 outputs a positive polarity blanking pulse. The pulse is applied to the base of Q161, while R161 and R16 bias the base emitter junction of Q161. The signal will invert and amplify to a 5vpp level. The pulse will then be applied to IC104 pins 1, 4, and 10. An active low at these pins will enable the buffer OSD outputs on pins 3, 6, and 8 red, green, and blue respectively.

The red, green and blue OSD video will be applied to the anodes of diodes DR03, DG03, and DB03 respectively. The diodes will buffer through the OSD video to the cathodes where they will mix with the video from the emitters of QR01, QG01, and QB01. The OSD video can now be amplified, along with the RGB video.



LM1207 Horizontal Blanking

The horizontal blanking circuit receives a H-flyback pulse from the main pcb horizontal deflection circuit and this pulse is connect to CN204 pin 8 on the video pcb. The H-FLB pulse is applied to the base of D161. D162, R166, and C165 bias the base emitter junction of Q164. Q164 will amplify the H-FLB to a negative polarity 5vpp pulse. At this point H-FLB will be supplied to pin 5 of the OSD IC103 and also buffered by Q163 to pin 13 of IC101.



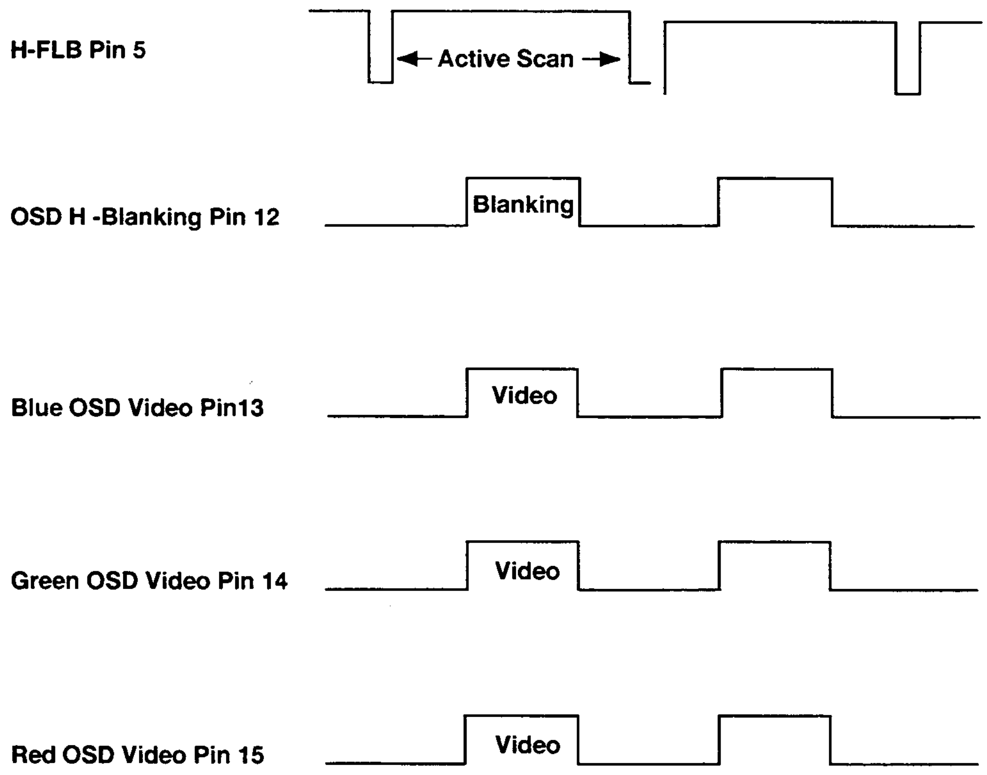
Horizontal Blanking Circut

OSD Blanking

The OSD blanking is generated out of IC103 pin 12 as a positive polarity and will be applied to the base of R162. R164 and C163 set the biasing for the base emitter circuit. Q162 will amplify and invert the blanking signal to a negative polarity 5 vpp signal at the collector and apply it to IC101 pin 13 during OSD function.

OSD Timing

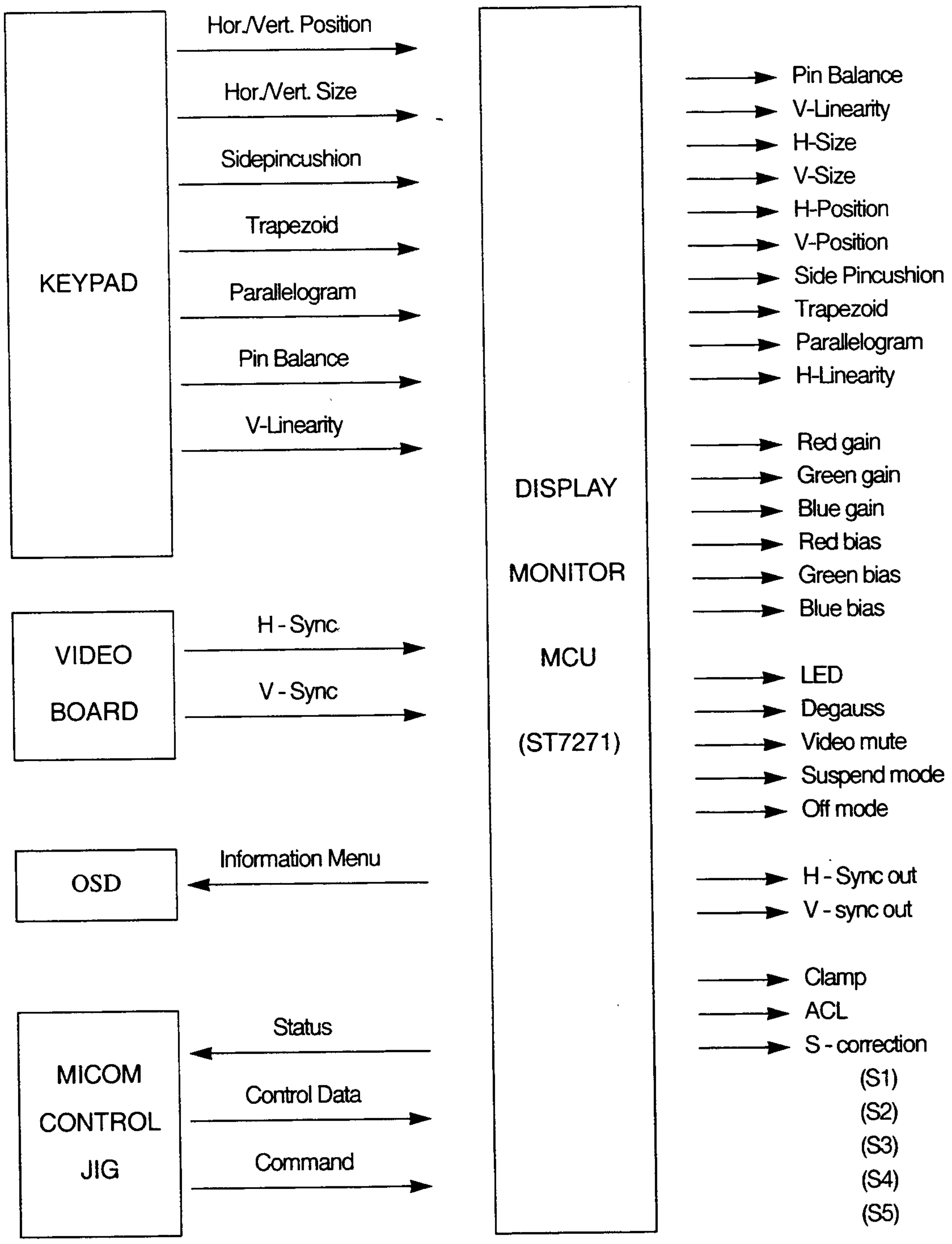
Below is the timing relationship between the OSD video and blanking output from IC103(MC43209) and the horizontal scan rate as it is input to pin 5 of IC103.



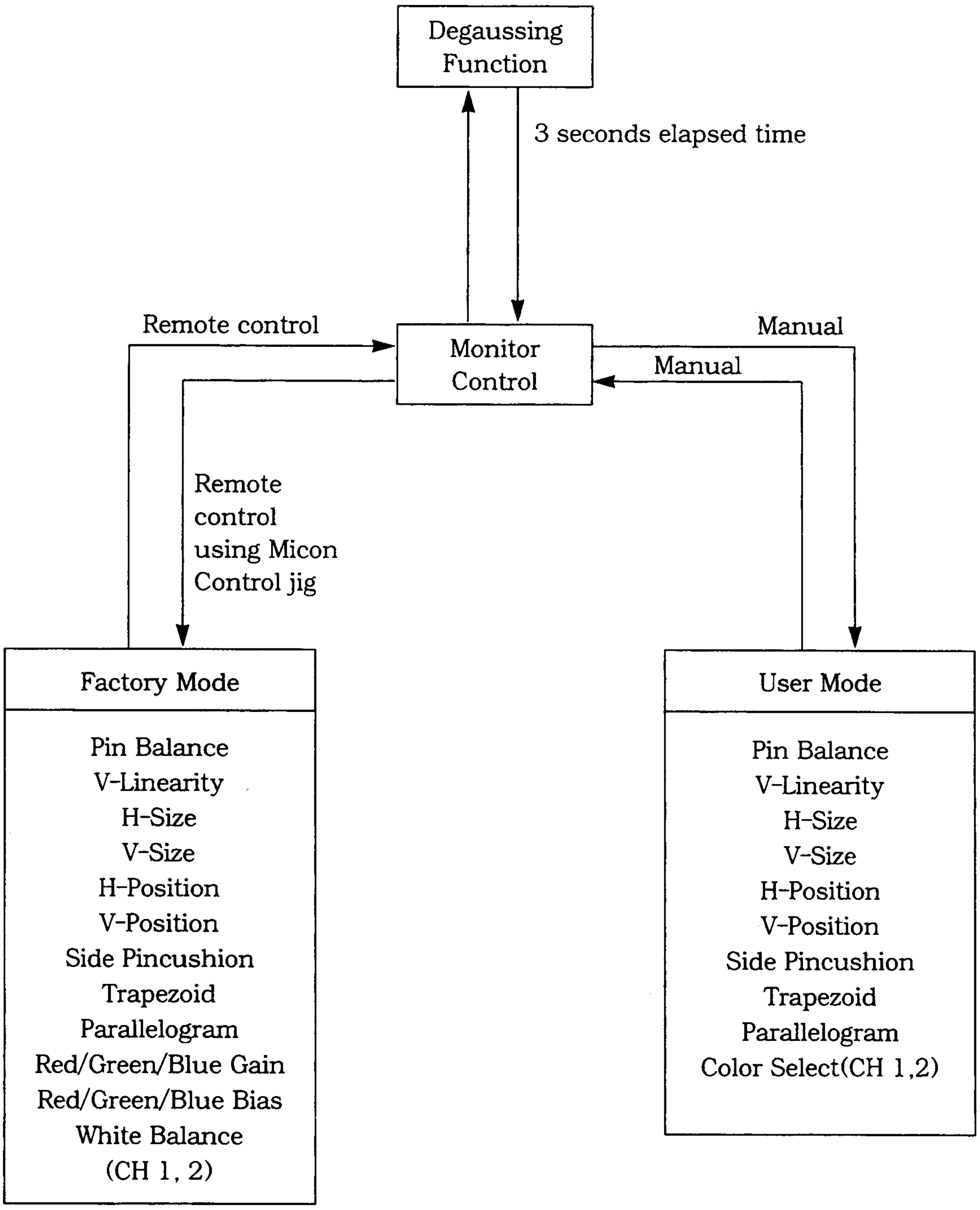
4) Microprocessor Unit

(1) Specification of Monitor control software

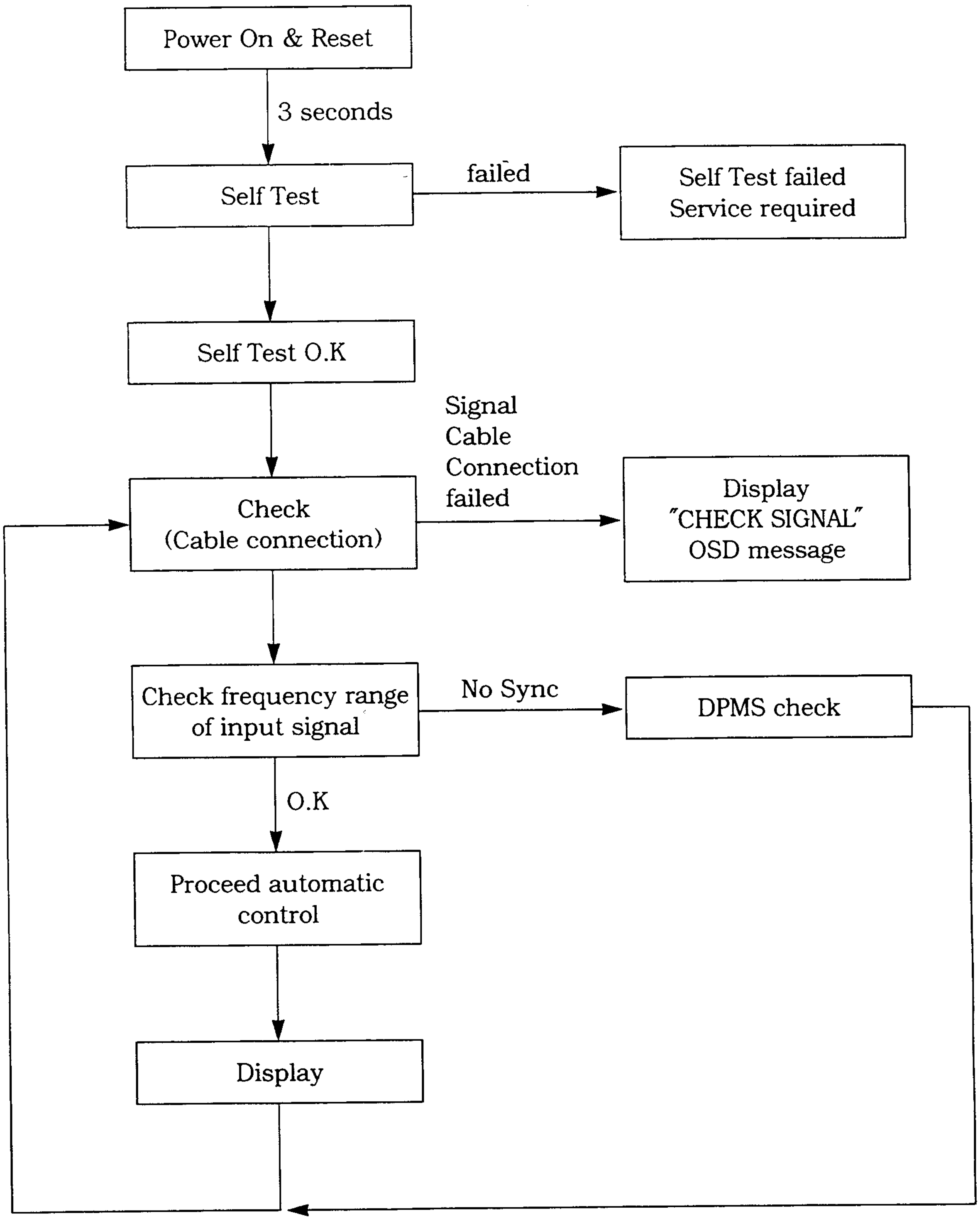
(1-1) Context Diagram



(1-2) Monitor Control Menu Tree

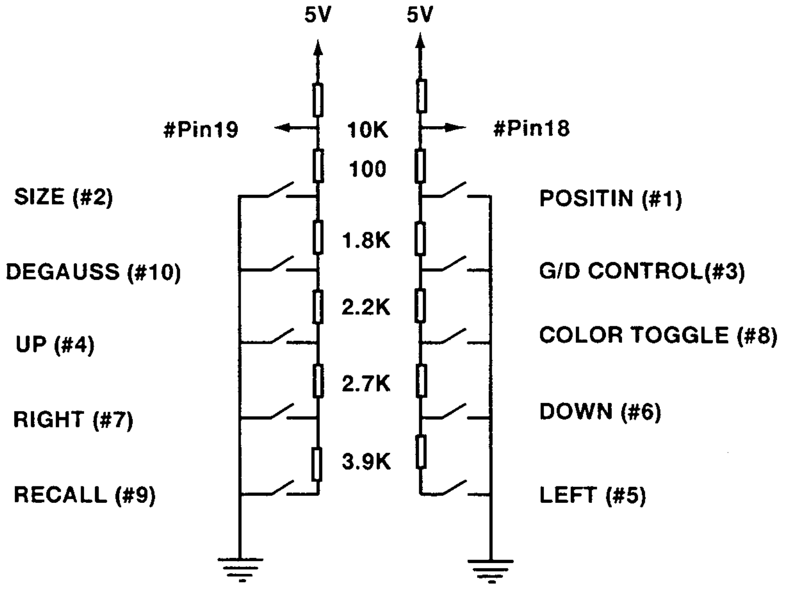


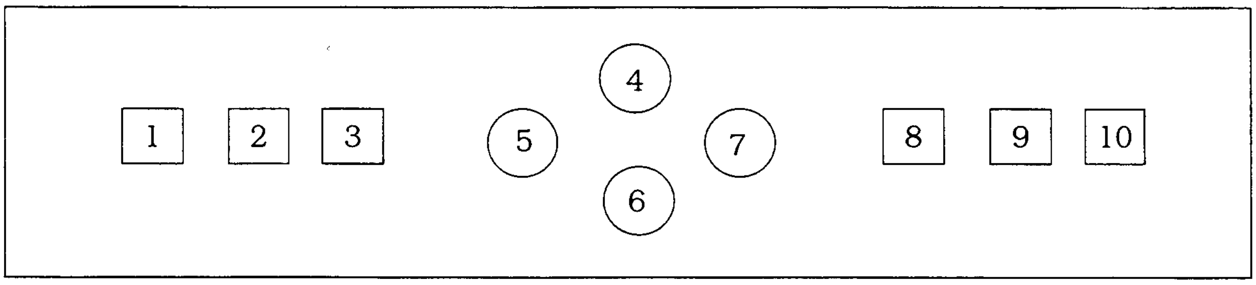
(1-3) Flow Chart of Operation



(2) Description of MCU Pin Configuration

(2-1) Input Key Pad Definition

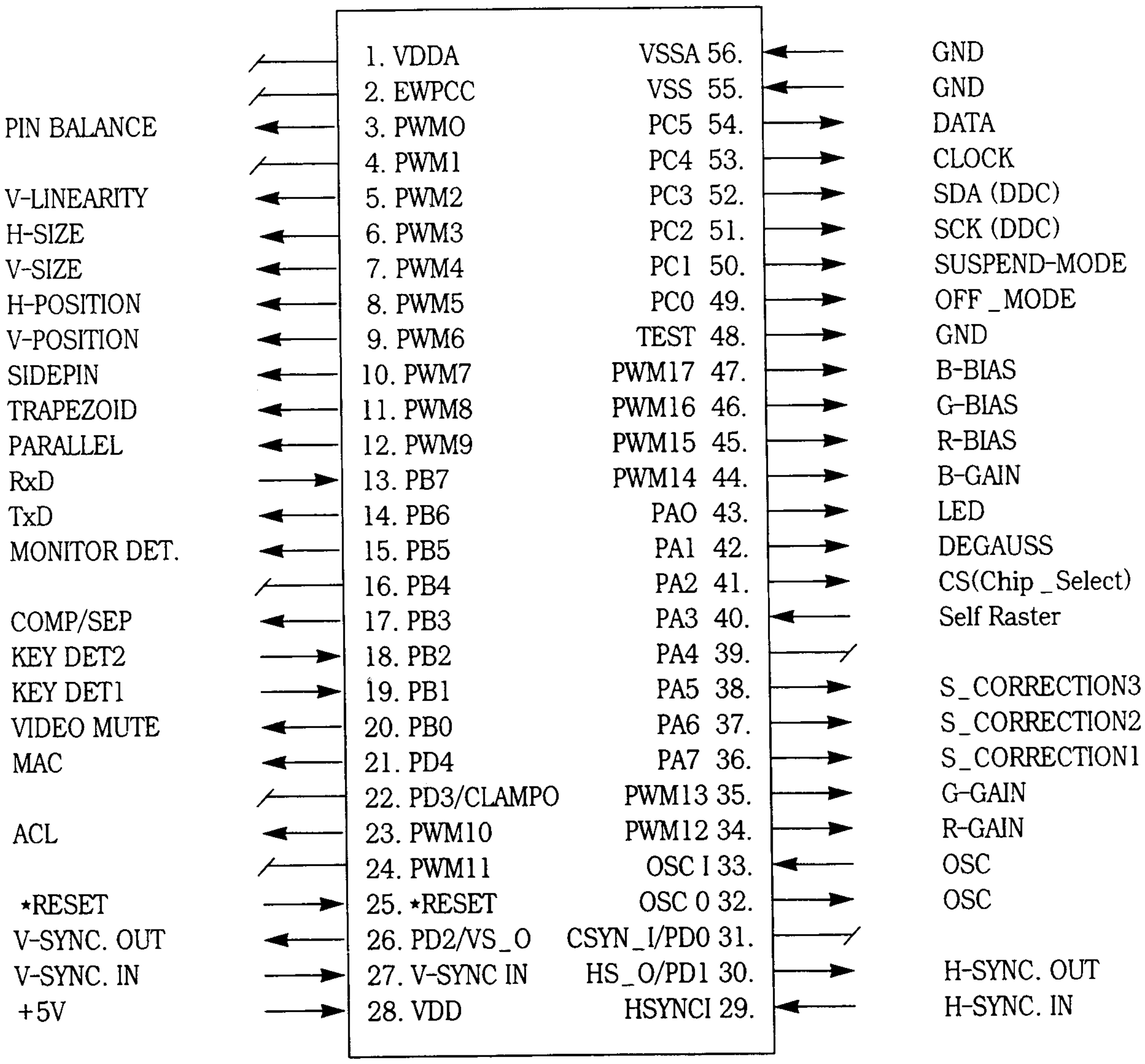




2) MCU Port Configuration

- Pin 3~12(PWM 0 ~ PWM 9) : DAC output port to get DC voltage by filtering output of PWM system. pin-Balance, V-Linearity H-size, V-size, H-position. V-position, side pincushion, trapezoid, parallelogram along with horizontal, vertical oscillation and **deflection** circuits.

- ● Pin 13~14(PB6, PB7) : Transmission, Reception port. The communication line of micom control JIG and monitor
- ● Pin 15(PB5) : Input port sensing monitor model
  - ○ Low : Samsung basic model
  - ○ High : Private model



- ● Pin 17(PB3) : Sync type output port to **correct V-Sync.**
  - ○ Composite Sync input :
  - ○ Seperate Sync input :

- Pin 18~19(PB1, PB2) : Key input port
- Pin 20(PB0) : Video mute signal output
- Pin 21(PD4) : Macintosh Timing select output port
  - ○ Macintosh Timing : High
  - ○ Others : Low
- Pin 22(PD3) : Clamp signal output port
- Pin 23(PWM10) : AS 7DAC output, ACL level control signal output.
- Pin 25(*Reset) Reset port Low Active
- Pin 26(PD2) : V-Sync output port
- Pin 27(V-SYNC IN) : V-Sync input port
- Pin 28(VDD) : B^+
- Pin 29(H-SYNC IN) : H-Sync input port
- Pin 30(PD1) : H-Sync input port
- Pin 32~33(OSC_0, OSC_1) : Oscillation port
- Pin 34~35(PWM12, PWM13) : ASDAC output, Red, Green Gain output port
- Pin 36~38(PA5~PA7) : S-correction output port

	S1(PA7)	S2(PA6)	S3(PA5)
30~36KHz	LOW	LOW	HIGH
36~40KHz	HIGH	LOW	HIGH
40~53KHz	LOW	HIGH	HIGH
53~65KHz	HIGH	HIGH	HIGH

- Pin 40(PA3) : Cable connection sensing port to output self raster output.
  - ○ Low input : Connection
  - ○ High input : No Connection
- Pin 41(PA2) : Chip Select port
- Pin 42(PA1) : Degaussing signal output port
  - ○ Enable : High(3 seconds)
  - ○ Disable : Low
- Pin 43(PA0) : LED Signal output
  - ○ High : Orange color
  - ○ Low : Green color

- Pin 44~47(PWM4~PWM17) : ASDAC output Blue Gain, Red, Green, Blue bias output port
- Pin 48(TEST) : Test port, Connected to the ground
- Pin 49(PC0) : Off mode signal output port
  - ○ Enable : High
  - ○ Disable : Low
- Pin 50(PC1) : Suspend mode signal output port.
  - ○ Enable : High
  - ○ Disable : Low
- Pin 51~52(PC2, PC3) : DDC Data, DDC Clock port
- Pin 53(PC4) : Clock line
- Pin 54(PC5) : Serial Data Line
- Pin 55~56(VSS, VSSA) : Ground Path

(3) Deflection Processor

OPERATING DESCRIPTION

Power Supply

The typical value of the power supply voltage Vcc is 12V. Perfect operation is obtained if Vcc is maintained in the limits : 10.8V → 13.2V.

In order to avoid erratic operation of the circuit during the transient phase of Vcc switching on, or switching off, the value of Vcc is monitored and the outputs of the circuit are inhibited if it is too low.

In order to have a very good power supply rejection, the circuit is internally powered by several internal voltage references (The unique typical value of which is 8V). Two of these voltage references are externally accessible, one for the vertical part and one for the horizontal part. These voltage references can be used for the DC control voltages applied on the concerned pins by the way of potentiometers or digital to analog converters(DAC's).

DC Control Adjustments

The circuit has 10 adjustment capabilities : 3 for the horizontal part, 1 for the SMPS part, 2 for the E/W correction, 4 for the vertical part

The corresponding inputs of the circuit have to be driven with a DC voltage typically comprised between 2 and 6V for a value of the internal voltage reference of 8V.

The input currents of the DC control inputs are typically very low (about a few μA). Depending on the internal structure of the inputs, the input currents can be positive or negative (sink or source).

HORIZONTAL PART

Input section

The horizontal input is designed to be sensitive to TTL signals typically comprised between 0 and 5V. The typical threshold of this input is 1.6V. This input stage uses an NPN differential stage and the input current is very low.

Concerning the duty cycle of the input signal, the following signals may be applied to the circuit.

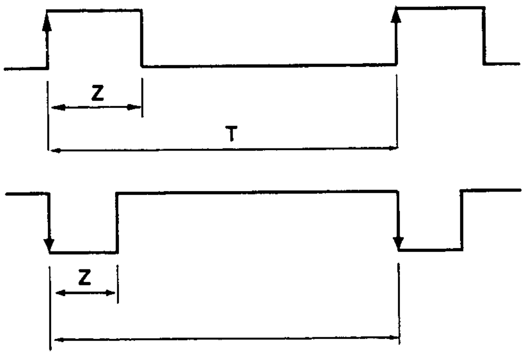


Figure 1

Using internal integration, both signals are recognized on condition that $Z/T \leq 25\%$. **Synchronization** occurs on the leading edge of the rectified signal. the minimum value of Z is 1 μs.

PLL1

The PLL1 is composed of a phase comparator, an external filter and a voltage Controlled Oscillator(VCO).

The phase comparator is a "phase frequency" type, designed in CMOS technology. This kind of phase detector avoids locking on false frequencies. It is followed by a "charge pump", composed of 2 current sources sink and source (1=1mA typ.)

The dynamic **behavior** of the PLL is fixed by an external filter which integrates the current of the charge pump. A "CRC" filter is generally used.

PLL1 is inhibited by applying a high level on Pin 35 (PLLinhib) which is a TTL compatible input. The inhibition results from the opening of a switch located between the charge pump and the filter.

The VCO uses an external RC network. It delivers a linear sawtooth obtained by charge and discharge of the capacitor, by a current **proportional** to the current in the resistor. Typical thresholds of sawtooth are 1.6V and 6.4V.

The control voltage of the VCO is typically comprised between 1.6V and 6V. The theoretical frequency range of this VCO is in the ratio 1 → 3.75, but due to spread and thermal drift of external components and the circuit itself, the effective frequency range has to be smaller (e.g. 30kHz →65kHz). In the absence of **synchronization** signal the control voltage is equal to 1.6V type. and the VCO oscillates on its lowest frequency (free frequency).

The synchro frequency has to be always higher than the free frequency and a margin has to be taken. To compensate for the spread of external components and of the circuit itself, the free frequency may be adjusted by a DC voltage on Pin 14 (Fmin adjust).

The PLL1 ensures the coincidence between the leading edge of the synchro signal and a phase reference obtained by comparison between the sawtooth of the VCO and an internal DC voltage adjustable between 2.4V and 4V (by Pin 15). So a ±45° phase adjustment is possible.

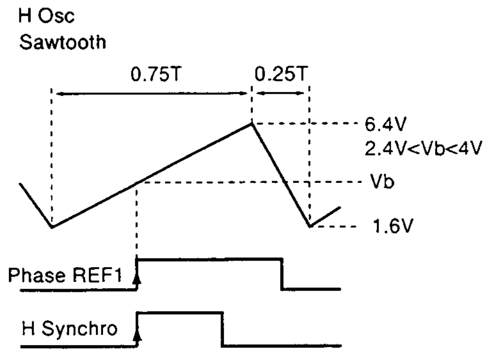


Figure 2 PLL1 Timing Diagram

Phase REF1 is obtained by comparison between the sawtooth and a DC voltage adjustable between 2.4V and 4V. The PLL1 ensures the exact coincidence between the signals phase REF and HSYNS. A±45° Phase adjustment is possible.

PLL 2

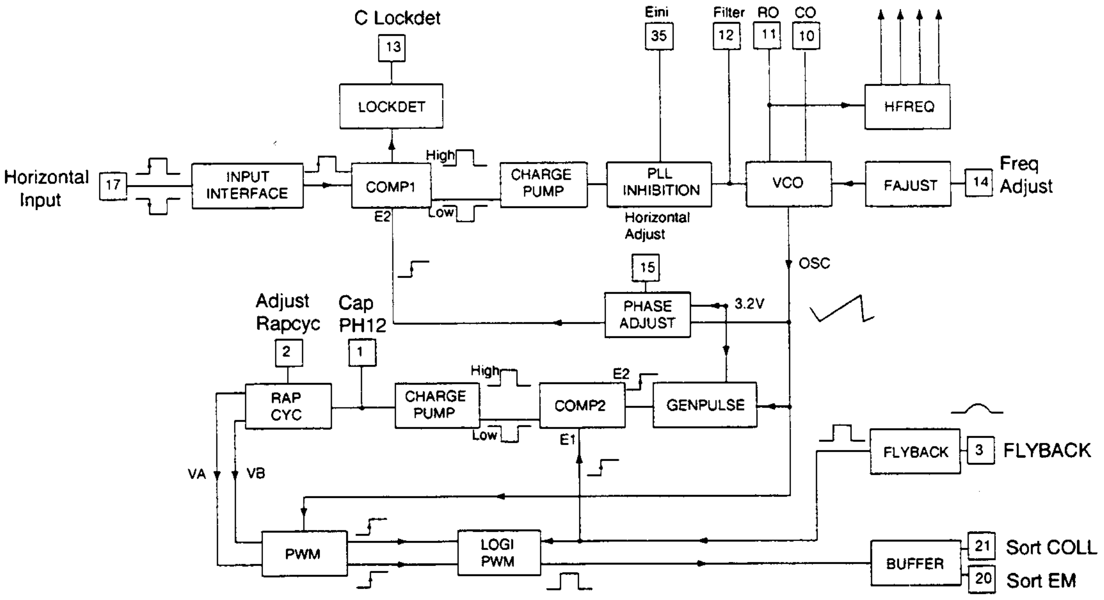


Figure 3 Dual PLL Block Diagram

The PLL2 ensures the coincidence between the leading edge of the shaped flyback signal and a phase reference signal obtained by comparison of the sawtooth of the VCO and a constant DC voltage (3.2V) (see Figure 4).

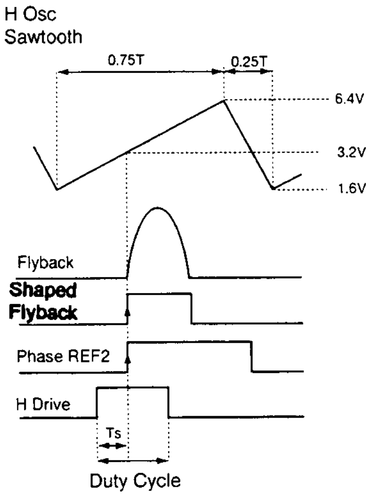


Figure 4 PLL2 Timing Diagram

Phase REF2 is obtained by comparison between the sawtooth and a 3.2V (constant). The PLL2 ensures the exact coincidence between the signals phase REF2 and the flyback signal. The duty cycle of H-drive is adjustable between 30% and 50%.

The phase comparator of PLL2 is similar to the one of PLL1, it is followed by a charge pump with a ±0.5mA(typ.) output current.

The flyback input is composed of an NPN transistor.

This input has to be current driven. The maximum recommended input current is 2mA.

Output Section

The H-drive signal is transmitted to the output through a shaping block ensuring a duty cycle adjustable from 30% to 50%.

The output stage is composed of a Darlington NPN bipolar transistor. Both the collector and the emitter are accessible.

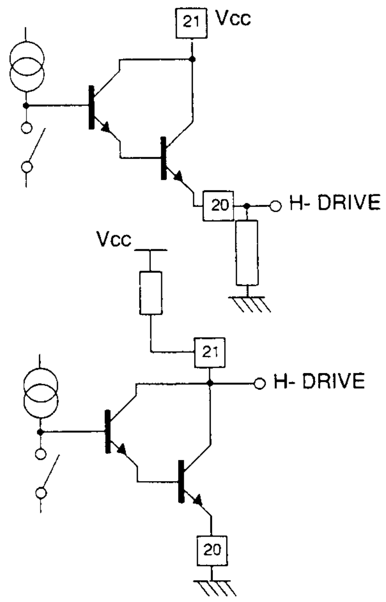


Figure 5 Output stage simplified diagram, showing the two possibilities of connection

The output Darlington is in off-state when the power scanning transistor is also in off-state.

The maximum output current is 20mA, and the corresponding voltage drop of the output darlington is 1.1V typically.

It is evident that the power scanning transistor cannot be directly driven by the integrated circuit.

An interface has to be designed between the circuit and the power transistor which can be of bipolar or MOS type.

PARABOLA GENERATION FOR EAST-WEST CORRECTION(see Figure 6)

Starting from the vertical ramp a parabola is generated for E/W correction.

The core of the parabola generator is an analog multiplier which generates a current in the form:

$$I=k(V_{RAMP} - V_{MID})^2$$

Where V_{RAMP} is the vertical ramp, typically comprised between 2 and 5V, V_{MID} is a DC voltage with a nominal value of 3.5V, but adjustable in the range 3.2V ⟶ 3.8V in order to generate a dissymmetric parabola if required (keystone adjustment).

The current is converted into voltage through a variable gain transresistance amplifier. The gain, controlled by the voltage on Pin 37 (E/W-AMP) can be adjusted in the ratio 3/1.

The parabola is available on Pin 36 by the way of an emitter follower which has to be biased by an external resistor(10kΩ). It must be AC coupled with external circuitry.

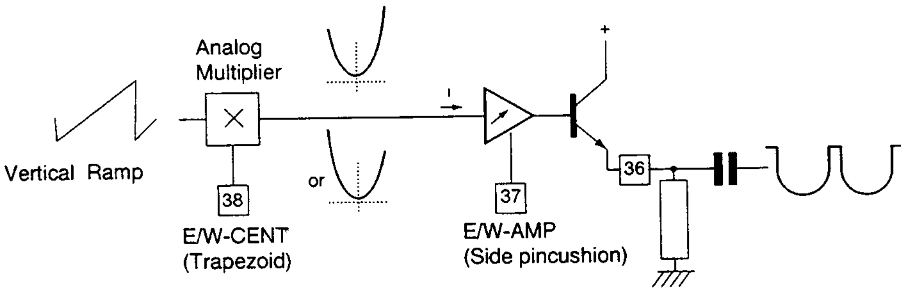


Figure 6 Parabola Generation Principle

The typical parabola amplitude (AC), with the DC control voltages V_{37} and V_{38} set to 4V, is 2V. It is important to note that the parasitic parabola during the discharge of the vertical oscillator capacitor is suppressed.

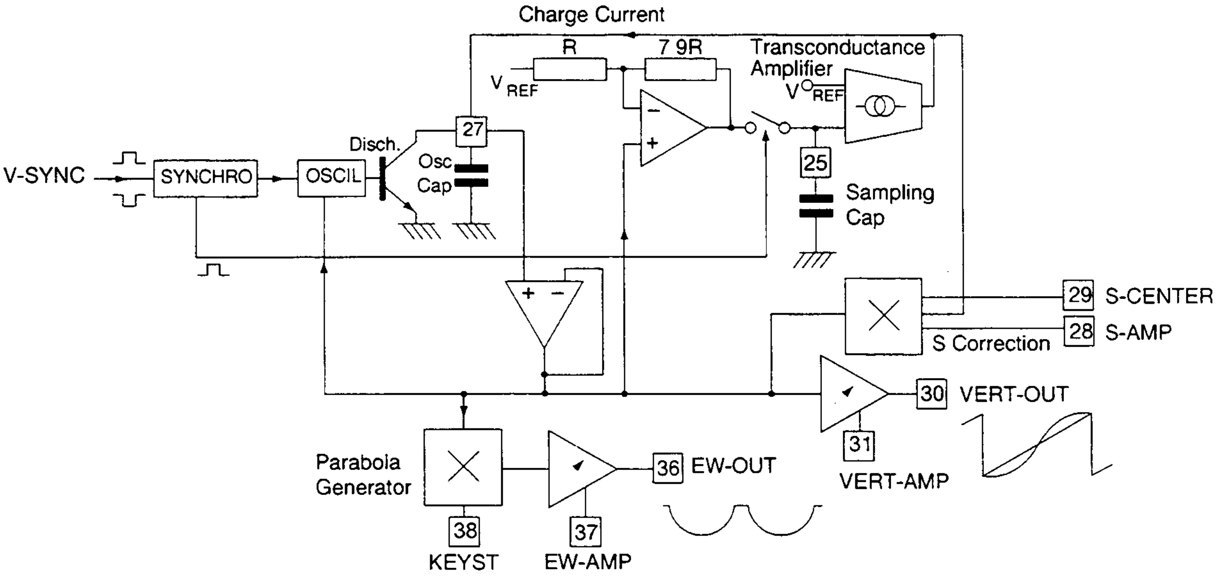


Figure 8 Vertical Part Block Diagram

VERTICAL PART (see Figure 8)

The Vertical part generates a fixed amplitude ramp which can be affected by a S correction shape. Then, the amplitude of this ramp is adjusted to drive an external power stage.

The internal reference voltage used for the vertical part is available between Pin 26 and Pin 24. It can be used as voltage reference for any DC adjusment to keep a high accuracy to each adjustment. Its typical value is :

$$V_{26} = V_{REF} = 8V.$$

The charge of the external capacitor on Pin 27 (V_{CAP}) generates a fixed amplitude ramp between the internal voltages, $V_L(V_L = V_{REF}/4)$ and VH ($V_H = 5/8 \cdot V_{REF}$).

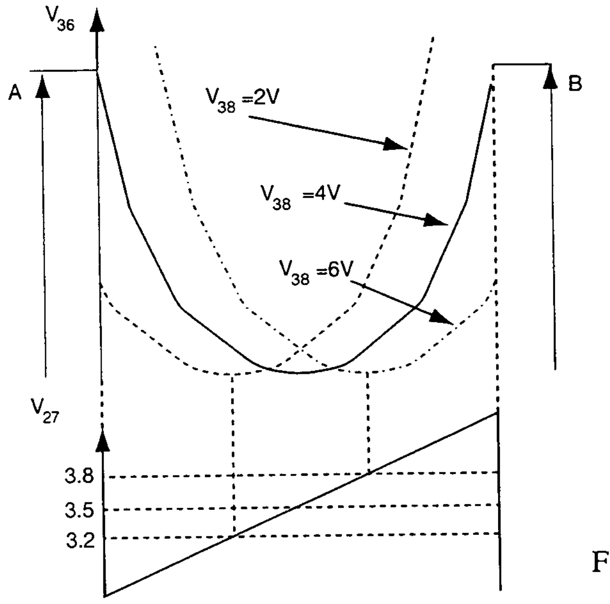


Figure 7 Trapezoid Adjustment

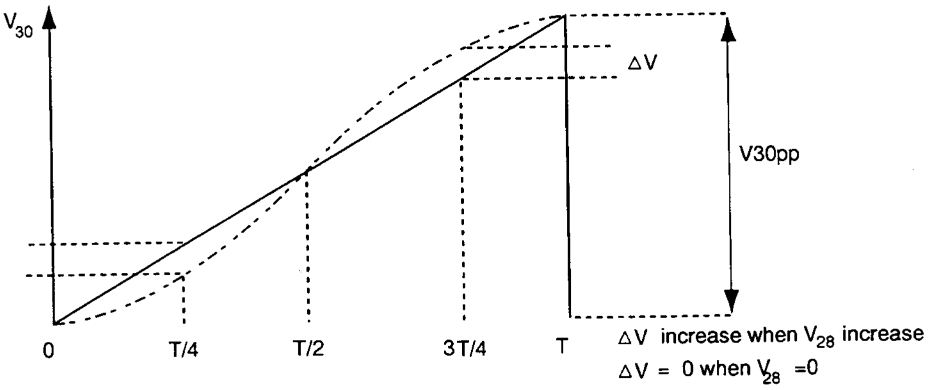


Figure 9 S Amplitude Adjustment

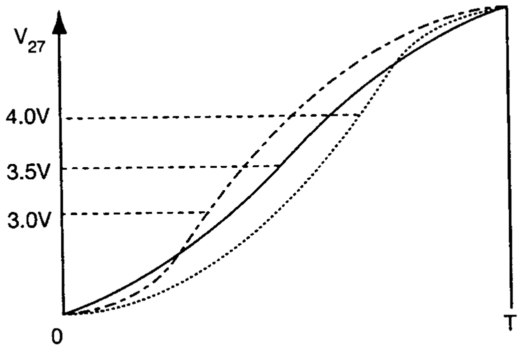


Figure 10 C Correction Adjustment

Function

When the **synchronization** pulse is not present, an internal current source sets the free running frequency. For an external capacitor. Cosc = 220nF, the typical free running frequency is 68Hz. Typical free running frequency can be calculated by :

$$f_0(Hz) = 1.5 \cdot 10^{-5} \cdot \frac{1}{Cosc(nF)}$$

A negative or positive TTL level pulse applied on Pin 34 (VSYNC) can **synchronize** the ramp in the frequency range [fmin, fmax]. This frequency range depends on the external capacitor connected on Pin 27. A capacitor in the range [150nF, 220nF] is **recommended** for application in the following range : 50Hz to 120Hz.
Typical maximum and minimum frequency, at 25℃ and without any correction (S correction or C correction), can be calculated by :

$$f_{max} = 2.5 \cdot f_0$$
$$f_{max} = 0.33 \cdot f_0$$

If S or C corrections are applied, these values are slighty affected.
If an external **synchronization** pulse is applied, the internal oscillator is **automatically** caught but the amplitude is no more constant. An internal correction is activated to adjust it in less than half a second : the highest voltage of the ramp on Pin 27 is sampled on the sampling capacitor connected on Pin 25 (VAGCCAP) at each clock pulse and a transconductance amplifier generates the charge current of the capacitor.**The** ramp amplitude becomes again constant.
It is **recommended** to use a AGC capacitor with low leakage current. A value lower than 100nA is mandatory.

DC Control Adjustments

Then, a S correction shape can be added to this ramp. This frequency in dependent S correction is generated internally; its amplitude is DC adjustable on Pin 28 (V_{SAMP}) and it can be centered to generate C correction, according to the voltage applied on Pin 29 (V_{SCENT}).
The amplitude of this S corrected ramp can be adjusted by the voltage applied on Pin 31 (V_{AMP}). The adjusted ramp is available on Pin 30 (V_{OUT}) to drive an external power stage.
A DC voltage is available on Pin 32 (V_{DCOUT}). It is driven by the voltage applied on Pin 33 (V_{POS}).

$$V_{DCOUT} = 7/16 \cdot V_{REF} \pm 300mV.$$

So, the V_{DCOUT} voltage is correlated with DC value of V_{OUT}. It increases the accuracy when temperature varies.

