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Raster Manipulation Unit

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c 1980

Raster Manipulation Unit

Sherry Miller Hocking, with Richard Brewster and Walter Wright 1978-1980

Description

A raster manipulation unit or 'wobbulator' is a prepared television which permits a wide variety of treatments to be performed on video images; this is accomplished by the addition of extra yokes to a conventional black and white receiver and by the application of signals derived from audio or function generators on the yokes. The unit is a receiver modified for monitor capability; all of the distortions can thus be performed either on broadcast signals or, when the unit is used as a monitor, on images from a live or prerecorded source. Although the image manipulations cannot be recorded directly, they can be recorded by using an optical interface. The patterns displayed on the unit are rescanned; a camera is pointed directly at the picture tube surface and scans the display. The video signal from this rescan camera is then input to a videotape recorder for immediate recording or to a processing system for further image treatment. The notion of prepared television has been investigated by a number of video artists and engineers; this particular set of modifications was popularized by Nan June Paik.

The distortions performed on the image result from the actions of audio signals on the yokes. Audio signals which are periodic and regular, such as sine or square waves, are normally used when treating a video image; these signals are derived from an audio or function generator. However, any audio signal source may be employed; these devices include audio synthesizers as well as more conventional components such as audio tape recorders, tuners, microphones or phonographs. These types of signals are most evident visually when used in conjunction with the horizontal or vertical collapse functions which reduce the raster to a horizontal or vertical line. These audio signals cause the line to distort in direct correspondence with changes in the audio signal; often the frequencies present in this type of signal are such that the distortions produced by their actions on a complete image are not very noticeable.

The unit is also capable of reversing the raster around the vertical or horizontal axis, producing images which are reversed left to right or top to bottom in orientation. The raster reversal in combination with audio treatments generate an almost endless series of patterns which are highly controllable. The unit can be used as a normal receiver or monitor end has raster reversal and collapse capabilities with image manipulation functions. It can be utilized in a single camera system or a multiple camera system with or without additional components such as keyers to produce greater versatility in the creation of images.

System Configuration

The complete raster manipulation unit contains a modified receiver/monitor with raster reversal and collapse functions, one stereo and one mono amplifier and three audio generators.

The normal small yoke on the receiver is an electromagnet; when an electrical current is passed through the small yoke on the receiver it generates a magnetic field which deflects the electron beam in the CRT in a regular pattern of horizontal lines called the raster. The scanning process has both horizontal and vertical components. The yoke wires have been extended to two three-position switches. When the raster reversal switches are in the normal position a raster with the customary left to right and top to bottom orientation is achieved. By reversing the direction of the electric current through this small yoke on the receiver the raster is reversed in either its top-bottom or left-right orientation or both simultaneously. This occurs when the switches are in the reverse positions. The normal scanning operation is actually reversed in orientation; the electron beam in the horizontal scanning process is deflected from right to left rather than left to right, while in the vertical scanning process the beam is deflected from bottom to top rather than top to bottom. When both switches are in reverse positions, the beam is deflected bottom to top and right to left simultaneously.

By removing the electric current from either the horizontal or vertical deflection systems of the stall yoke, one horizontal or vertical line is produced. If the current is removed from the horizontal scanning operation, one vertical line is produced. This indicates that the electron beam is not moving to the left or right but is only being drawn downward on the CRT, producing a vertical line.

If current is removed from the vertical operation, one horizontal line is obtained because the electron beam is scanning to the left and right but it is not being drawn downward. When no current is passed to either the horizontal or vertical systems the electron beam is not moving either horizontally or vertically, and one point is produced. It is important to note that when the raster is collapsed to a point or line, the contrast and brightness controls on the receiver/monitor should be turned down to prevent permanent burning of the CRT.

Two other yokes have been added to the unit, one color yoke and one continuous wind yoke. If a continuous current is passed through the horizontal portion of this large color yoke, the effect of both large and small yokes is combined; the raster is shifted horizontally either to the left or right depending upon the direction of the current. If the continuous current is passed through the vertical component of the color yoke, the effect of both large and small yokes is combined to shift the raster in a vertical direction either up or down. The effect of the continuous wind yoke which was added to the receiver/monitor produces an 'S carve' distortion of the raster.

The purpose of the audio amplifier in the system is to drive the yokes of the receiver/monitor. Because the yokes are electromagnets, they react to the audio amplifier in much the same manner that a sound speaker responds; the yokes are driven with the audio amplifier. A mono amplifier is a single channel device which accepts an audio signal as an input and amplifies or increases the signal; a stereo amplifier amplifies two separate sound inputs.

The audio generators provide audio signals to the mono and stereo amps in much the same