INTERNAL SCHEMATICS

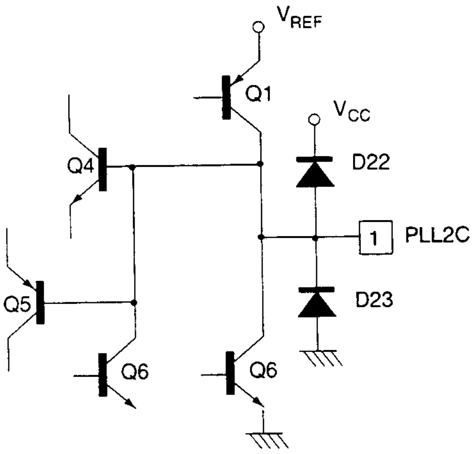


Figure 11

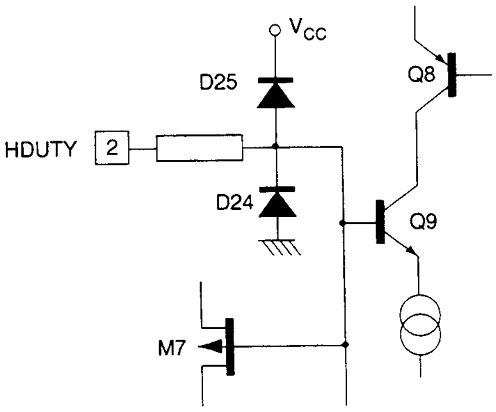


Figure 12

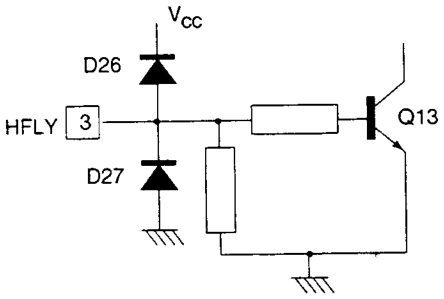


Figure 13

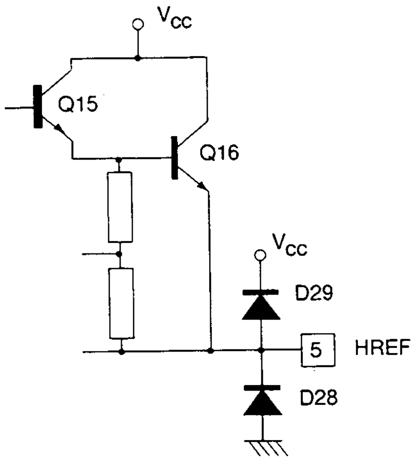


Figure 14

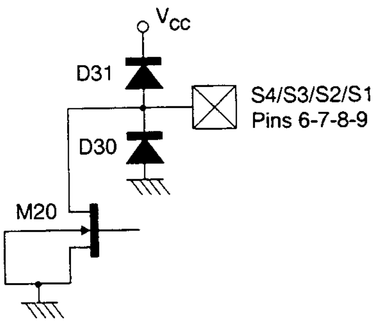


Figure 15

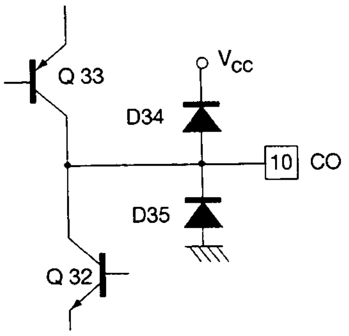


Figure 16

INTERNAL SCHEMATICS (continued)

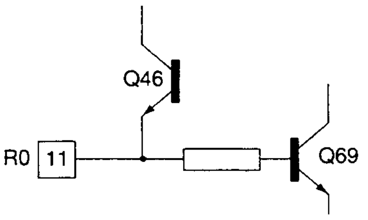


Figure 17

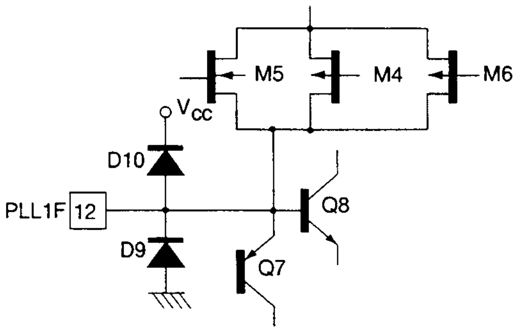


Figure 18

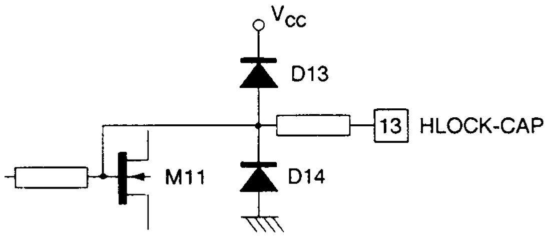


Figure 19

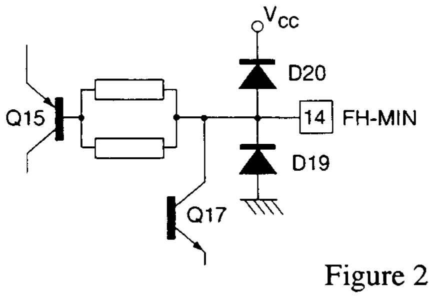
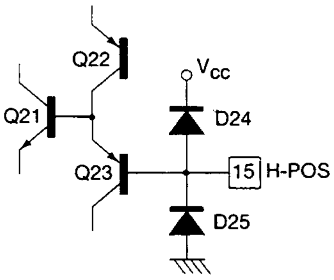


Figure 20



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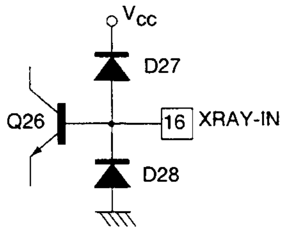

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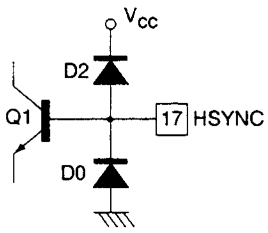

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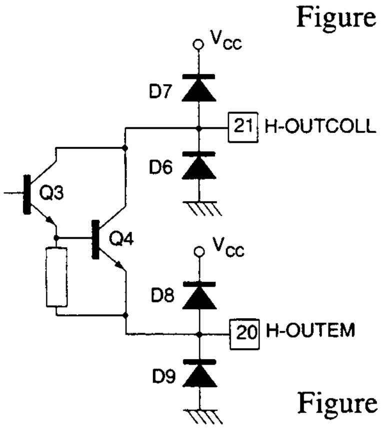


Figure 24

INTERNAL SCHEMATICS (continued)

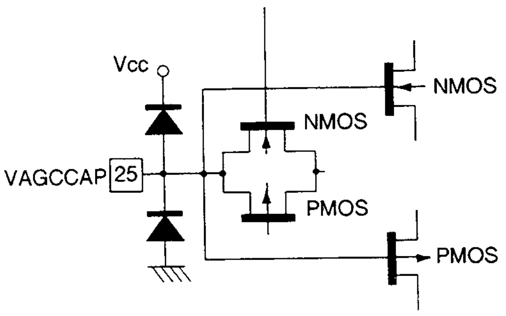
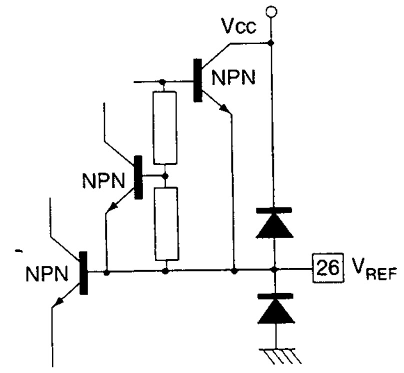


Figure 25



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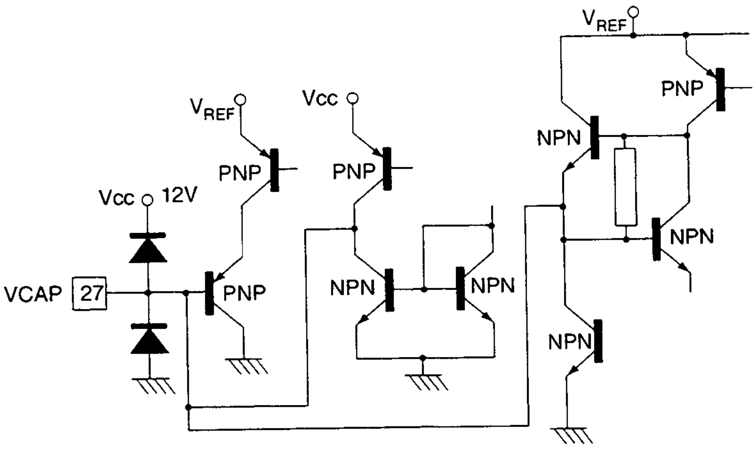


Figure 27

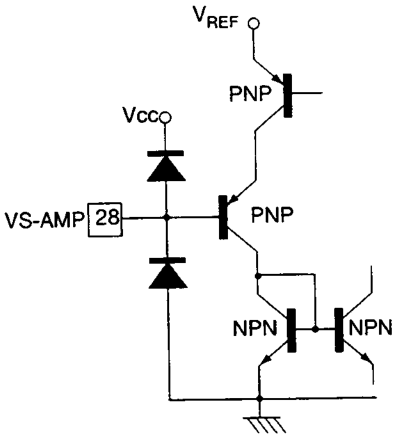


Figure 28

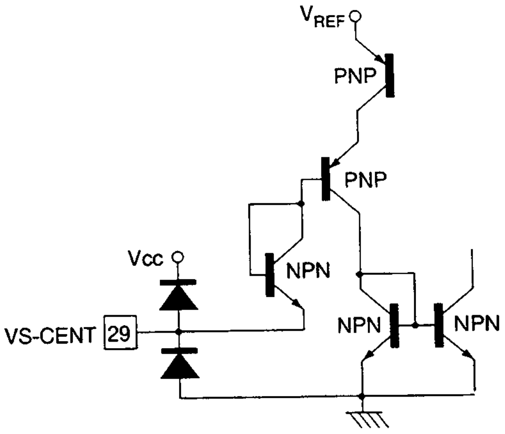


Figure 29

INTERNAL SCHEMATICS (continued)

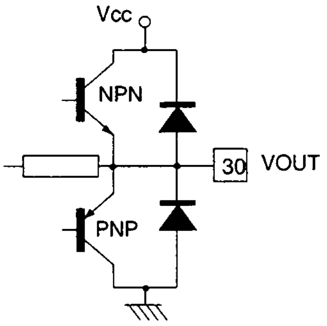


Figure 30

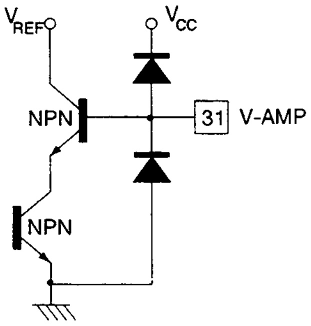


Figure 31

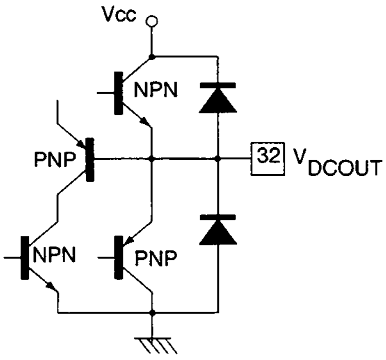


Figure 32

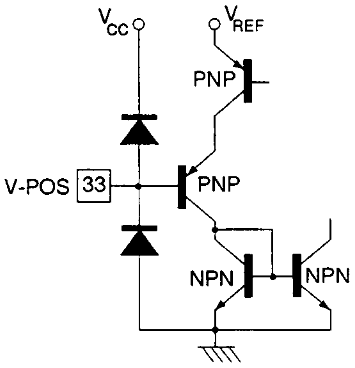


Figure 33

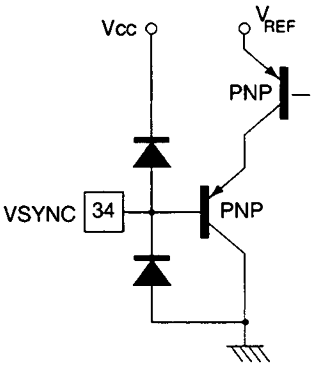


Figure 34

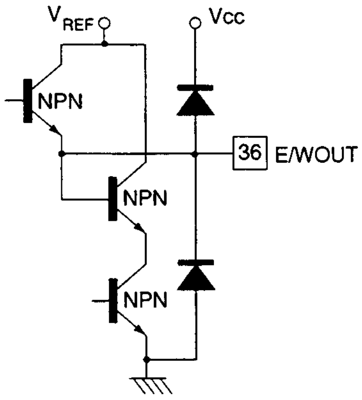


Figure 35

INTERNAL SCHEMATICS (continued)

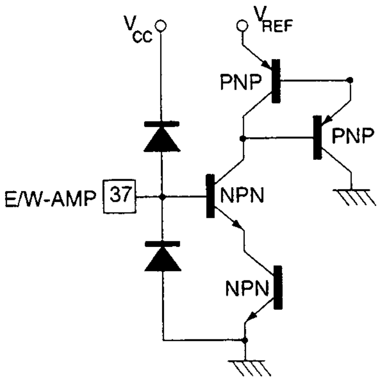


Figure 36

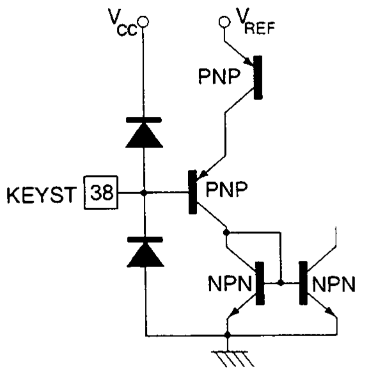


Figure 37

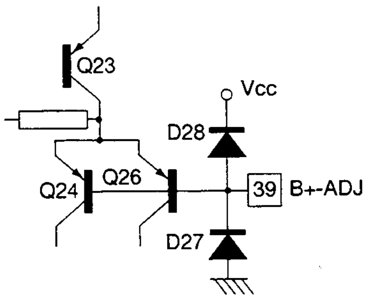


Figure 38

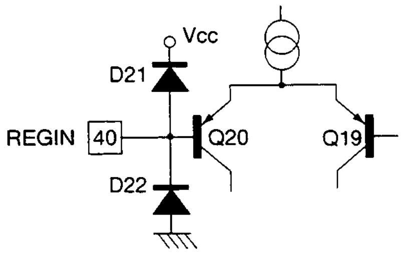


Figure 39

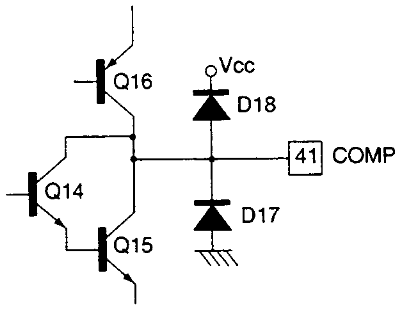


Figure 40

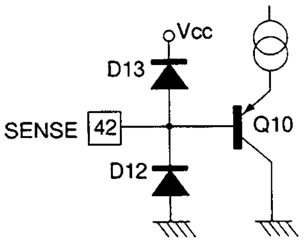
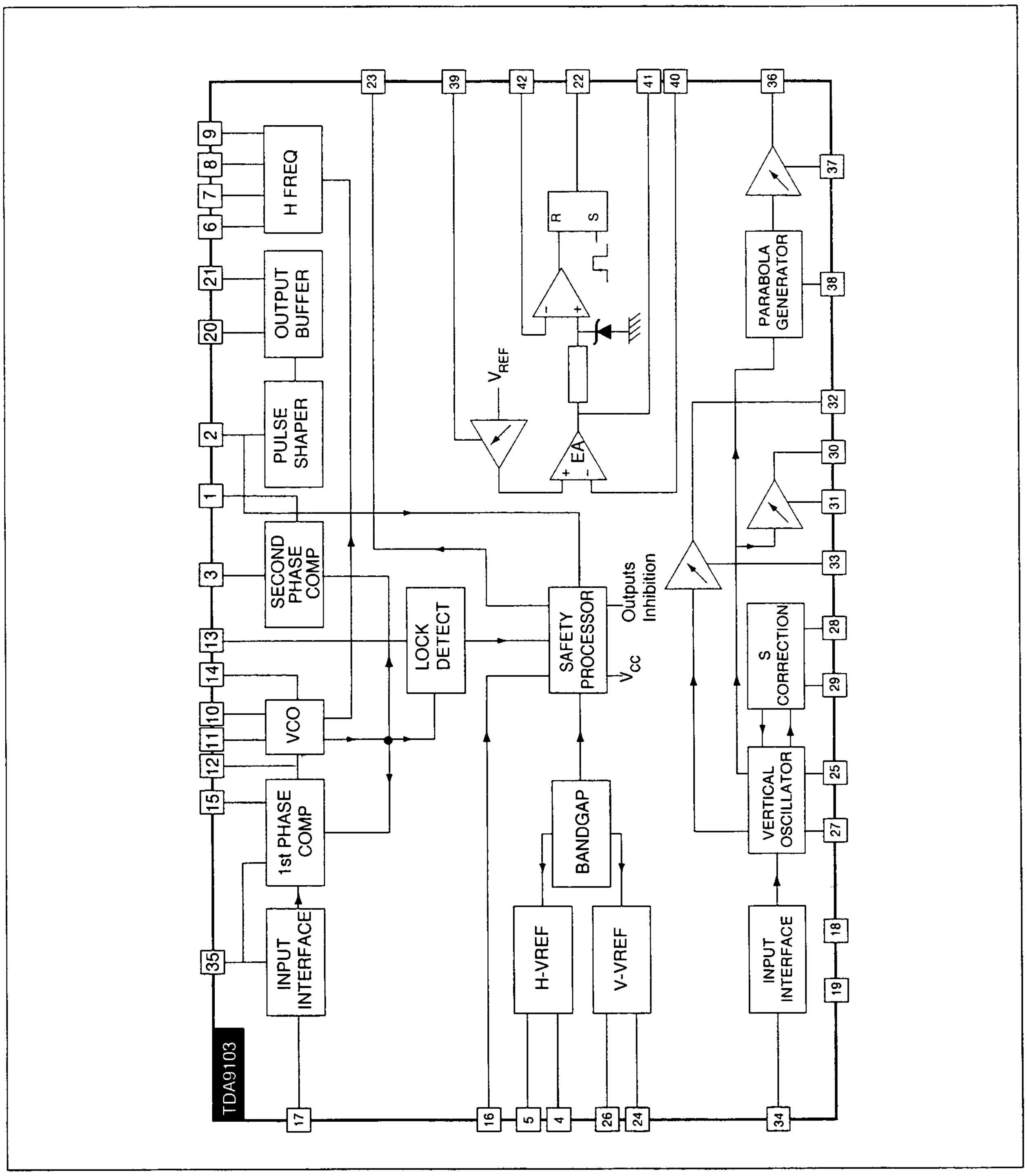


Figure 41

BLOCK DIAGRAM

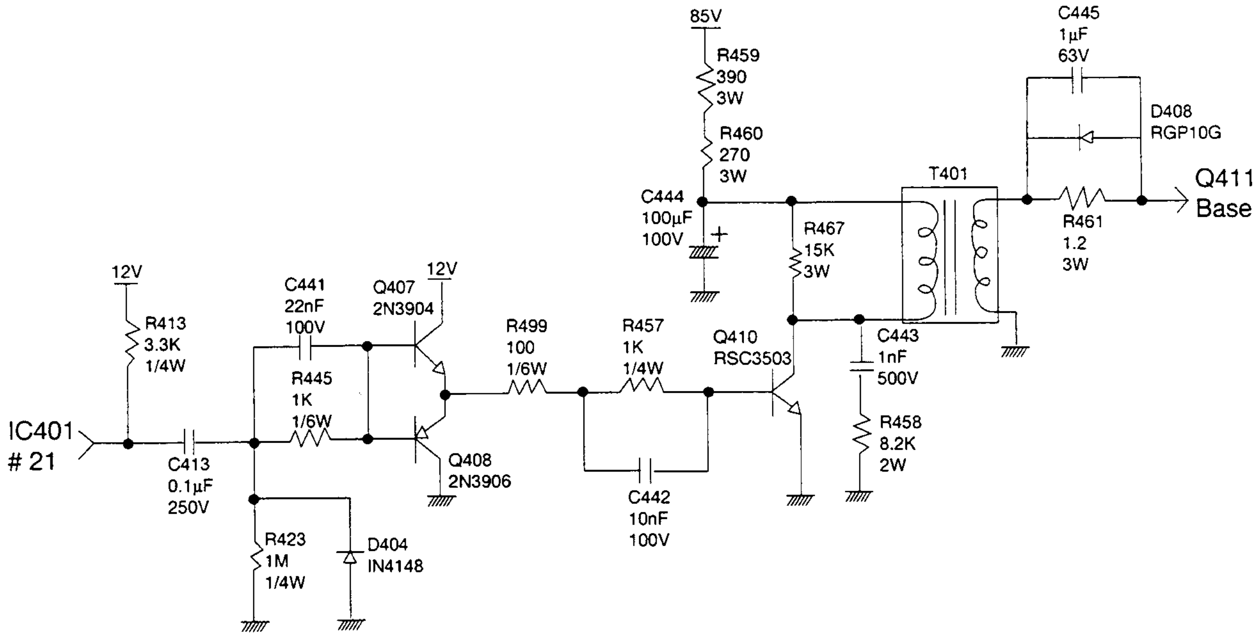


PIN-OUT DESCRIPTION

Pin N°	Name	Function
1	PLL2C	Second PLL Loop Filter
2	H-DUTY	DC control of Horizontal Drive Output Pulse Duty-cycle. If this pin is grounded, the horizontal and vertical outputs are inhibited. By connecting a capacitor on this pin, a soft-start function may be realized on h-drive output.
3	H-FLY	Horizontal Flyback Input (positive Polarity)
4	H-GND	Horizontal Section Ground. Must be connected only to components related to H blocks.
5	H-REF	Horizontal Section Reference Voltage. Must be filtered by capacitor to Pin 4
6	S4	Hor S-CAP Switching
7	S3	Hor S-CaP Switching
8	S2	Hor S-CAP Switching
9	S1	Hor S-CAP Switching
10	CO	Horizontal Oscillator Capacitor. To be connected to Pin 4.
11	RO	Horizontal Oscillator Resistor. To be connected to Pin 4.
12	PLL1F	First PLL Loop Filter. To be connected to Pin 4.
13	HLOCK-CAP	First PLL Lock/Unlock time Constant Capacitor. Capacitor filtering the frequency change detected on Pin 13. When frequency is changing, a blanking pulse is generated on Pin 23, The duration of this pulse is proportional to the capacitor on Pin 13. To be connected to Pin 4.
14	FH-MIN	DC Control for Free Running Frequency Setting. Coming from DAC output or DC voltage generated by a resistor bridge connected between Pin 5 and 4.
15	H-POS	DC Control for Horizontal Centering
16	XRAY-IN	X-RAY Protection Input (with internal latch function)
17	H-SYNC	TTL Horizontal Sync Input
18	Vcc	Supply Voltage (12V Typical)
19	GND	Ground
20	H-OUTEM	Horizontal Drive Output (emitter of internal transistor). See description on pages 15-16.
21	H-OUTCOL	Horizontal Drive Output (open collector of internal transistor). See description on pages 15-16.
22	B+ OUT	B+ PWM Regulator Output
23	SBLK OUT	Safety Blanking Output. Activated during frequency changes, when X-RAY input is triggered or when VS is too low.
24	VGND	Vertical Section Signal Ground
25	VAGCCAP	Memory Capacitor for Automatic Gain Control Loop in Vertical Ramp Generator
26	VREF	Vertical Section Reference Voltage
27	VCAP	Vertical Sawtooth Generator Capacitor
28	VS-AMP	DC Control of Vertical S Shape Amplitude
29	VS-CENT	DC Control of Vertical S Centering
30	VOUT	Vertical Ramp Output (with frequency independent amplitude and S-correction)
31	V-AMP	DC Control of Vertical Amplitude Adjustment
32	VDCOUT	Vertical Position Reference Voltage Output Temperature Matched with V-AMP Output
33	V-POS	DC Control of Vertical Position Adjustment
34	VSYNC	Vertical TTL Sync Input
35	PLL1INHIB	TTL Input for PLL1 Output Current Inhibition (To be used in case of comp sync input signal)
36	E/WOUT	East/West Pincushion Correction Parabola Output
37	E/W-AMP	DC Control of East/West Pincushion Correction Amplitude
38	KEYST	DC Control of Keystone Correction
39	B+ADJ	DC Control of B+ Adjustment
40	REGIN	Regulation Input of B+ Control Loop
41	COMP	B+ Error Amplifier Output for Frequency Compensation and Gain Setting
42	ISENSE	Sensing of External B+ Switching Transistor Emitter Current

Horizontal Drive

IC401 drives the base of Q410(KSC 3503) through complementary emitter follower (Q407, Q408). Q410 amplifies and inverts the signal at the collector. The drain drives T401. The horizontal drive transformer(T401) produces an impedance matched drive signal for the base of the horizonfal output Q411(2SC 388G).
The drive signal is amplified to a ________Vpp output signal. The collector DC voltage will decide the horizontal raster size. An increase in collector voltage will increase the size while a decrease in collector voltage will decrease the raster size.



Horizontal Drive

Horizontal Bt Control

The collector voltage on the horizontal output is controlled by pulse width modulation. The PWM is controlled by IC401.
The output pulse width is controlled by B+ PWM Regulator output of IC 401(pin 21). This pulse drives the gate of Q406(IRF630) through complementary emitter follower(Q404, Q405).

The drain pulse is **rectified** by D406, C481 and C480(C480 is connected in the case of H-freq. higher than 40KHZ).
This is supplied to the collector of Q411

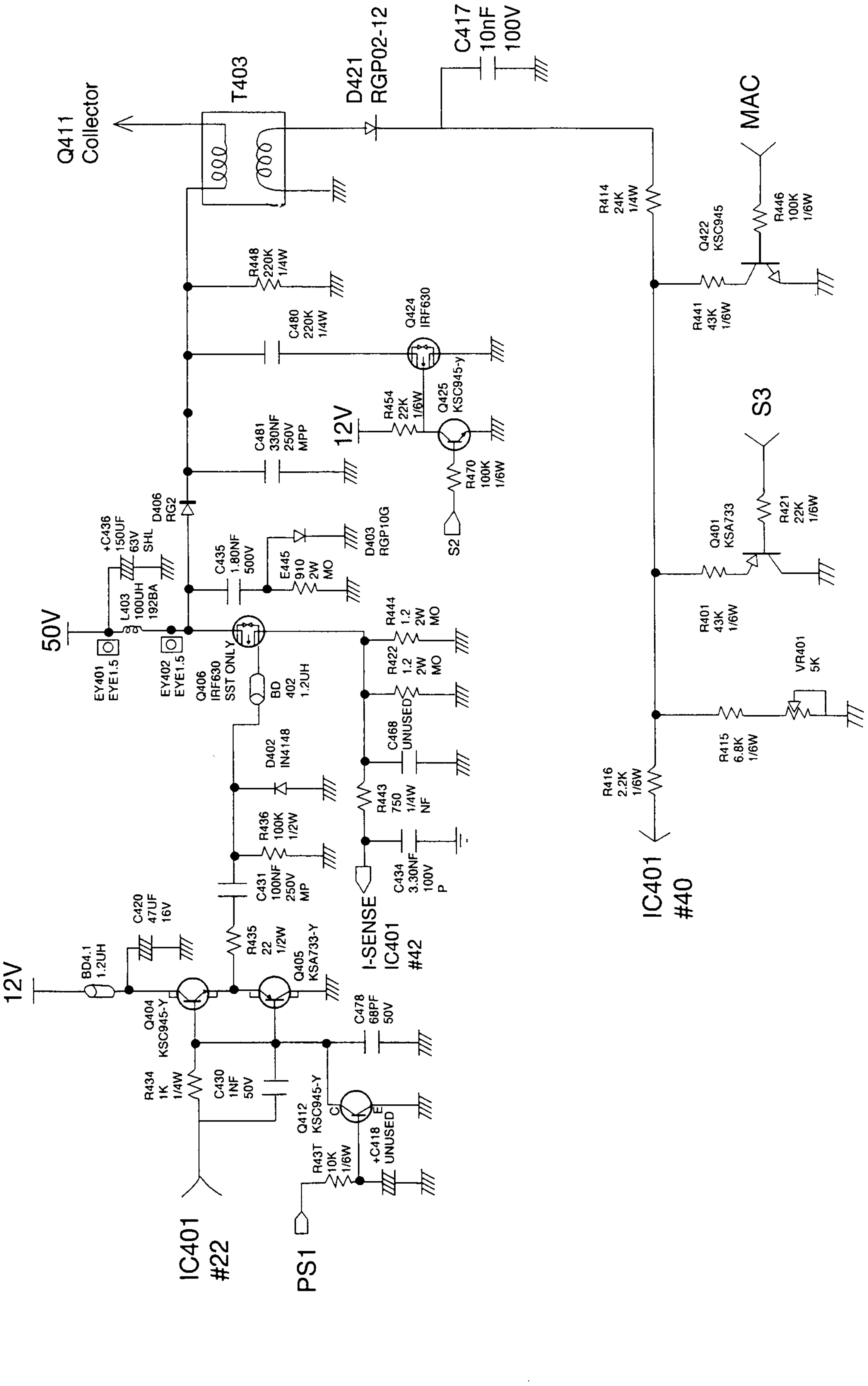
By controlling the pulse width and frequency at the gate the collector voltage of the horizontal output can be controlled. An increase in pulse width and frequency will increase the collector voltage to the horizontal output.

Sensing

The source current is **detected** by R422 and R444. It is monitored by IC401 PIN42 and limit the ratio Ton / Ton + T off of the horizontal B+ switching FET to 75%

Horizontal Flyback

The horizontal output energizes T403, pin2, to provide a secondary flyback pulse at pin10. H-FLB is used for feedback to regulation input of B+ control loop(IC401). Q401 and Q422 is the switch to compensate H-size between horizontal scan frequencies.


Q411 Collector
T403
D421 RGP02-12
C417 10nF 100V
MAC
R414 24K 1/4W
Q422 KSC945
R446 100K 1/6W
R441 43K 1/6W
R448 220K 1/4W
C480 220K 1/4W
Q424 IRF630
R454 22K 1/6W
Q425 KSC945-y
12V
C481 330NF 250V MPP
R470 100K 1/6W
S2
S3
Q401 KSA733
R421 22K 1/6W
R401 43K 1/6W
D406 RG2
+C436 150UF 63V SHL
L403 100UH 192BA
50V
C435 1.80NF 500V
E445 910 2W MO
D403 RGP10G
R444 1.2 2W MO
R422 1.2 2W MO
EY401 EYE1.5
EY402 EYE1.5
Q406 IRF630 SST ONLY
BD 402 1.2UH
VR401 5K
R415 6.8K 1/6W
C468 UNUSED
D402 IN4148
R443 750 1/4W NF
R416 2.2K 1/6W
R436 100K 1/2W
C434 3.30NF 100V P
IC401 #40
C431 100NF 250V MP
I-SENSE IC401 #42
C420 47UF 16V
R435 22 1/2W
12V
BD4.1 1.2UH
Q404 KSC945-Y
Q405 KSA733-Y
C478 68PF 50V
R434 1K 1/4W
C430 1NF 50V
Q412 KSC945-Y
C
E
R43T 10K 1/6W
+C418 UNUSED
IC401 #22
PS1

S-Correction

S-Correction is a side and linearity distortion correction between horizon scan frequencies. Due to the variety of scan frequencies compensation must by done to correct for the linearity in the horizontal yoke circuit. Correction is performed by FET switches. Capacitors (46) and C469 is switched into the circuit by FETS Q419, Q420and capacitor C465 is switched in to the circuit by RL 401.

Horizontal Centering

Horizontal centering switch SW401 is a 3 position switch that can position the raster on the face of the CRT, by changing the point where scan starts and retrace points. In order to position the raster towards the left, SW401 will have to switch D411 into the H-D.Y. circuit while switching D412 out of the circuit. Center position will switch D412 and D411 out of the circuit. In order to shift the deflection point of the raster to the right, SW401 must switch D412 into the circuit while switching D411 out of the circuit.

High Voltage Regulation

The high voltage is maintained by a PWM IC501(TL494). IC501 achieves an oscillator frequency by the RC time constant of R510 and C508. C508 is charged and discharged by the H-drive applied to R501, C501, D501, Q502 and D503. 12vdc is supplied to Vcc pin12 in which a V_{ref} is developed. V_{ref} will be used for comparison of error amp 1&2. Error amp 1 at pin 1 monitors the change in voltage drop across VR501 and R516. As the voltage drop increases; the pulse width output decreases, causing a decrease in high voltage at the anode lead. Adecrease in voltage drop will increase the pulse width and **high voltage.**
A positive **polarity** pulse width at the horizontal rate from pin 9 is buffered through Q504. Q505 ON/OFF transition time maintains the anode voltage constant with each change in scan frequency.

High Voltage Drive

The high voltage circuit uses the same drive pulse as the horizontal deflection circuit does from IC 401 pin21. Pin21 supplies the drive signal to Q501 gate. Q501 drives T501 **and couples the** HV drive signal to Q503. Q503 amplifies the signal to be applied to flyback transformer T402.

Flyback Transformer

T402(FSA-15A003) produces following outputs.
Pin3 --- Vpp is rectified by D413 and AC filtered to produce +210vdc. 210vdc is developed for the spot killer circuit.
Pin5 --- Vpp is rectified by D415 and AC filtered to produce +30vdc. 30vdc is developed for O.V.P circuit.
Pin4 --- Vpp is rectified by D414 and AC filtered to produce -90vdc. -90vdc will be used for G1 biasing of the CRT, via the brightness control.
Pin8 controls the ACL(Auto Contrast Limiter).
Screen voltage is supplied to G2 of the CRT. The voltage varies between 400-800vdc. Focus red wire supplies the focus voltage of the CRT.
Anode voltage should be 25KV.

Over Voltage Protection

Over voltage is monitored from pin5 of T402(FBT). D415 rectifies a flyback pulse to a 30DC voltage and C458 **smooths** the DC. The DC voltage is divided by R411 and R412 and **dropped** by D401. IC401 pin16 monitors the voltage drop across R410. IC401 pin 16 is X-ray Protection input.
The activation of the X-ray protection is obtained by application of a high level on the X-ray input(>1.6V). Consequences of X-ray protection are:

- Inhibition of H drive output.
- Inhibition of SPMS output.
- Activation of safety blanking output.

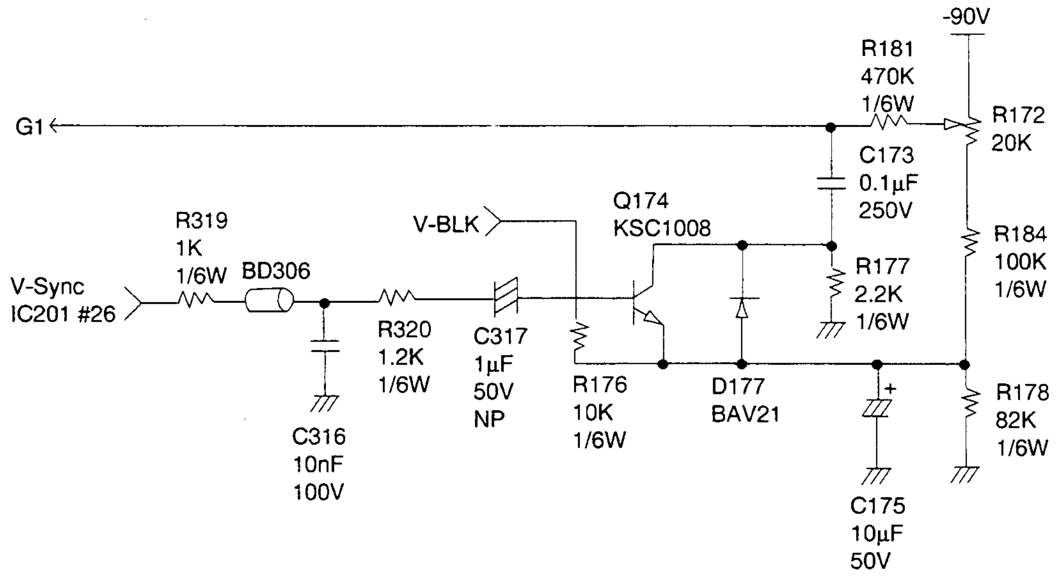
The reset of this protection is obtained by Vcc switch off.

Video Mute

In case of DPMS mode and change of scanning frequency, video mute is activated by pin 20 of IC 201. This will decrease the contrast voltage of CN204 PIN10 to 0 voltage.

Brightness control

The user's brightness control VR172 controls the G1 voltage applied to the CRT.



ACL, Contrast, Video Mute, and Brightness Control

The F.B.T. monitors the beam current generated by the C.R.T. from pin 8. Through this connection with the ACL circuit, high intensity to low intensity video levels can be maintained.

ACL Adjustment

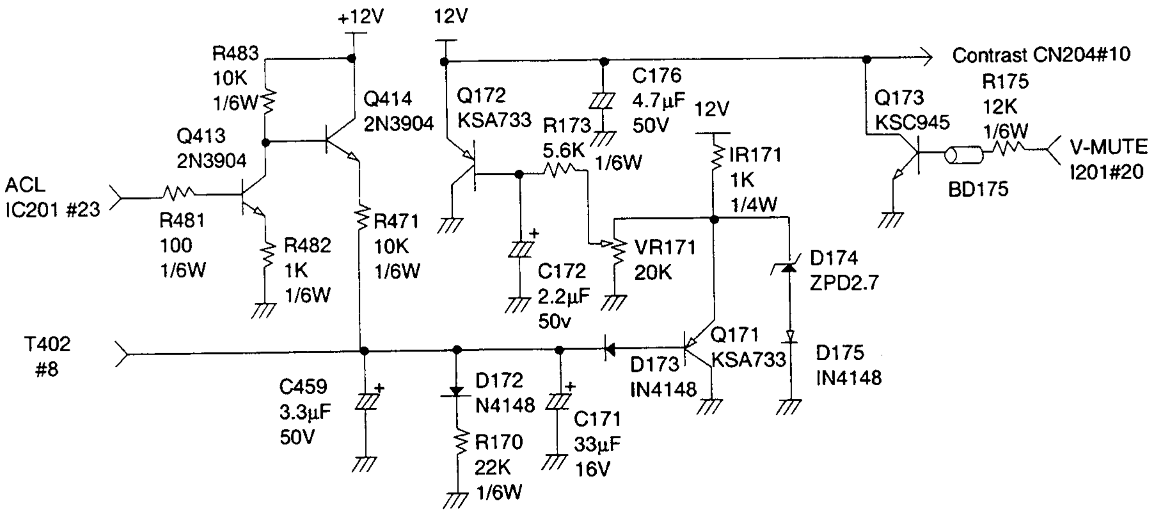
ACL Adjustment can be performed by micom control. With a decrease of ACL Voltage,D173 starts to conduct, causing Q171 to start conducting **from collector to emitter. This will cause a** decrease in emitter voltage.

A decrease in emitter voltage will cause Q172 to conduct collector to emitter, causing a decrease in contrast voltage. With an increase in ACL voltage applied to the monitor,D173 will not conduct,causing Q171 to cut off and increase the emitter voltage.Q172 will also operate in cut off increasing the emitter voltage thus increasing the contrast **voltage.**

D174 and D175 limit the operating voltage applied to Q172 Base.

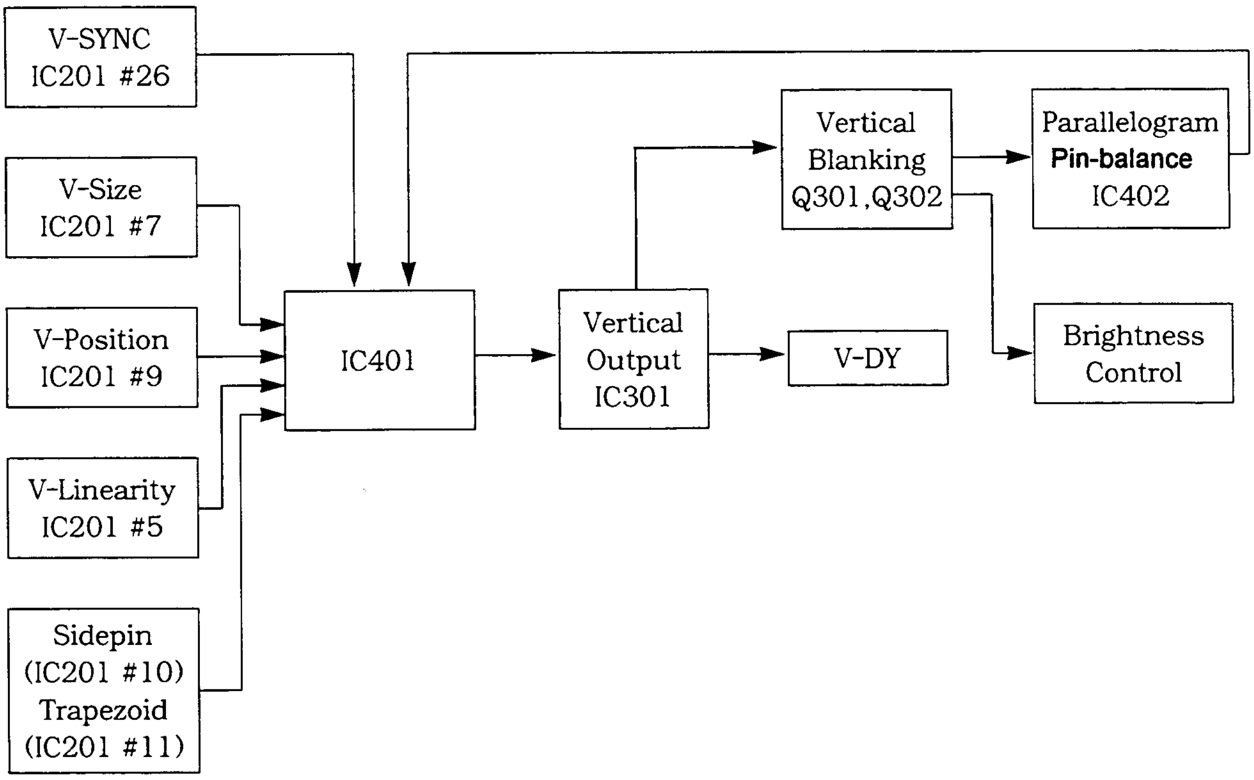
Contrast control

The user's contrast control, VR171, also controls current through Q172.



4) Vertical Deflection

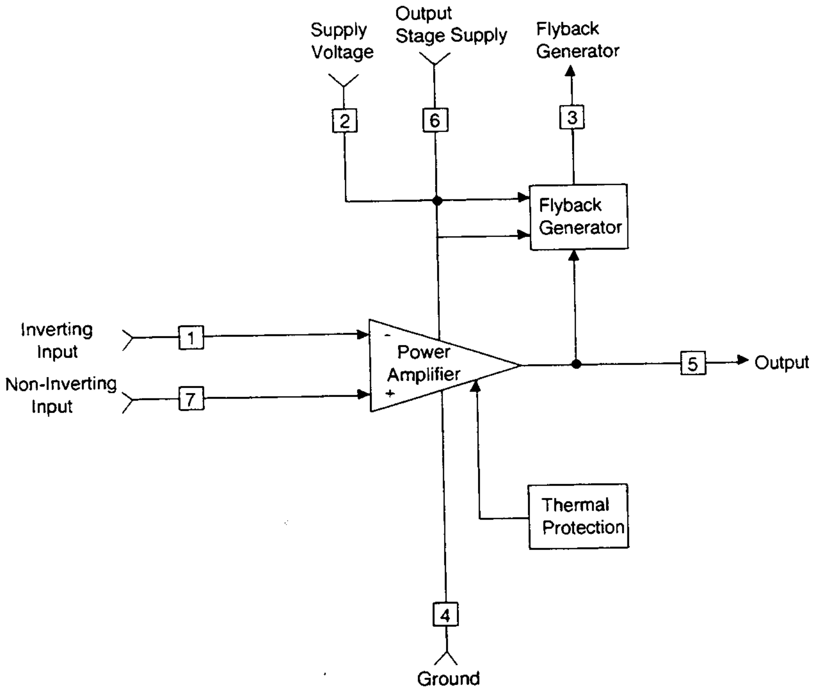
The vertical deflection circuit is used to scan from top to bottom of the display. IC401 provides oscillation, size correction, and linearity correction. **The preceeding are** controlled by the micom D/A convertor voltage applied to the vertical processor. The processor drives the output to create the deflection signal for the V-D.Y. Also a blanking pulse is produced by the output to produce parallelogram and pin-balance correction signals, as well as blanking out the raster during vertical retrace.



Vertical Block Diagram

Vertical Output

IC301 (TDA8172) receives the ramp signal from IC401 pin 30 through R305. Pin 1 input triggers a power amplifier driving the flyback generator. The flyback generator is biased by the +12Vdc and -12vdc source and D301. C306 will charge and discharge to develop a 25vpp positive polarity flyback pulse. This pulse will be used for retracing the CRT electron beam from bottom to top. Pin 5 will drive the V-D.Y. with the flyback pulse and ramp for scanning from top to bottom.



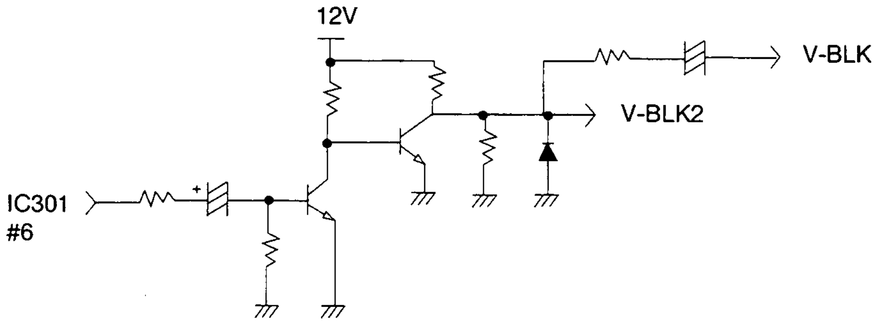
TDA8172 Block Diagram

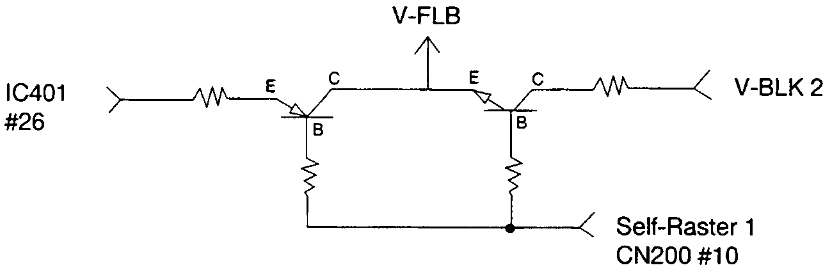
Vertical Blanking Pulse

The vertical blanking pulse will be used for blanking of the G1 grid during vertical refrace (V-BLK) creating parallelogram and pin-balance correction waveforms(V-BLK2)

Vertical Flyback Pulse

The vertical Flyback Pulse(V-FLB) is applied to IC103 pin10(OSD.IC). This synchronizes the vertical **control** circuit of IC103.

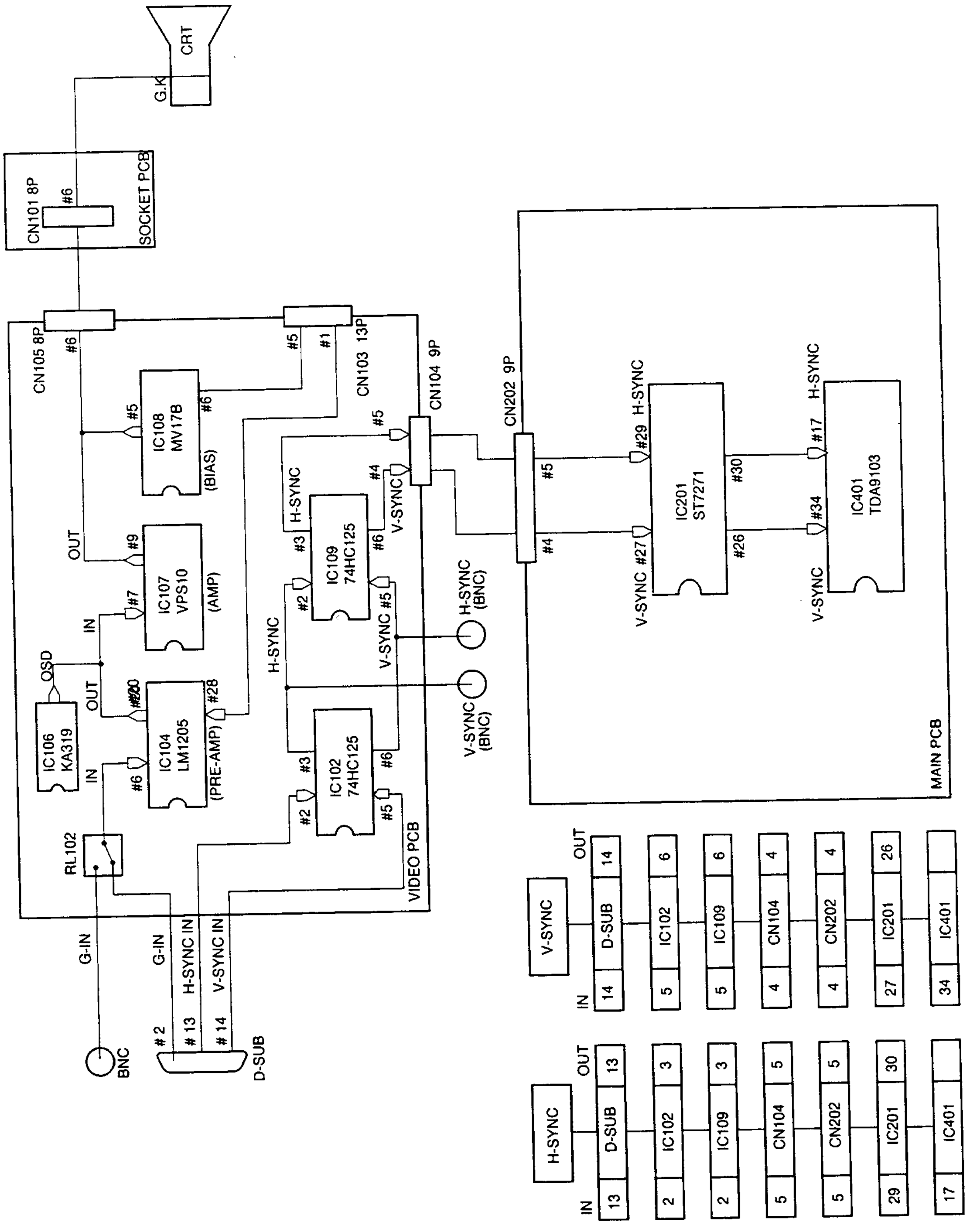




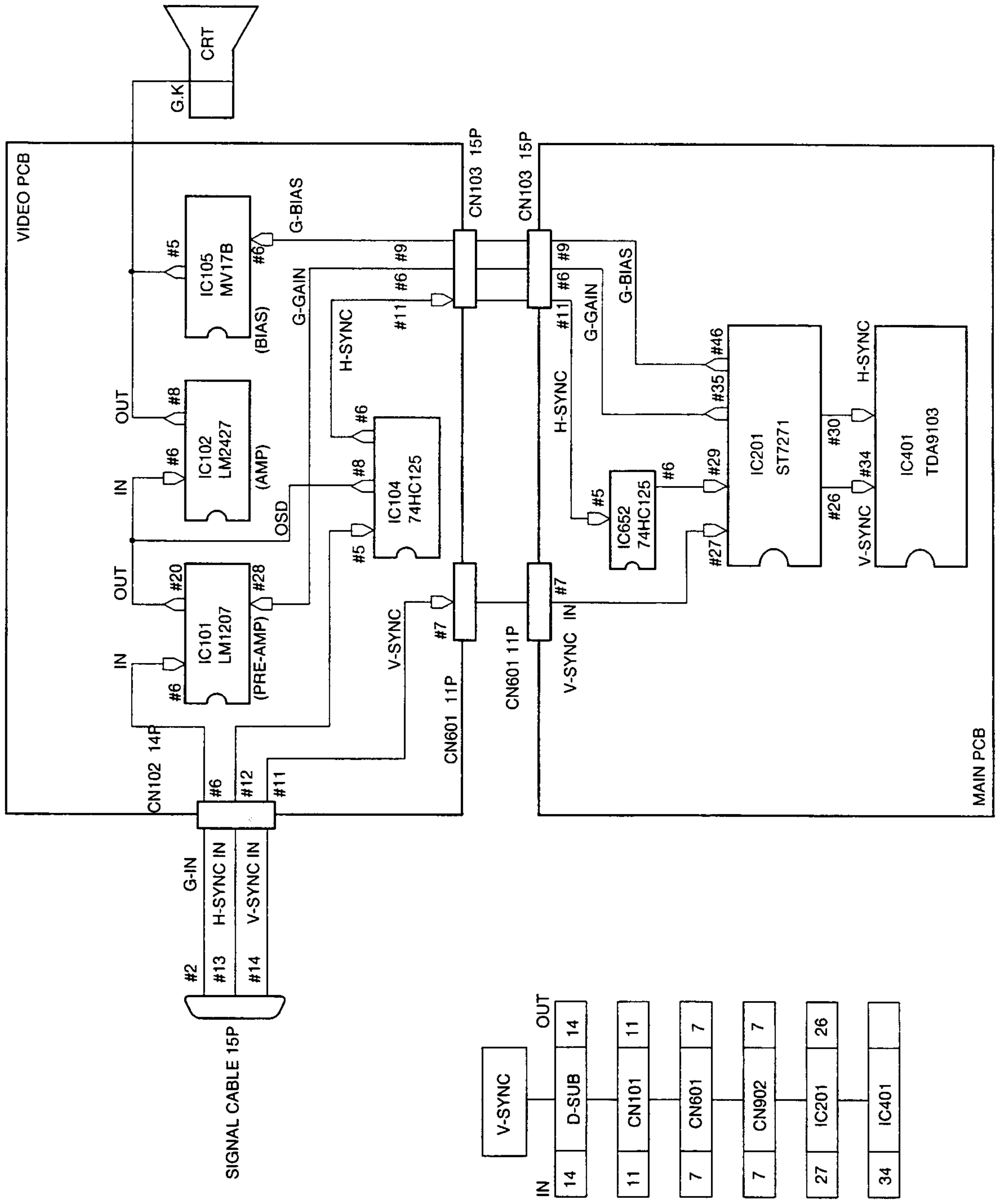
Ⅴ. SUPPLEMENTANY INFORMATION

1. Signal Flow Process

1) CMH(17GLsi)



2) CMG(17GLi)



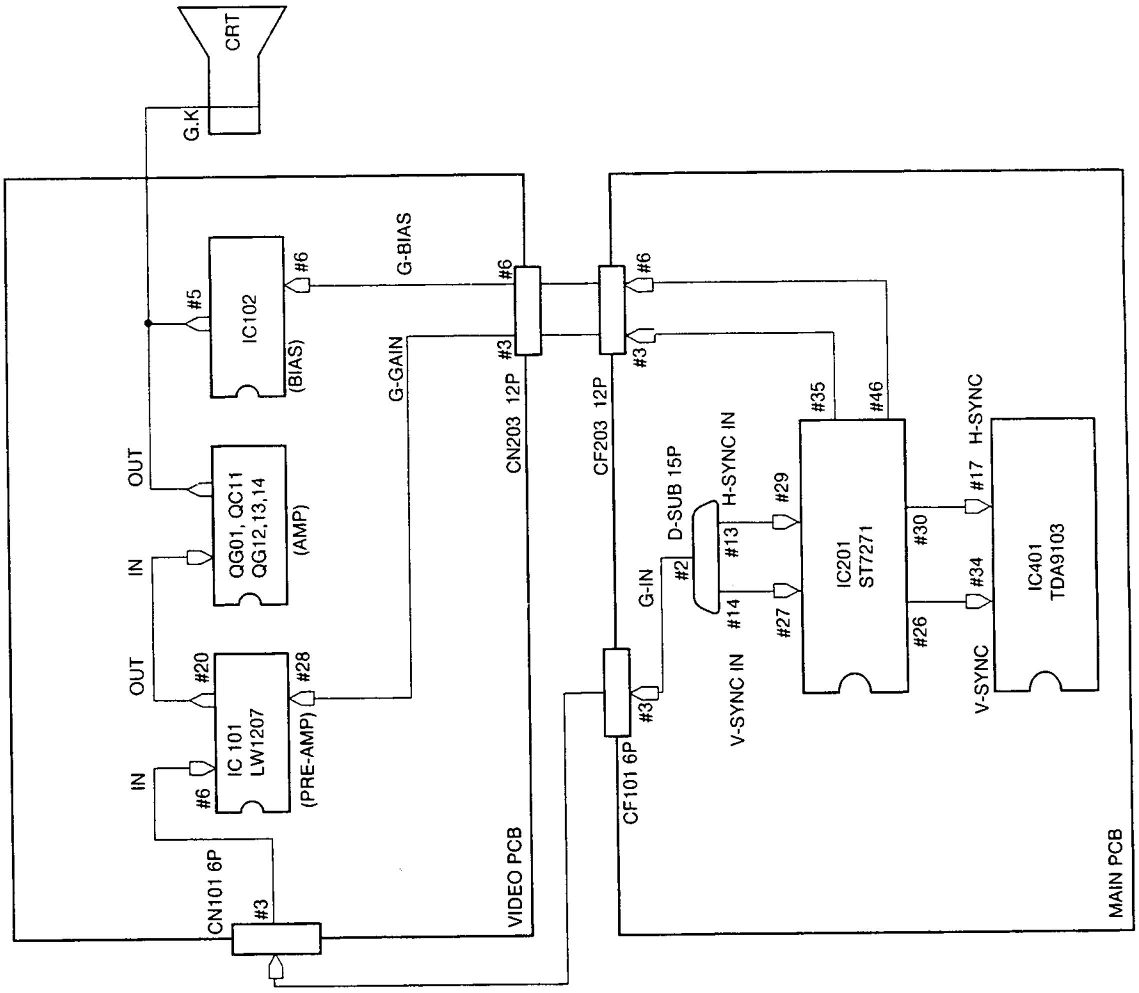
V-SYNC

IN		OUT
14	D-SUB	14
11	CN101	11
7	CN601	7
7	CN902	7
27	IC201	26
34	IC401	

H-SYNC

IN		OUT
13	D-SUB	13
12	CN101	12
5	IC104	6
11	CN103	11
11	CN901	11
5	IC652	6
29	IC201	30
17	IC401	

3) CMB(15GLi)



V-SYNC

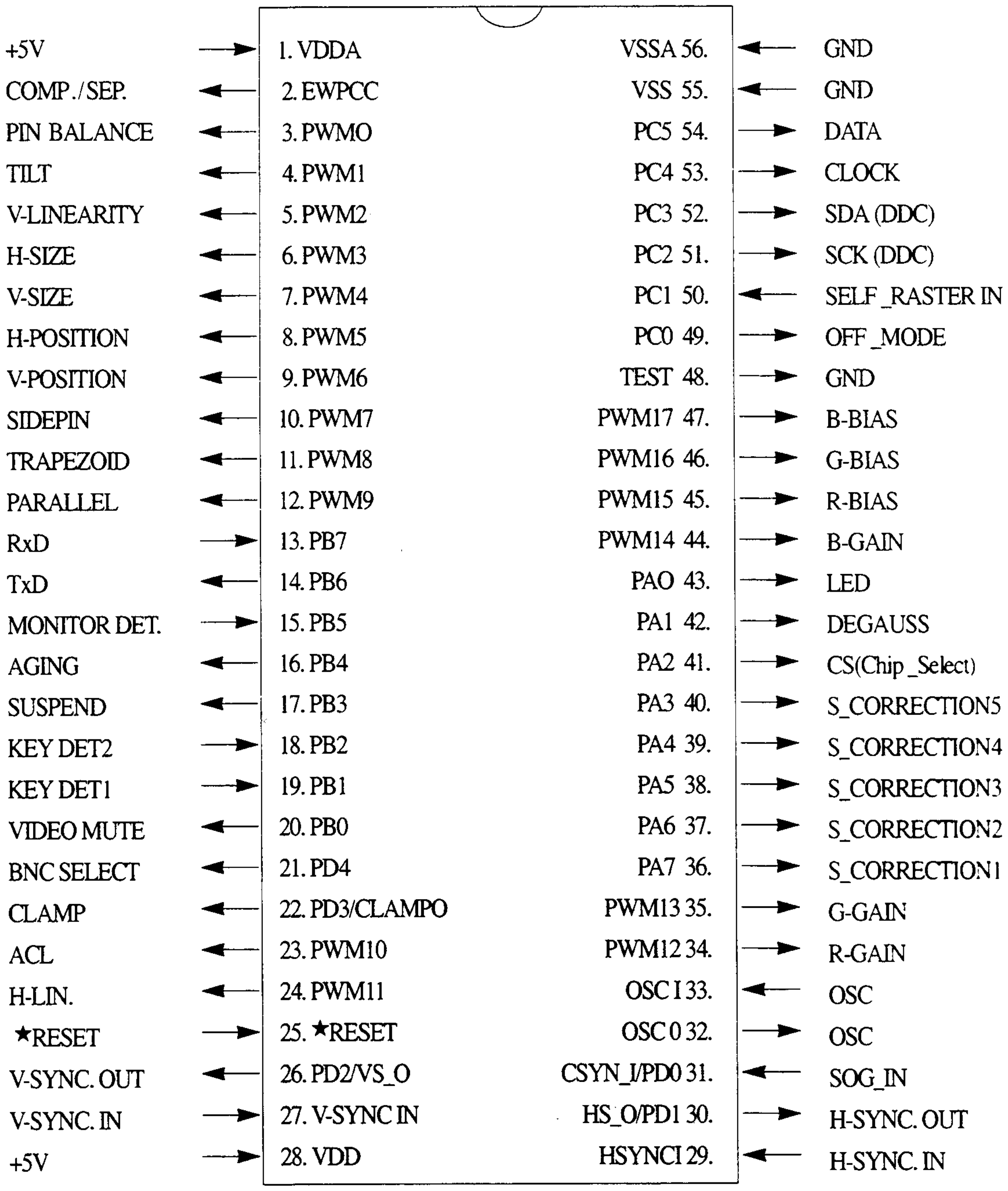
IN		OUT
14	D-SUB	14
27	IC201	26
34	IC401	

H-SYNC

IN		OUT
13	D-SUB	13
29	IC201	30
17	IC401	

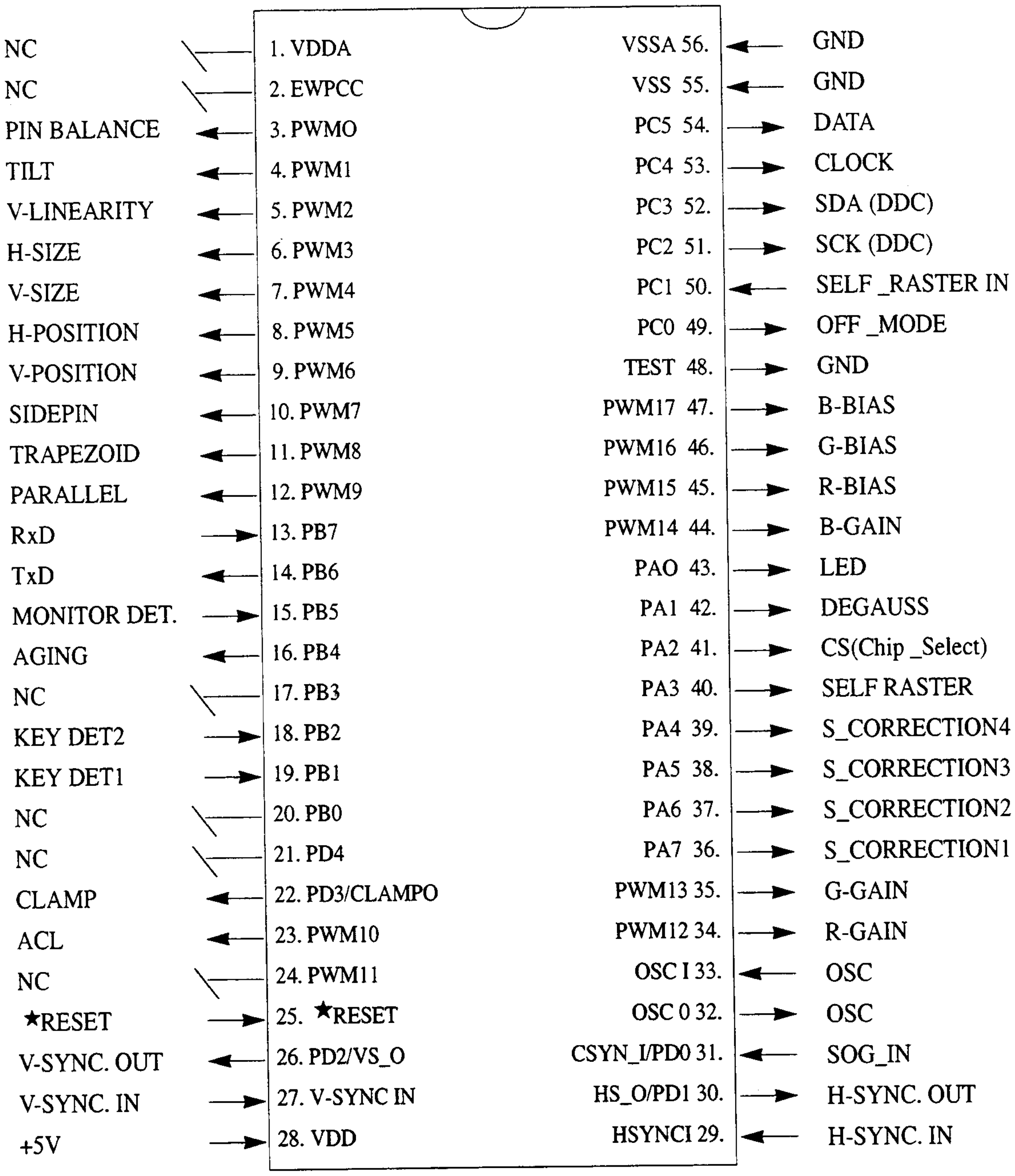
2. μ - processor pin configuration for each models

1) SyncMaster 17GLsi

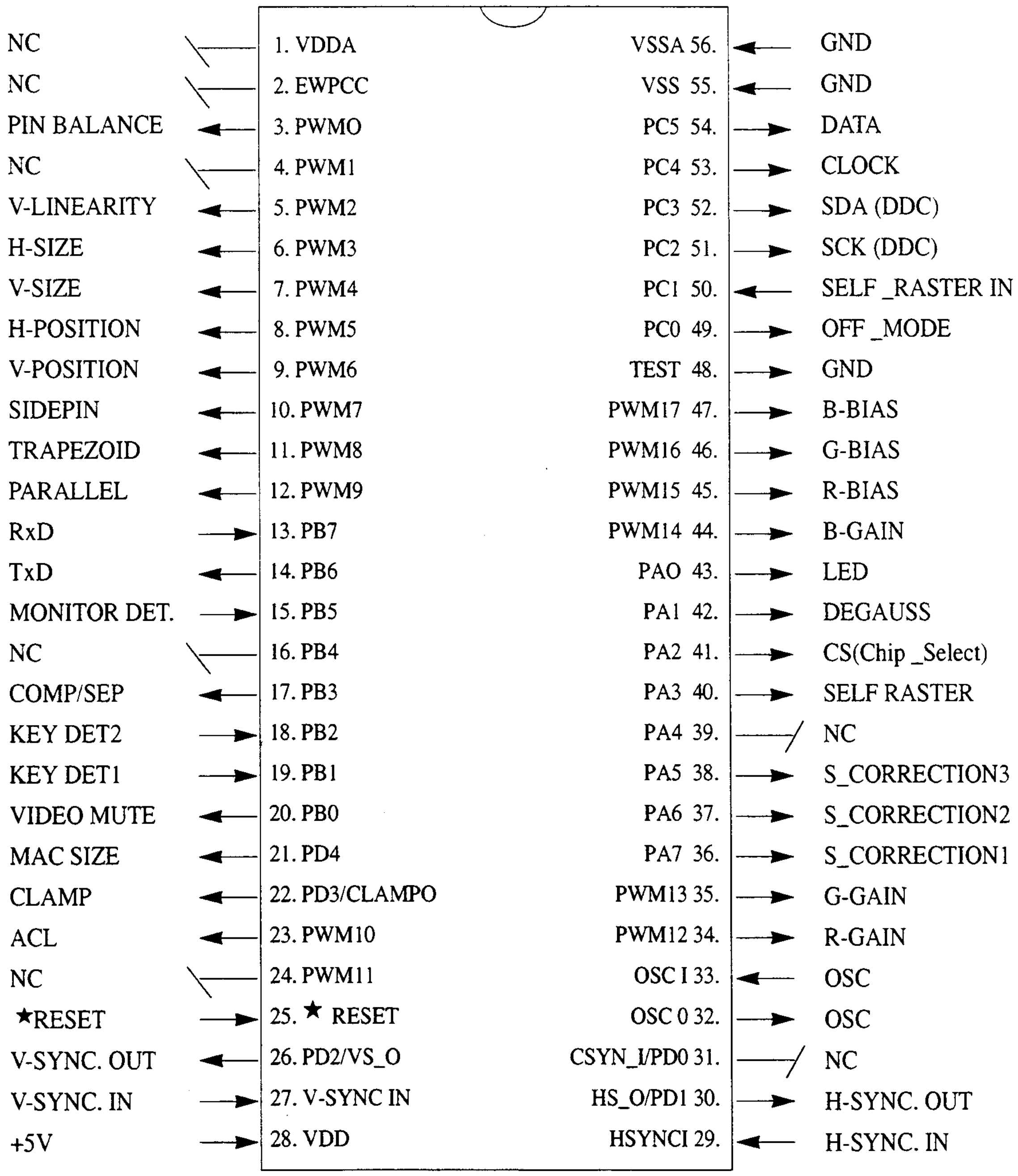


+5V	→	1. VDDA	VSSA 56.	←	GND
COMP./SEP.	←	2. EWPCC	VSS 55.	←	GND
PIN BALANCE	←	3. PWMO	PC5 54.	→	DATA
TILT	←	4. PWM1	PC4 53.	→	CLOCK
V-LINEARITY	←	5. PWM2	PC3 52.	→	SDA (DDC)
H-SIZE	←	6. PWM3	PC2 51.	→	SCK (DDC)
V-SIZE	←	7. PWM4	PC1 50.	←	SELF_RASTER IN
H-POSITION	←	8. PWM5	PC0 49.	→	OFF_MODE
V-POSITION	←	9. PWM6	TEST 48.	→	GND
SIDEPIN	←	10. PWM7	PWM17 47.	→	B-BIAS
TRAPEZOID	←	11. PWM8	PWM16 46.	→	G-BIAS
PARALLEL	←	12. PWM9	PWM15 45.	→	R-BIAS
RxD	→	13. PB7	PWM14 44.	→	B-GAIN
TxD	←	14. PB6	PAO 43.	→	LED
MONITOR DET.	→	15. PB5	PA1 42.	→	DEGAUSS
AGING	←	16. PB4	PA2 41.	→	CS(Chip_Select)
SUSPEND	←	17. PB3	PA3 40.	→	S_CORRECTION5
KEY DET2	→	18. PB2	PA4 39.	→	S_CORRECTION4
KEY DET1	→	19. PB1	PA5 38.	→	S_CORRECTION3
VIDEO MUTE	←	20. PB0	PA6 37.	→	S_CORRECTION2
BNC SELECT	←	21. PD4	PA7 36.	→	S_CORRECTION1
CLAMP	←	22. PD3/CLAMPO	PWM13 35.	→	G-GAIN
ACL	←	23. PWM10	PWM12 34.	→	R-GAIN
H-LIN.	←	24. PWM11	OSCI 33.	←	OSC
★RESET	→	25. ★RESET	OSCO 32.	→	OSC
V-SYNC. OUT	←	26. PD2/VS_O	CSYN_I/PD0 31.	←	SOG_IN
V-SYNC. IN	→	27. V-SYNC IN	HS_O/PD1 30.	→	H-SYNC. OUT
+5V	→	28. VDD	HSYNCI 29.	←	H-SYNC. IN

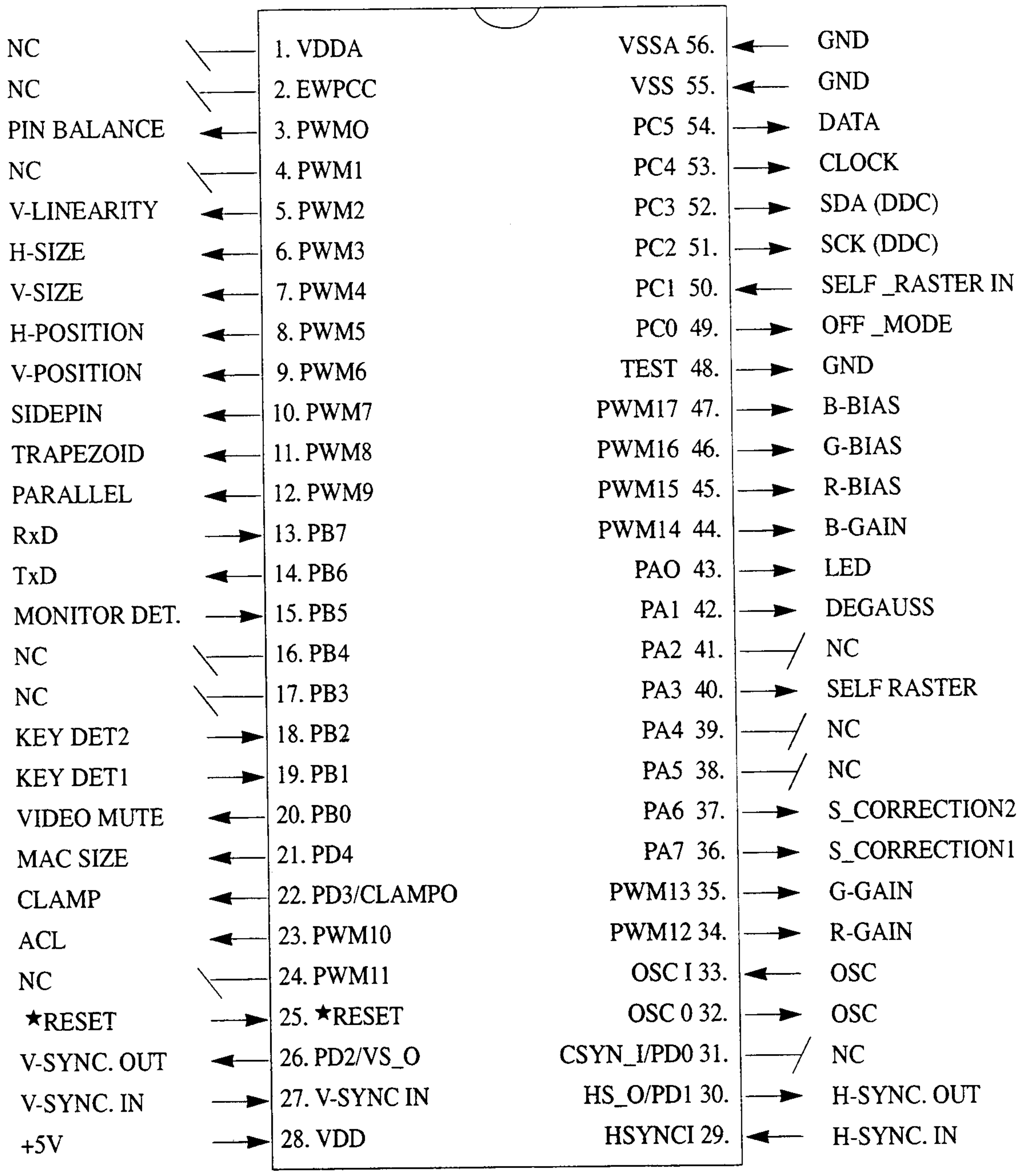
2) SyncMaster 17GLi



3) SyncMaster 15GLi

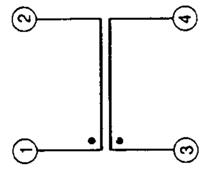


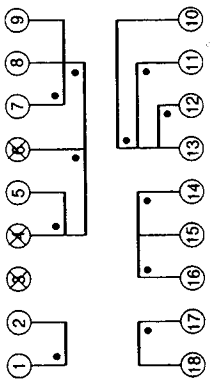
4) SyncMaster 15GLe

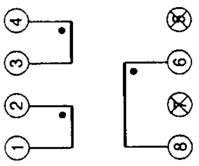


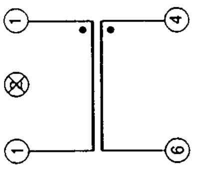
3. Wiring Specification of Transformers

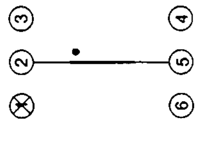
1) CMH(17GLsi)

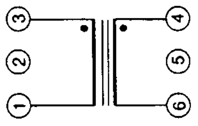

1. LF601(LINE FILTER)

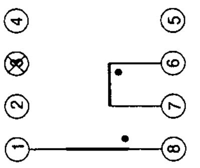

2. T601(S/W TRANS)

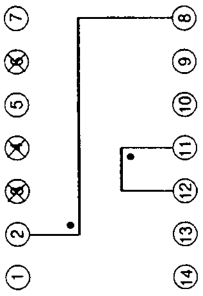

3. T602(DPMS)

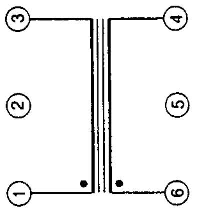

4. T603(SYNC TRANS)

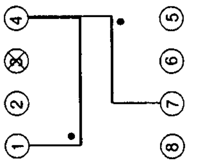

5. L401(H-CENTERING)

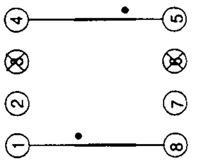

6. L402(H-LINEARITY)

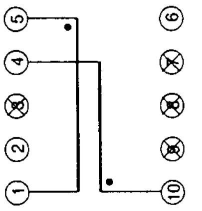

7. T401(H-DEFL.D.T)


8. T402(H-OUTPUT TRANS)


9. T404(H-SIZE DRIVE TRANS)

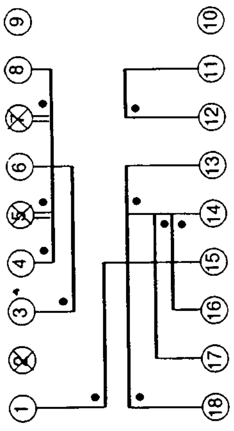

10. T405(FOCUS TRANS)


11. T501(H/V .D.T)

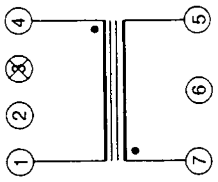

12. T503(H/V REGULATION TRANS)

2) CMG(17GLi)

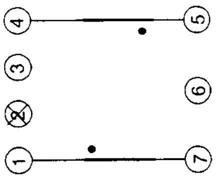
1. T601(S/W TRANS)



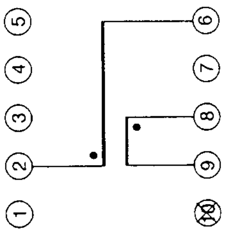
2. T501(H/V .D.T)



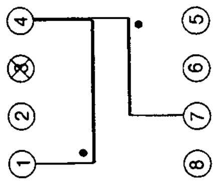
3. T401(HDT)



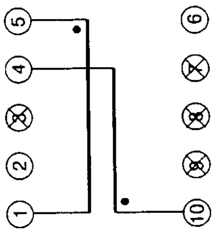
4. T402(H.PULSE)



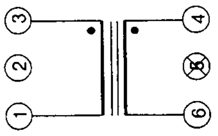
5. T504(FOCUS)



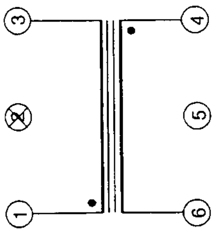
6. T502(H/V REG.)



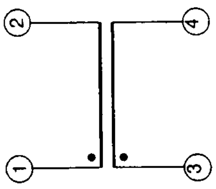
7. T602(POWER SYNC)



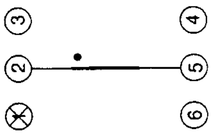
8. T404(H-SIZE DRIVE)



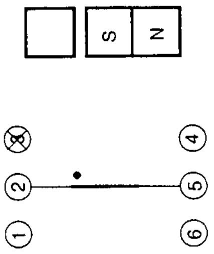
9. L601(LINE FILTER)



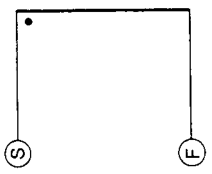
10. L401(COIL-CHOKE)



11. L403(H-LINEARITY)

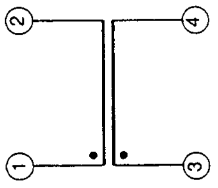


12. L404(H-LINEARITY)

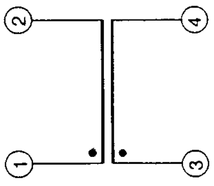


3) CMB(15GLi)

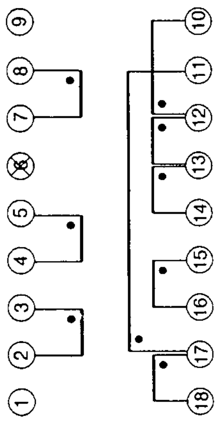
1. L601(LINE FILTER)



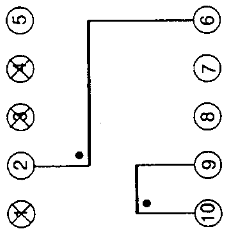
2. L602(LINE FILTER)



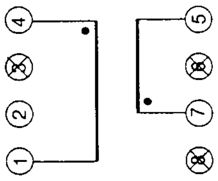
3. T601(S/W TRANS)



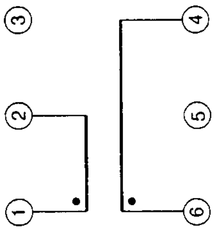
4. T403(H - PULSE TRANS)



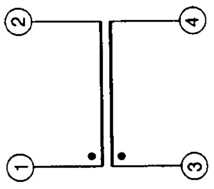
5. T401(H/V DRIVEC TRANS)

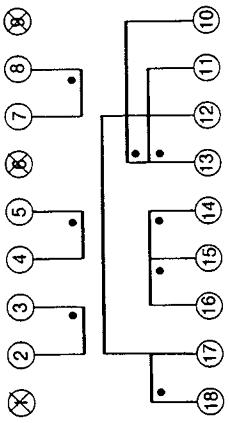


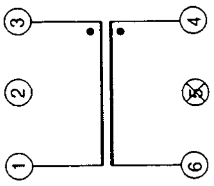
6. T501(H.D.T)

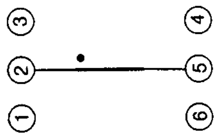


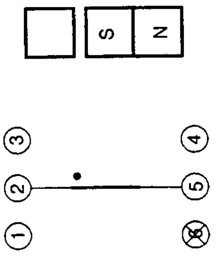
4) CMA(15GLe)

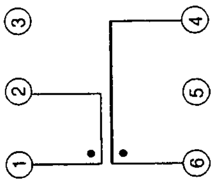

1. L601(LINE FILTER)

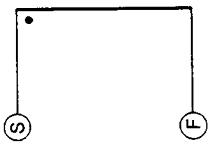

2. T601(S/W TRANS)


3. T602(SYNC TRANS)


4. L401(H-CENTERING)


5. L407(H-LINEARITY)


6. T401(H-DEFL.D.T)


7. L403(STEP-UP COIL)

Ⅵ. DISASSEMBLY AND REASSEMBLY

1. SyncMaster 17GLSi(CMH7379L)

This section of the training manual describes the disassembly and reassembly procedures for SyncMaster 17GLSi, CMH7389L monitor.

WARNING

This monitor contains electrostatically sensitive devices. Use caution when handling any components.

Disassembly

Removing the Cabinet

1) With a pad underneath it, stand the monitor on its front with the screen facing downward and the base closest to you. Make sure nothing will damage the screen.
2) Working from the back of the monitor, remove the four screws (six screws for CMH7389L).

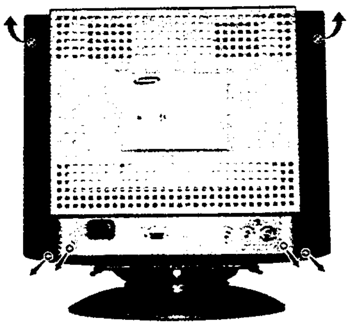


Figure 6-1

3) Tilt the cabinet away to release the three tabs and pull it up and away from the monitor.
4) Remove the two screws from the cabinet bottom. Lift the bottom off and away from the monitor.

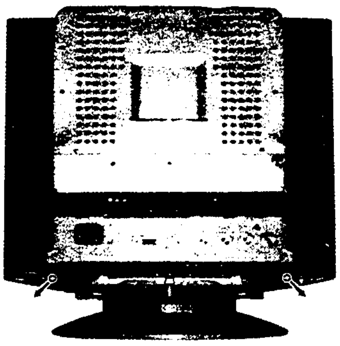


Figure 6-2

5) Remove the 14 screws from around the metal shielding. Lift the shielding up and away from the CRT.

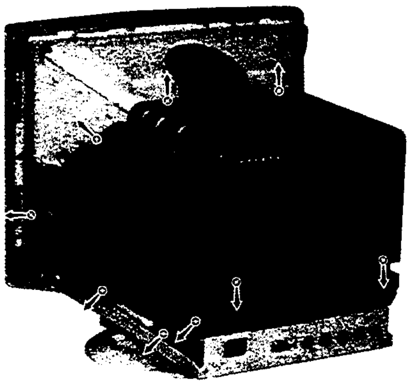


Figure 6-3

Removing the Video PCB

1) Remove the four connectors:
   - Sync
   - Power
   - Video out
   - Color controller
2) Remove the three screws (A) holding the Video PCB Ass'y onto the main PCB Ass'y and slide it off.
3) Remove the six screws on the Video PCB Shield and lift the top off.
4) Remove the one screw holding the video PCB Shield bottom and left the PCB out.
5) Set Video PCB on a smooth, level surface which is protected from static electricity.

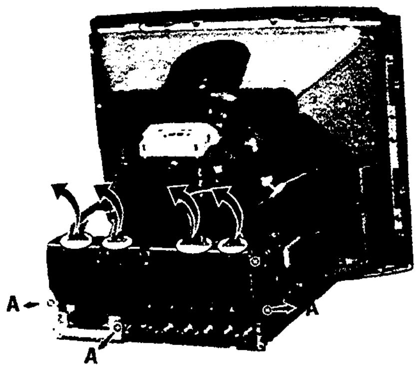


Figure 6-4

Removing the Main PCB

1) If you have not already done so, remove the Video PCB.

2) Remove the CRT PCB.

3) Remove the two screws holding the main PCB Ass'y to the front cover.

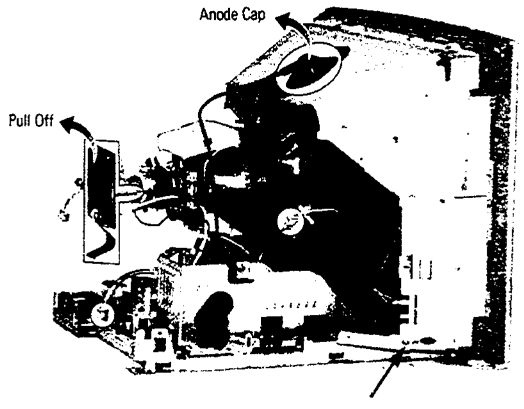


Figure 6-5

4) Remove the accessible connectors:

Ground wire
tilt
Degaussing coil
Anode cap

5) Lift the Main PCB Ass'y up slightly and tilt it away from the CRT so that you can reach and remove the following connectors:

Horizontal deflection yoke
Vertical deflection yoke
Controller
Function key

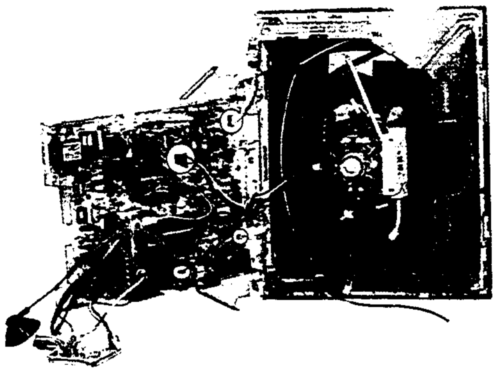


Figure 6-6

6) Pull the Main PCB Ass'y away from the CRT.
7) Remove the eight screws holding the main PCB in the PCB Bracket, remove the power shaft and lift the Main PCB out.
8) Set main PCB on a smooth, level surface which is protected from static electricity.

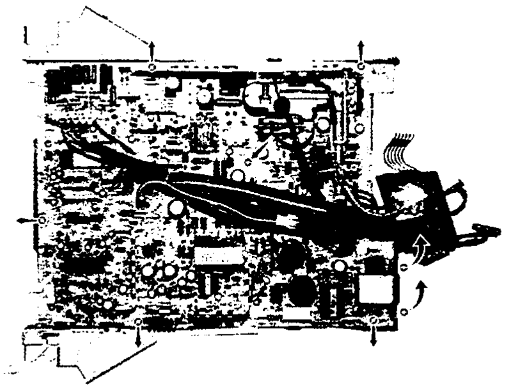


Figure 6-7

Removing the CRT

Caution : Do not touch the Anode

1) If you have not already done so, remove the Main PCB.
2) Remove the eight screws securing the CRT Bracket Assembly.
3) Release the grounding wire clips from the grounding prongs on the CRT Bracket Ass'y.
4) Lift the CRT Bracket Ass'y up and away from the CRT. The CRT Bracket Ass'y includes the bracket, degaussing coil and tilt coil.
5) Remove the screw at each of the four corners of the CRT. This releases the CRT and the CRT Ground Ass'y. Lift the CRT tube (do not lift by the tube neck) out of the Front Cover Assembly.
6) Remove the CRT Ground Ass'y

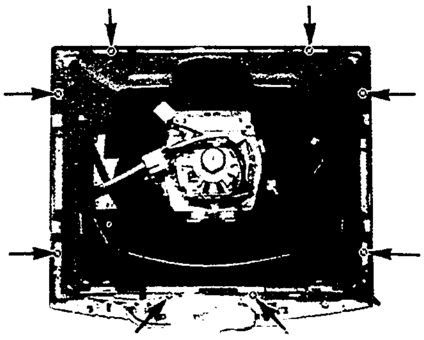


Figure 6-8

Reassembly

With the CRT facing downward on a protective pad, use the steps that follow to reassemble the monitor.

Replacing the CRT

1) With the front cover assembly face down on a protective pad, position the CRT so that the corner metal tabs fit properly in the Front Cover.
2) Position the CRT Ground Ass'y around the CRT and secure it and the CRT at each of the four corners with the CRT screws. Make sure the grounding wire clips are accessible.
3) Position the CRT Bracket Ass'y around the CRT and replace the eight screws. Attach the grounding wire clips onto the grounding prongs on the CRT Bracket Ass'y.

Replacing the Video PCB

1) Place the Video PCB in the Video Shield bottom and replace the one screw that holds it in place.
2) Position the Video Shield top on the bottom and replace the six screws.
3) Slide the Video PCB Ass'y onto the Main PCB Ass'y and secure it with two screws.
4) Reconnect the four connectors:

Color controller
Video out
Power
Sync

Replacing the Main PCB

1) Set the Main PCB in the PCB bracket and secure it with eight screws.
2) Hold the Main PCB Ass'y close to the CRT as shown in figure 6-7 and reconnect the following connectors:

Function key
Controller
Vertical deflection yoke
Horizontal deflection yoke
Anode cap
Degaussing coil
Tilt control
Ground coil

3) Replace the CRT PCB
4) Position the Main PCB Ass'y on the front cover (see figure 6-5) and hold it secure with two screws.
5) If you have not already done so, replace the Video PCB.

Replacing the Cabinet

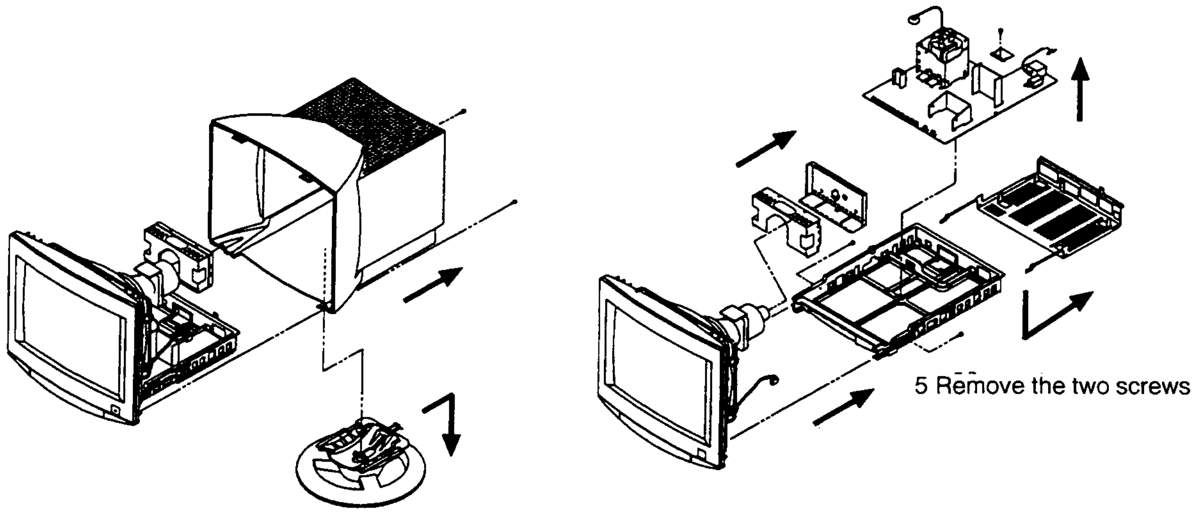
1) Position the metal shielding around the CRT. If so equipped, make sure the tabs are snapped in place. Replace the 14 screws. See figure 6-3
2) Position the cabinet bottom and replace the two screws (see figure 6-2)
3) Position the cabinet top making sure the three tabs along the upper front edge are properly snapped in place. Replace the four screws (six screws for CMH7389L).
4) Set the monitor on its base and make sure that the CRT screen was not scratched or otherwise damaged.

2. SyncMaster 15GLe(CMA5377L)

This section of the training manual describes the assembly and disassembly procedures for the SyncMaster 15Ge, SyncMaster 15GLe and SyncMaster 4Ne.

Disassembly

1. Stand monitor on its front with the screen down and the base closest to you. (Make sure nothing will damage the screen)
2. Pull the snap downward from the PCB frame and push the stand assembly backward from the PCB frame.



3. Working from the back of the monitor, remove the two screws.
4. Tip the cabinet away to release **tabs** and pull it up and away from the monitor.

Assembly

To reassemble the monitor, follow the instructions for disassembly, but use the reverse order.

Ⅶ. ALIGNMENTS AND ADJUSTMENTS

1. SyncMaster 17GLSi, 17GLi

This section of the training manual explains how to control the linearity, raster, size, position, pincushion, parallelogram, trapezoid, and pinbalance. Additionally, this section describes how to use the micom control jig to make the adjustments.

Adjustment Conditions

Caution : Changes made without the micom jig are saved only to the user mode settings. As such, the settings are not permanently stored and may be inadvertently deleted by the user.

Direction : When servicing, always face the monitor toward the East and, whenever possible, use magnetic field isolation such as a helmholtz field around the monitor.

Caution : Other electrical equipment may cause external magnetic fields.
During servicing, use an external degaussing coil to limit magnetic build up. If an external degaussing coil is not available, use the internal degaussing circuit, but not more than once per minute.After finishing all adjustments, test the monitor in all directions, If, for example, the monitor does not meet adjustment specifications when facing in a northerly direction, face the monitor eastward again and readjust the monitor to the smallest error possible within a reasonable time limit. Test the unit again in all directions. If the monitor again fails to meet specifications in a non-easterly direction, contact your region's main service center for possible CRT replacement.

Testing and Burn-in Mode

For testing and burn-in, remove the signal cable from the monitor. Power on the monitor and warm it up. Use the burn-in mode to age the monitor.

Power Supply Voltage

AC 90-132/198-264 Volt(60/50Hz±3Hz).

High Voltage Control

Adjust VR501 to 26 kV±0.2kV.

Warm-Up Time

The display must be on for 30 minutes before starting alignment. Warm-up time is especially critical in color temperature and white balance adjustments.

Signal

Video analog 0.714 Vp-p positive at 75 ohm terminated.

Sync: Separate/composite (TTL level negative/positive).

Sync-on-Green: Composite sync 0.286 Vp-p negative(Video 0.714 Vp-p positive).

Scanning Frequency

Horizontal : 30kHz-85kHz (Automatic) : 17GLSi
30~65KHz : 17GLi
Vertical : 50Hz-120Hz (Automatic)

Unless otherwise specified, adjust to 1024×768 mode (H : 60kHz, V : 75Hz) signals.

Prepare Main PCB for Adjustment

+B 195V Line Adjustment

No beam, Contrast: Minimum,

Brightness: Minimum.

Adjust VR601 to DC 195V±V at Q406 heat sink and GND.

High Voltage Adjustment

No beam, Contrast: Minimum,

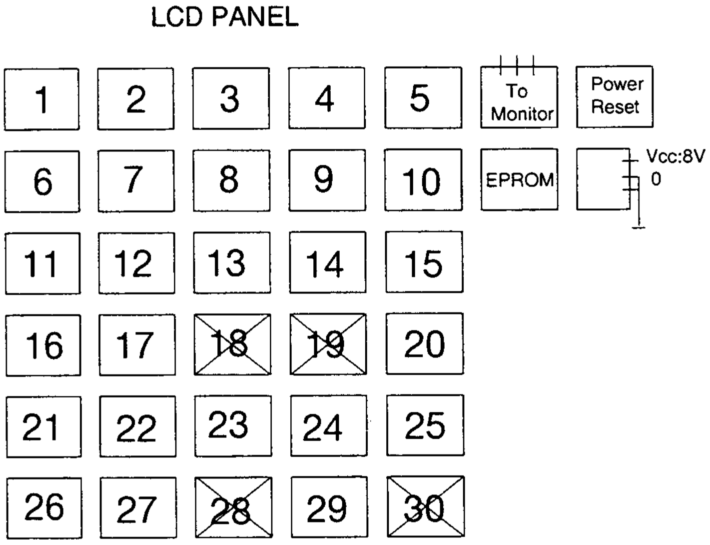
Brightness: Minimum

Adjust VR501 to 26kV±0.2kV.

Center Raster

Adjust SW401 so that the back raster comes to the center when you apply a signal of 60 kHz/75Hz.

Using the Microcomputer Control Jig



Changes made without the micom jig are saved only to the user mode settings. As such, these settings are not permanently stored and may be inadvertently deleted by the user.

Selecting the monitor series and type:

1. SyncMaster 17GLsi

1) Simultaneously press buttons 29 and 24 to select "M-Project" as the monitor series.
2) Press button 25 to select the monitor type. Hold down button 25 until you see "M17H" plus the OEM name for the monitor under test. For example, hold down button 25 until you see "M17H" if you are working on a "Dell 17".

2. SyncMaster 17GLi

1) Simultaneously press buttons 29 and 24 to select "M-Project" as the monitor series.
2) Press button 25 to select the monitor type. Hold down button 25 until you see "M17L" plus the OEM name for the monitor under test. For example, hold down button 25 until you see "M17L" if you are working on a "Dell 17".

Table 7-1 Micom Control Jig Function Keys

Key No.	General Control Key Function	Color Control Key Function
1	Horizontal Position Right	R-Gain Increase
2	Horizontal Position Left	R-Gain Decrease
3	Parallelogram Right	ACL Increase
4	Parallelogram Left	ACL Decrease
5	Mode Save	Color Save
6	Horizontal Size Increase	G-Gain Increase
7	Horizontal Size Decrease	G-Gain Decrease
8	Vertical Linearity Increase	Color CH-1 Standard Save
9	Vertical Linearity Decrease	Color CH-2 Standard Save
10	Standard Save	ACL Save
11	Vertical Position Up	B-Gain Increase
12	Vertical Position Down	B-Gain Decrease
13	Pinbalance Left	No function(Don't Use)
14	Pinbalance Right	No Function(Don't Use)
15	All Mode Save	No Function(Don't Use)
16	Vertical Size Increase	R-Bias Increase
17	Vertical Size Decrease	R-Bias Decrease
18	Tilt Up	No Function(Don't Use)
19	Tilt Down	No Function(Don't Use)
20	User Mode Delete	No Function(Don't Use)
21	Barrel	G-Bias Increase
22	Pincushion	G-Bias Decrease
23	Horizontal Linearity Increase	No Function(Don't Use)
24	Horizontal Linearity Decrease	No Function(Don't Use)
25	Model Selection	No Function(Don't Use)
26	Trapezoid Up	B-Bias Increase
27	Trapezoid Down	B-Bias Decrease
28	No Function(Don't Use)	No Function(Don't Use)
29	Shift	Shift
30	No Function(Don't Use)	Manual/Auto Color Control
29+23	Color/General Control toggle	Color/General Control toggle
29+24	F-Project/M-Project toggle	F-Project/M-Project toggle

General Control

Use general control to test and adjust the shape and size of the display.

1) Simultaneously press buttons 29 and 23 to toggle between General Control and Color Control. Select "General Control".
2) Standard Save: Press button 10 to do a memory data dump and load the standard picture data from the EPROM on the micom control jig.

   Note : This step is necessary only if the EPROM on the control jig has more recent data than the EPROM on the monitor PCB. Check for a Service Bulletin or Service Manual Supplement.
3) Optimize the standard timing mode (60kHz/75Hz) using the micom control jig.
4) After completing all standard timing mode adjustments, press button 15 to save the data for all modes. The monitor's microprocessor adjusts the other modes according to a predefined formula.
5) Using a signal generator, scan the other timing modes and make adjustments as needed. Each time you make a change, press button number 5 to save the data.

Color Control

Use color control to test and adjust the color coordinates the monitor displays.

1) Simultaneously press buttons 29 and 23 to toggle between General Control and Color Control. Select "Color Control".
2) Press button 8 (for 9300K setting) or 9 (for 6500K settings) to do a memory data dump and to load the standard picture color data from the micom control jig.

   Note : This step is necessary only if the EPROM on the control jig has more recent data than the EPROM on the monitor PCB. Check for a Service Bulletin or Service Manual Supplement.
3) Optimize the standard timing mode using the micom control jig.
4) Press button 5 to save the picture color data.
5) Press button 10 to save ACL data.
6) When you are through, disconnect the micom control jig and proceed with other tests and adjustments.

Display control Adjustments

Unless otherwise specified, adjust the EXT-VR:

Contrast : Max. (Fully clockwise)
Brightness: Max. (Fully clockwise)

Centering

Centering means to position the center point of the display in the middle of the display area. Horizontal size and position and vertical size and position control the centering of the display. Adjust the horizontal size and vertical size to their optimal settings: 306mm(H) × 230mm(V) Adjust the horizontal position and vertical position to ≤4.0mm of the center point of the screen.

$|A - B| \leq 4.0$mm.
$|C - D| \leq 4.0$mm.

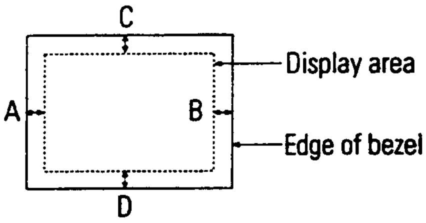


Figure 7-2 Centering

Horizontal Size Adjustment

With microcomputer control jig:

Press the horizontal size up button 6 or horizontal size down button 7 to adjust the horizontal size of the display pattern to 306mm. (Tolerance: ±3mm.)

Without microcomputer control jig:

After pushing the size button, push the (▶) button or (◀) button to adjust the horizontal size of the display pattern to 306mm. (Tolerance ±3mm.)

Vertical Size Adjustment

With microcomputer control jig:

Press the vertical size increase button 16 or the vertical size decrease button 17 to adjust the vertical image or pattern to 230mm.(Tolerance: ±3mm)

Without microcomputer control jig:

After pushing the size button, push the (▲) button or (▼) button to adjust the vertical size of the display pattern to 230mm.(Tolerance: ±3mm.)

Horizontal Position Adjustment

With microcomputer control jig:

Press the horizontal position right button 1 or the horizontal position left button 2 to center the image or test pattern on the raster.

Without microcomputer control jig:

After pushing the position button, push the (▶) button (move right) or (◀) button (move left) to center the image or test pattern on the raster.

Vertical Position Adjustment

With microcomputer control jig:

Press the vertical position up button 11 or vertical position down button 12 to center the vertical image or the pattern on the raster.

Without microcomputer control jig:

After pushing the position button, push the (▲) button (move up) or (▼) button (move down) to center the image or the test pattern on the raster.

Vertical Linearity Adjustment

Linearity affects the symmetry of images on the screen. Unless each row or column of blocks in a crosshatch pattern is of equal size, or within the tolerances shown in Tables 7-2 and 7-3, an image appears distorted, elongated or squashed.

To adjust the Vertical and Horizontal Linearity, refer to Tables 7-2 and 7-3 for the tolerance range.

Table 7-2. Standard Mode Linearity: 60.023kHz/75Hz, 79.976kHz/75Hz

Standard Mode	Factory Preset Timing Modes	
	Each block(5%)	Difference between adjacent blocks(4%)
800 X600/75Hz 1024X768/75Hz	Horizontal : 18.2~20.1 Vertical : 18.2~20.1	Horizontal : Less than 0.8mm Vertical : Less than 0.8mm
1280X1024/75Hz	Horizontal : 17.1~18.9 Vertical : 18.2~20.1	Horizontal : Less than 0.7mm Vertical : Less than 0.8mm

Table 7-3 Other Modes Linearity: VGA, 8514/A, XGA, MAC, etc.

Screen Ratio	Supported Timing Modes	
	Each block(7%)	Difference Between adjacent blocks(5%)
4:3	Horizontal : 17.8~20.5 Vertical : 17.8~20.5	Horizontal : Less than 1.0mm Vertical : Less than 1.0mm
5:4	Horizontal : 16.7~19.2 Vertical : 17.8~20.5	Horizontal : Less than 0.9mm Vertical : Less than 1.0mm

With microcomputer control jig:

Press the vertical linearity increase button 8 or vertical linearity decrease button 9 to optimize the image or the test pattern.

Without microcomputer control jig:

To activate the vertical linearity adjustment function, push and hold in both the position and the size buttons for longer than three seconds, or until the power indicator LED changes from orange to green and back to orange.

Use the right (▶) and left (◀) buttons to correct the vertical linearity.

Horizontal Linearity Adjustment

With microcomputer control jig:

Press the horizontal linearity increase button 23 or horizontal linearity decrease button 24 to optimize the image or the test pattern.

Without microcomputer control jig:

After pushing G/D button once, push the (▼) button or (▲) button to make the image or the test pattern rectangular.

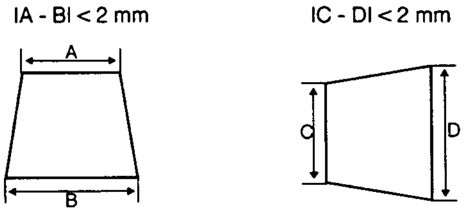


Figure 7-3 Trapezoid

Pinbalance Adjustment

With microcomputer control jig:

Press the pinbalance left button 13 or pinbalance right button 14 to optimize the image or test pattern.

Without microcomputer control jig:

To activate the pinbalance adjustment function, push and hold in both the position and the size buttons for longer than three seconds, or until the power indicator LED changes from orange to green and back to orange.

Use the up (▶) and down (◀) buttons to correct the pinbalance distortion of one or both sides.

Parallelogram Adjustment

With microcomputer control jig:

Press the parallelogram right button 3 or the parallelogram left button 4 to make the image or test pattern rectangular.

Without microcomputer control jig:

After pushing G/D button twice, push (▶) button or (◀) button to make the image or test pattern rectangular.

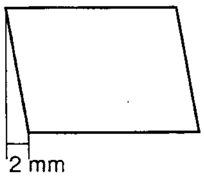


Figure 7-4 Parallelogram

Side Pincushion Adjustment

With microcomputer control jig:

Press the barrel button 21 or the pincushion button 22 to straighten the sides of the test pattern or image.

Without microcomputer control jig:

After pushing G/D button once, push (▶) button or (◀) button to straighten the sides of the test pattern or the image.

|C1|, |C2| ≤ 2.0mm.

|D1|, |D2| ≤ 2.0mm.

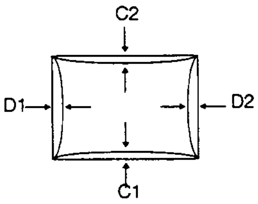


Figure 7-5 Pincushion

Tilt Adjustment

Direction:

Monitor MUST face to the East.

Use mechanical adjustment if correction needed is > 1.5mm.

With microcomputer control jig:

Press the tilt up button 18 or the tilt down button 19 to correct the tilt of the display.

Without microcomputer control jig:

Push the G/D button twice to display the tilt OSD. Push either the tilt up (▲) or down (▼) button to display the tilt OSD.

Use the up (▲) and down (▼) buttons again to correct the tilt of the display.

CRT Tilt Adjustment

Mechanical Adjustment:

Reassemble the CRT with fastening screws so that the dimensions A, B and C, D are separately equal. If you are unable to correct the tilt, contact the regional service center for CRT replacement.

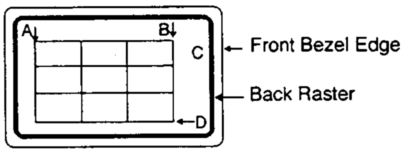


Figure 7-6 CRT Tilt Adjustment

Degauss

No adjustments available for degaussing circuit. The degaussing circuit can effectively function only once per minute. If available, use an external degaussing coil during servicing.

Warning:

Don't hold the degauss button down for longer than 3 seconds. If you do, it resets all data in the user memory area. If this occurs, you must remake the user adjustments.

To Delete the User Mode Data

With microcomputer control jig:

To delete the picture data from user's modes, push user's mode delete button 20.

Without microcomputer control jig:

To delete the picture data from user's modes, press the degaussing button for 5 or more seconds.

Save the Data

With microcomputer control jig:

To save the picture data for a mode, push the mode save button 5

Color Adjustments

Note : To make color adjustments you must have one of the following configurations:

1) Micom Control Jig and Signal Generator. or
2) Micom Control Jig and Computer with Samsung DM 200 software or DisplayMate for Windows software from Sonera Technologies.

Before making adjustments check that the video signals are as follows:

Video : Analog 0.714 Vp-p (at 75 Ω terminated).

Sync : synchonizing : **separate TTL level.**

Unless otherwise specified, use 1024×768 signal (60kHz/75Hz) for the adjustments.

Color Coordinates (Temperature)

Color temperature is a measure of the radiant energy transmitted by a color. For computer monitors, the color temperature refers to the radiant energy transmitted by white. Color coordinates are the X and Y coordinates on the chromaticity diagram of wavelengths for the visible spectrum.

Table 7-4 Color Coordinates

Value	9300°K : x=0.283±0.02, y=0.298±0.02. 6500°K : x=0.313±0.02, y=0.329±0.02.
Conditions	Display Image : White flat field at the center of display area. Luminance : Min : 5 ft-L, Max : 24 ft-L.

Luminance Uniformity

Luminance uniformity means that the luminance at the position of the lowest brightness must be more than 75% of the luminance at the area with the highest brightness. Luminance is considered uniform only if the ratio of lowest to highest brightness is not less than 7.5:10.

Table 7-5 Computing Luminance Uniformity

Value	75% (Min) Variation = $\frac{C}{A} \times 100$
Conditions	Display Image : White flat field. Luminance : Brightness cut off, Contrast Max. A : Luminance at position of highest brightness. C : Luminance at position of lowest brightness.

Color Adjustments for 9300°K

(a) Adjustment of the Back Raster Color (60 kHz/75Hz, Back raster pattern)

1) Turn the contrast and the brightness controls fully clockwise (maximum condition).
2) Adjust the screen VR of the FBT so that the brightness of back raster is 0.5 to 0.7 ft-L (typically 0.6 ft-L).
3) Press button 8 to download the standard color data (channel 1) from the micom jig.
   For 9300°K color adjustment:
   x=0.283±0.02, y=0.298±0.02.
   For 6500°K color adjustments see section "Color Adjustments for 6500°K".
4) Use buttons 26 and 27 to set the "y" coordinate to 0.298±0.02.
5) Use buttons 16 and 17 to set the "x" coordinate to 0.283±0.02.

   Note : If the above adjustments cannot be done to each coordinate, press button 21 to increase the green bias, or button 22 to decrease the green bias and repeat procedures 4 and 5.
6) After completing the adjustments, press button 5 to save the data.

(b) Video Gain Adjustment
(60kHz/75Hz, green box pattern)

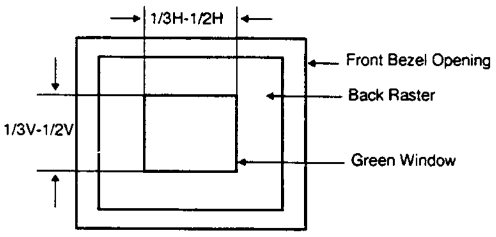


Figure 7-7 Green Box Pattern

1) Display the green window pattern using a range for which the ACL Circuit is not active (within ranges 1/3 to 1/2H and 1/3 to 1/2V).

2) Turn the contrast and the brightness controls fully clockwise.

3) Press buttons 6 and 7 (G-Gain control) to adjust the brightness of the green gain to 37±1 ft-L.

Note: If you can't increase the green gain to the appropriate value, press button 3 to increase the ACL point.

(c) White Balance Adjustment(50kHz/75Hz, Full white Pattern)

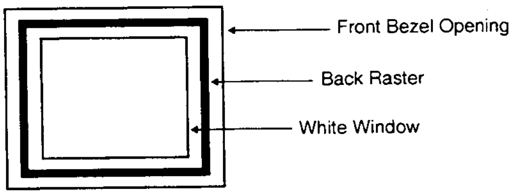


Figure 7-8 Full White Pattern

1) Turn the contrast and the brightness controls fully clockwise.

2) Use the R-Gain buttons 1 and 2 and B-Gain buttons 11 and 12 to make the video white. (For 9300°K color adjustment: x=0.283±0.02, y=0.298±0.02)

Note : Do not touch buttons 6 and 7.

3) Press button 5 to save the data.

(d) White Balance Fine Adjustment(x=0.283±0.02, y=0.298±0.02, Full White pattern)

Note : Do not touch buttons 6 and 7 (G-Gain).

1) Adjust the contrast control so that the brightness of the video is about 5 ft-L.

2) Check whether the white coordinates of the video meets the above coordinate spec.

3) Adjust the contrast control so that the brightness of the video is about 20 ft-L.

4) Check whether the white coordinates of the video **satisfy** the above spec.

5) If the white balance differs from the above spec, readjust it to within specifications. When correct, press buttons 5 to save.

(e) ACL point Adjustment

1) Display the full white pattern.

2) Turn the contrast and the brightness controls fully clockwise.

3) Press buttons 3 and 4 (ACL) so that the brightness is 30±1 ft-L.

4) Press button 10 to save the ACL setting value.

Color Adjustments for 6500°K

(a) Back Raster Color Adjustment

1) Display the back raster pattern.
2) Turn the contrast and the brightness controls fully clockwise.
3) Press button 9 to load the standard color data (channel 2) for 6500°K from micom control jig.
4) Adjust the brightness of the back raster to 0.5 to 1.0 ft-L using buttons 21 or 22 (G-Bias control). If you don't need to adjust the brightness, skip this step.

   Note : For 6500°K adjustments you must not control the screen VR of the FBT. If you do so, the 9300°K setting values are changed.
5) Using buttons 16, 17, 26 and 27, adjust the R-Bias to $x=0.313 \pm 0.02$ and B-Bias to $y=0.329 \pm 0.02$.
6) Press button 5 to save the bias data for 6500°K

(b) Video Gain Adjustment

1) This procedure is the same as that of 9300°K
2) Refer to the procedure for 9300°K

(c) White Balance Adjustment

1) Display a full white pattern.
2) Turn the contrast and the brightness controls fully clockwise.
3) Using buttons 1, 2, 11 and 12 set the R/B gain data to $x=0.313 \pm 0.02$, $y=0.329 \pm 0.02$.

(d) White Balance Fine Adjustment

Refer to the procedure for 9300°K

(e) ACL Point Adjustment

Refer to the procedure for 9300°K

Focus Adjustment

1. Display the H character pattern so that the focus adjustment can be done.
   (Apply 1280 × 1024/60Hz mode to the monitor.)
2. Turn the contrast and the brightness controls fully clockwise.
3. Adjust the focus control of the FBT to display the sharpest image possible.
4. Use locktite to seal the focus control in position.

Color Purity Adjustment

Color purity is the absence of undesired color. Conspicuous mislanding (unexpected color in a uniform field) within the display area shall not be visible at a distance of 50cm from CRT surface.

Conditions

Direction : Monitor facing east.
Display image : White flat field.
Luminance : Cutoff point at the center of display area.

***Note*:** Color purity adjustments should only be a attempted by qualified personnel.

For trained and experienced service technicians only.

Use the following procedure to correct minor color purity problems:

1) Make sure the display is not affected by external magnetic fields. Use an external degaussing coil to neutralize magnetic fields which may be affecting color purity.
2) Very carefully break the glue seal between the two-pole purity convergence magnets (PCM), band and the spacer.

   ***Caution*:** The convergence bow magnets are not user or service technician adjustable. Do not allow these magnets to move.
3) Make sure the spacing between the PCM assembly and the CRT stem is 29mm ± 1mm.
4) Display a red pattern over the entire display area.
5) Adjust the purity magnet rings on the PCM assembly to display a pure red pattern. (Optimum setting: X=0.625±0.015, Y=0.340±0.015)
6) Adjust each corner and the center to meet the red color tolerances listed below.
7) Repeat steps 4 through 6 using a green pattern and again, using a blue pattern.

Table 7-6 Color Purity Tolerances

Red:	X=0.63±0.02	Y=0.34±0.02
Green:	X=0.28±0.02	Y=0.61±0.02
Blue:	X=0.15±0.02	Y=0.07±0.02

(For 9300° K color adjustment: X=0.283±0.02, Y=0.298±0.02)

8) When you have the PCMs properly adjusted, carefully glue them together to prevent their movement during shipping.

Convergence Adjustments

Misconvergence occurs when one or more of the electron beams in a multi beam CRT fail to meet the other beams at a specified point.

Table 7-7 Misconvergence Tolerances

Position	Error in mm	CRT Dot Pitch	Remark
Center(A)	0.30	0.25	-
Edge (B)	0.30	0.26	≥ 800×600 resolution
	0.40	0.26	< 800×600 resolution

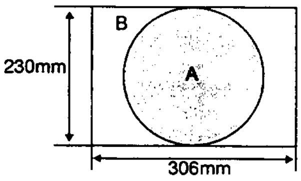


Figure 7-9 Convergence Measurement Areas

Static (Center) Convergence

Static convergence involves the alignment of the red, blue and green lines in the center area of the display.

See "Dynamic Convergence" for alignment of the color fields around the edges of the display.

Conditions

Direction : Monitor facing east
Warm-up : 30 minutes
Display image : Crosshatch pattern
Tolerances : See Table 7-7

As shown in Figures 7-10, CRTs used in these monitors all have the same magnet configuration as shown in Table 7-8 below.

Table 7-8 Magnet Configurations

CRT Manufacturer	Magnet Order from Front of CRt
Samsung Hitachi	Convergence bow, two-pole, four-pole, six-pole
Toshiba	Convergence bow, two-pole, Six-pole, four-pole

Use the following steps to correct any static misconvergence:

1) Locate the pair of four-pole magnet rings.
2) Unlock the rings and rotate the individual rings (change the spacing between tabs) to converge the vertical red and blue lines.
3) Rotate the pair of rings (maintaining the spacing between tabs) to converge the horizontal red and blue lines.
4) After completing the red and blue center convergence adjustment, locate the pair of 6-pole magnet rings.
5) Rotate the individual rings (change the spacing between tabs) to converge the vertical red and blue (magenta) and green lines.
6) Rotate the pair of rings (maintaining the spacing between tabs) to converge the horizontal red and blue (magenta) and green lines. Don't rotate the 2-pole magnets, as they adjust for color purity.
7) Mark the correct position for the magnets and apply a small line of glue to hold the magnets in place. Lock the rings in place.

Dynamic (Edge) Convergence

Use the following procedure to correct minor dynamic (edge) misconvergence. If, after using this procedure, dynamic misconvergence is still greater than the tolerance around the periphery of the display area, contact the Regional Service Center for possible CRT replacement.

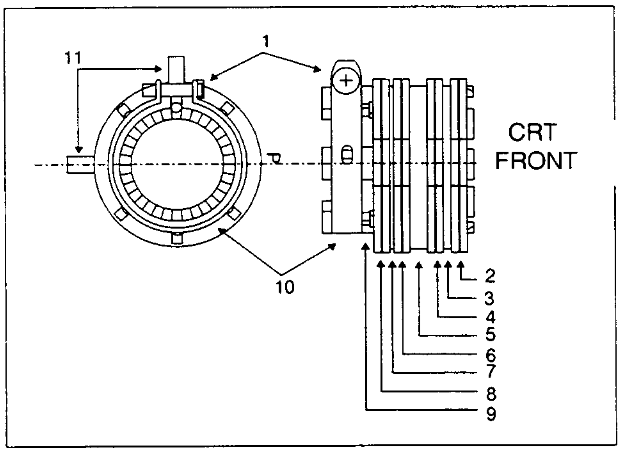
1) Make sure the display is not affected by external magnetic fields.
2) Make sure the static convergence is properly adjusted.

3) Strategically place small magnetic strips on the back of the CRT to correct the misconvergence. Be careful not to remove the paper protecting the adhesive on the magnetic strip until you are satisfied with their placement and the dynamic convergence.
4) When you are satisfied with the convergence around the edge of the CRT, permanently glue the magnets to the back of the CRT.

Table 7-9 Magnetic Strips

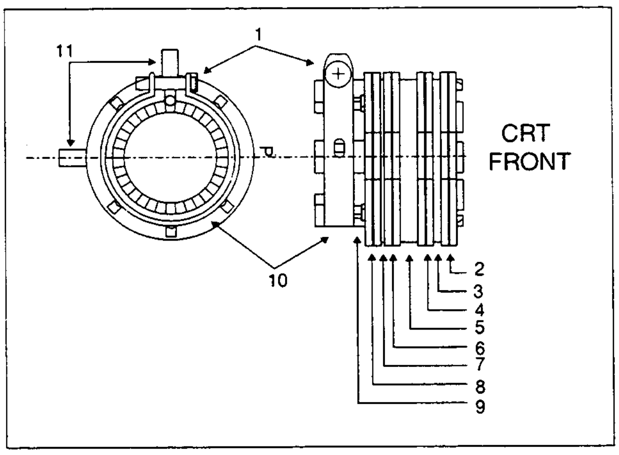
Description	Size	Code Number
Magnet Sheet	5mm X 80mm	937 319004CA
Magnet Sheet	10mm X 80mm	937 319004AA

Warning ⚠ Do not remove or change the position of the factory installed wedges.These wedges were installed by the CRT manufacturer and are properly placed for this CRT. Removal may result in damage to the CRT.



Toshiba CRT			
1 Setup Bolt	2 Bow Magnet	3 Spacer	4 2-Pole Magnet
5 Band	6 6-Pole Magnet	7 Spacer	8 4-Pole Magnet
9 Holder	10 Band	11 Tabs	

Figure 7-10 Magnet Configuration



Samsung and Hitachi CRT			
1 Setup Bolt	2 Bow Magnet	3 Band	4 2-Pole Magnet
5 Spacer	6 4-Pole Magnet	7 Spacer	8 6-Pole Magnet
9 Holder	10 Band	11 Tabs	

Figure 7-11 Magnet Configuration

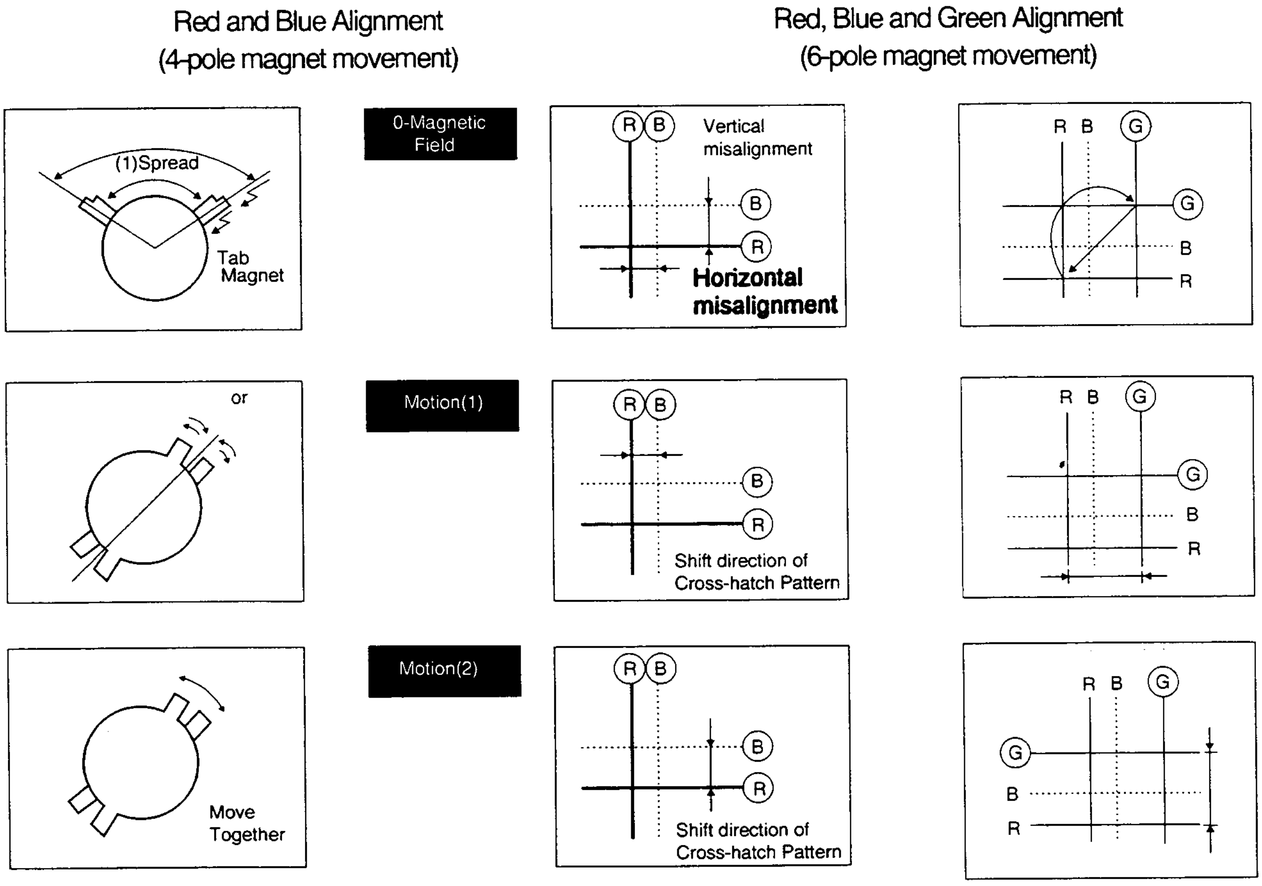


Figure 7-12 Magnet Movements

Bow Convergence Adjustments

Conditions

Direction: Monitor facing East.

Display Image: Crosshatch pattern mixed with RGB colors.

Bow convergence adjustments are not available for any of the CRTs used in the SyncMaster 17GLsi, CMH7389L monitors. While all the CRTs have bow convergence magnets, they are sealed in the CRT factory and are not user or service technician adjustable. Do not touch these magnets (see Figures 7-10 and 7-11). If color convergence bow adjustment is out of alignment, replace the CRT. Bow misconvergence should not exceed the values listed in Table 7-7: Misconvergence tolerances.

Balance Convergence Adjustments

Balance Convergence involves the alignment of the red and blue lines when they are misaligned at one end more so than at the other (X). The deflection yoke holds the balance coils which can correct balance misconvergences.

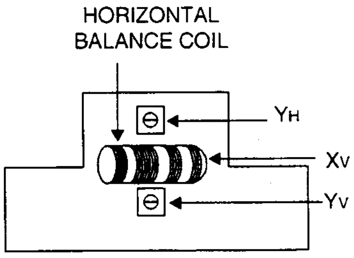


Figure 7-13 Samsung and Hitachi Deflection Yoke

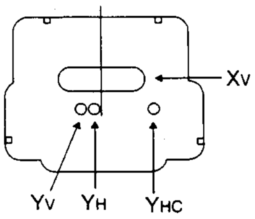


Figure 7-14 New Hitachi Deflection Yoke

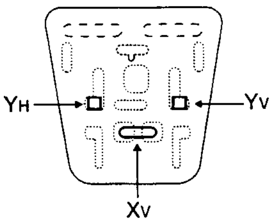


Figure 7-15 Toshiba Deflection Yoke

(a) Horizontal Line Red and Blue Balance Convergence

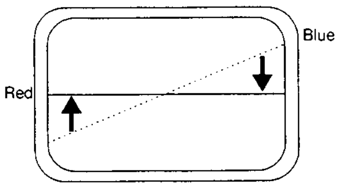


Figure 7-16 Horizontal Line Balance Misconvergence

Use a #0 hexdriver at the Horizontal Balance Coil(Xv). Turning the VR to the right raises the right end of the blue line and lowers the left end. Turning the VR to the left lowers the right end of the blue line and raises the left end.

(b) Vertical Red and Blue Balance Convergence

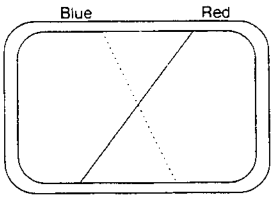


Figure 7-17 Vertical Line Balance Misconvergence

Use a #0 screwdriver (flat-head [—] for Samsung and Hitachi DYs and phillips type [+] for Matsushita [Panasonic] DYs) at the Y_H variable register. Turning the VR to the left tilts the blue line to the right. Turning it to the right tilts the blue line to the left.

(c) Upper and Lower Horizontal Line Convergence

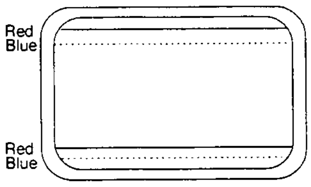


Figure 7-18 Upper and Lower Balance Misconvergence

Use a #0 screwdriver (flat-head [—] for Samsung and Hitachi DYs and phillips type [+] for **Matsushita**[Panasonic] DYs) at the Y_V variable register. Turning the VR to the left moves the blue line at the top upward and at the bottom the line moves downward. Turning it to the right moves the blue line at the top downward and at the bottom the line moves upward.

2. SyncMaster 15GLi

This section of the **training** manual explains how to control the linearity, raster, size, position, pincushion, parallelogram, trapezoid, and pinbalance. Additionally, this section describes how to use the micom control jig to make the adjustments.

Adjustment Conditions

WARNING

Changes made without the micom jig are saved only to the user mode settings. As such, the settings are not permanently stored and may be inadvertently deleted by the user.

Power Supply Voltage

AC 90~264volt(60/50Hz±3Hz).

High Voltage Control

Adjust VR501 to 25kV±0.2kV.

Note: When using PHILIPS CRT, set the high voltage to 24±0.2kV.

Testing and Burn-in Mode

For testing and burn-in, remove the signal cable from the monitor. Power on the monitor and warm it up. Use the burn-in mode to age the monitor.

Warm-Up time

The display must be on for 30 minutes before starting alignment. Warm-up time is especially critical in color temperature and white balance adjustments.

Signal

Video analog 0.714 Vp-p positive at 75 ohm terminated.

Sync: Separate/composite (TTL level negative/positive).

Scanning Frequency

Horizontal : 30kHz-65kHz (Automatic).

Vertical : 50Hz-120Hz (Automatic).

Unless otherwise specified, adjust to 640×480 mode (H: 37kHz, V: 75Hz) signals.

Prepare Main PCB for Adjustment

+B 85 V Line Adjustment (No beam, Contrast: Min, Brightness: Min)

Adjust VR601 to be DC 85V±1V at TP601 and GND.

High Voltage Adjustment (No beam, Contrast: Min, Brightness: Min)

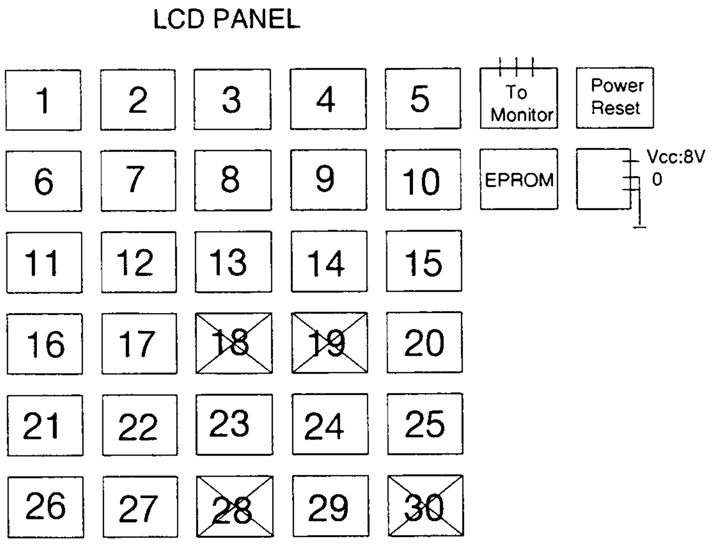
Adjust VR501 to 25kV±0.2kV (For other CRTs).

Adjust VR501 to 24kV±0.2kV (For PHILIPS CRT).

Horizontal Raster Center

Adjust SW401 so that the back raster comes to the center when you apply a signal of 37kHz/75Hz.

Block Diagram of the Microcomputer Control Jig



Note : Selecting the monitor series and type:

1) Simultaneously press buttons 29 and 24 to select "M-Project" as the monitor series.
2) Press button 25 to select the monitor type. Hold down button 25 until you see "M15H" plus the OEM name for the monitor under test. For example, hold down button 25 until you see "M15H" if you are working on a "Dell 15".

Table 7-2-1 Micom Control Jig Function Keys

Key No.	General Control Key Function	Color Control Key Function
1	Horizontal Position Up	R-Gain Up
2	Horizontal Position Down	R-Gain Down
3	Parallelogram Up	ACL Up
4	Parallelogram Down	ACL Down
5	General Save	Color Save
6	Horizontal Size Up	G-Gain Up
7	Horizontal Size Down	G-Gain Down
8	Vertical Linearity Up	Color CH-1 Standard Save
9	Vertical Linearity down	Color CH-2 Standard Save
10	Standard Save	ACL Save
11	Vertical Position UP	B-Gain Up
12	Vertical Position Down	B-Gain Down
13	Pinbalance Up	No Function (Don't Use)
14	Pinbalance Down	No Function (Don't Use)
15	All mode save	No Function (Don't Use)
16	Vertical Size Up	R-Bias Up
17	Vertical Size Down	R-Bias Down
18	No Function (Don't Use)	No Function (Don't Use)
19	No Function (Don't Use)	No Function (Don't Use)
20	User Mode Delete	No Function (Don't Use)
21	Barrel	G-Bias Up
22	Pincushion	G-Bias Down
23	Color/General Control toggle	Color/General Control toggle
24	F-Project/M-Project toggle	F-Project/M-Project toggle
25	Model Selection	Model Selection
26	Trapezoid Up	B-Bias Up
27	Trapezoid Down	B-Bias Down
28	No Function (Don;t Use)	No Function (Don't Use)
29	Shift	Shift
30	No Function (Don't Use)	Manual/Auto Color Control

Display Control Adjustments

Unless otherwise specified, adjust the EXT-VR:

Contrast : Max. (Fully clockwise)

Brightness: Max. (Fully clockwise)

Horizontal Size Adjustment

Adjust minimum picture size of VGA1/70Hz to 260mm using VR401.

With microcomputer control jig:

Press the horizontal size up button (6) or horizontal size down button (7) to adjust the horizontal size of the display pattern to 267mm. (The tolerance is ±3mm.)

Without microcomputer control jig:

After pushing the size button, push the (▶) button or (◀) button to adjust the horizontal size of the display pattern to 267mm. (The tolerance is ±3mm.)

Vertical Size Adjustment

With microcomputer control jig:

Press the vertical size up button (16) or the vertical size down button (17) to adjust the vertical image or pattern to 200mm. (The tolerance is ±3mm)

Without microcomputer control jig:

After pushing the size button, push the (▲) button or (▼) button to adjust the vertical size of the display pattern to 200mm. (The tolerance is ±3mm)

Horizontal Position Adjustment

With microcomputer control jig:

Press the horizontal position up button (1) or the horizontal position left button (2) to center the image or test pattern on the raster.

Without microcomputer control jig:

After pushing the position button, push the (▶) button (move right) or (◀) button (move left) to center the image or test pattern on the raster.

Vertical Position Adjustment

With microcomputer control jig:

Press the vertical position up button (11) or vertical position down button (12) to center the vertical image or pattern on the raster.

Without microcomputer control jig:

After pushing the position button, push the (▲) button (move up) or (▼) button (move down) to center the image or the test pattern on the raster.

Vertical Linearity Adjustment

With microcomputer control jig:

Press the vertical linearity up button (8) or vertical linearity down button (9) to optimize the image or the test pattern.

Trapezoid Adjustment

With microcomputer control jig:

Press the trapezoid up button (26) or trapezoid down button (27) to make the image or the test pattern rectangular.

Without microcomputer control jig:

After pushing G/D button once, push the (▲) button or (▼) button to make the image or the test pattern rectangular.

Pinbalance Adjustment

With microcomputer control jig:

Press the pinbalance up button (13) or pinbalance down button (14) to optimize the image or test pattern.

Without microcomputer control jig:

After pushing G/D button twice, push the (▲) button or (▼) button to optimize the image or test pattern.

Parallelogram Adjustment

With microcomputer control jig:

Press the parallelogram up button 3 or the parallelogram down button 4 to make the image or test pattern rectangular.

Without microcomputer control jig:

After pushing G/D button twice, push (▶) button or (◀) button to make the image or test pattern rectangular.

Side Pincushion Adjustment

With microcomputer control jig:

Press the barrel button 21 or the side pincushion button 22 to straighten the sides of the test pattern or image.

Without microcomputer control jig:

After pushing G/D button once, push (▶) button or (◀) button to straighten the sides of the test pattern or the image.

Save the Data

With microcomputer control jig:

To save the picture data for a mode, push the mode save button 5.

Degauss

Without microcomputer control jig:

Magnetic fields can build up on the CRT and cause color impurity. Use the degauss button to demagnetize the CRT. Push the button once to activate the degaussing circuit. The degaussing circuit automatically turns itself off after a few seconds.

To Delete the User Mode Data

With microcomputer control jig:

To delete the picture data of user's mode, push user's mode delete button 20.

Without microcomputer control jig:

To delete the picture data of user's mode, press the degaussing button for 5 or more seconds.

Color Adjustments

Note **:** To make color adjustments you must have one of the following configurations:

1. Micom Control Jig and Signal Generator. or
2. Micom Control Jig and Computer and Samsung DM 200 software or Display Mate for Windows software from Sonera Technologies.

Before making adjustments check that the video signals are as follows:

Video: Analog 0.714 Vp-p(at 75 Ω terminated).

Sync: Synchronizing: Separate TTL level. Unless otherwise specified, use VGA signals (37kHz/75Hz) for the adjustments.

Color Adjustments for 9300°K

(a) Adjustment of the Back Raster Color(37kHz/75Hz, Back raster pattern)

1) Turn the contrast and the brightness controls fully clockwise (Maximum condition).
2) Adjust the screen VR of the FBT so that the brightness of back raster is 0.3 to 0.5 ft-L (Typically 0.4 ft-L).
3) Press button 8 to download the standard color data (channel 1) from the micom jig. For 9300°K color adjustment: x=0.283±0.02, y=0.298±0.02. For 6500°K color adjustments see section 6-5-2 "Color Adjustment for 6500°K"
4) Press buttons 26 and 27 and set the "y" coordinate to 0.298±0.02.
5) Press buttons 16 and 17 and set the "x" coordinate to 0.283±0.02. ***Note*****:** If the above adjustments cannot be done to each coordinate, press buttons 21 and 22 and repeat procedures 4 and 5.
6) After the adjustments are done, press button 5 to save the data.

(b) Video Gain Adjustment (37kHz/75Hz, Green box pattern)

1) Display the green window pattern using a range for which the ACL Circuit is not active (within ranges 1/3 to 1/2H and 1/3 to 1/2V).

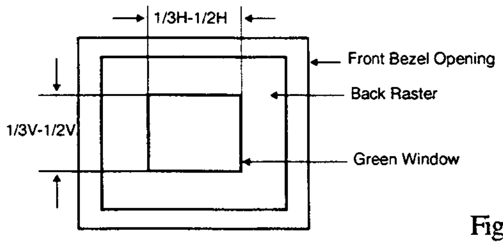


Figure 7-2-1 Green Box Pattern

2) Turn the contrast and the brightness controls fully clockwise.

3) Press buttons 6 and 7 (G-Gain control) so that the brightness of the green gain is 42±1 ft-L. (Typically 42 ft-L)

Note : If you can't increase the green gain to the appropriate value, press button 3 to increase the ACL point.

(c) White Balance Adjustment (37kHz/75Hz, Full white Pattern)

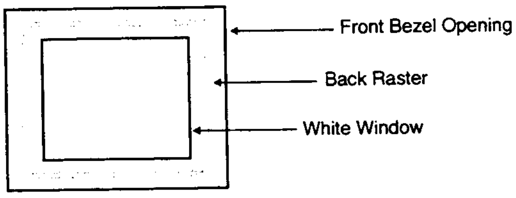


Figure 7-2-2 Full White Pattern

1) Turn the contrast and the brightness controls fully clockwise.

2) Press buttons 11 and 12 and buttons 1 and 2 to make the video white.

(For 9300°K color adjustment: x=0.283±0.02, y=0.298±0.02)

Note: Do not touch buttons 6 and 7.

3) Press button 5 to save the data.

(d) White Balance Fine Adjustment (x=0.283±0.02, y=0.298±0.02, Full White pattern)

Note : Do not touch buttons 6 and 7 (G-Gain).

1) Adjust the contrast control so that the brightness of the video is about 5 ft-L.

2) Check whether the white coordinates of the video meet the above coordinate spec or not.

3) Adjust the contrast control so that the brightness of the video is about 20 ft-L.

4) Check whether the white coordinates of the video **satisfy** the above spec or not.

5) If the white balance differs from the above spec, readjust it to within specifications. When correct, press button 5 to save.

(e) ACL point Adjustment

1) Display the full white pattern.

2) Turn the contrast and the brightness controls fully clockwise.

3) Press buttons 3 and 4 (ACL) so that the brightness is 32±1 ft-L.

4) Press button 10 to save the ACL setting value.

Color Adjustments for 6500° K

(a) Back Raster Color Adjustment

1) Display the back raster pattern.

2) Turn the contrast and the brightness controls fully clockwise.

3) Pressing button 9 load the standard color data of 6500° K from micom control jig.

4) If you need to set the brightness of back raster to set 0.5 to 1.0 ft-L, then press button 21 or 22 (G-Bias control). If you don't need to do, skip this step.

Note : In the case of 6500° K adjustment you must not control the screen VR of FBT. If you do so, the 9300° K setting value are changed.

5) Using buttons 26, 27, 16 and 17 adjust the R-Bias and B-Bias values to x=0.313±0.02, y=0.329±0.02.

6) Press button 5 to save the bias data of 6500° K

(b) Video Gain Adjustment

1) This procedure is the same as that of 9300° K

2) Refer to the procedure for 9300° K

(c) White Balance Adjustment

1) Display a full white pattern.

2) Turn the contrast and the brightness controls fully clockwise.

3) Using buttons 11, 12, 1 and 2, set the R/B gain data to x=0.313±0.02, y=0.329±0.02.

(d) White Balance Fine Adjustment

Refer to the procedure for 9300° K

(e) ACL Point Adjustment

Refer to the procedure for 9300° K

Focus Adjustment

1) Display the H character pattern so that the focus adjustment can be done. (Apply 1280 × 1024/60Hz mode to the monitor.)

2) Turn the contrast and the brightness controls fully clockwise.

3) Adjust the focus control of the FBT so that the focus **displays** the sharpest possible image.

CRT Tilt Adjustment

Reassemble the CRT with fastening screws so that the dimensions A, B and C, D are separately equal.

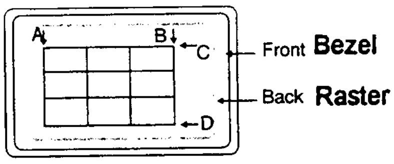


Figure 7-2-3 CRT Tilt Adjustment

Purity Adjustment

Note : Color purity adjustments are not available for monitors using Phillips CRTs.

Use the following procedure to correct minor color purity problems:

1) Make sure the display is not affected by external magnetic fields.
2) Very carefully break the glue seal between the two-pole purity convergence magnets (PCM) and the convergence bow magnets (see figure 6-12).

Caution

The convergence bow magnets are not user or service technician adjustable. Do not allow these magnets to move.

Also break the seal between the two PCMs.

3) Make sure the spacing between the PCM assembly and the CRT stem is 29mm ± 1mm.
4) Display a red pattern over the entire display area.
5) Adjust the purity magnet rings on the PCM assembly to display a pure red pattern. (Optimum setting: $X \geq 0.620$ and $Y \leq 0.336$)
6) Adjust each corner and the center to meet the red color tolerances listed below.
7) Repeat steps 4 through 6 using a green pattern and **again**:, using a blue pattern.

Table 7-2-2 Color Purity Tolerances

Red:	$X \geq 0.62 \pm 0.02$	$Y \leq 0.34 \pm 0.02$
Green:	$X \geq 0.31 \pm 0.02$	$Y \leq 0.59 \pm 0.02$
Blue:	$X \geq 0.14 \pm 0.02$	$Y \leq 0.06 \pm 0.02$

(For 9300° K color adjustment: $X = 0.283 \pm 0.02$, $Y = 0.298 \pm 0.02$)

8) When you have the PCMs properly adjusted, carefully glue them together to prevent their movement during shipping.

Convergence Bow Adjustment

Convergence bow adjustments are not available for any of the CRTs used in the SyncMaster 15GLi monitors. While the Toshiba CRTs have convergence bow magnets, they are sealed in the CRT factory and are not user or service technician adjustable. Do not touch these magnets (see figure 6-12). Phillips CRTs do not have convergence bow magnets, and, therefore, no convergence bow adjustments are available. If color purity is out of alignment, replace the CRT. Bow misconvergence should not exceed the values listed below:

Table 7-2-3 Convergence Error Tolerances

Position	Error in mm	CRT Dot Pitch
Center	0.3	0.28
Edge	0.4	–

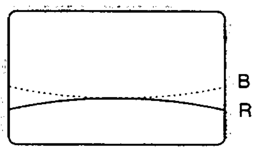


Table 7-2-4 Bow Misconvergence

Static (Center) Convergence

Switch the monitor on and warm it up for 15 minutes. Display a crosshatch pattern on the screen. Convergence errors should not exceed the values listed below.

Table 7-2-4 Convergence Error Tolerances

Position	Error in mm	CRT Dot Pitch
Center	0.3	0.28
Corner	0.4	–

Use the following steps to correct any static **or** disconvergence:

1) As shown in figures 6-11 through 6-12, the three CRTs used in SyncMaster 15GLi monitors use the following magnet configurations:

Table 7-2-5 Magnet Configurations

CRT Manufacfurer	Magnet Order From Front of CRT
Toshiba	Convergence bow, tow-pole, six-pole, four-pole
Phillips	four-pole, six-pole

2) Locate the pair of four-pole magnet rings.

3) Rotate the individual rings (change the spacing between tabs) to converge the vertical red and blue lines.

4) Rotate the pair of rings (maintaining the spacing between tabs) to converge the horizontal red and blue lines.

5) After completing the red and blue center convergence, locate the pair of 6-pole magnet rings.

6) Rotate the individual rings (change the spacing between tabs) to converge the vertical red and blue (magenta) and green lines.

7) Rotate the pair of rings (maintaining the spacing between tabs) to converge the horizontal red and blue (magenta) and green lines. Don't rotate the 2-pole magnet because it is for purity adjustments.

8) Lock the locking plastic. Mark the correct position for the magnets and apply a small line of glue to hold the magnets in place.

Alignment of Red and Blue with the 4-pole magnet

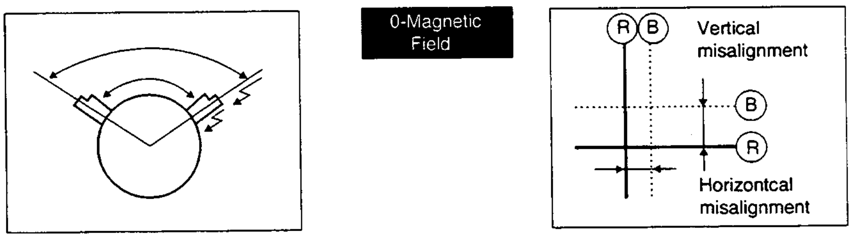


Figure 7-2-5 Movable in Spread Condition

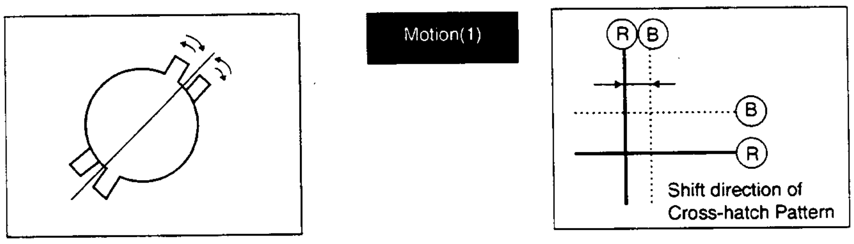


Figure 7-2-6 Vertical Direction

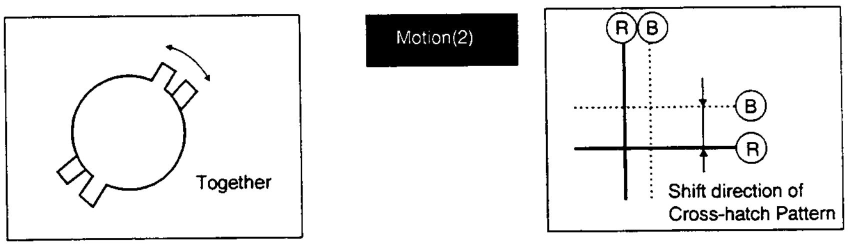


Figure 7-2-7 Horizontal Direction

3. SyncMaster 15GLe

This section of the training manual explains how to control the linearity, raster, size, position, pincushion, parallelogram, trapezoid, and pinbalance. Additionally, this section describes how to use the micom control jig to make the adjustments.

Adjustment Conditions

Power Supply Voltage

AC 100-240 volt (60/50Hz±3Hz).

High Voltage Control

Adjust VR401 to 25kV±0.2kV (PHILIPS CRT: 24kV±0.2kV).

Testing and burn-in mode

For testing and burn-in, temporarily disable the power saving feature. To disable the feature, disconnect the signal cable. You can now power on the monitor and warm it up without the monitor switching to a power saving mode.

Warm-Up Time

The display must be on for 30 minutes before starting alignment. Warm-up time is especially critical in color temperature and white balance adjustments.

Signal

Video analog 0.714 Vp-p positive at 75 ohm terminated.
Sync: Separate/composite (TTL level negative/positive).

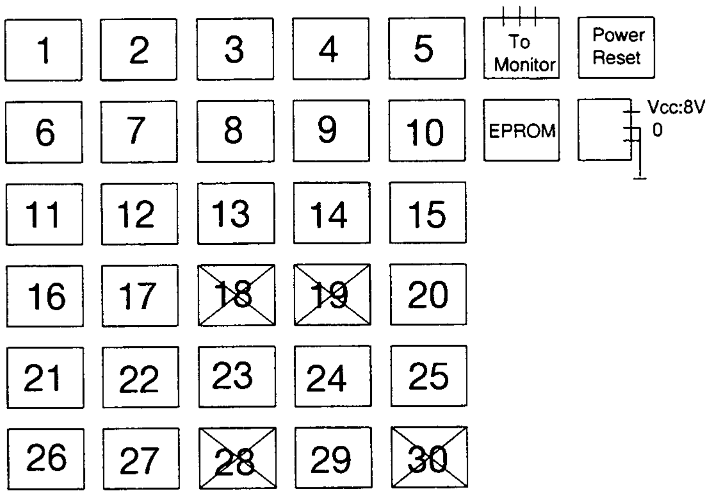
Scanning Frequency

Horizontal: 30kHz - 50kHz (Automatic).
Vertical : 50Hz - 120Hz (Automatic).
Unless otherwise specified, adjust to SVGA(H: 37kHz, V: 75Hz) signals.

Note : Changes made without the micom jig are saved only to the user mode settings. As such, these settings are not permanently stored and may be inadvertently deleted by the user.

Setting up the Microcomputer Control Jig

LCD PANEL



Key No.	General Control Key Function	Color Control Key Function
1	Horizontal Position Up	R-Gain Up
2	Horizontal Position Down	R-Gain Down
3	Parallelogram Up	ACL Up
4	Parallelogram Down	ACL Down
5	General Save	Color Save
6	Horizontal Size Up	G-Gain Up
7	Horizontal Size Down	G-Gain Down
8	Vertical Linearity Up	Channel Color (Standard Dump)
9	Vertical Linearity **Down**	No Function (Don't Use)
10	Standard Save	ACL Save
11	Vertical Position **Up**	B-Gain Up
12	Vertical Position Down	B-Gain Down
13	Pinbalance Up	No Function (Don't Use)
14	Pinbalance Down	No Function (Don't Use)
15	All Mode save	No Function (Don't Use)
16	Vertical Size Up	R-Bias Up
17	Vertical Size Down	R-Bias Down
18	No Function (Don't Use)	No Function (Don't Use)

Key No.	General Control Key Function	Color Control Key Function
19	No Function (Don't Use)	No Function (Don't Use)
20	User Mode Delete	No Function (Don't Use)
21	Barrel	G-Bias Up
22	Pincushion	G-Bias Down
23	Color Control/General Control	Color Control/General Control
24	M-Project/F-Project	No Function (Don't Use)
25	Model Selection	No Function (Don't Use)
26	Trapezoid Up	B-Bias Up
27	Trapezoid Down	B-Bias Down
28	No Function **(Don't Use)**	No Function (Don't Use)
29	Shift	Shift
30	Auto/Manual Selection	Auto/Manual Selection

The key function on microcomputer control jig Continued

Note : Selection of monitor series and type

1) **Simultaneously** press buttons(29) and(24) to select "M-Series" as the monitor series.
2) Press button (25) to select the monitor type. Hold down button (25) until you see "M15L" plus the OEM or CRT name for the monitor under test. For example, hold down button (25) until you see "M15L OEM (or CRT name)."

General Control

Use General Control to test and adjust the shape and size of the display.

1) Simultaneously press buttons (29) and(23) to toggle between General Control and Color Control. Select "General Control".
2) Press button 10 to do a memory data dump and load the general control data from the micom control jig. (H: 37kHz, V: 75Hz)

   Note : This step is necessary only if the EPROM on the control jig has more recent data than the EPROM on the monitor PCB. Check for a Service Bulletin or Service Manual Supplement.
3) Optimize the standard timing mode using the micom control jig, or the monitor controls, as described on pages 17 and 18 of this manual.
4) Press button 15 to save the data for all modes. The monitor's microprocessor adjusts the

other modes according to a predefined formula.

5) Test and adjust the color control parameters when you are through adjusting the monitor's general control parameters.

Color Control

Use Color Control to test and adjust the colors the monitor displays.

1) Simultaneously press buttons (29) and (23) to toggle between General Control and Color Control. Select "Color Control".
2) Press button 10 to do a memory data dump and load the color control data from the micom control jig.

   Note : This step is necessary only if the EPROM on the control jig has more recent data than the EPROM on the monitor PCB. Check for a Service Bulletin or Service Manual Supplement.
3) Optimize the standard timing mode using the micom control jig, or the monitor controls, as described on pages 18 and 19 of this manual.
4) Using a signal generator, scan the other timing modes and make adjustments as needed. Each time you make a change, press button number 5 to save the data.
5) When you are through, disconnect the micom control jig and proceed with other tests and adjustments.

Display Control Adjustments

Unless otherwise specified, adjust the external variable register.

Contrast: Max. (fully clockwise)

Brightness: So that no background raster appears.

Horizontal Size Adjustment.

Optimum: 267mm±3mm.

With microcomputer control jig:

Press the horizontal size up button 6 or horizontal size down button 7 to adjust the horizontal size of the display pattern to 267mm. (The tolerance is ±3mm.)

Without microcomputer control jig: ↔

After pushing the horizontal size button, push the increase (+) button or decrease (—) button to adjust the horizontal size of the display pattern to 267mm. (The tolerance is ±3mm.)

Vertical Size Adjustment

Optimum: 200mm ± 3mm.

With microcomputer control jig:

Press the vertical size up button 16 or the vertical size down button 17 to adjust the vertical image or pattern to 200mm. (The tolerance is ±3mm)

Without microcomputer control jig: ↕

After pushing the vertical size button, push the increase (+) button or decrease (—) button to adjust the vertical size of the display pattern to 200mm. (The tolerance is ±3mm)

Horizontal Position Adjustment

With microcomputer control jig:

Press the horizontal position up button 1 or the horizontal position down button 2 to center the image (or test pattern) on the raster.

Without microcomputer control jig: ◫

After pushing the horizontal position button, push the increase (+) button (move right) or decrease (−) button (move left) to center the image or test pattern on the raster.

Vertical Position Adjustment

With microcomputer control jig:

Press the vertical position up button 11 or vertical position down button 12 to center the vertical image or pattern on the raster.

Without microcomputer control jig: ⊟

After pushing the vertical position button, push the plus (+) button (move up) or minus (−) button (move down) to center the image or the test pattern on the raster.

Vertical Linearity

With microcomputer control jig:

Press the vertical linearity up button 8 or vertical linearity down button 9 to optimize the image (or the test pattern).

Without microcomputer control jig: ⊟ + ⏢

Push and hold the vertical position and trapezoid buttons for 4-5 seconds, or until the power indicator changes color from orange to green. Use the plus (+) or minus(−) button to control vertical linearity of the display.

Trapezoid Adjustment

With microcomputer control jig:

Press the trapezoid up button 26 or trapezoid down button 27 to make the image or pattern rectangular.

Without microcomputer control jig: ⏢

After pushing the trapezoid button, push plus (+) button or minus (−) button to optimize the image or pattern.

Pinbalance Adjustment

With microcomputer control jig:

Press the pinbalance up button 13 or pinbalance down button 14 to optimize the image or pattern.

Without microcomputer control jig: ⊟ + ⌷

Push and hold the vertical position and side pincushion for 4 - 5 seconds, or until the power indicator changes color from orange to green. Use the plus (+) button or minus (−) button to control pinbalance of the display.

Parallelogram Adjustment

With microcomputer control jig:

Press the parallelogram up button 3 or the **parallelogram** down button 4 to make the image or **pattern** rectangular.

Without microcomputer control jig: ⊟ + ↕

Push and hold the vertical position and vertical size buttons for 4 - 5 seconds, or until the power indicator changes color from orange to green. Use the plus (+) button or minus (−) button to control the parallelogram of the display.

Side Pincushion Adjustment

With microcomputer control jig:

Press the side pincushion barrel button 21 or the side pincushion button 22 to straighten the sides of the pattern or image.

Without microcomputer control jig: ⌷

After pushing the side pincushion button, push the plus (+) button or minus (−) button to straighten the sides of the pattern or the image.

Save the Data

With microcomputer control jig:

To save the picture data for a mode, push the mode save button (5).

Without microcomputer control jig:

The monitor automatically saves the new settings 3-4 seconds after the last control adjustment using the up (+) or down (−) buttons.

Degauss

Without microcomputer control jig: ⦸

Magnetic fields can build up on the CRT and cause color impurity. Use the degauss button to demagnetize the CRT. Push the button once to activate the degaussing circuit. The degaussing circuit automatically turns itself off after a few seconds.

To Delete the User Mode Data

With microcomputer control jig:

To delete the user mode data, push user's mode delete button 20.

Without microcomputer control jig:

To delete the user mode data, press the degaussing button for 3 or more seconds.

Color Adjustments

Note : To make color adjustments you must have one of the following configurations:

1) Micom Control Jig and Signal Generator.

or

2) Micom Control Jig and Computer and Samsung DM 200 software or DisplayMate for Windows software from Sonera Technologies.

Before making adjustments check that the video signals are as follows:

Video : Analog 0.714 Vp-p (at 75Ω terminated).

Sync : Synchronizing: Separate TTL level.
Unless otherwise specified, use VGA signal (37kHz/75Hz) for the adjustments.

Adjustment of the Back Raster Color (37kHz/75Hz, Back Raster pattern)

1) Display the back raster pattern (without video signal).
2) Turn the contrast and the brightness controls fully clockwise.

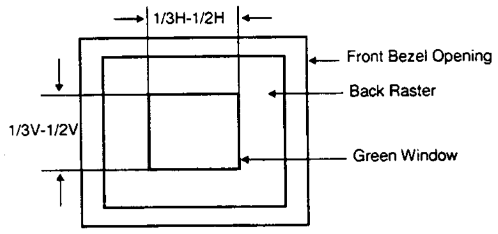
3) Adjust the screen VR of FBT so that the brightness of back raster is 0.5 to 1.0 Ft/L (Typically 0.75 Ft/L)

4) Press buttons 16 and 17 (R-bias control buttons on the micom jig), buttons 26 and 27 (B-bias control buttons on the micom jig) so that the back raster color is white. (X=0.283±0.02, Y=0.298±0.02)

5) If the brightness of back raster and back raster color differ from the spec, readjust to within specifications. When correct, press button 5, to save.

Adjustment of Video's Gain (37kHz/75Hz, Green box pattern)

1) Display the green window pattern using a range for which the ACL circuit is not active (within ranges 1/3 to 1/2H and 1/3 to 1/2V).

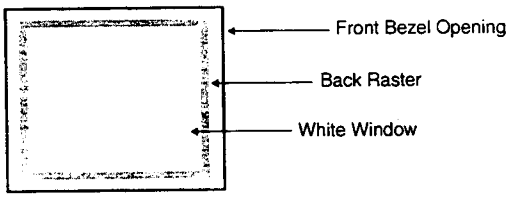


2) Turn the contrast and the brightness controls fully clockwise.

3) Press buttons 6 and 7 (G-Gain control buttons on the micom jig) so that the brightness of the green gain is 45±2 Ft/L. (Typically 45 Ft/L)

Adjustment of White Balance of Video

1) Display a full white pattern.



2) Turn the contrast and the brightness controls fully clockwise.

3) Adjust the contrast control so that the brightness of the video is about 20 Ft/L.

4) Press the buttons 1 and 2 (R-Gain control buttons on the micom jig), buttons 11 and 12 (B-Gain control buttons on the micom jig) to make the video white.
(X=0.283±0.02, Y=0.298±0.02)

Fine Adjustment of White Balance (X=0.283±0.02, Y=0.298±0.02)

Attention : Do not touch buttons(6) and (7) (G-Gain).

1) Display the full white pattern.
2) Turn the contrast control so that the brightness of the video is about 5 Ft/L.
3) Check whether the white coordinate of the video meets the above coordinate spec or not.
4) Set the contrast control so that the brightness of the video is about 20 Ft/L.
5) Check whether the white coordinate of the video satisfies the above spec or not.
6) If the white balance differs from the above spec, readjust to within specifications. When correct, press button(5), to save.

Adjustment of ACL point

1) Display the full white pattern.
2) Turn the contrast and the brightness controls fully clockwise.
3) Press buttons (3) and (4) (ACL control button on the microcomputer jig) so that the brightness is 28-30 Ft/L and press button (10) to save.

Focus Adjustment

1) Display the H character Pattern. (1024×768/60Hz is recommended).
2) Turn the contrast and the brightness controls fully clockwise.
3) Adjust the focus control of the FBT so that the focus displays the sharpest possible image.

Purity Adjustment

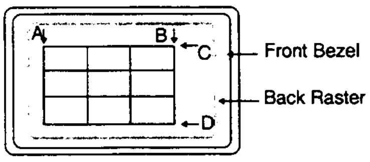
1) Make sure the display is not affected by external magnetic fields.
2) Unlock the locking plastic ring.
3) Make sure the spacing between the purity convergence magnet (PCM) assembly and the CRT stem is 29mm±1mm.
4) Display a red pattern over the entire display area.
5) Adjust the purity magnet rings on the PCM assembly to display a pure red pattern. (Optimum setting: X≥0.680, Y≥0.230)
6) Adjust each corner and the center to meet the red color tolerances listed below.
7) Repeat the process using a blue pattern and again, using a green pattern.

Red:	X≥0.68±0.02	Y≥0.23±0.02
Green:	X≤0.17±0.02	Y≥0.08±0.02
Blue:	X≤0.33±0.02	Y≤0.56±0.02

8) Lock the locking plastic, mark the correct position for the purity magnet and apply a small line of glue to hold the magnets in place.

CRT Tilt Adjustment

Reassemble the CRT with fastening screws so that the dimensions A, B and C, D are separately equal.



Static(Center) Convergence

Switch the monitor on and warm it up for 15 minutes. Display a crosshatch pattern on the screen. Convergence errors should not exceed the values listed below.

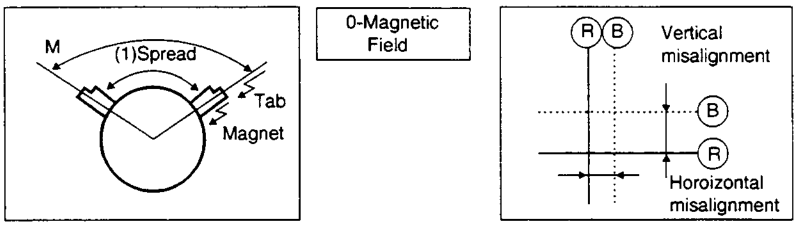
Position	Error in mm	CRT Dot Pitch
Center	0.3	0.28
Corner	0.4	—

Proceed as Follows:

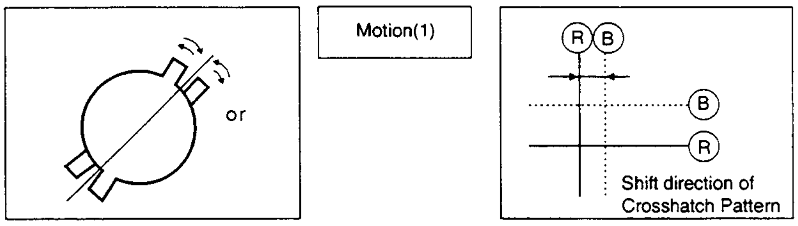
1) The magnet position is 4-pole/6-pole/2-pole (from the front of the CRT).
2) Locate the pair of four-pole magnet rings.
3) Rotate the individual rings (change the spacing between tabs) to converge the vertical red and blue lines.
4) Rotate the pair of rings (maintaining the spacing between tabs) to converge the horizontal red and blue lines.
5) After completing the red and blue center convergence, locate the pair of six-pole magnet rings.
6) Rotate the individual rings (change the spacing between tabs) to converge the vertical red and blue (magenta) and green lines.
7) Rotate the pair of rings (maintaining the spacing between tabs) to converge the horizontal red and blue (magenta) and green lines.
8) Don't rotate the 2-pole magnet because its purpose is to adjust the purity.
9) Lock the locking plastic mark the correct position for the magnets and apply a small line of glue to hold the magnets in place.

Alignment of Red and Blue with the 4-pole magnet

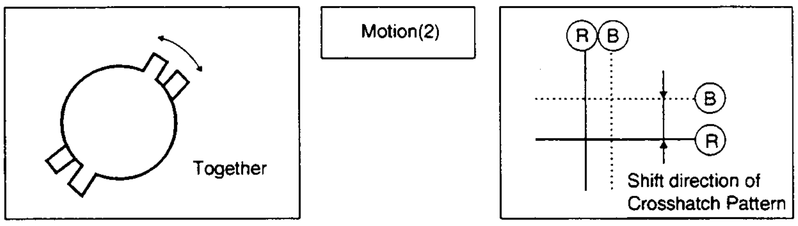
Movable in Spread Condition



Vertical Direction



Horizontal Direction



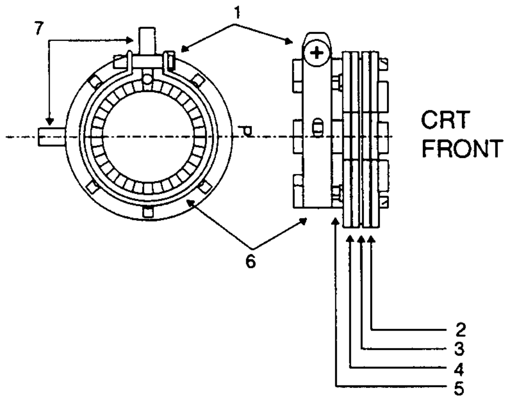


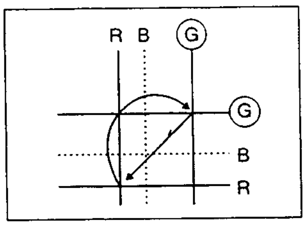
Figure 7-3-1 Convergence magnet

PHILIPS CRT			
1 Setup Bolt	2 4-Pole Magnet	3 Spacers	4 6-Pole Magnet
5 Holder	6 Band	7 Tobs	

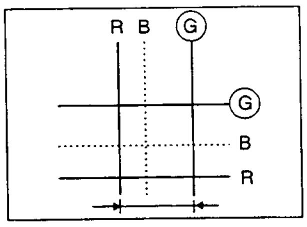
TOSHIBA CRT			
1 Setup Bolt	2 6-Pole Magnet	3 Spacers	4 4-Pole Magnet
5 Holder	6 Band	7 Tabs	

Alignment of Red, Blue and Green with the 6-pole magnet

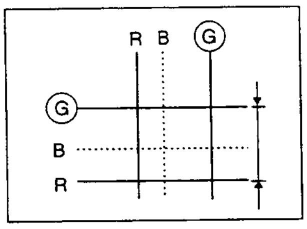
0-Magnetic Field



Motion(1)



Motion(2)



Dynamic Edge Convergence

Use the following procedure to correct minor dynamic (edge) misconvergence. If, after using this procedure, dynamic misconvergence is still greater than the 0.4mm tolerance (around the periphery of the display area), replace the CRT.

1) Make sure the display is not affected by external magnetic fields.
2) Make sure the static convergence is properly adjusted.
3) Strategically place small magnetic strips on the back of the CRT to correct the misconvergence. Be. careful not to remove the paper protecting the adhesive on the magnetic strips until you are satisfied with their placement and the dynamic convergence.
4) When you are satisfied with the convergence around the edge of the CRT, permanently glue the magnets to the back of the CRt.

Description	Size	Code Number
Magnet Sheet	5mm×80mm	937 319004CA
Magnet Sheet	10mm×80mm	937 319004AA

WARNING

⚠

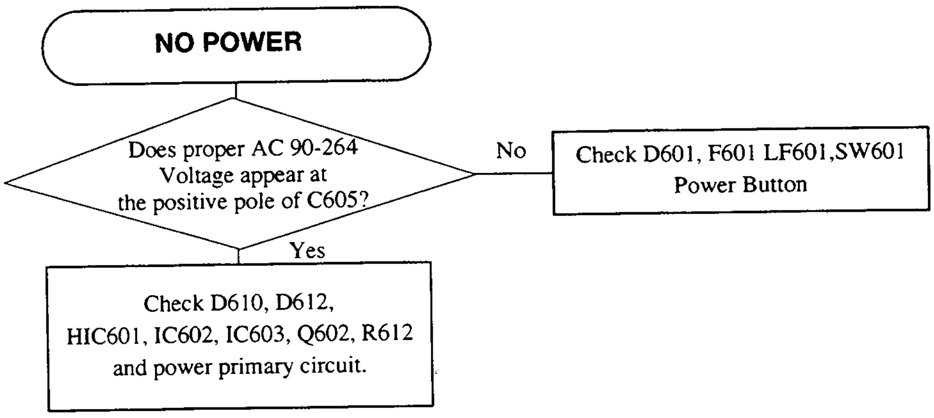
Do not remover the factory installed wedges. These wedges were installed by the CRT manufacturer and are properly placed for this CRT.
Removal may result in damage to the CRT.

Ⅷ. TROUBLESHOOTING

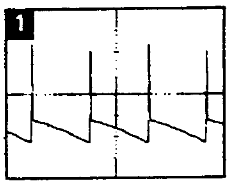
1. SyncMaster 17GLsi

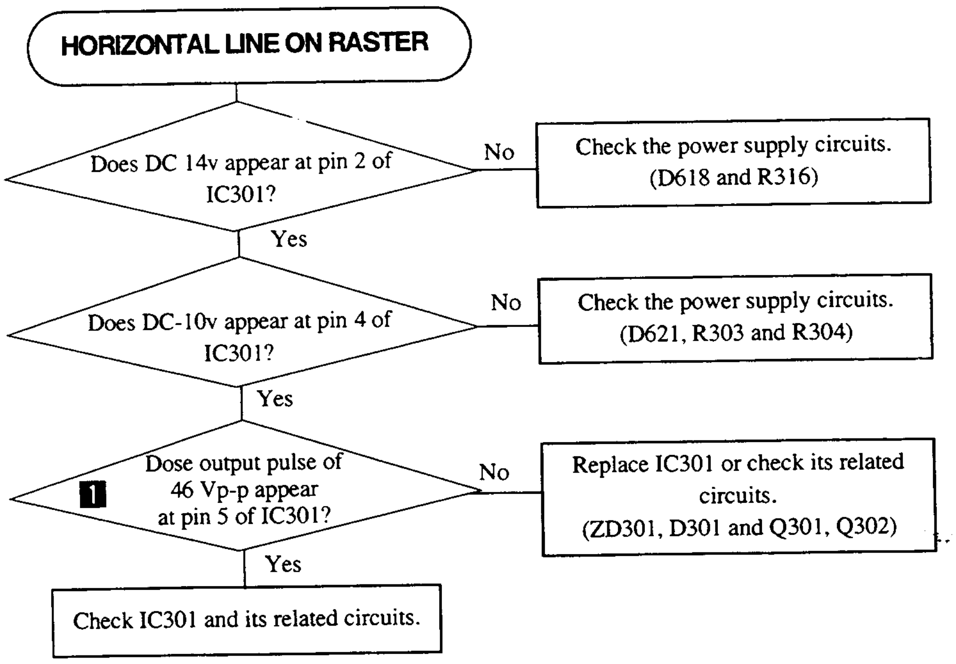
NOTES : 1. If picture does not appear, fully rotate the brightness and contrast controls clockwise before inspection.

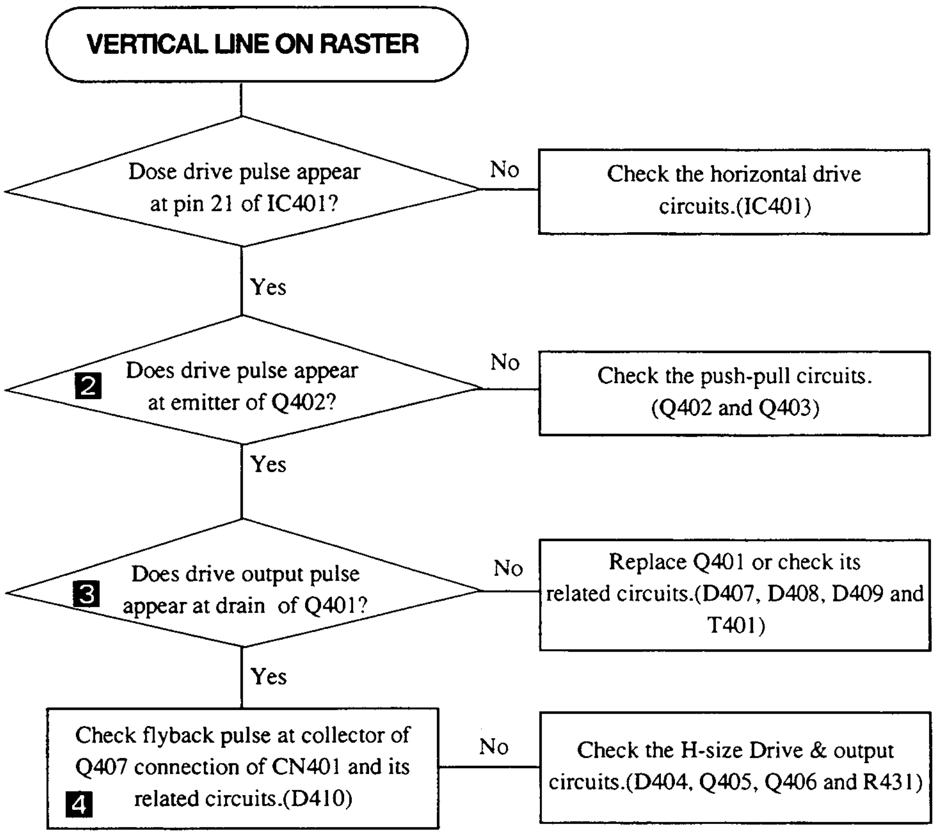
2. Check the following circuits :
- No raster appears:Power circuit, horizontal output circuit, H/V control circuit and H/V output circuit.
- High voltage develops but raster appers;Video circuits.
- High voltage does not develop:Horizental output circuits.

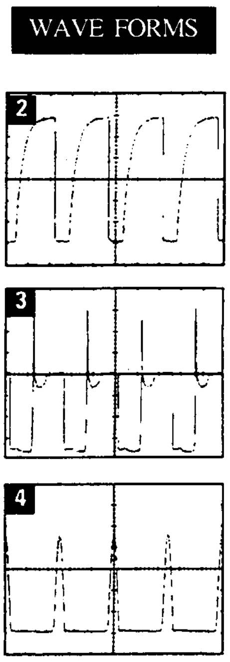


WAVE FORMS

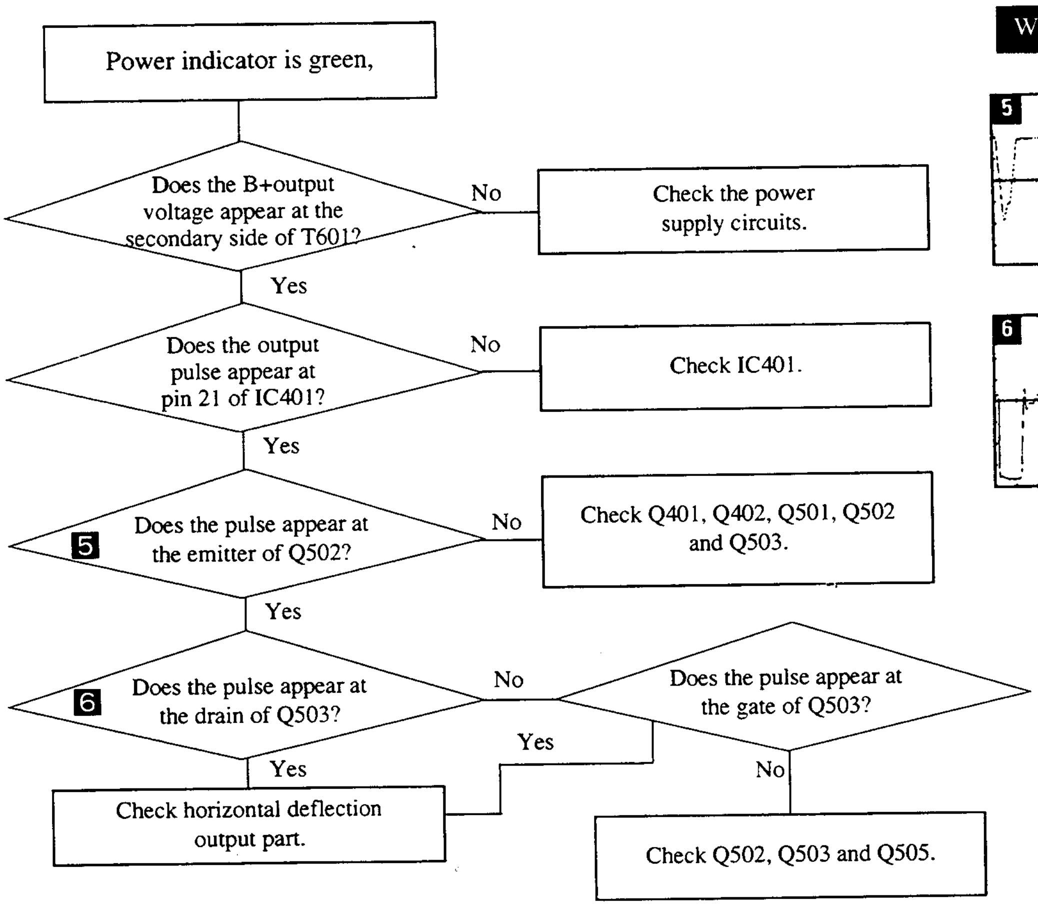


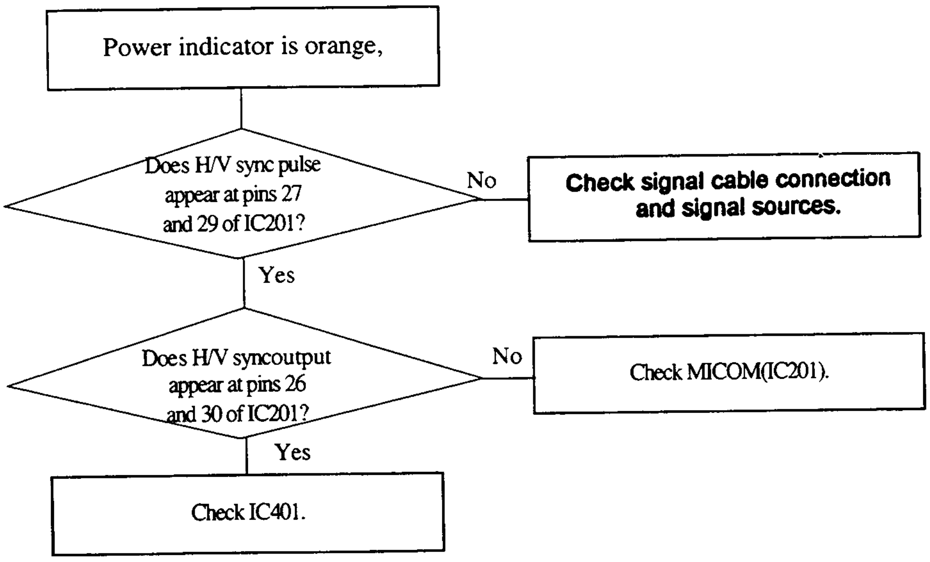



VERTICAL LINE ON RASTER
Dose drive pulse appear at pin 21 of IC401?
No
Check the horizontal drive circuits.(IC401)
Yes
2 Does drive pulse appear at emitter of Q402?
No
Check the push-pull circuits. (Q402 and Q403)
Yes
3 Does drive output pulse appear at drain of Q401?
No
Replace Q401 or check its related circuits.(D407, D408, D409 and T401)
Yes
Check flyback pulse at collector of Q407 connection of CN401 and its 4 related circuits.(D410)
No
Check the H-size Drive & output circuits.(D404, Q405, Q406 and R431)

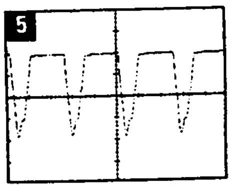

WAVE FORMS
2
3
4

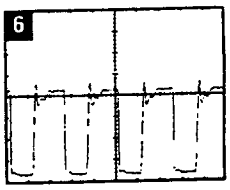
NO RASTER

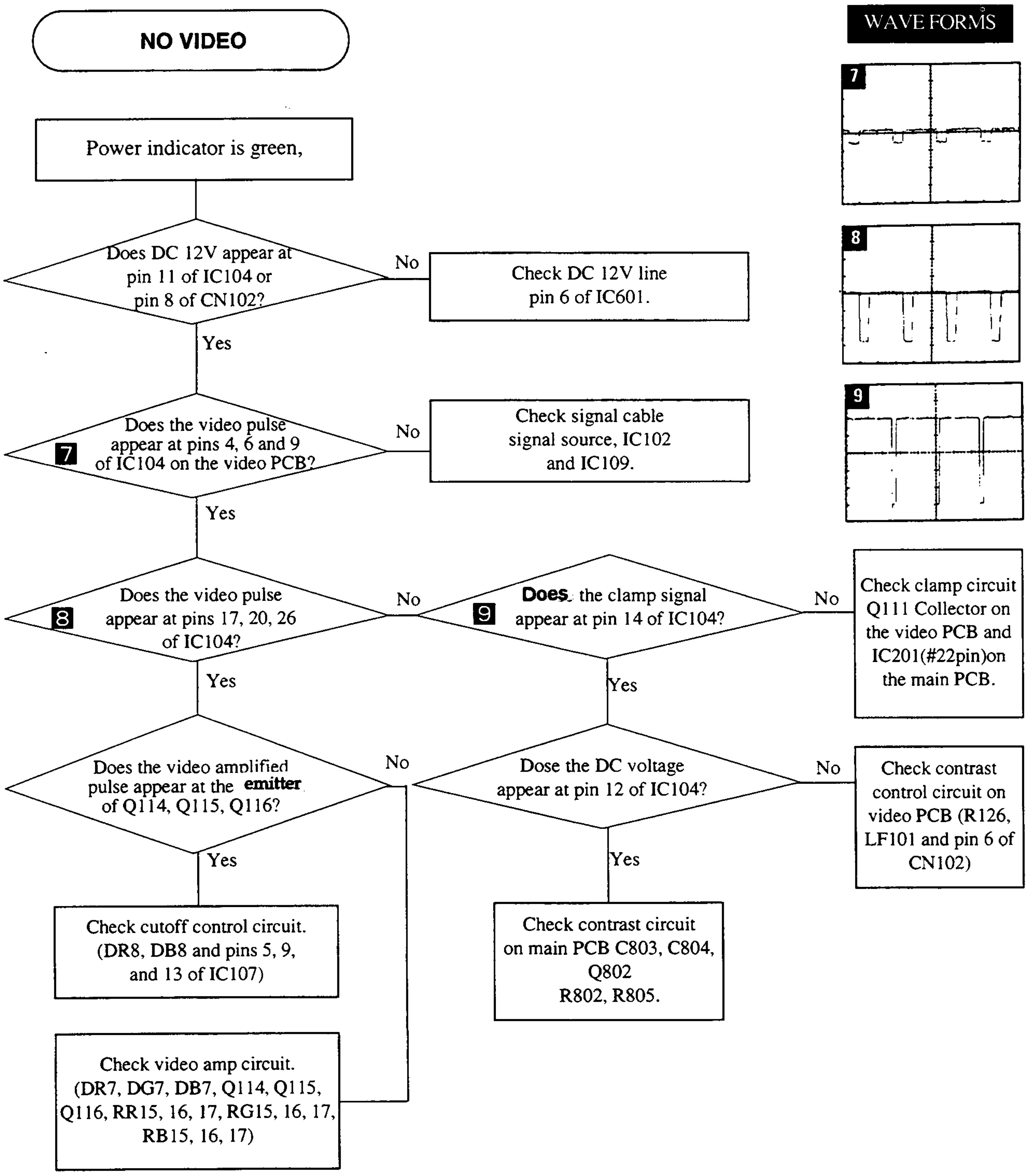


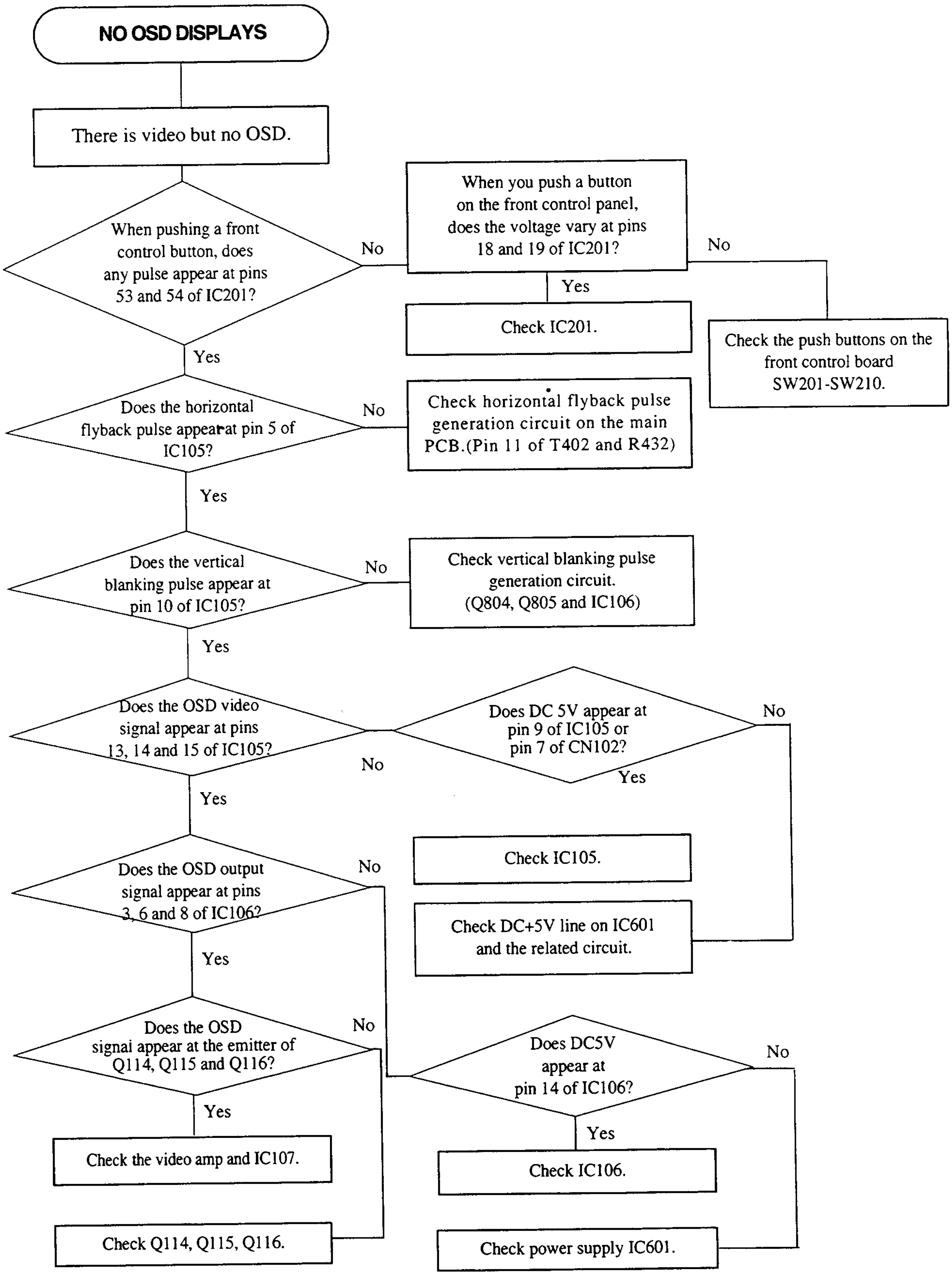


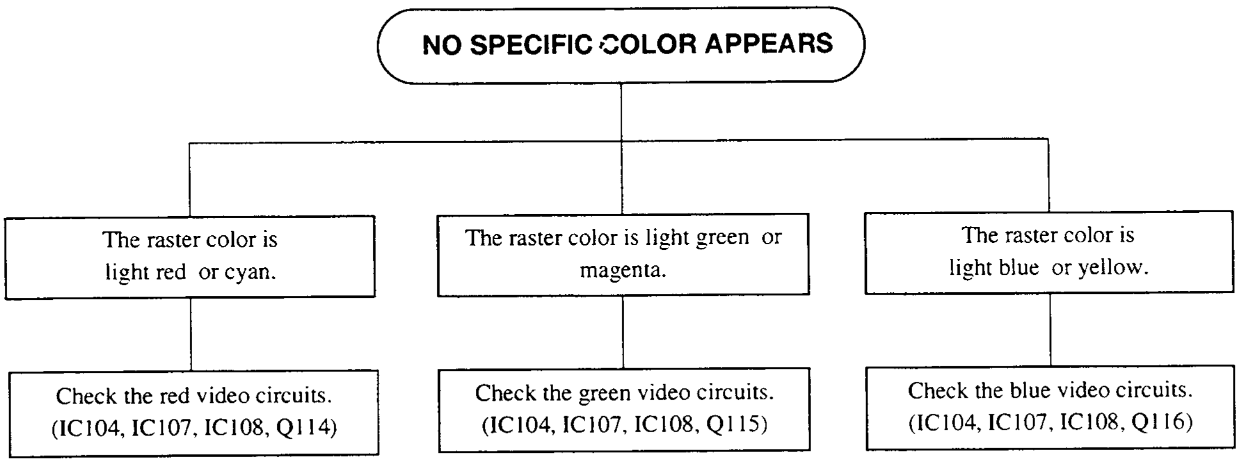
WAVE FORMS



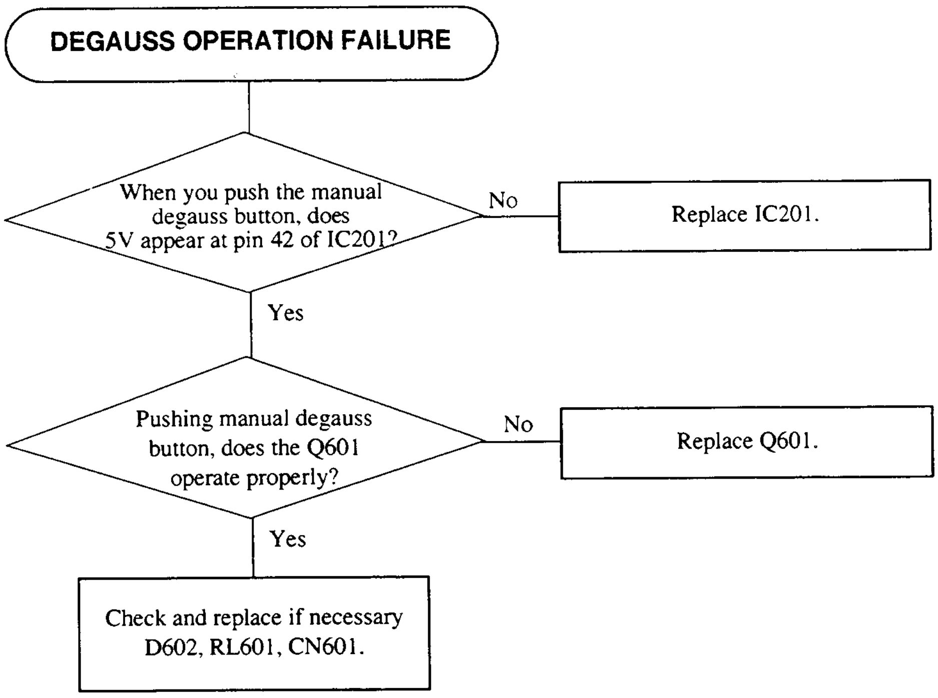



NO VIDEO
Power indicator is green,
Does DC 12V appear at pin 11 of IC104 or pin 8 of CN102?
No
Check DC 12V line pin 6 of IC601.
Yes
7
Does the video pulse appear at pins 4, 6 and 9 of IC104 on the video PCB?
No
Check signal cable signal source, IC102 and IC109.
Yes
8
Does the video pulse appear at pins 17, 20, 26 of IC104?
No
9
Does the clamp signal appear at pin 14 of IC104?
No
Check clamp circuit Q111 Collector on the video PCB and IC201(#22pin)on the main PCB.
Yes
Yes
Does the video amplified pulse appear at the emitter of Q114, Q115, Q116?
No
Dose the DC voltage appear at pin 12 of IC104?
No
Check contrast control circuit on video PCB (R126, LF101 and pin 6 of CN102)
Yes
Yes
Check cutoff control circuit. (DR8, DB8 and pins 5, 9, and 13 of IC107)
Check contrast circuit on main PCB C803, C804, Q802 R802, R805.
Check video amp circuit. (DR7, DG7, DB7, Q114, Q115, Q116, RR15, 16, 17, RG15, 16, 17, RB15, 16, 17)
WAVE FORMS
7
8
9

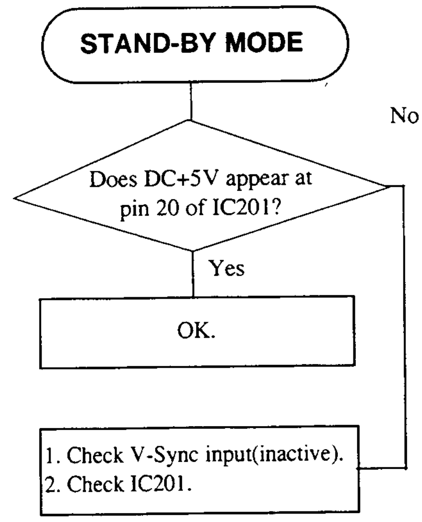

NO OSD DISPLAYS
There is video but no OSD.
When pushing a front control button, does any pulse appear at pins 53 and 54 of IC201?
No
When you push a button on the front control panel, does the voltage vary at pins 18 and 19 of IC201?
No
Check the push buttons on the front control board SW201-SW210.
Yes
Check IC201.
Yes
Does the horizontal flyback pulse appear at pin 5 of IC105?
No
Check horizontal flyback pulse generation circuit on the main PCB.(Pin 11 of T402 and R432)
Yes
Does the vertical blanking pulse appear at pin 10 of IC105?
No
Check vertical blanking pulse generation circuit. (Q804, Q805 and IC106)
Yes
Does the OSD video signal appear at pins 13, 14 and 15 of IC105?
No
Does DC 5V appear at pin 9 of IC105 or pin 7 of CN102?
No
Yes
Check IC105.
Check DC+5V line on IC601 and the related circuit.
Yes
Does the OSD output signal appear at pins 3, 6 and 8 of IC106?
No
Does DC5V appear at pin 14 of IC106?
No
Yes
Check IC106.
Check power supply IC601.
Yes
Does the OSD signai appear at the emitter of Q114, Q115 and Q116?
No
Yes
Check the video amp and IC107.
Check Q114, Q115, Q116.

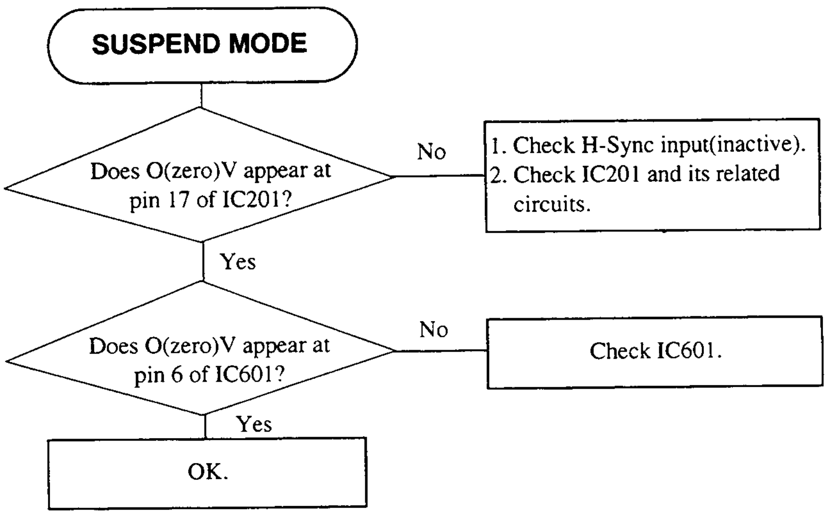


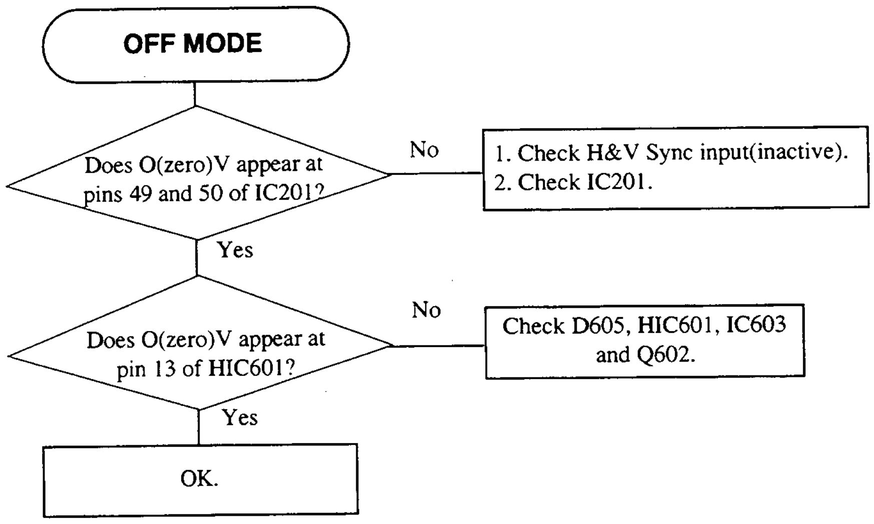
Note : Removing the signal cable displays a self raster screen. This screen displays the message "check signal cable" along with red, green and blue boxes. Use these boxes to check whether each individual color(R, G, B) is operating or not.



POWER SAVE MANAGEMENT SYSTEM FAILURE



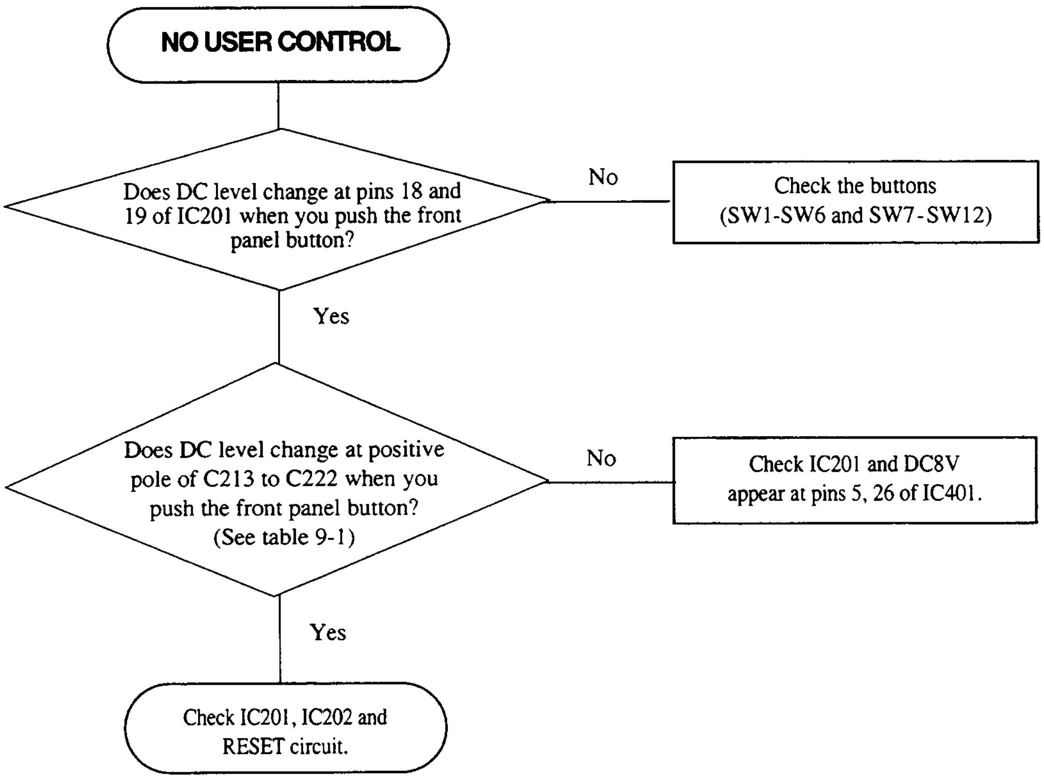




DPMS Logic Table

Mode	SYNC		Video	LED Color
	H	V		
Normal	Active	Active	Active	Green
Stand-By	Inactive	Active	Blanked	Orange
Suspend	Active	Inactive	Blanked	Orange/Green blanking
Off	Inactive	Inactive	Blanked	Orange blanking

Note : If signal cable is removed, DPMS function does not operate and a self raster is **displayed.**



Front Panel Button

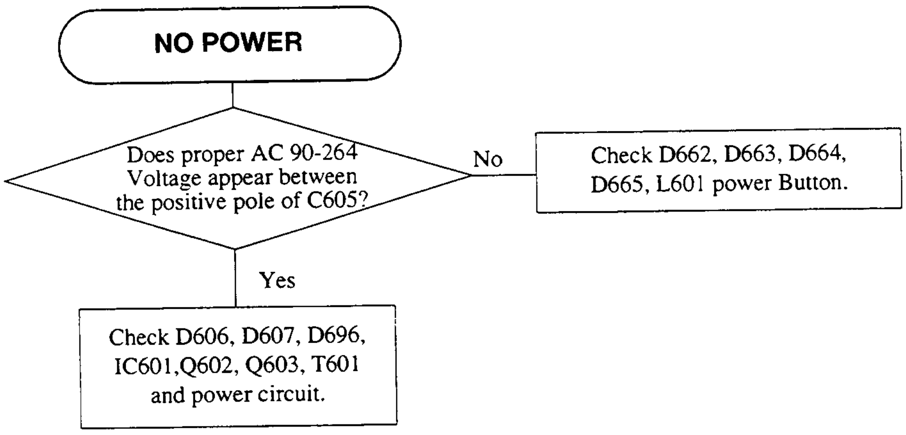
Location	Function
C213	Pin Balance
C214	Tilt
C215	Vertical Linerity
C216	Horizontal Size
C217	Vertical Size
C218	Horizontal Position
C219	Vertical Position
C220	Side Pincushion
C221	Trapezoid
C222	Parallelogram

2. Sync Master 17GLi

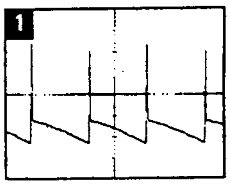
Notes : 1. If picture does not appear, fully rotate the brightness and contrast controls clockwise before inspection.

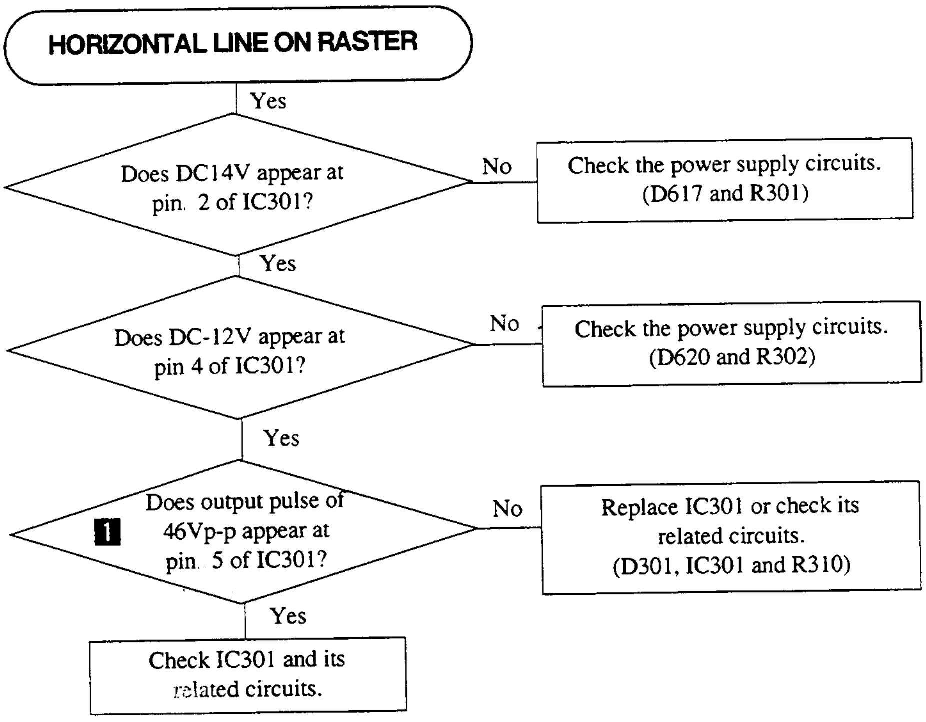
2. Check the following circuits :

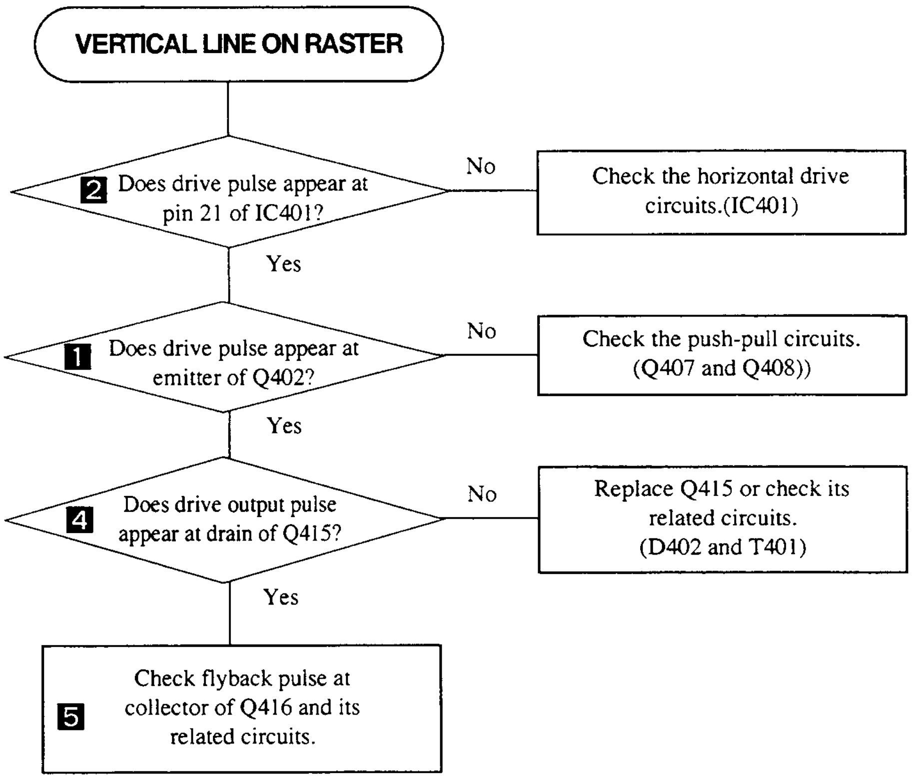
- No raster appears:Power circuit, horizontal output circuit, H/V control circuit and H/V output circuit.
- High voltage develops but no raster **appears; Video output circuits.**
- High voltage does not develop:Horizontal output circuits.



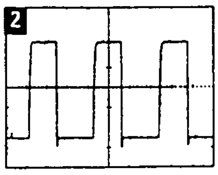
WAVE FORMS






VERTICAL LINE ON RASTER
2 Does drive pulse appear at pin 21 of IC401?
No
Check the horizontal drive circuits.(IC401)
Yes
1 Does drive pulse appear at emitter of Q402?
No
Check the push-pull circuits. (Q407 and Q408))
Yes
4 Does drive output pulse appear at drain of Q415?
No
Replace Q415 or check its related circuits. (D402 and T401)
Yes
5 Check flyback pulse at collector of Q416 and its related circuits.

WAVE FORMS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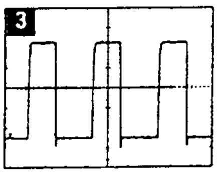
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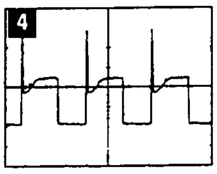
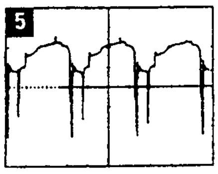
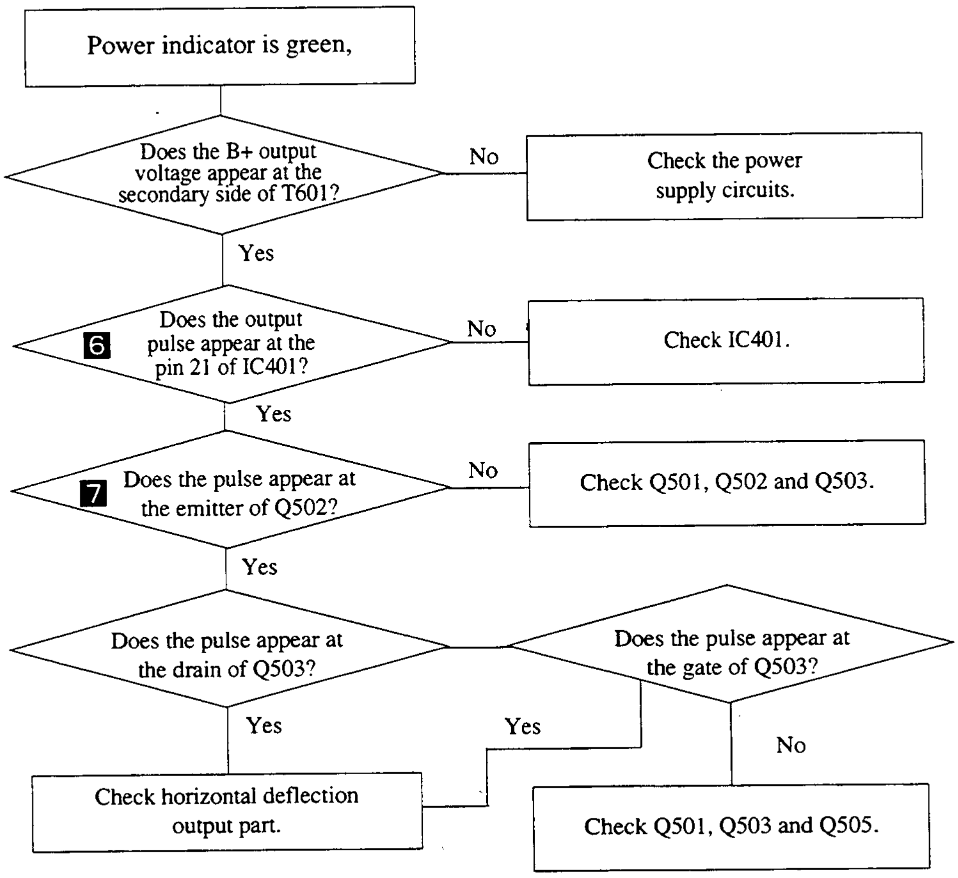
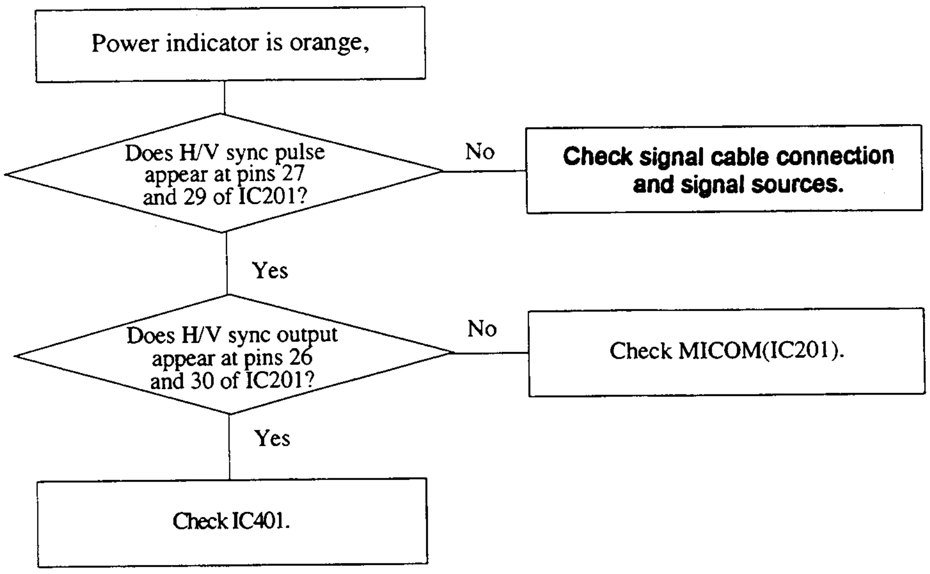

4

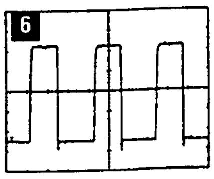

5

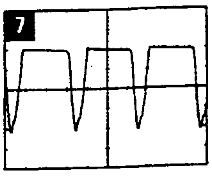
NO RASTER

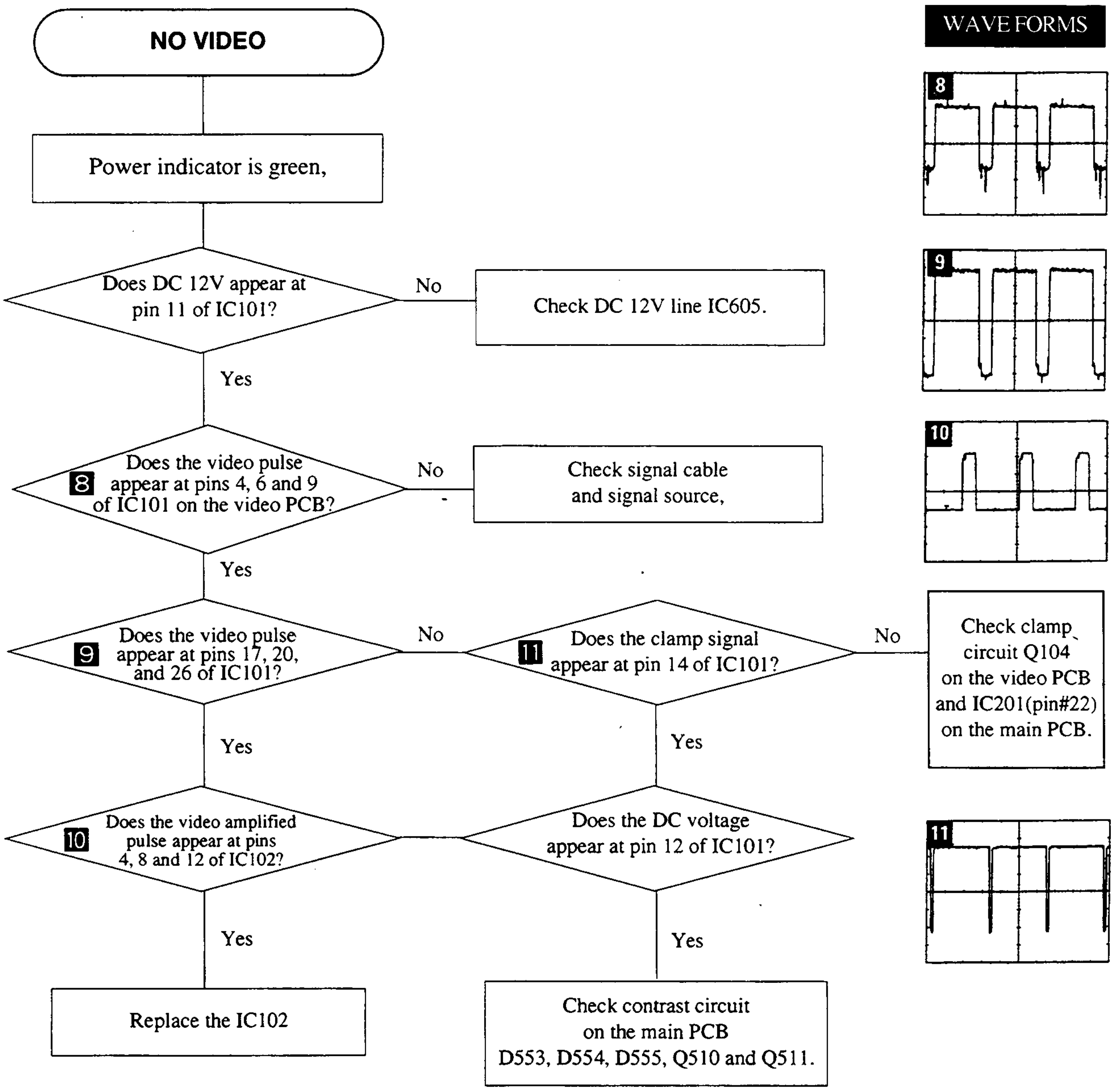


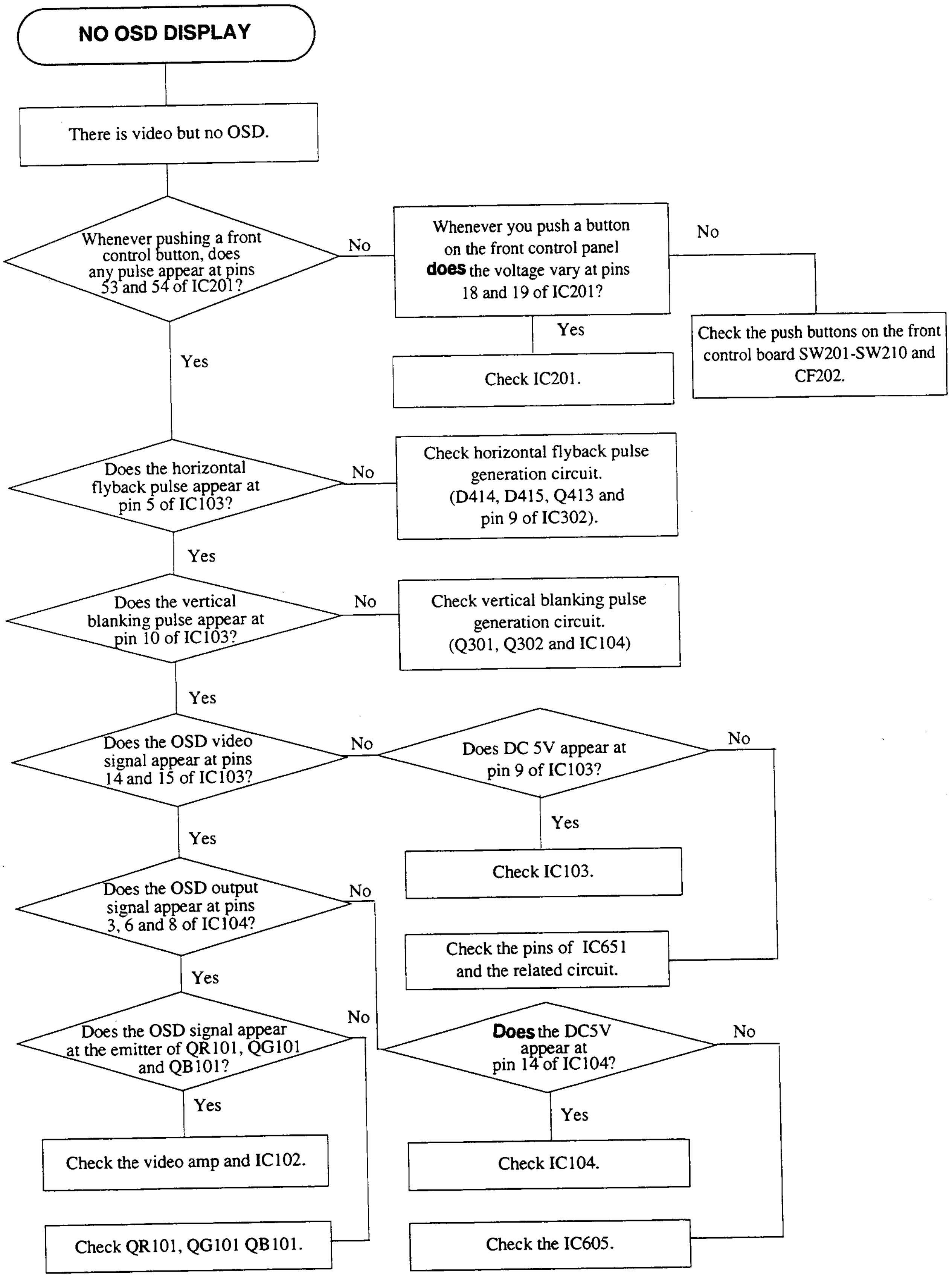


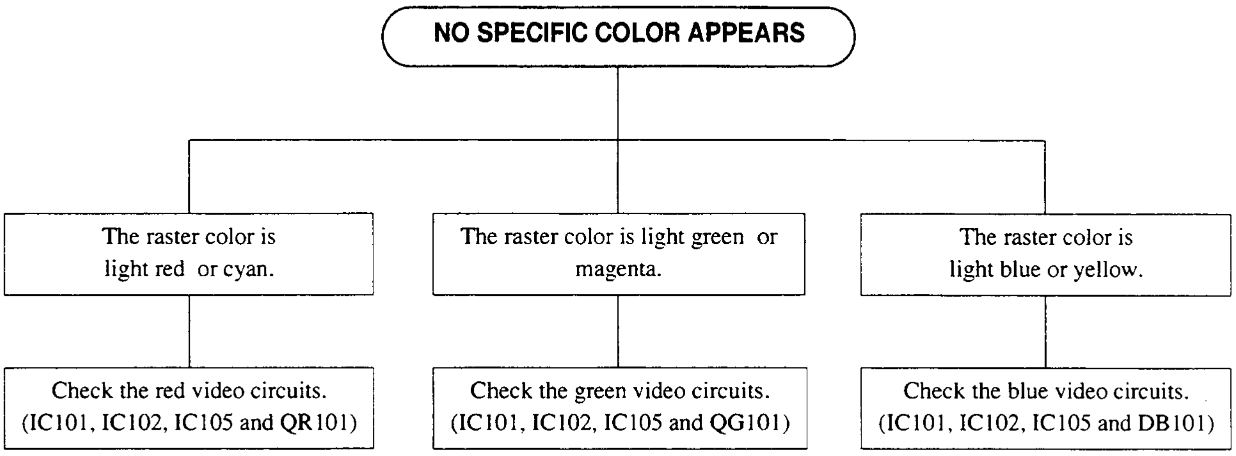
WAVE FORMS



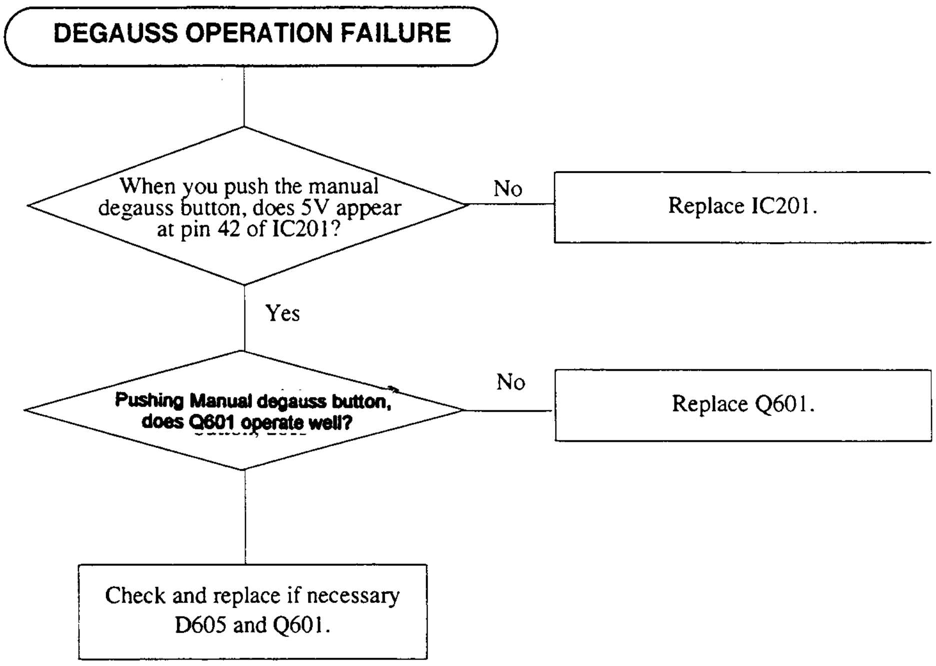



NO VIDEO
Power indicator is green,
Does DC 12V appear at pin 11 of IC101?
No
Check DC 12V line IC605.
Yes
8 Does the video pulse appear at pins 4, 6 and 9 of IC101 on the video PCB?
No
Check signal cable and signal source,
Yes
9 Does the video pulse appear at pins 17, 20, and 26 of IC101?
No
11 Does the clamp signal appear at pin 14 of IC101?
No
Check clamp circuit Q104 on the video PCB and IC201(pin#22) on the main PCB.
Yes
Yes
10 Does the video amplified pulse appear at pins 4, 8 and 12 of IC102?
Does the DC voltage appear at pin 12 of IC101?
Yes
Yes
Replace the IC102
Check contrast circuit on the main PCB D553, D554, D555, Q510 and Q511.
WAVE FORMS
8
9
10
11

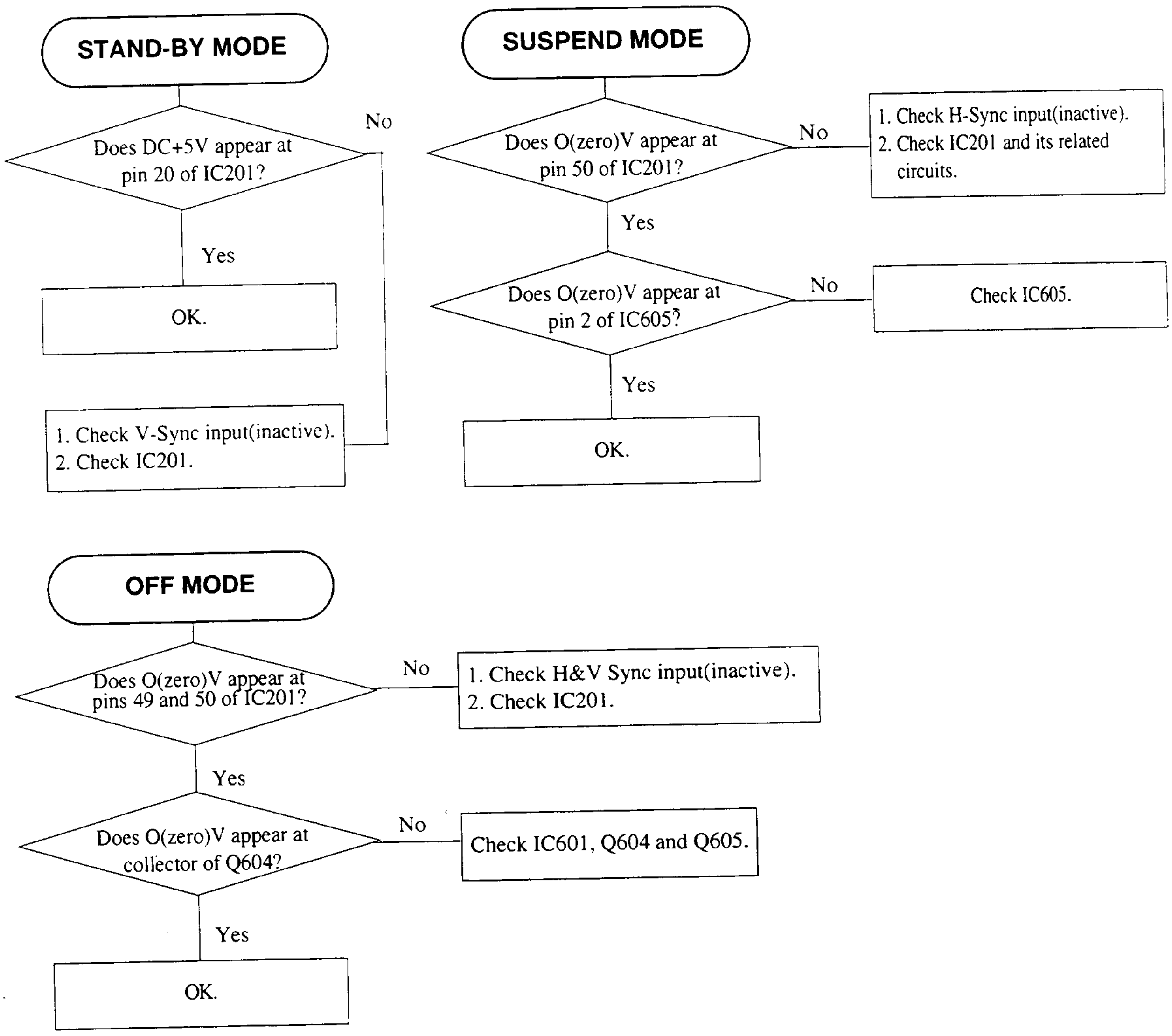

NO OSD DISPLAY
There is video but no OSD.
Whenever pushing a front control button, does any pulse appear at pins 53 and 54 of IC201?
No
Whenever you push a button on the front control panel does the voltage vary at pins 18 and 19 of IC201?
No
Check the push buttons on the front control board SW201-SW210 and CF202.
Yes
Check IC201.
Yes
Does the horizontal flyback pulse appear at pin 5 of IC103?
No
Check horizontal flyback pulse generation circuit. (D414, D415, Q413 and pin 9 of IC302).
Yes
Does the vertical blanking pulse appear at pin 10 of IC103?
No
Check vertical blanking pulse generation circuit. (Q301, Q302 and IC104)
Yes
Does the OSD video signal appear at pins 14 and 15 of IC103?
No
Does DC 5V appear at pin 9 of IC103?
No
Yes
Check IC103.
Check the pins of IC651 and the related circuit.
Yes
Does the OSD output signal appear at pins 3, 6 and 8 of IC104?
No
Yes
Does the OSD signal appear at the emitter of QR101, QG101 and QB101?
No
Does the DC5V appear at pin 14 of IC104?
No
Yes
Check the video amp and IC102.
Yes
Check IC104.
Check QR101, QG101 QB101.
Check the IC605.



Notes : Removing the signal cable displays a self raster screen. This screen displays the message "check signal cable" along with red, green and blue boxes. Use these boxes to check whether each individual color(R, G, B) is operating or not.



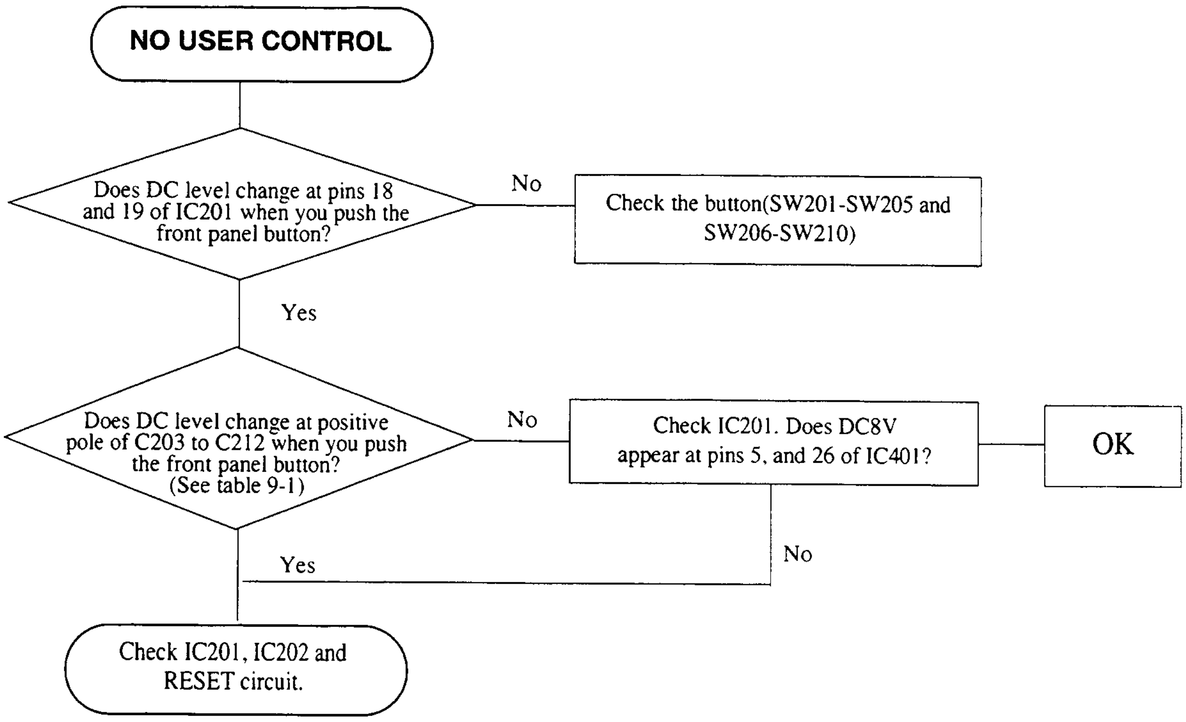
POWER SAVE MANAGEMENT SYSTEM FAILURE



DPMS Logic Table

Mode	SYNC		Video	LED Color
	H	V		
Normal	Active	Active	Active	Green
Stand-By	Inactive	Active	Blank	Orange
Suspend	Active	Inactive	Blank	Orange/Green blinking
Off	Inactive	Inactive	Blank	Orange blinking

Note: **If signal cable is removed, DPMS function does not operate and a self raster is displayed.**



Front Panel Button

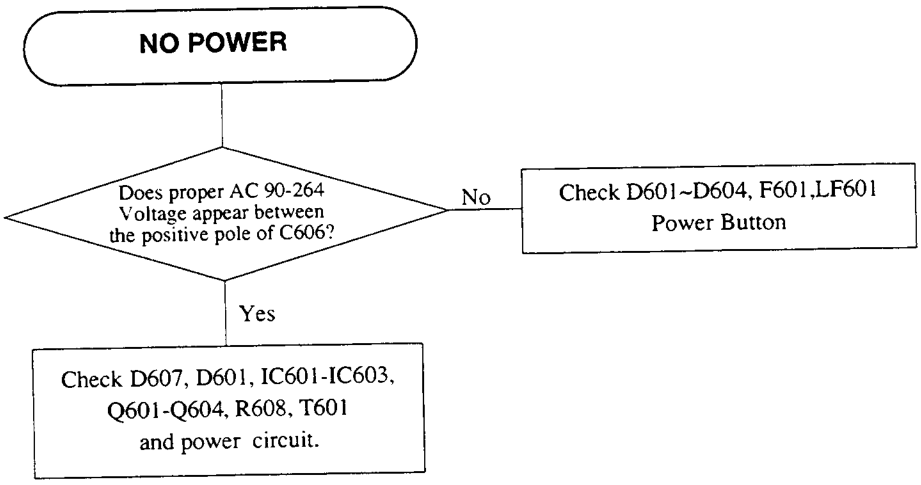
Location	Function
C203	Pin Balance
C205	Vertical Linearity
C206	Horizontal Size
C207	Vertical Size
C208	Horizontal Position
C209	Vertical Position
C210	Side Pincushion
C211	Trapezoid
C212	Parallelogram

3. Sync Master 15GLi

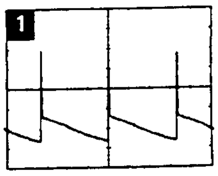
NOTES : 1. If picture does not appear, fully rotate the brightness and contrast controls clockwise before inspection.

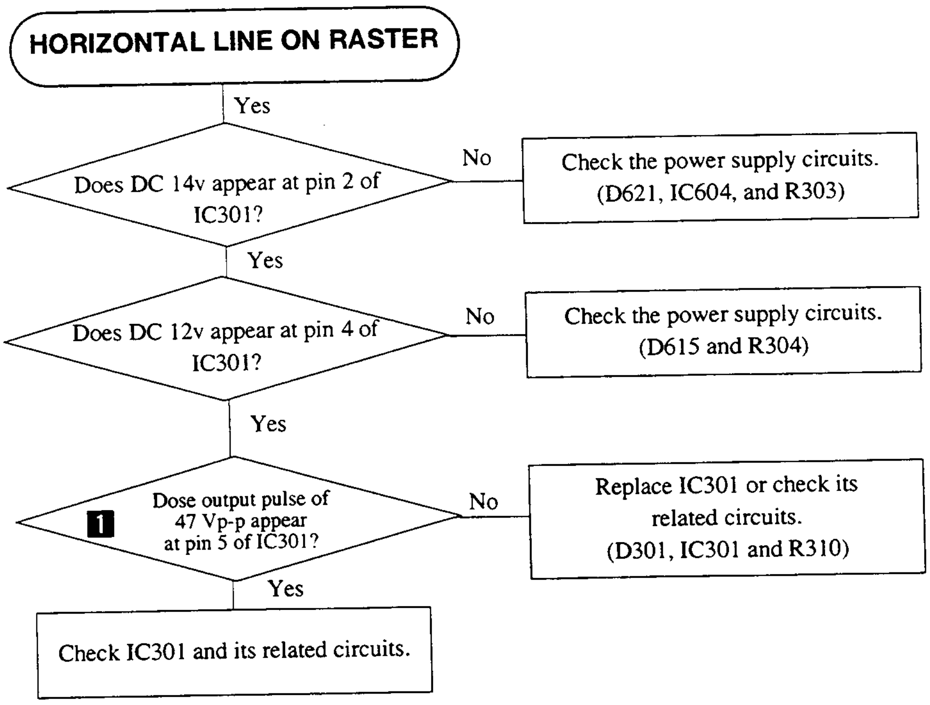
2. Check the following circuits :

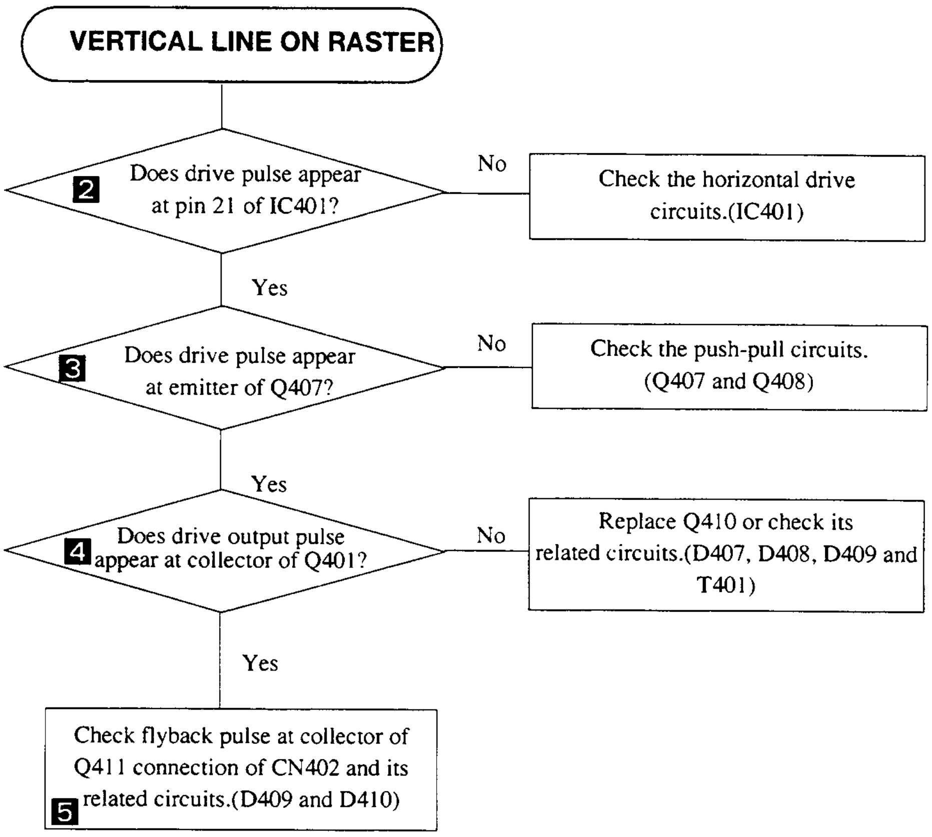
- No raster appears:Power circuit, horizontal output circuit, H/V control circuit and H/V output circuit.
- High voltage develops but no raster appears; Video output circuits.
- High voltage does not develop:Horizontal output circuits.



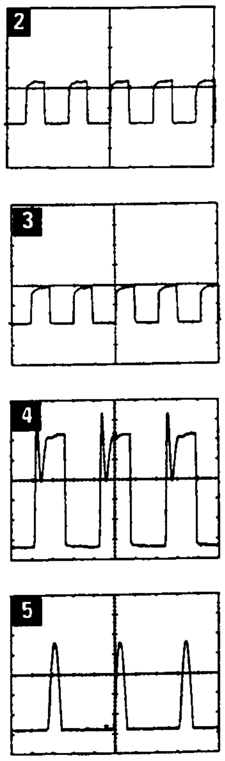
WAVE FORMS



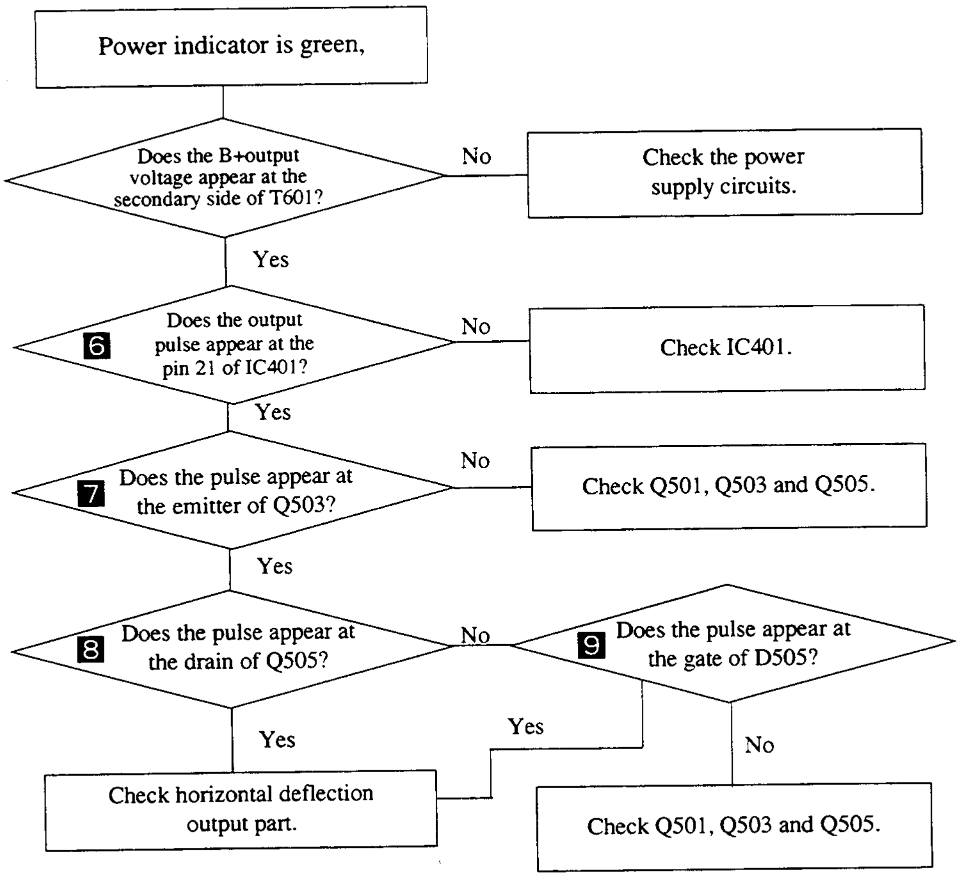



VERTICAL LINE ON RASTER
2
Does drive pulse appear at pin 21 of IC401?
No
Check the horizontal drive circuits.(IC401)
Yes
3
Does drive pulse appear at emitter of Q407?
No
Check the push-pull circuits. (Q407 and Q408)
Yes
4
Does drive output pulse appear at collector of Q401?
No
Replace Q410 or check its related circuits.(D407, D408, D409 and T401)
Yes
5
Check flyback pulse at collector of Q411 connection of CN402 and its related circuits.(D409 and D410)

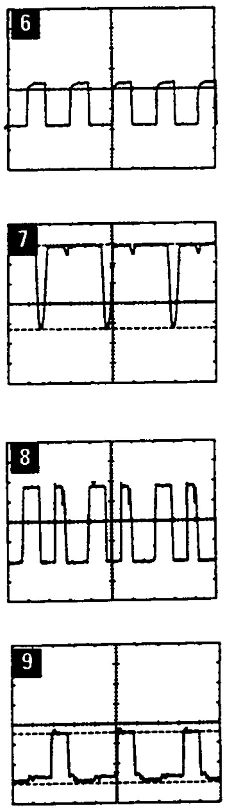
WAVE FORMS

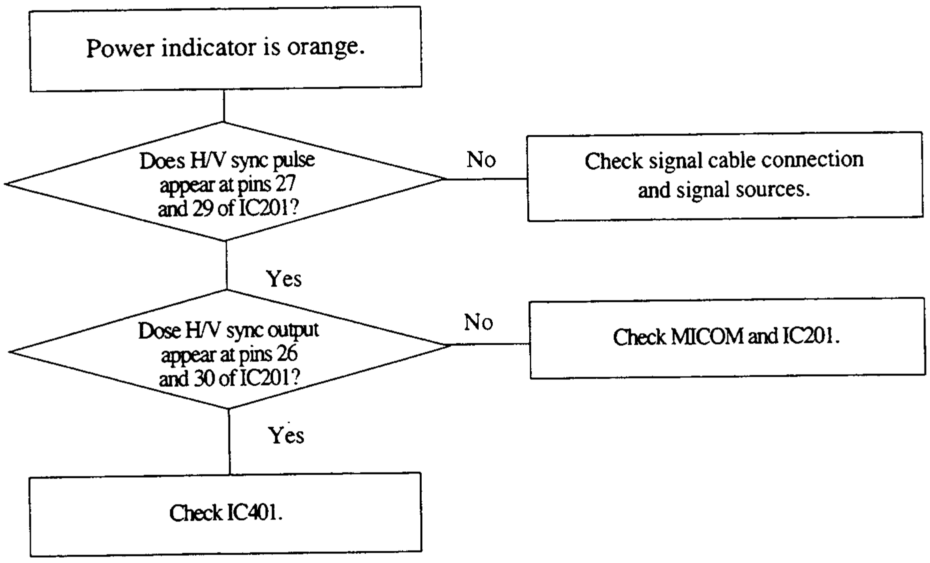

2
3
4
5

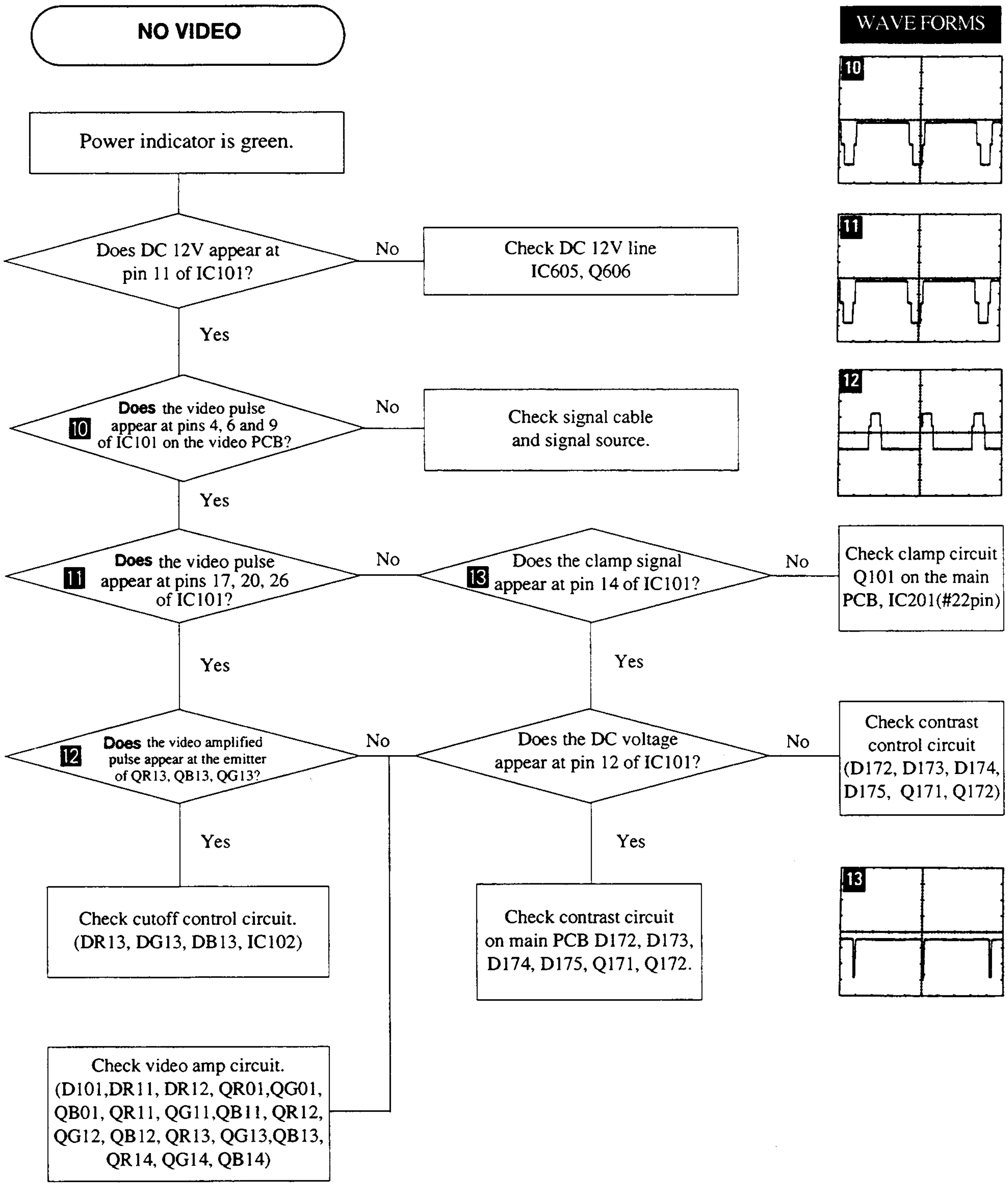
NO RASTER

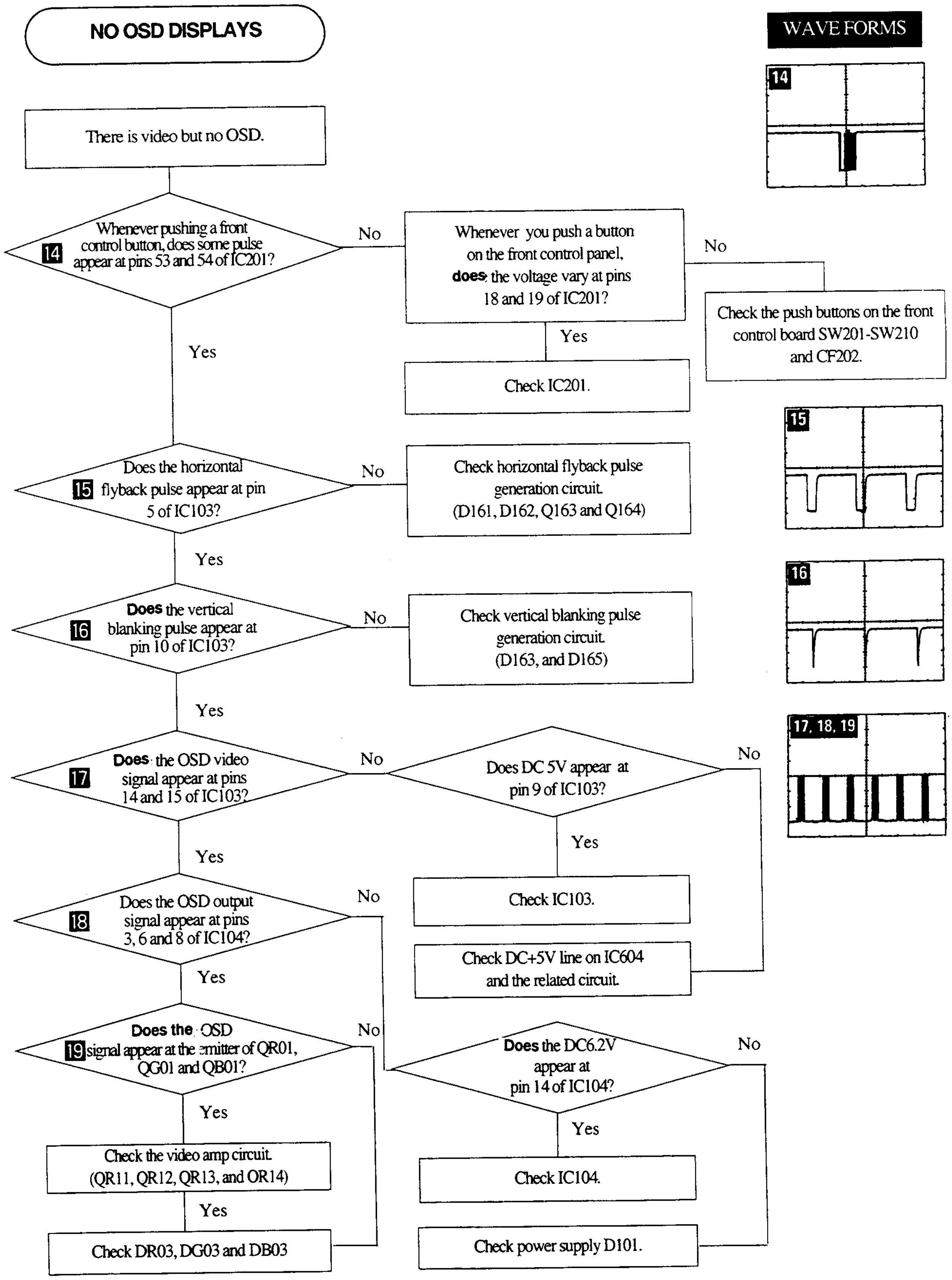


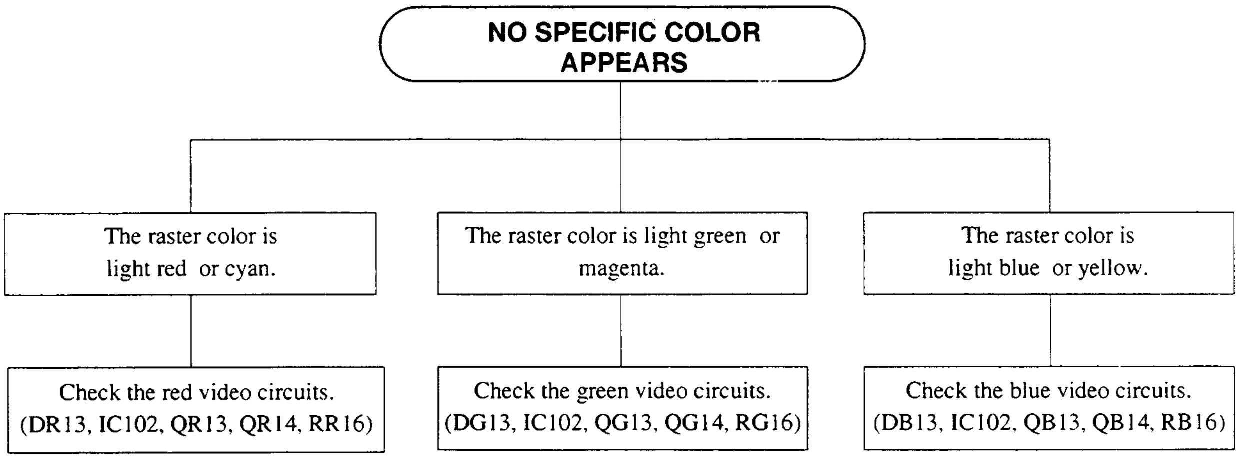
WAVE FORMS



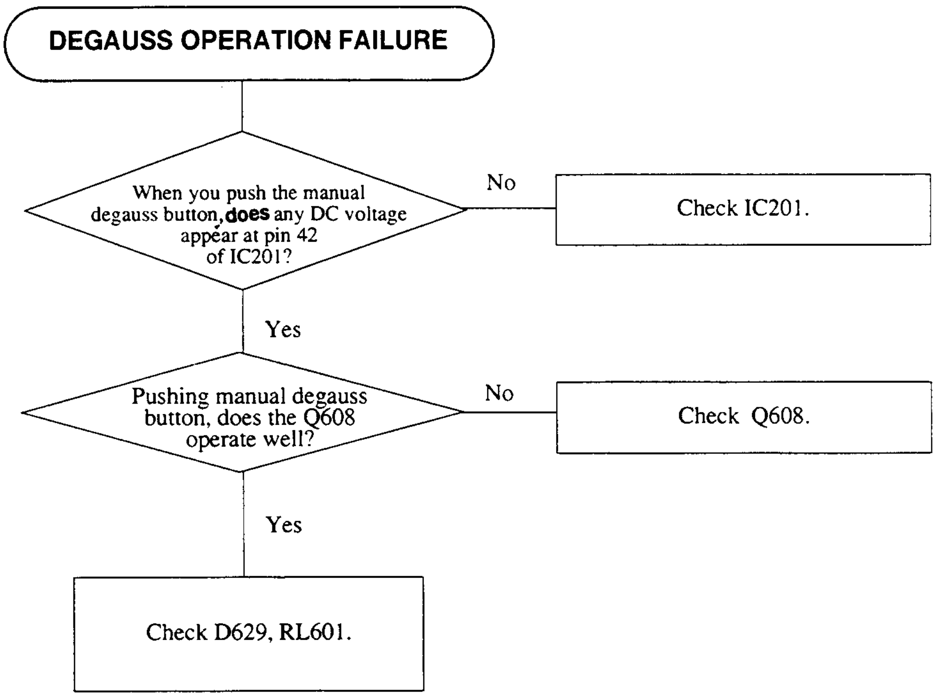



NO VIDEO
WAVE FORMS
Power indicator is green.
Does DC 12V appear at pin 11 of IC101?
No
Check DC 12V line IC605, Q606
Yes
10 Does the video pulse appear at pins 4, 6 and 9 of IC101 on the video PCB?
No
Check signal cable and signal source.
Yes
11 Does the video pulse appear at pins 17, 20, 26 of IC101?
No
13 Does the clamp signal appear at pin 14 of IC101?
No
Check clamp circuit Q101 on the main PCB, IC201(#22pin)
Yes
Yes
12 Does the video amplified pulse appear at the emitter of QR13, QB13, QG13?
No
Does the DC voltage appear at pin 12 of IC101?
No
Check contrast control circuit (D172, D173, D174, D175, Q171, Q172)
Yes
Yes
Check cutoff control circuit. (DR13, DG13, DB13, IC102)
Check contrast circuit on main PCB D172, D173, D174, D175, Q171, Q172.
Check video amp circuit. (D101,DR11, DR12, QR01,QG01, QB01, QR11, QG11,QB11, QR12, QG12, QB12, QR13, QG13,QB13, QR14, QG14, QB14)
10
11
12
13

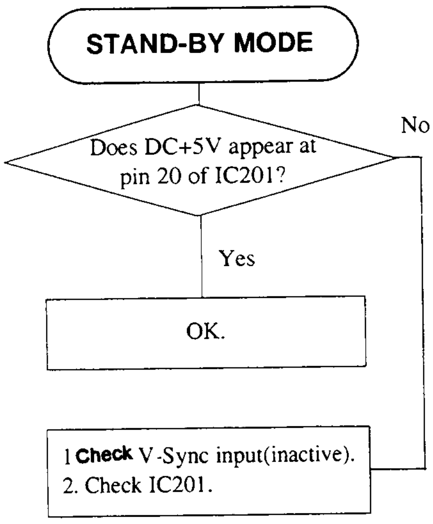

NO OSD DISPLAYS
WAVE FORMS
There is video but no OSD.
14 Whenever pushing a front control button, does some pulse appear at pins 53 and 54 of IC201?
No
Whenever you push a button on the front control panel, does the voltage vary at pins 18 and 19 of IC201?
No
Check the push buttons on the front control board SW201-SW210 and CF202.
Yes
Check IC201.
Yes
15 Does the horizontal flyback pulse appear at pin 5 of IC103?
No
Check horizontal flyback pulse generation circuit. (D161, D162, Q163 and Q164)
Yes
16 Does the vertical blanking pulse appear at pin 10 of IC103?
No
Check vertical blanking pulse generation circuit. (D163, and D165)
Yes
17 Does the OSD video signal appear at pins 14 and 15 of IC103?
No
Does DC 5V appear at pin 9 of IC103?
No
Yes
Check IC103.
Check DC+5V line on IC604 and the related circuit.
Yes
18 Does the OSD output signal appear at pins 3, 6 and 8 of IC104?
No
Yes
19 Does the OSD signal appear at the emitter of QR01, QG01 and QB01?
No
Does the DC6.2V appear at pin 14 of IC104?
No
Yes
Check IC104.
Check power supply D101.
Yes
Check the video amp circuit. (QR11, QR12, QR13, and OR14)
Yes
Check DR03, DG03 and DB03
14
15
16
17, 18, 19

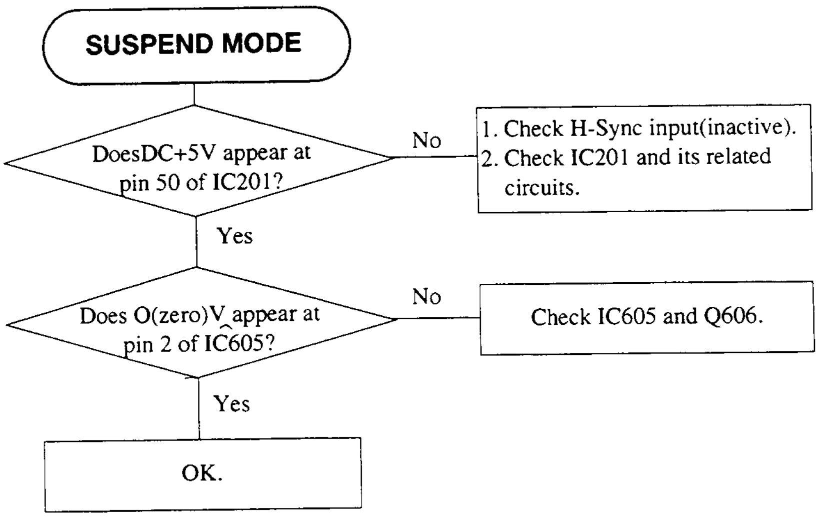


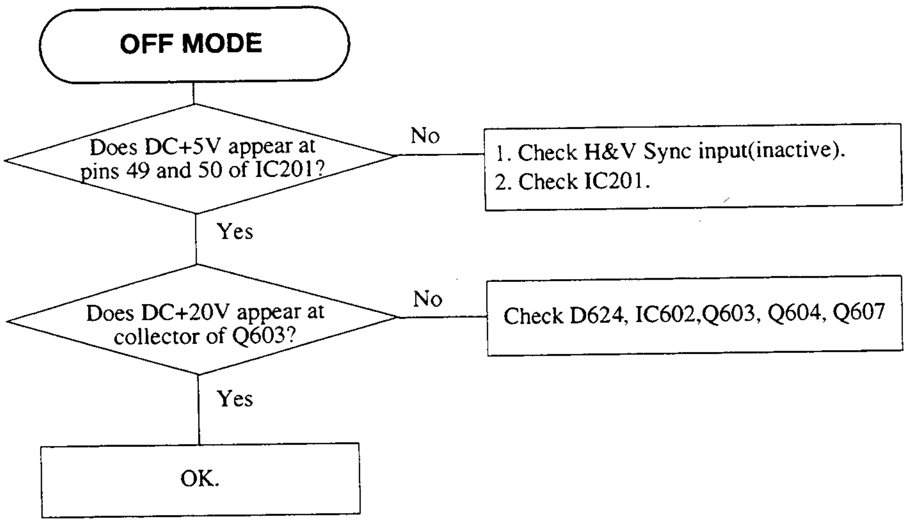
Note: : Removing the signal cable displays a self raster screen. This screen displays the message "check signal cable" along with red, green and blue boxes. Use these boxes to check whether each individual color(R, G, B) is operating or not.



POWER SAVE MANAGEMENT SYSTEM FAILURE



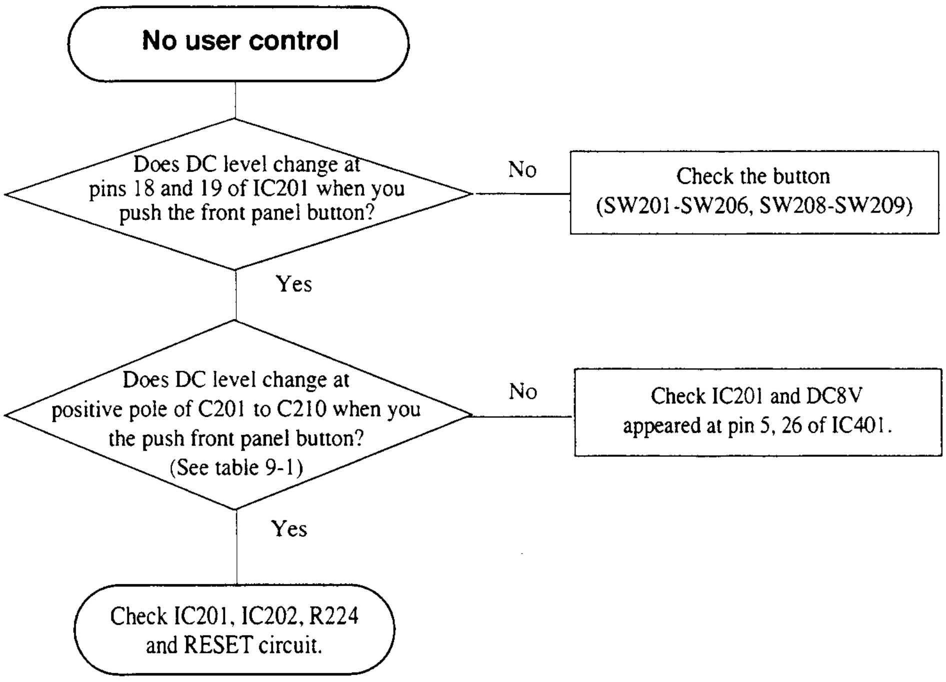




DPMS Logic Table

Mode	SYNC		Video	LED Color
	H	V		
Normal	Active	Active	Active	Green
Stand-By	Inactive	Active	Blanked	Orange
Suspend	Active	Inactive	Blanked	Orange/Green blanking
Off	Inactive	Inactive	Blanked	Orange blanking

Note : If signal cable is removed, DPMS function does not operate and a self raster is displayed.

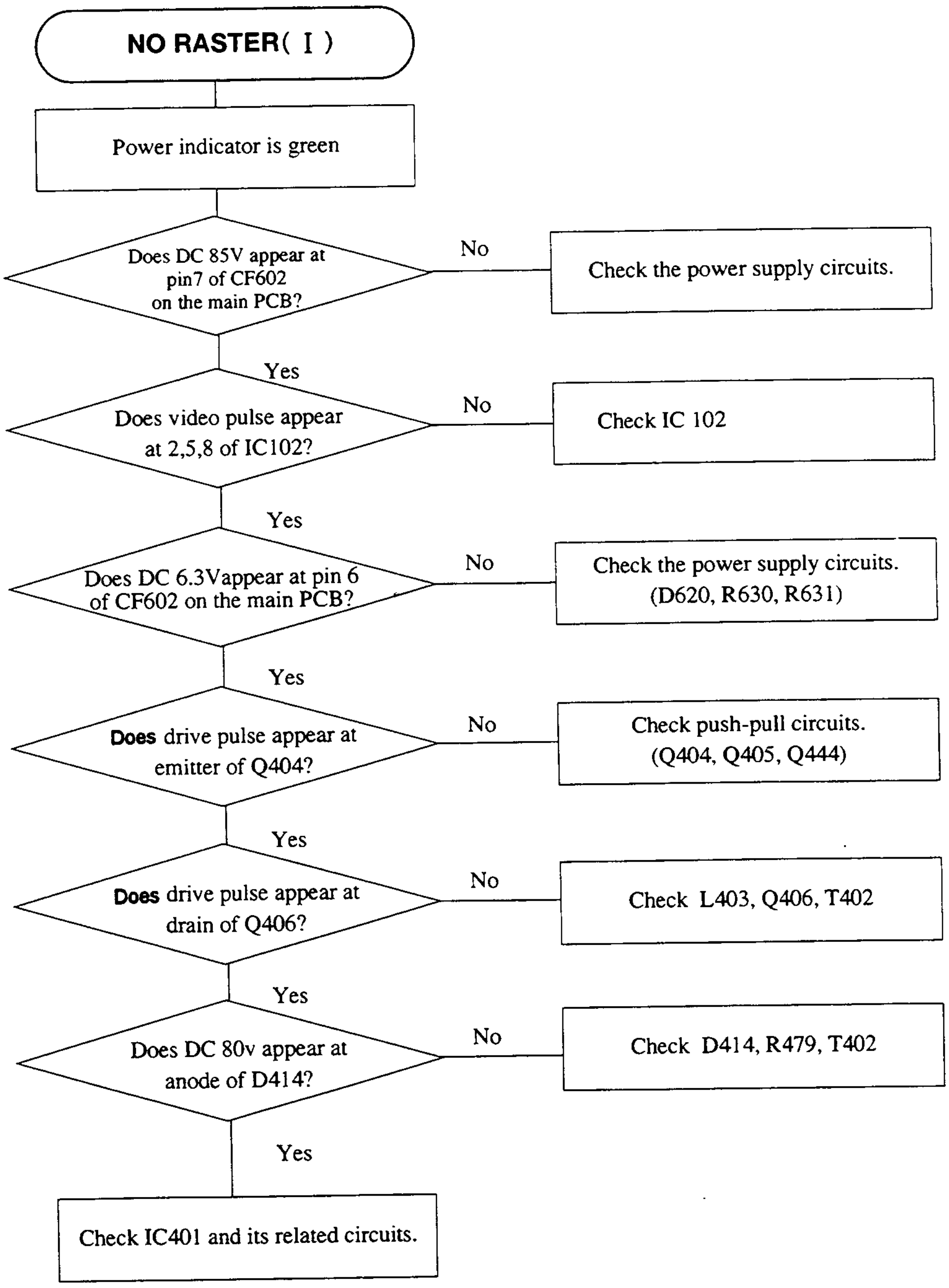


Front Panel Button

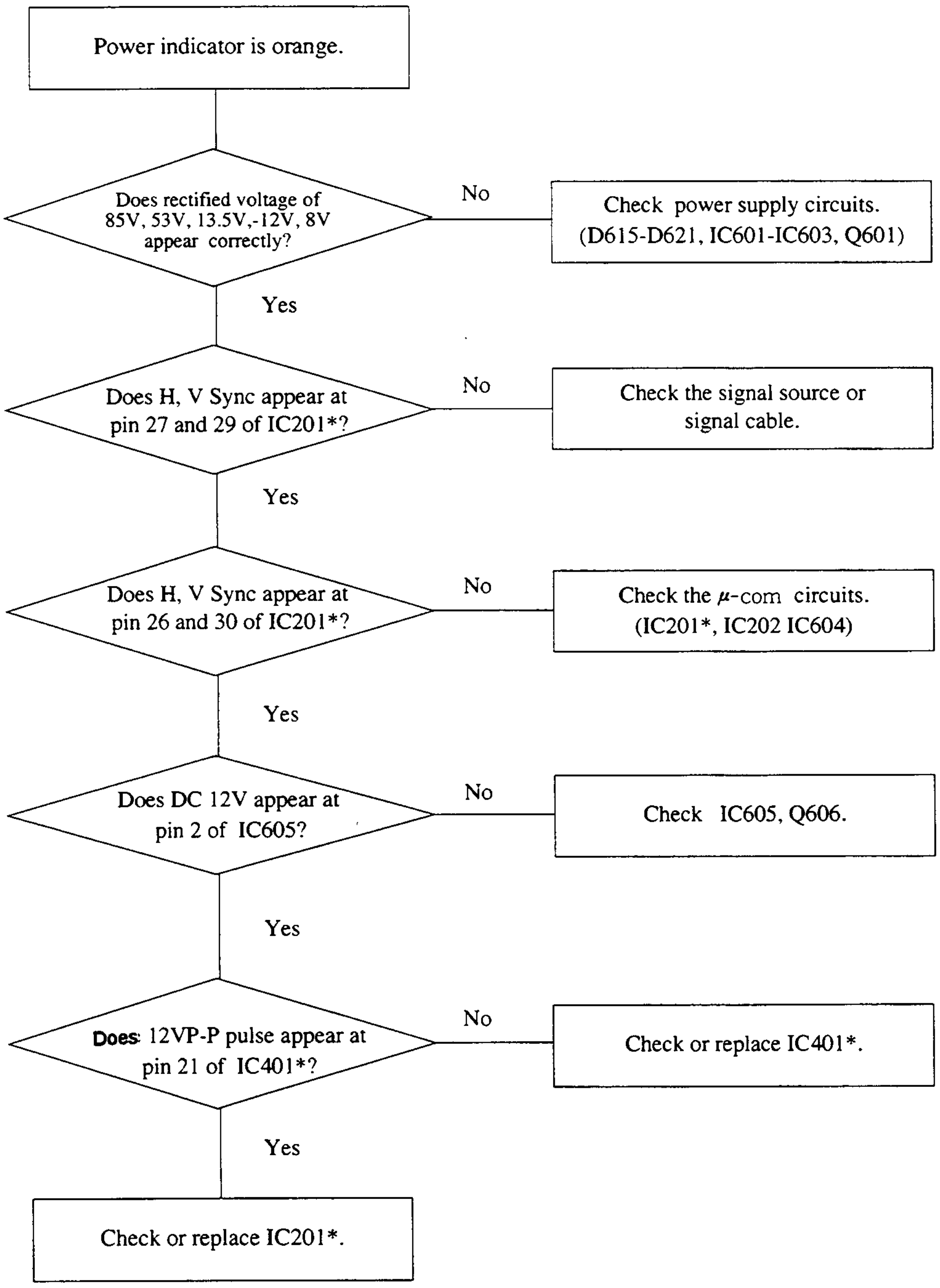
Location	Function
C201	Pin Balance
C202	Vertical Linearity
C203	Horizontal Size
C204	Vertical Size
C205	Horizontal Position
C206	Vertical Position
C208	Side Pincushion
C209	Trapezoid
C210	Parallelogram

4. SyncMaster 15GLe

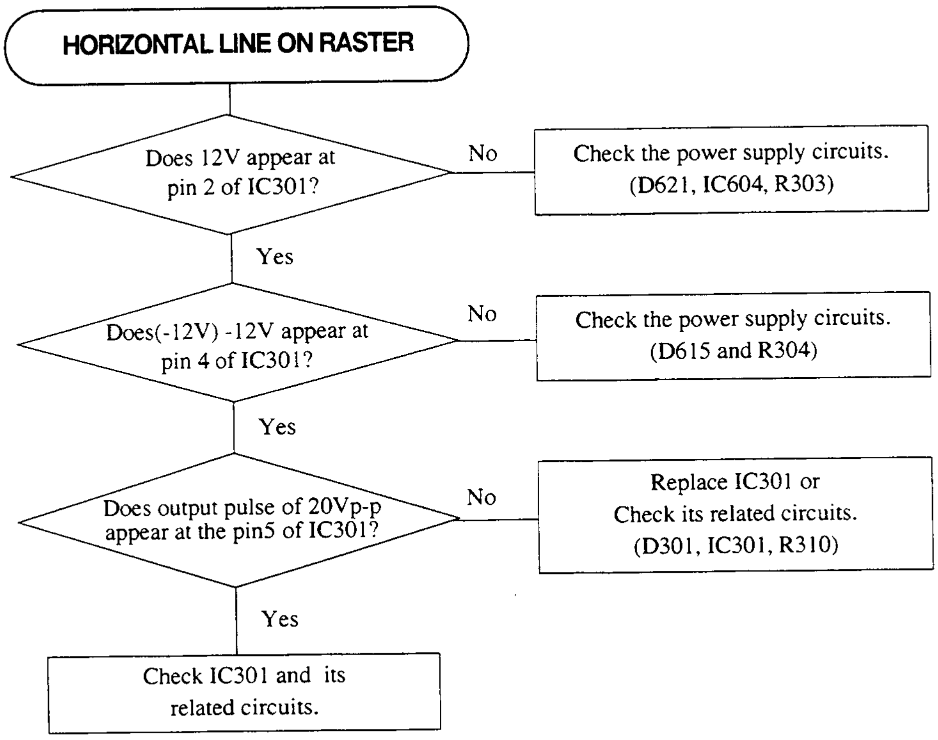
Notes :
1. If picture does not appear, fully rotate the brightness and contrast controls clockwise before inspection.
2. Check the following circuits :
    - No raster appears:Power circuit, horizontal output circuit.
    - High voltage develops but raster appears:Video output circuits.
    - High voltage does not develop:Horizontal output circuits.

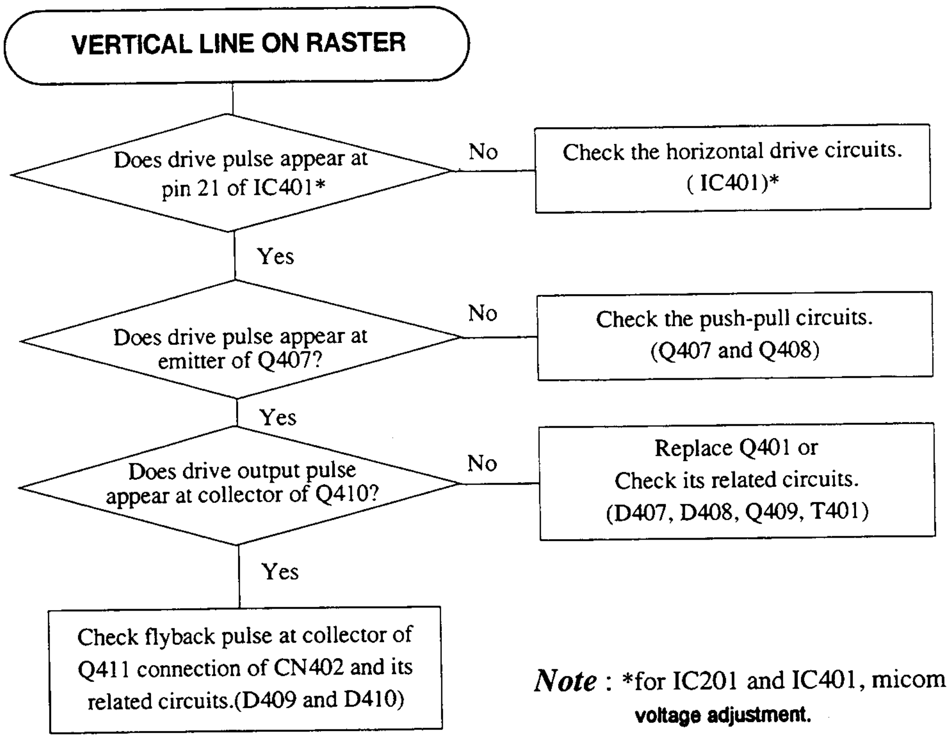


NO RASTER (I)



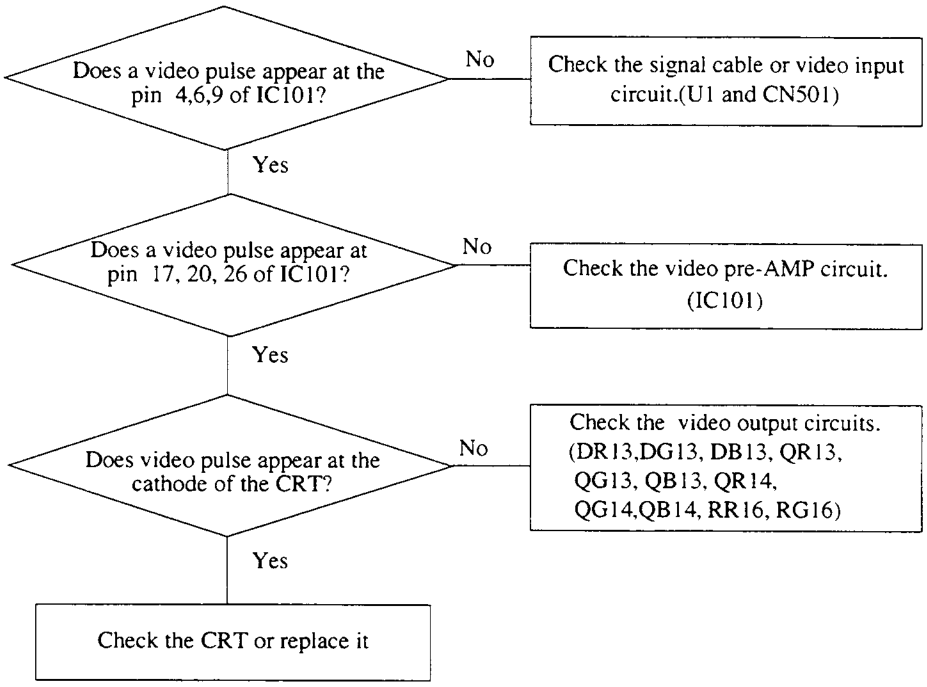
Note : * for IC201 and IC401, micom jig required for oscillation voltage adjustment



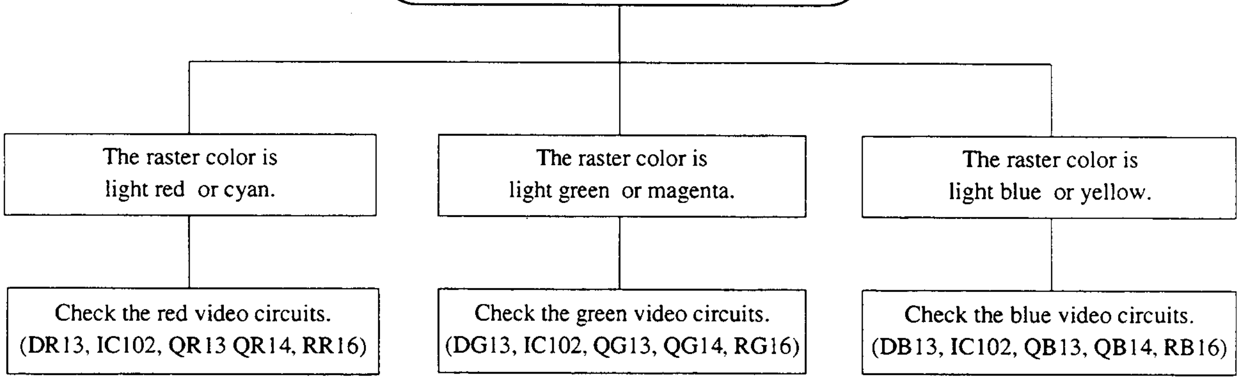


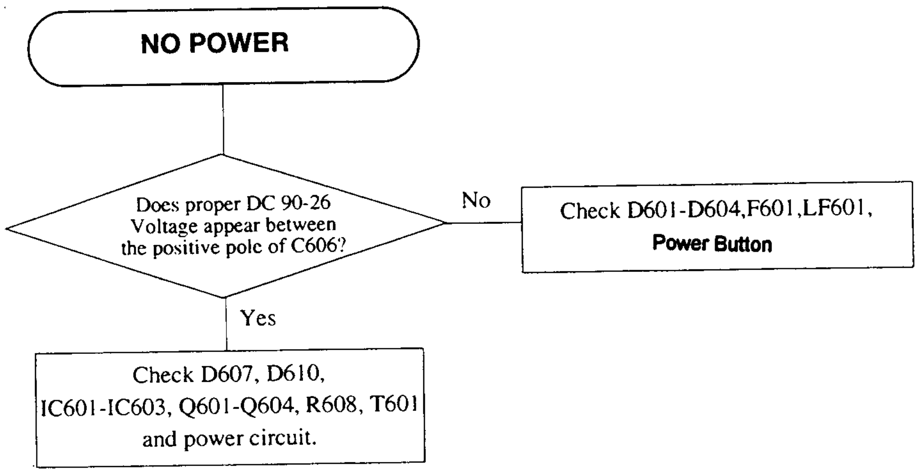
Note : *for IC201 and IC401, micom jig required for oscillation **voltage adjustment.**

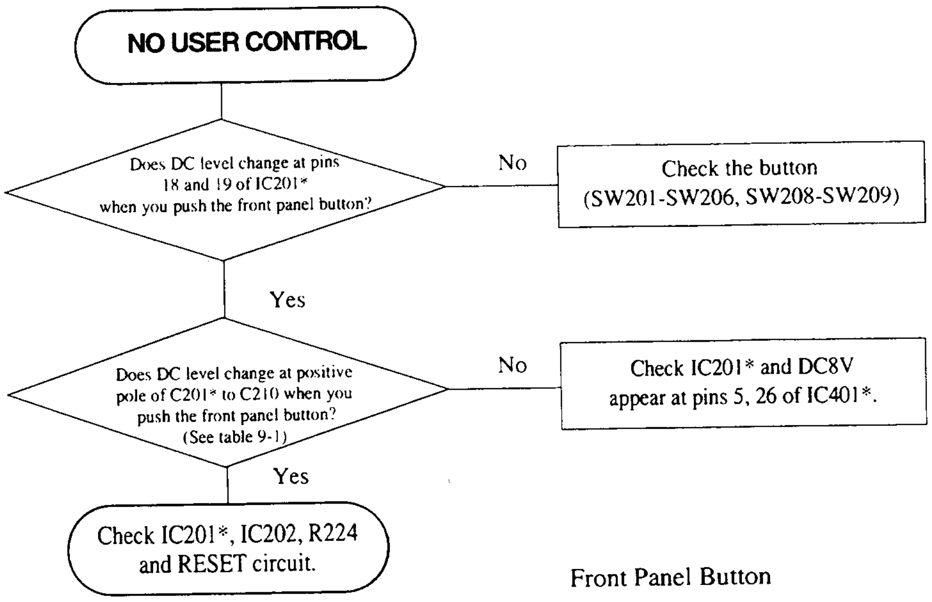
RASTER APPEARS BUT PICTURE DOES NOT APPEAR



NO SPECIFIC COLOR APPEARS



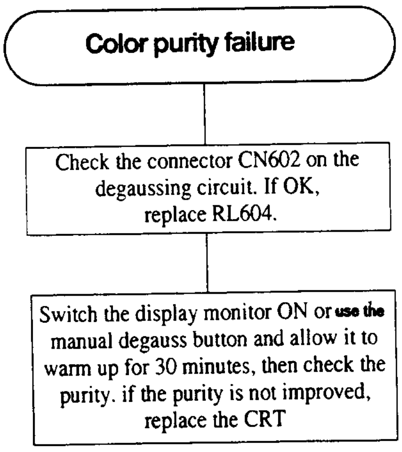




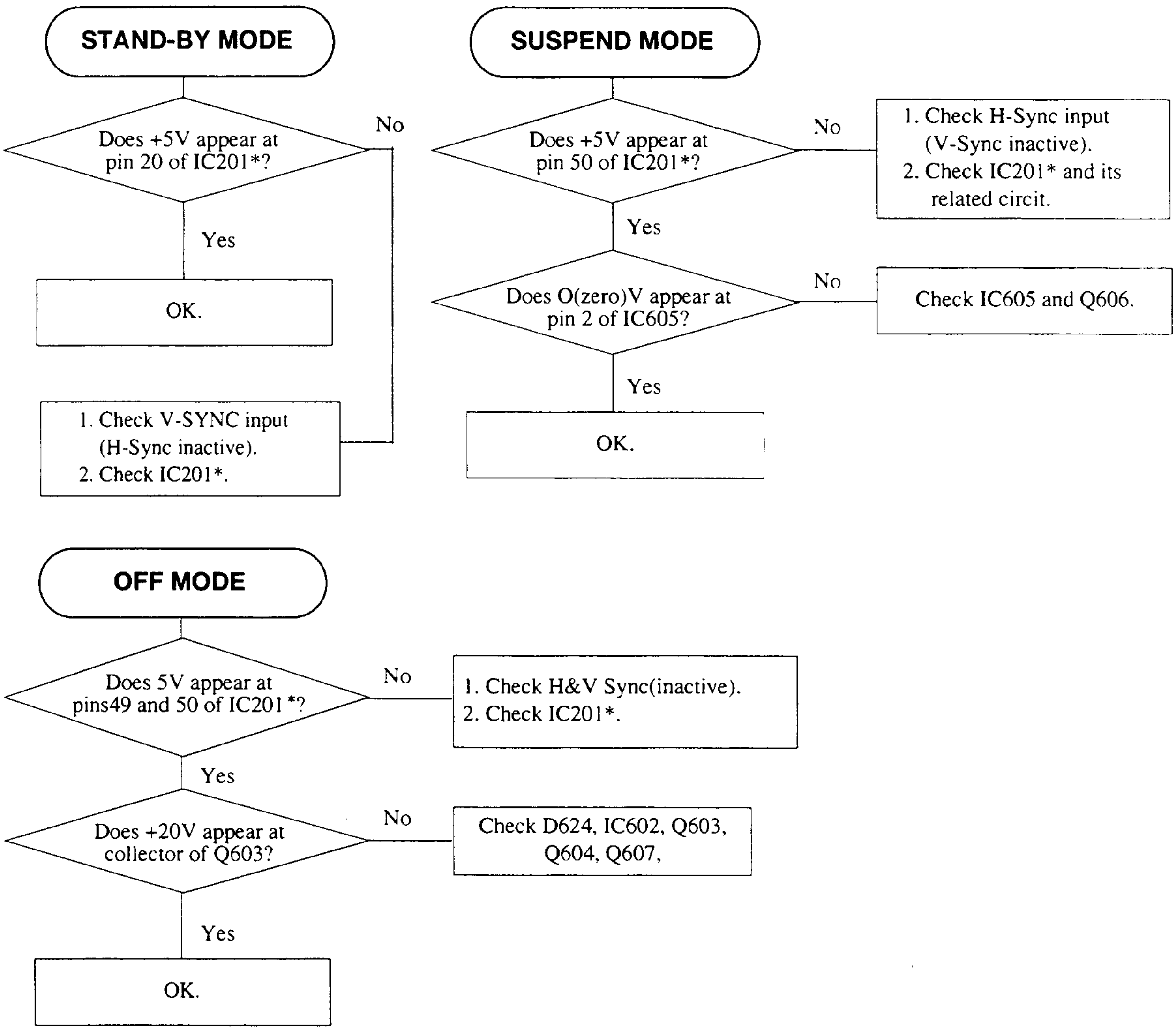
Front Panel Button

Location	Function
C201	Pin Balance
C202	Vertical Linerity
C203	Horizontal Size
C204	Vertical Size
C205	Horizontal Position
C206	Vertical Position
C208	Side Pincushion
C209	Trapezoid
C210	Parallelogram

Note : *for IC201 and IC401, micom jig required for oscillation voltage adjustment.



POWER SAVE MANAGEMENT SYSTEM FAILURE



Mode	SYNC		LED Color
	H	V	
Normal	Active	Active	Green
Stand-By	Inactive	Active	Orange
Suspend	Active	Inactive	Orange/Green blinking
Off	Inactive	Inactive	Orange blinking

Notes : *for IC201 and IC401, micom jig **required for oscillation voltage adjustment.**

IX. PARTS LIST FOR DIFFERENT CRT TYPES

1. SyncMaster 17GLsi

CRT Loc.NO	HITACHI (M41KKL180 × 12) NUQ: MULTI-897 250155AA NQ : SILICA-897 250130AA	TOSHIBA (M41DL27 × 16 ARACS 897 250187AA	SDD (M41KUN26 × 01) A: MULTI BH03-10006A E: SILICA BH03-10008A	REMARK
MAIN PCB				
C334	POL 4700pF 100V (916 164470LJAH)	Not use	POL 4700pF 100V (916 164470LJAH)	
R418	CF 270K 1/6W (911 162707YA)	CF 180K 1/6W (911 161807YA)	CF 270 1/6W (911 162707YA)	
R419	CF 10K 1/6W (911 151007YA)	MF 12K 1/4W (911 451207DA)	CF 10K 1/6W (911 151007YA)	
R422	CF 3.9K 1/6W (911 143907YA)	CF 5.6K 1/6W (911 145607YA)	CF 3.9K 1/6W (911 143907YA)	
R459	CF 9.1K 1/6W (911 149107YA)	CF 12K 1/6W (911 151207YA)	CF 15K 1/6W (911 151507YA)	
R305	MF 6.8K 1/6W (911 446805DA)	MF 6.8K 1/4W (911 446805DA)	MF 6.8 1/4W (911 446805DA)	
R440	MO 220 2W (911 332207JF)	MO 390 3W (911 333907LF)	MO 220 2W (911 332207JF)	
C434	CERAMIC 102K 500V (915 324100VKPH)	CERAMIC 332K 500V (915 324330VKPX)	CERAMIC 102K 500K (915 324100VKPH)	
T405	500T (923 460170CA)	400T (BH26-30014A)	500T (923 460170CA)	
VIDEO PCB				
JP3	CF 82 1/6W (911 128207YA)	CF 82 1/6W (911 128207YA)	CF 82 1/6W (911 128207YA)	
R126	CF 2.4K 1/6W (911 142207YA)	CF 2.4K 1/6W (911 142407YA)	CF 3K 1/6W (911 14307YA)	
RR9	CF 20K 1/6W (911 152007YA)	CF 20K 1/6W (911 152007YA)	Not use	
C130	CAP-CERAMIC, 101J, 1H, NPO (915 313100HJXH) *Note : *In TCO MODEL this item is 680pF.*	CAP-CERAMIC, 331J, 1H, NPO (915 323330HKPH)	CAP-CERAMIC, 331J, 1H, NPO (915 313100HJXH)	
CRT SOCKET PCB				
R181	MO 1.2 3W (911 311207LA)	MO 1.5 3W (911 311507LA)	MO 1.5 3W (911 311507LA)	
R182	MO 1.2 3W (911 311207LA)	MO 1.5 3W (911 311507LA)	MO 1.5 3W (911 311507LA)	

Note : We manage the CRT by surface coating method as below :

SDD CRT —> M41KUN 26 × 01 (A) —> MULTI - Coating
M41KUN 26 × 01 (E) —> SILICA - Coating

HITACHI - > M41KKL 180 × 12 (NUQ) → MULTI - Coating
M41KKL 180 × 12 (NQ) → SILICA- Coating

As above the code no. fo each CRT is different

2. Sync Master 17GLi

(1) Multi Vendors

17" 0.28 FST

Vendor	Type	Code no	Coating	Remarks
Hitachi	M41KVZ680X72(UQ)	897 250144CA	Multi	
	M41KVZ680X72(Q)	BH03-10003A	Silica	
SDD	M41KUK36X01(A)	897 250183AA	Multi	
	M41KUK36X01(E)	BH03-10001A	Silica	
Matsushita	M41KXH100X06	897 250171AA	Multi	
Mitsubishi	AF17RSLB22-K-TC901		Multi	

(2) Material List for Crt Vendors

Vender Loc No.	Hitachi	SDD	Matsushita	Remarks
D-Coil	82T, 9 45ohm (925 460193CA)	←	102T, 12.6ohm (BH27-10005A)	
T504	100/650T (923 460167GA)	100/600T (923 460167HA)	100/850T (BH26-30018A)	Focus
T503	FSW17A002 (923 460167BA)	←	FSW17A002 A (BH27-10003A)	FBT
R616	R-FUSIBLE 3W 1.8 (911 811807LA)	←	FUSIBLE 3W 2.2 (2008-00002)	Heater Resistor
R527	R-CF 1/6W 180K (911 161807YA)	R-CF 1/6W 220K (911 162207YA)	R-CF 1/6W 180K (911 161007YA)	V-Focus
C428	C-MPP 250V 104J (916 656100QJAL)	←	C-MPP 250V 274J (916 656270QJAL)	H-Linearity
R215	R-CF 1/6W 3.9K (911 143907YA)	←	R-CF 1/6W 2.2K (911 142207YA)	V-Size
SK501	SPARK GAP 300V (04569-002-210)	←	SPARK GAP 1KV (04569-001-110)	
SK502	SPARK GAP 300V (04569-002-210)	←	—	

3 . Sync Master 15GLi

L-NO	PHILIPS	TOSHIBA	SDD	REMARKS
CRT	M36EDR320X	M36KUT23XX01	M36KUK35X02	
R184	R-CAR, 1/6W 100K 911 161007YA	R-CAR, 1/6W 75K 911 157507YA	R-CAR, 1/6W 100K 911 161007YA	SCREEN VOLTAGE CONTROL
R207	R-CAR, 1/6W 9.1K 911 149107YA	R-CAR, 1/6W 4.7K 911 144707YA	SAME AS LEFT	H-SIZE CONTROL
R209	R-CAR, 1/6W 10K 911 151007YA	R-CAR, 1/6W 15K 911 151507YA	SAME AS LEFT	V-SIZE CONTROL
R307	R-CAR, 1/2W 470 911 134707FF	R-CAR, 1/2W 470 911 134707FF	R-CAR, 1/2W 330 911 133307FF	VERTICAL RASTER WIDEN
R310	R-M, OXIDE 2W 1 911 311007JF	R-M, OXIDE 2W 1 911 311007JF	R-M, OXIDE 2W 1 911 311007JF	V-SIZE CONTROL
R414	R-M, F 1/4W 22K 911 452205DA	R-M, F1/4W 24K 911 452405DA	SAME AS LEFT	H-SIZE CONTROL
R422	R-M, OXIDE 2W 1.2 911 311207JF	R-M, OXIDE 2W 1.5 911 311507JF	R-M, OXIDE 2W 1.5 911 311507JF	CORRECTING FAULTY RASTER
R444	R-M, OXIDE 2W 1.5 911 311507JF	R-M, OXIDE 2W 1.5 911 311507JF	R-M, OXIDE 2W 1.5 911 311507JF	CORRECTING FAULTY RASTER
R461	R-M, OXIDE 3W 1.5 911 311507LFXA	R-M, OXIDE 3W 1.2 911 311207LF	SAME AS LEFT	HORIZONTAL OUTPUT
R463	R-CAR, 1/6W 15K 911 151507YA	R-CAR, 1/6W 10K 911 151007YA	R-CAR, 1/6W 15K 911 151507YA	PIN, G/D RANGE
R472	R-M, OXIDE 2W 180 911 331807JF	R-M, OXIDE 2W 180 911 331807JF	R-M, OXIDE 2W 75 911 327507JA	RINGING
R630	R-M, OXIDE 3W 3.9 911 313907LF	R-M, OXIDE 3W 3.9 911 313907LF	R-M, OXIDE 3W 1.5 911 311507LFXA	HEATER CURRENT
R631	R-M, OXIDE 2W 2.7 911 312707JF	R-M, OXIDE 2W 2.7 911 312707JF	R-M, OXIDE 2W 2.7 911 311507JF	HEATER CURRENT
D428	×	×	RGP02-12 02169-206-297	RINGING
JP25	JUMPER	R-CAR, 1/6W 27K 911 152707YA	JUMPER	VOLTAGE CONTROL
C419	C-POLY, 100V 102-J 916 164100LJAH	C-POLY, 100V 182-J 916 164180LJAH	C-POLY, 100V 182-J 916 164180LJAH	CORRECTING FAULTY RASTER
C461	C-MPP 1.6KV 552-J 916 944550YJAX	C-MPP 1.6KV 552-J 916 944550YJAX	C-MPP 1.6KV 502-J 916 354560YJAX	HORIZONTAL RETRACE TIME
C466	C-MPP 400V 184-J 916 656180TJAX	C-MPP 400V 184-J 916 656180TJAX	C-MPP 400V 184-J 916 656180TJAX	S-CORRECTION
C467	C-MPP 250V 564-J 916 656560QJAX	C-MPP 250V 564-J 916 656560QJAX	C-MPP 250V 564-J 916 656560QJAX	S-CORRECTION

PARTS LIST FOR DIFFERENT CRT TYPES

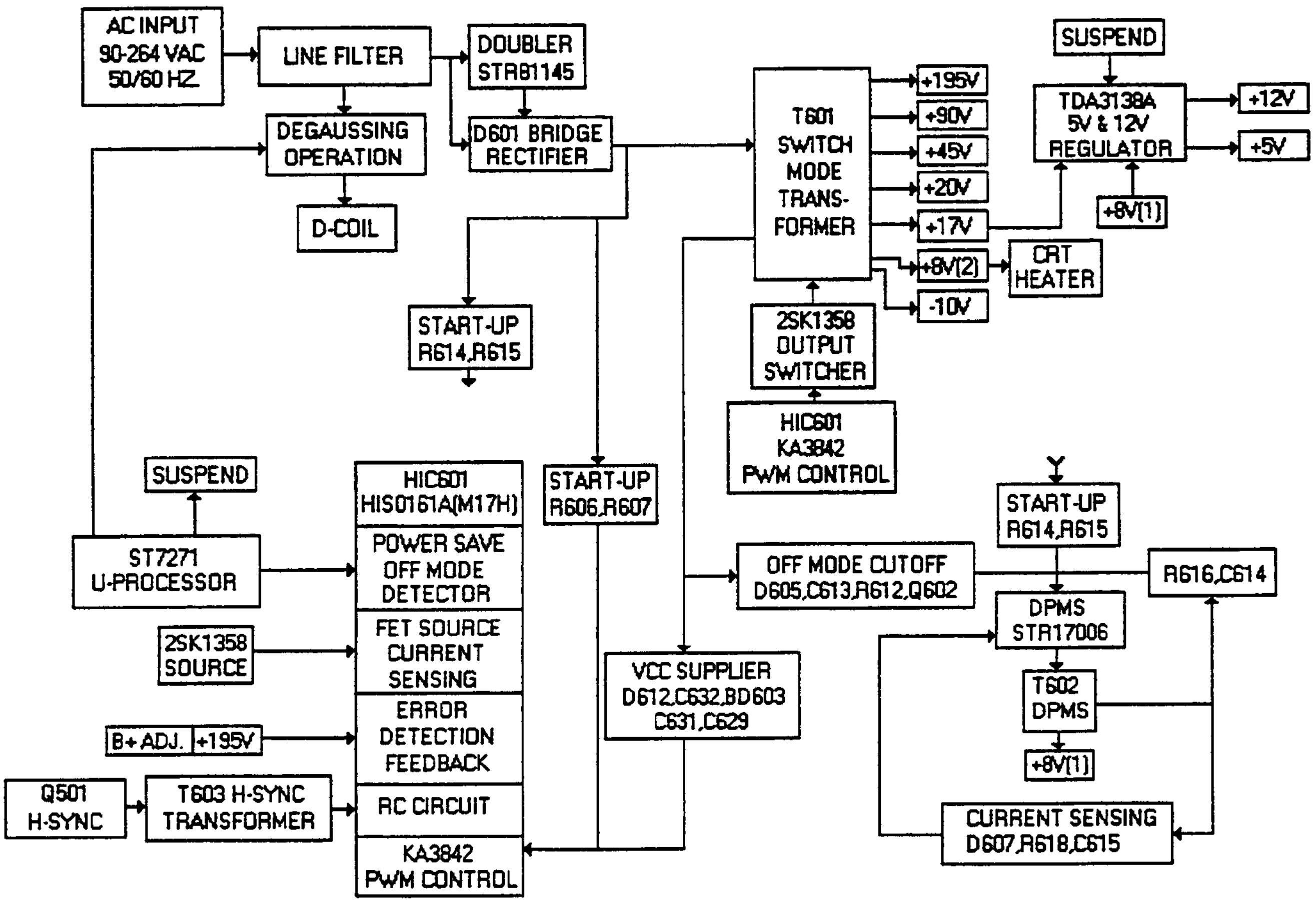
L-NO	PHILIPS	TOSHIBA	SDD	REMARKS
L403	COIL-CHOKE, 57uH 925 460191FA	COIL-CHOKE, 100uH 925 460192BA	SAFE AS LEFT	H-SIZE GD IMPROVED
L407	H-LIN, COIL, 4, 9uH 923 460191EA	H-LIN, COIL, 4, 9uH 923 460191EA	H-LIN, COIL, 4, 7uH BH26-30027A	LINEARITY IMPROVED(NEW)
T403	H-PULSE, TRANS,1,0 923 460169DA	H-PULSE, TRANS,1,5 BH26-30023A	H-PULSE, TRANS,1,5 BH26-30023A	**TRANSMITTING**
R102	R-CAR, 1/6W 470 911 134707YA	R-CAR, 1/6W 470 911 134707YA	R-CAR, 1/6W 470 911 134707YA	**CONTRAST**
C100	×	×	×	CLAMP
C218	C-CER 50V 102-K 915 324100HKPH	C-CER 50V 102-K 915 324100HKPH	C-CER 50V 102-K 915 324100HKPH	CLAMP
Q101	TR-NPN, 2N3904 891 323904XANC	TR-NPN, 2N3904 891 323904XANC	TR-NPN, 2N3904 891 323904XANC	CLAMP
R459	R-M, OXIDE 3W 390 911 333907LF	R-M, OXIDE 3W 390 911 333907LF	R-M, OXIDE 3W 390 911 333907LF	HORIZONTAL CHANGE
JP180	×	×	×	HORIZONTAL CHANGE
T402	R-M, OXIDE 3W 390 923 460169HA	FBT, FSA-15A003 923 460169HA	FBT, FSA-15A003 923 460169HA	NEW
R701	×	×	×	FOCUS MODULE
C701	×	×	×	FOCUS MODULE
C702	×	×	×	FOCUS MODULE
T701	×	×	×	FOCUS MODULE (NEW)
CN701	×	×	×	FOCUS MODULE (NEW)
CF701	×	×	×	FOCUS MODULE (NEW)
CRT-GND				NEW
R210	R-CF 1/6T 20K	R-CF 1/6T 20K	R-CF 1/6T 20K	

4. Sync Master 15GLe

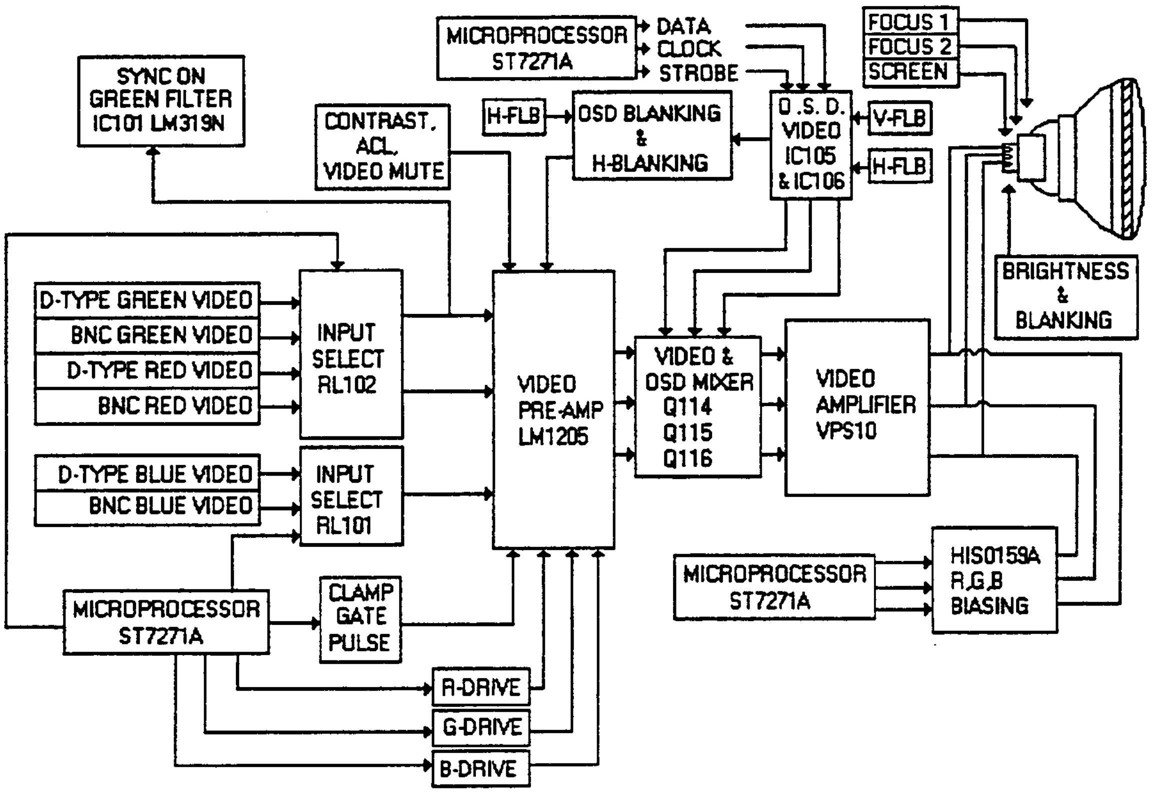
LOC NO	PHILIPS CRT (CODE:897 250089AA) (TYPE:M36DER320X131)	TOSHIBA(松下 DY) (CODE:897 250197AA) (TYPE:M36KUT23XX01)	SDD CRT(SEMCO DY) (CODE:BH03-10004A) (TYPE:M36KUK35X02)	REMARK
C462	C-PPF 1.6K 6000pF 916 454600YJAX	C-PPF 1.6K 6300pF 916 944630YJAX	C-PPF 1.6K 6000pF 916 354600YJAX	**MANUAL INSERTION**
C462	C-MPP 250V 0.25uF 916 656520QJAL	C-MPP 250V 0.25uF 916 656250QJAL	C-MPP 250V 0.27uF 916 656270QJAL	AUTO INSERTION
C463	C-MPP 250V 0.22uF 916 656220QJALF	C-MPP 250V 0.22uF 916 656220QJALF	C-MPP 250V 0.27uF 916 656270QJALF	AUTO INSERTION
L407	H-LINERITY COIL 925 460192(18.5T)	H-LINERITY COIL 925 460191(20.5T)	H-LINERITY COIL BH27-20016A(21.5T)	APPLIED FROM JULY
L403	COIL-CHOKE;150uH 925 460191BA	COIL-CHOKE;150uH 925 460191BA	COIL-CHOKE;120uH BH27-20008A	MANUAL INSERTION
R302	R-CF 1/6W 18KΩ 911 1515807YA	R-CF 1/6W 47Ω 911 124707YA	R-CF 1/6W 47Ω 911 124707YA	AUTO INSERTION
R463	R-CF 1/6W 33KΩ 911 153307YA	R-MF 1/6W 18KΩ 911 151807YA	R-CF 1/6W 27KΩ 911 152707YA	AUTO INSERTION
R438	R-MF 1/4W 4.7KΩ 911 444705DA	R-MF 1/4W 6.19KΩ 911 4416195DA	R-MF 1/4W 6.19KΩ 911 446195DA	AUTO INSERTION
R465	R-CF 1/6W 150KΩ 911 161507YA	R-CF 1/6W 120KΩ 911 161207YA	R-CF 1/6W 120KΩ 911 161207AY	AUTO INSERTION
R609	R-WW 1W 0.18Ω 911 601807GV	R-WW 2W 0.22Ω 911 602205JV	R-WW 2W 0.22Ω 911 602205JV	AUTO INSERTION
R630	R-MO 2W 2.7Ω 911 312707JF	R-MO 2W 2.7Ω 911 312707JF	JUMPER WIRE 955 005001AAAA	AUTO INSERTION
R210	R-CF 1/6W 91KΩ 911 151807YA	R-CF 1/6W 20KΩ 911 152007YA	R-CF 1/6W 33KΩ 911 153307YA	AUTO INSERTION
R462	R-CF 1/6W 18KΩ 911 151807AY	R-CF 1/6W 15KΩ 911 151507YA	R-CF 1/6W 15KΩ 911 151507YA	AUTO INSERTION
R308	....	....	R-CF 1/2W 1KΩ 911 141007FF	AUTO INSERTION
LABEL	PHILIPS ASSYLABEL BH68-20003A	TOSHIBA ASSY LABEL BH68-20003A	SDD용 ASSY LABEL BH68-2000	

SAMSUNG ELECTRONICS

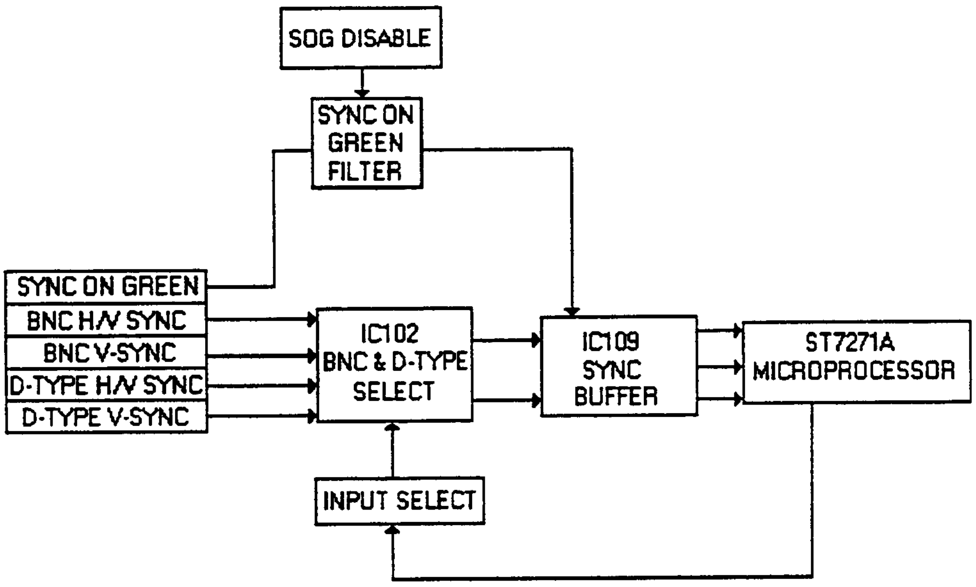
Block Diagrams



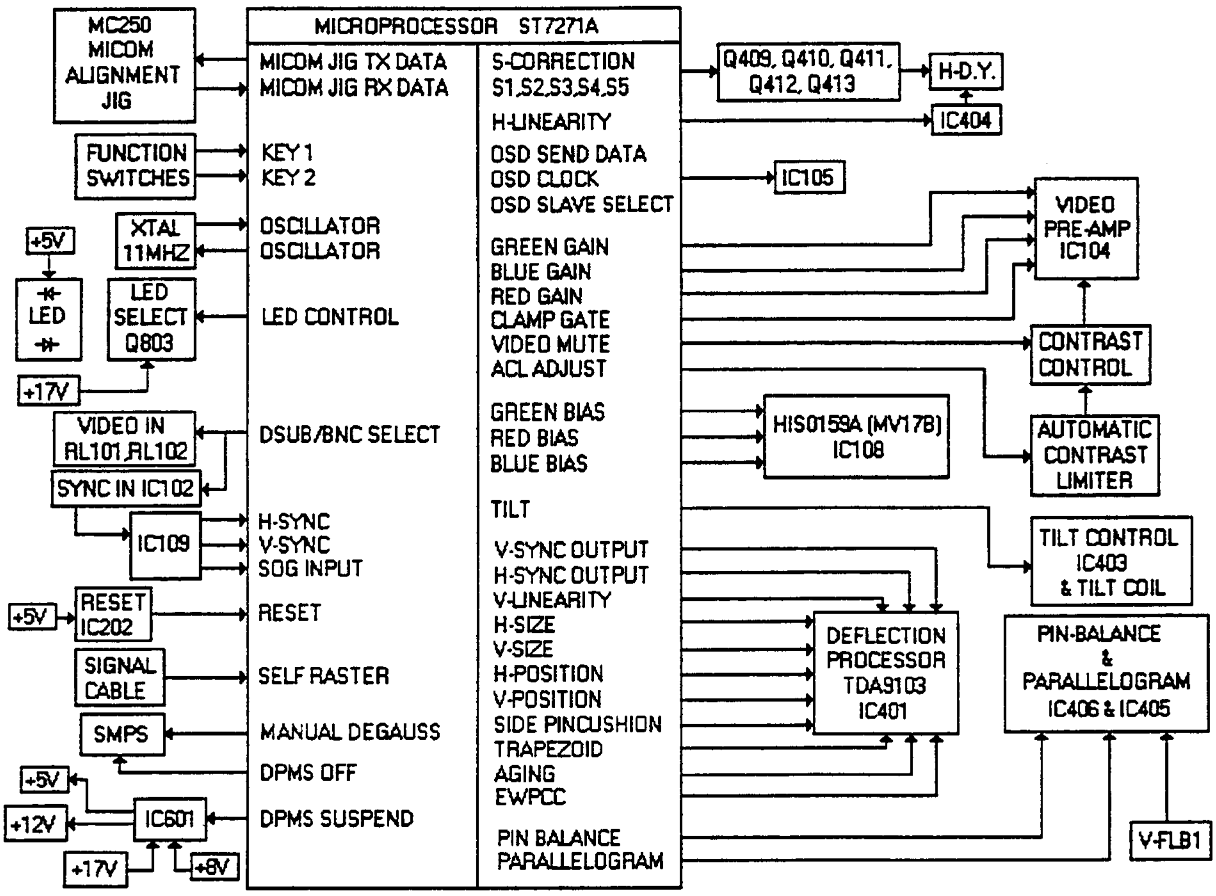
SMPS Block Diagram



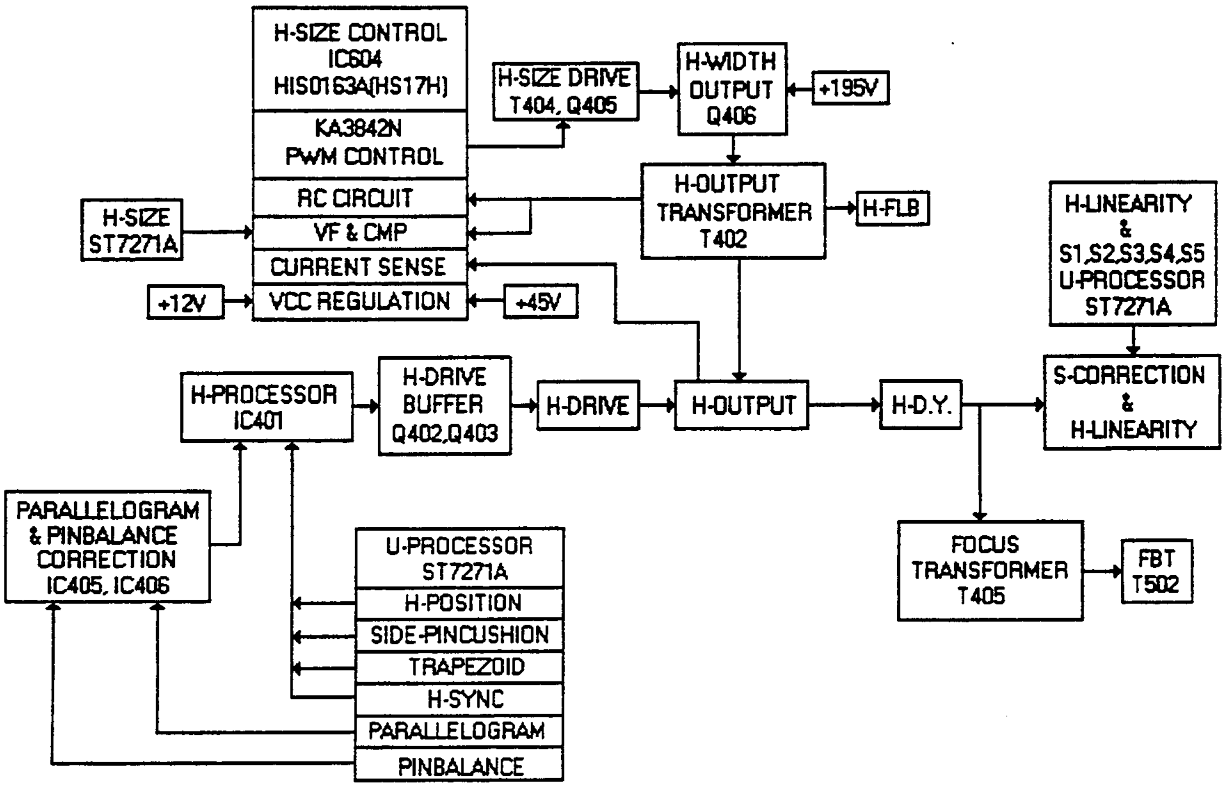
Video Block Diagram



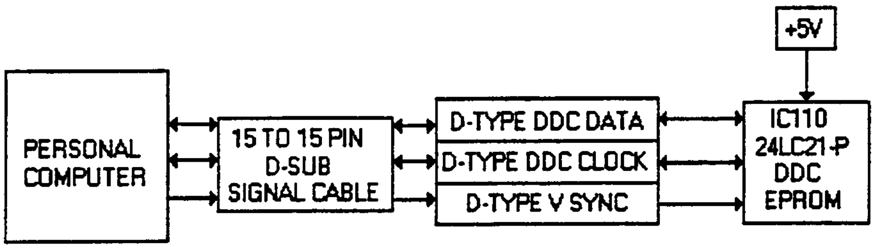
Sync Interface Block Diagram



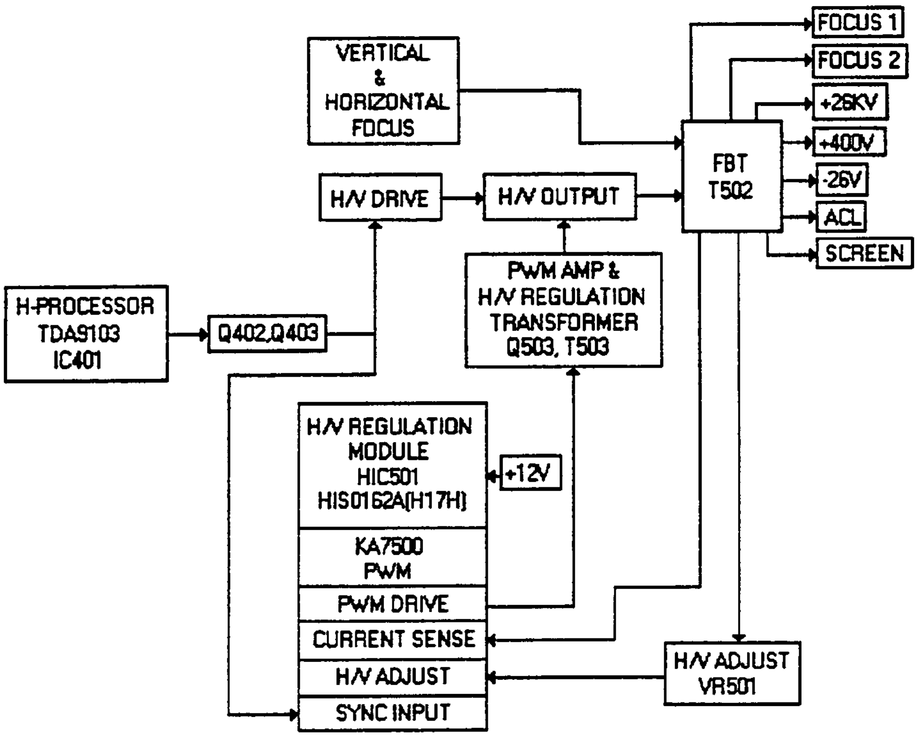
Microprocessor Block Diagram



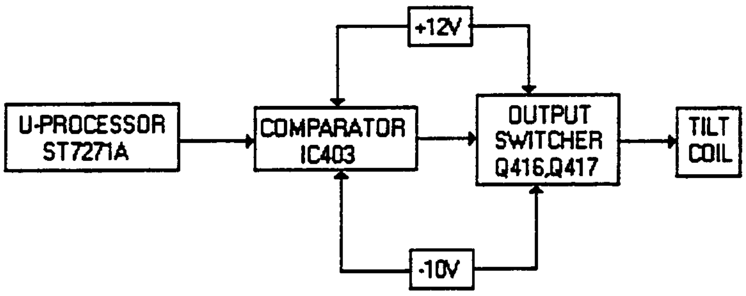
Horizontal Deflection Block Diagram



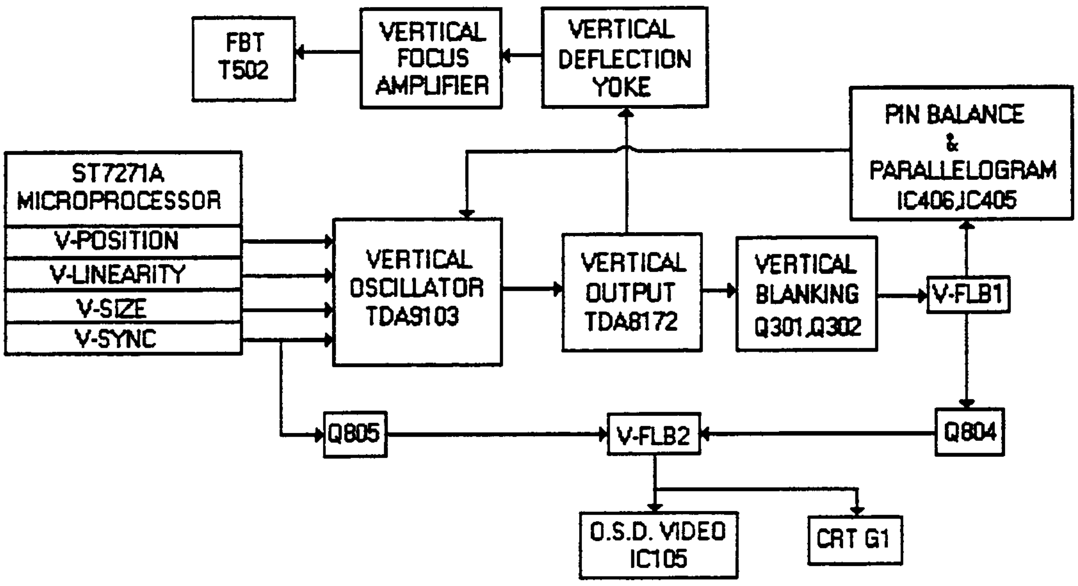
Display Data Channel Block Diagram



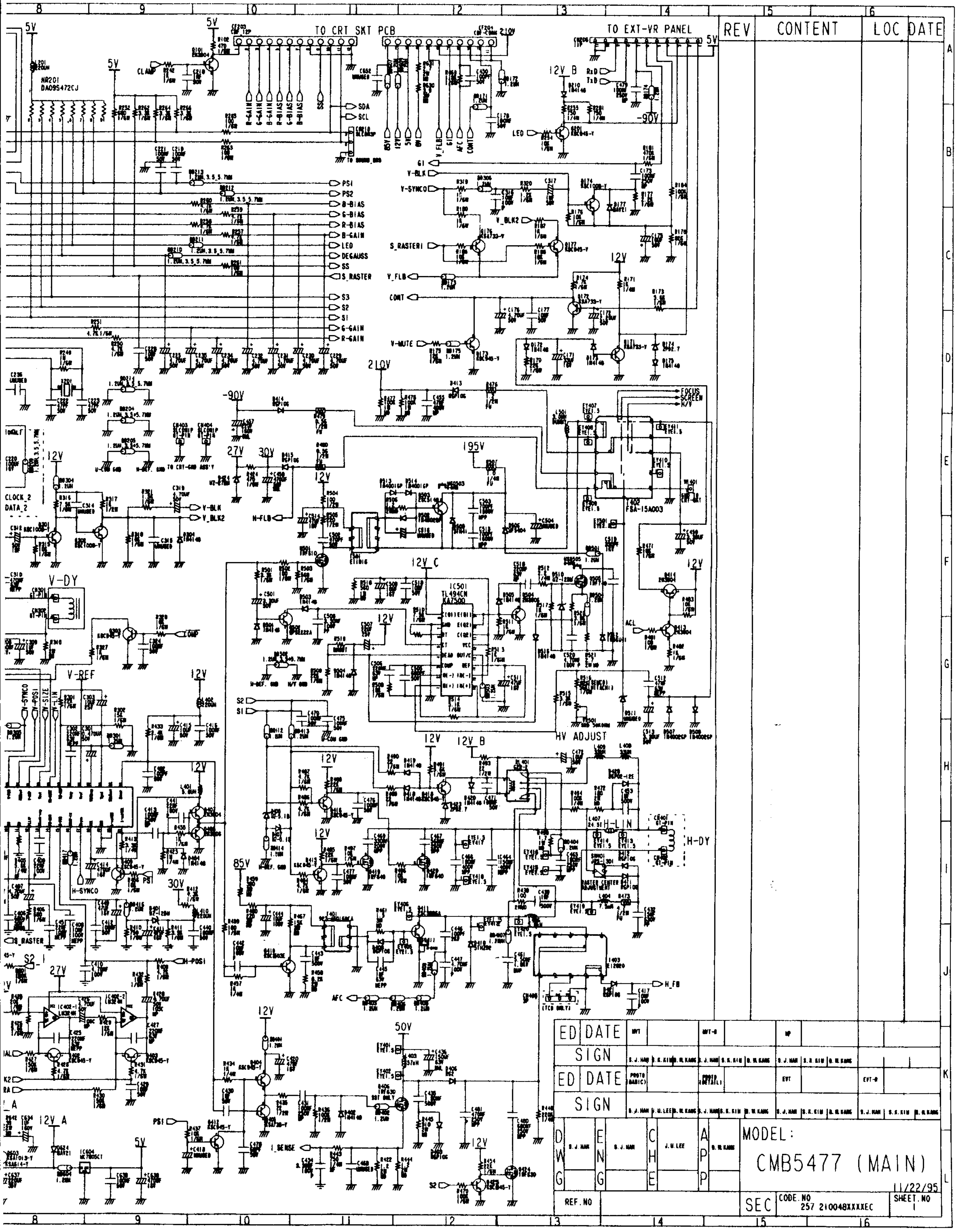
High Voltage Block Diagram



Tilt Block Diagram



Vertical Deflection Block Diagram


TO CRT SKT PCB
TO EXT-VR PANEL
REV
CONTENT
LOC
DATE
V-DY
V-REF
H-LIN
H-DY
HV ADJUST
IC501 TL494CN KA7500
T402 FBA-15A003
SDA
SCL
PS1
PS2
B-BIAS
G-BIAS
R-BIAS
B-GAIN
LED
DEGAUSS
SS
S_RASTER
S3
S2
S1
G-GAIN
R-GAIN
G1
V-BLK
V-SYNCO
V_BLK2
S_RASTER1
V_FLB
CONT
V-MUTE
FOCUS
SCREEN
H/V
RxD
TxD
CLAMP
CLOCK_2
DATA_2
H-SYNCO
H-POSI
AFC
H_FB
I_SENSE
5V
12V
12V_B
12V_C
12V_A
-90V
27V
30V
85V
195V
210V
50V
ED
DATE
MVT
MVT-B
MP
SIGN
S. J. HAN
S. K. KIM
D. W. KANG
PROTO (BASIC)
PROTO (DETAIL)
EVT
EVT-B
S. J. HAN
J. U. LEE
D. W. KANG
DWG
S. J. HAN
ENG
S. J. HAN
CHE
J. U. LEE
APP
D. W. KANG
MODEL:
CMB5477 (MAIN)
11/22/95
REF. NO
SEC
CODE. NO
257 210048XXXXEC
SHEET. NO
1

SCHEMATIC DIAGRAM

MODEL NO CMB5477(MAIN)
CHASSIS NO: MB Chassis

CAUTION

1. THE SHADED AREAS AND MARKS IN THE SCHEMATIC DIAGRAM AND THE PARTS LIST DESIGNATE COMPONENTS WHICH HAVE SPECIAL CHARACTERISTICS IMPORTANT FOR SAFETY AND SHOULD BE REPLACED ONLY WITH TYPES IDENTICAL TO THOSE IN THE ORIGINAL CIRCUIT OR SPECIFIED IN THE PARTS LIST. BEFORE REPLACING ANY OF THESE COMPONENTS, READ CAREFULLY THE "PRODUCT SAFETY NOTICE"
2. DURING A NUMEROUS MEASUREMENT OF THIS MONITOR MATTERS THAT DEMAND SPECIAL ATTENTION IS FOLLOWING.
   1) DO NOT USE YOUR INSTRUMENT BETWEEN PRIMARY GROUND (SYMBOL ⏚) AND SECONDARY CIRCUIT
   2) DO NOT USE YOUR INSTRUMENT BETWEEN SECONDARY GROUND (SYMBOL ⏚) AND PRIMARY CIRCUIT
3. THE SHADED AREAS IS A PRIMARY SECTION (HOT PART)

AVERTISSMENT:

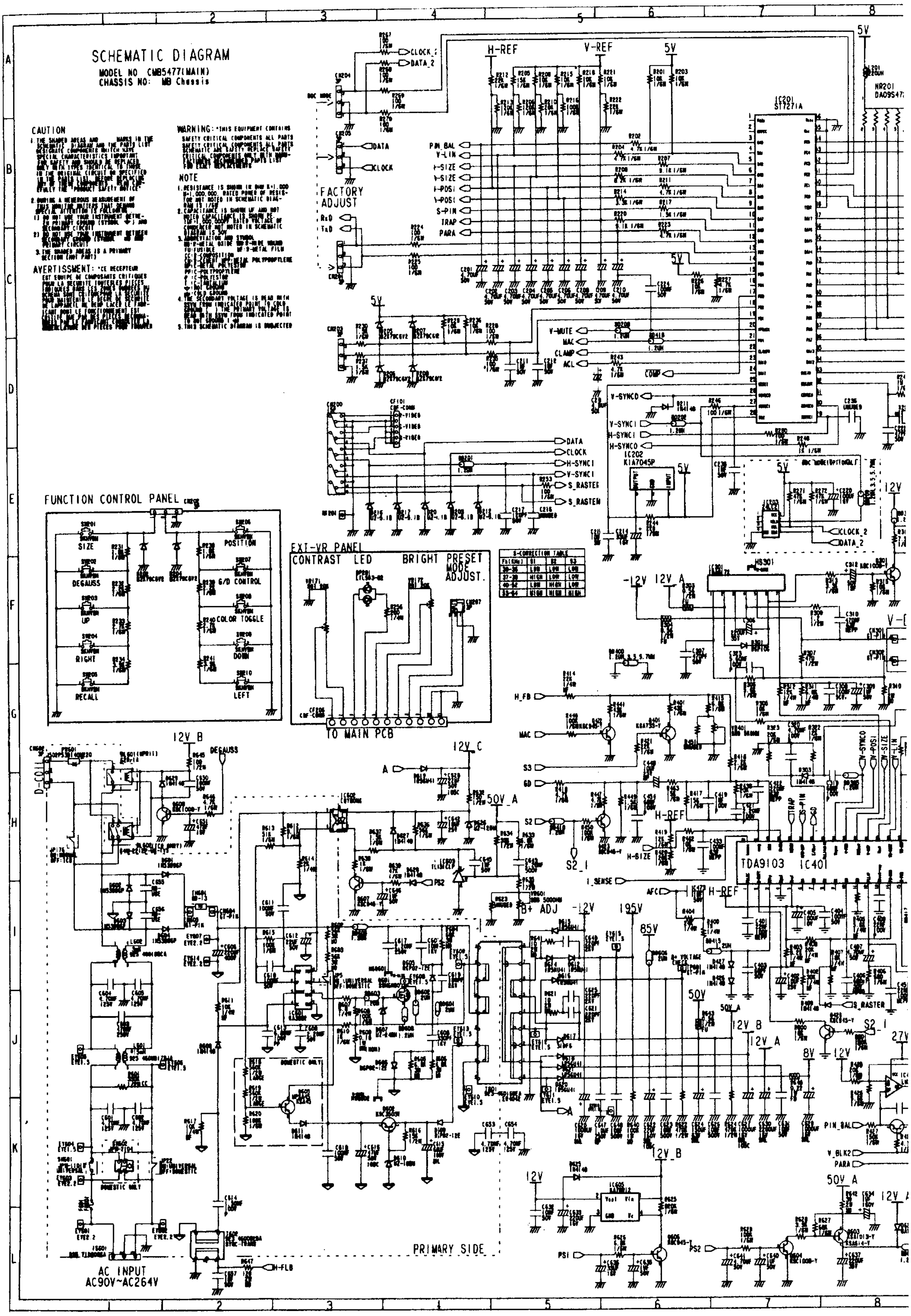
"CE RECEPTEUR EST EQUIPE DE COMPOSANTS CRITIQUES POUR LA SECURITE TOUTES LES PIECES INDIQUEES DANS LES ZONES OMBREES DU SCHEMA SONT CRITIQUES POUR LA SECURITE. POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LE FABRICANT DONT LE FONCTIONNEMENT EST CRITIQUE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT [illegible] PIECES POUR [illegible]

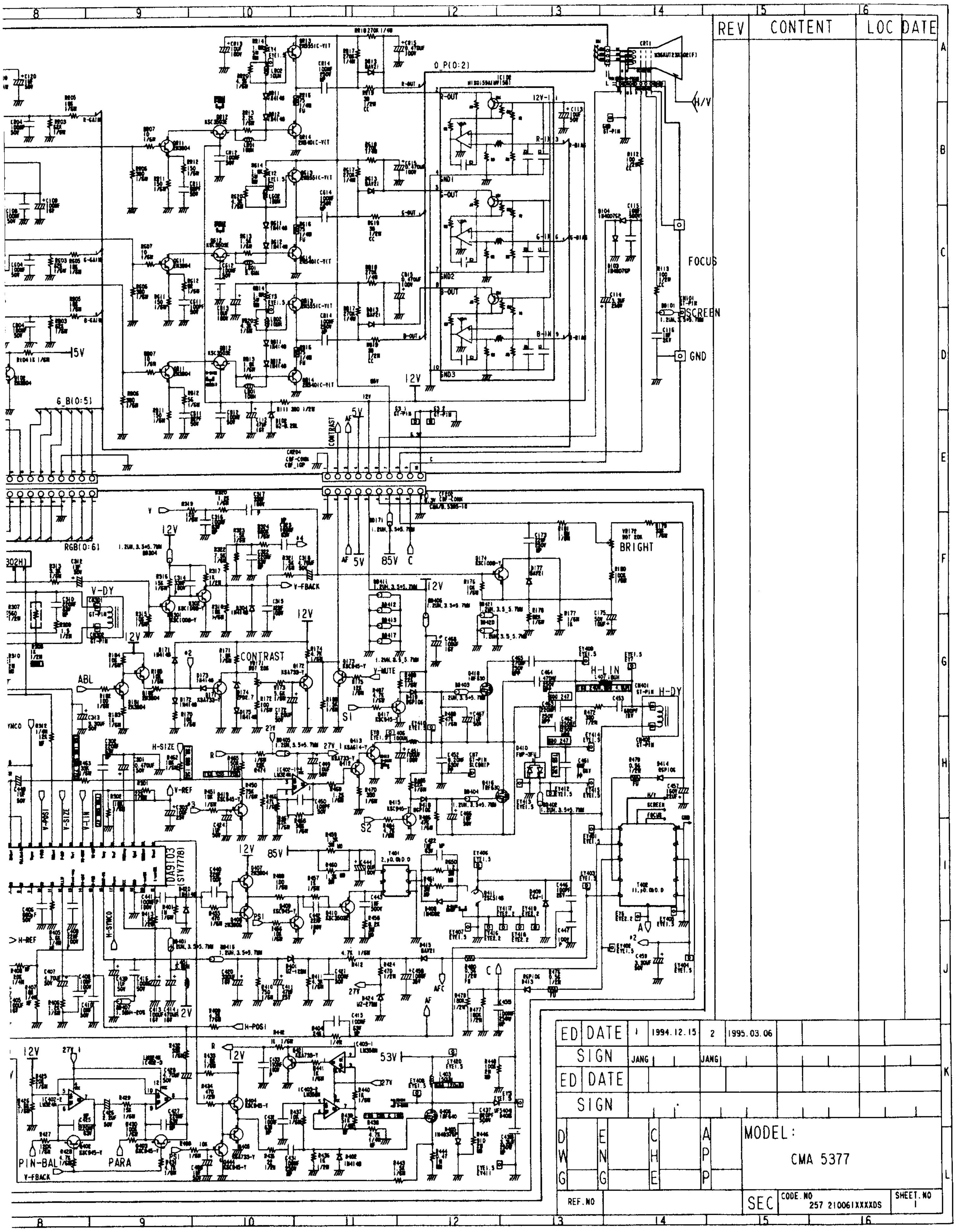
WARNING:

"THIS EQUIPMENT CONTAINS SAFETY CRITICAL COMPONENTS ALL PARTS SAFETY CRITICAL COMPONENTS ALL PARTS SCHEMATIC ARE SAFETY REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURERS RECOMMENDED PARTS LIST FOR EXACT REPLACEMENTS

NOTE

1. RESISTANCE IS SHOWN IN OHM K=1,000 M=1,000,000. RATED POWER OF RESISTOR NOT NOTED IN SCHEMATIC DIAGRAM IS 1/6W
2. CAPACITANCE IS SHOWN UF AND NOT NOTED CAPACITANCE IS SHOWN PF. 1UF=1,000,000PF RATED VOLTAGE OF CONDENSER NOT NOTED IN SCHEMATIC DIAGRAM IS 50V
3. ABBREVIATION AND SYMBOL
   MO:R-METAL OXIDE WW:R-WIRE WOUND
   FU:FUSIBLE MF:R-METAL FILM
   CC:R-COMPOSITION
   [illegible] METAL POLYPROPYLENE
   MP:C-METAL POLYESTER
   PP:C-POLYPROPYLENE
   P :C-POLYESTER
   T :C-TANTALUM
   ⏚:HOT GROUND
   ⏚:COLD GROUND
4. THE SECONDARY VOLTAGE IS READ WITH DVM FROM INDICATED POINT TO COLD GROUND ( ). THE PRIMARY VOLTAGE IS READ WITH DVM FROM INDICATED POINT TO HOT GROUND (⏚)
5. THIS SCHEMATIC DIAGRAM IS SUBJECTED





REV	CONTENT	LOC	DATE

ED	DATE	1	1994.12.15	2	1995.03.06
	SIGN	JANG		JANG	
ED	DATE				
	SIGN				

DWG ENG CHE APP

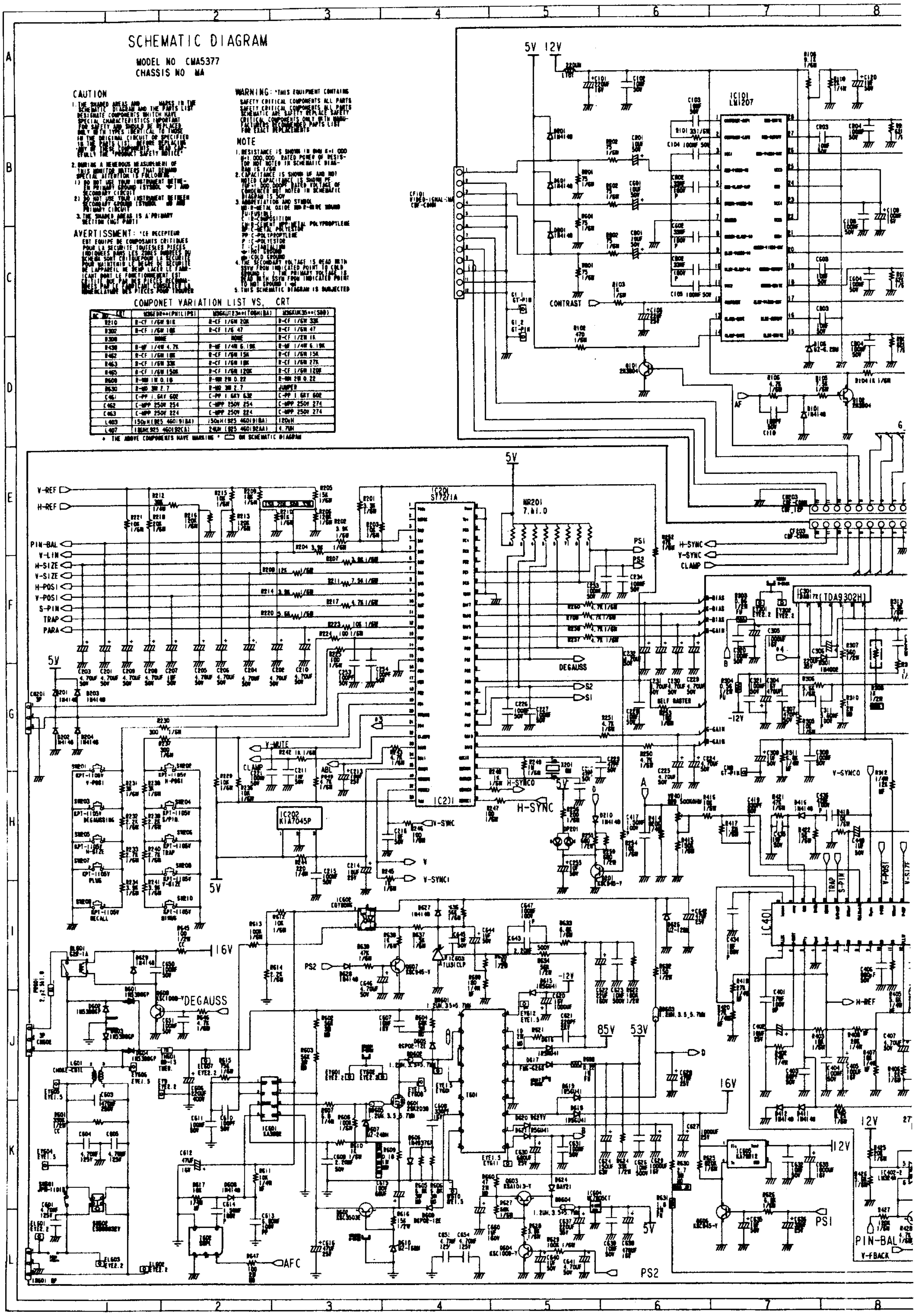
MODEL :

CMA 5377

REF.NO

SEC CODE.NO 257 21006IXXXXDS

SHEET.NO 1



SCHEMATIC DIAGRAM

MODEL NO CMA5377
CHASSIS NO MA

CAUTION

1. THE SHADED AREAS AND MARKS IN THE SCHEMATIC DIAGRAM AND THE PARTS LIST DESIGNATE COMPONENTS WHITCH HAVE SPECIAL CHARACTERISTICS IMPORTANT FOR SAFETY AND SHOULD BE REPLACED ONLY WITH TYPES IDENTICAL TO THOSE IN THE ORIGINAL CIRCUIT OR SPECIFIED IN THE PARTS LIST. BEFORE REPLACING ANY OF THESE COMPONENTS, READ CAREFULLY THE "PRODUCT SAFETY NOTICE"
2. DURING A [illegible] MEASUREMENT OF THIS MONITOR MATTERS THAT DEMAND SPECIAL ATTENTION IS FOLLOWING.
   1) DO NOT USE YOUR INSTRUMENT BETWEEN PRIMARY GROUND (SYMBOL ⏚) AND SECONDARY CIRCUIT
   2) DO NOT USE YOUR INSTRUMENT BETWEEN SECONDARY GROUND (SYMBOL ⏚) AND PRIMARY CIRCUIT
3. THE SHADED AREAS IS A PRIMARY SECTION (HOT PART)

AVERTISSMENT:

"CE RECEPTEUR EST EQUIPE DE COMPOSANTS CRITIQUES POUR LA SECURITE TOUTESLES PIECES INDIQUEES DANS LES ZONES OMBREES DU SCHEMA SONT CRITIQUEPOUR LA SECURITE POUR MAINTENIR LE DEGRE DE SECURITE DE LAPPAREIL NE REMP LACER LE FABRICANT DONT LE FONCTIONNEMENT EST CERTIFIE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT CONSULTER LA NOMENCLATURE DES PIECES POUR TROUVER

WARNING:

"THIS EQUIPMENT CONTAINS SAFETY CRITICAL COMPONENTS ALL PARTS SAFETY CRITICAL COMPONENTS ALL PARTS SCHEMATIC ARE SAFETY REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURERS RECOMMENDED PARTS LIST FOR EXACT REPLACEMENTS

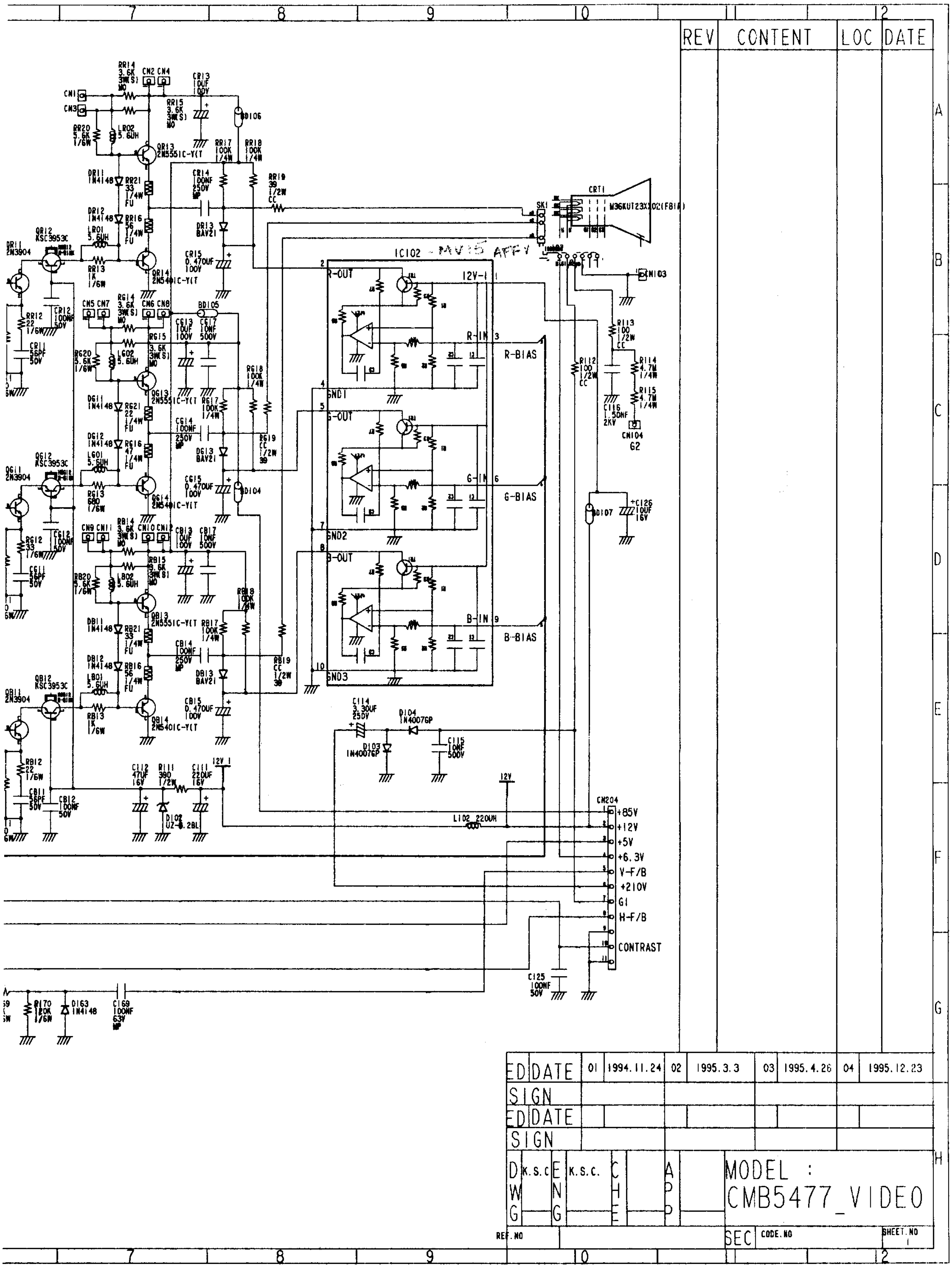
NOTE

1. RESISTANCE IS SHOWN IN OHM K=1,000 M=1,000,000. RATED POWER OF RESISTOR NOT NOTED IN SCHEMATIC DIAGRAM IS 1/6W
2. CAPACITANCE IS SHOWN UF AND NOT NOTED CAPACITANCE IS SHOWN PF. 1UF=1,000,000PF RATED VOLTAGE OF CONDENSER NOT NOTED IN SCHEMATIC DIAGRAM IS 50V
3. ABBREVIATION AND SYMBOL
   - MO: R-METAL OXIDE WW: R-WIRE WOUND
   - FU: FUSIBLE
   - C : R-COMPOSITION
   - CM: R-CEMENT MPP: METAL POLYPROPYLENE
   - MP: C-METAL POLYESTOR
   - PP: C-POLYPROPYLENE
   - P : C-POLYESTOR
   - T : C-TANTALIUM
   - ⏚: HOT GROUND
   - ⏚: COLD GROUND
4. THE SECONDARY VOLTAGE IS READ WITH SSVM FROM INDICATED POINT TO COLD GROUND ( ) THE PRIMARY VOLTAGE IS READ WITH SSVM FROM INDICATED POINT TO HOT GROUND (⏚)
5. THIS SCHEMATIC DIAGRAM IS SUBJECTED

COMPONET VARIATION LIST VS, CRT

RC NO. / CRT	M36EDR**(PHILIPS)	M36KUT23**(TOSHIBA)	M36KUK35**(SDD)
R210	R-CF 1/6W 91K	R-CF 1/6W 20K	R-CF 1/6W 33K
R302	R-CF 1/6W 10K	R-CF 1/6 47	R-CF 1/6W 47
R308	NONE	NONE	R-CF 1/2W 1K
R430	R-MF 1/4W 4.7K	R-MF 1/4W 6.19K	R-MF 1/4W 6.19K
R462	R-CF 1/6W 18K	R-CF 1/6W 15K	R-CF 1/6W 15K
R463	R-CF 1/6W 33K	R-CF 1/6W 18K	R-CF 1/6W 27K
R465	R-CF 1/6W 150K	R-CF 1/6W 120K	R-CF 1/6W 120K
R609	R-WW 1W 0.18	R-WW 2W 0.22	R-WW 2W 0.22
R630	R-MO 3W 2.7	R-MO 3W 2.7	JUMPER
C461	C-PP 1.6KV 602	C-PP 1.6KV 632	C-PP 1.6KV 602
C462	C-MPP 250V 254	C-MPP 250V 254	C-MPP 250V 274
C463	C-MPP 250V 224	C-MPP 250V 224	C-MPP 250V 274
L403	150uH(925 460191BA)	150uH(925 460191BA)	120uH
L407	18UH(925 460192CA)	24UH (925 460192AA)	4.7UH

* THE ABOVE COMPONENTS HAVE MARKING " ▭ " ON SCHEMATIC DIAGRAM



ED	DATE	01	1994.11.24	02	1995.3.3	03	1995.4.26	04	1995.12.23
SIGN									
ED	DATE								
SIGN									

DWG K.S.C ENG K.S.C. CHE APP

MODEL : CMB5477_VIDEO

REF.NO SEC CODE.NO SHEET.NO 1

CMB5477_VIDEO (1995.12.23)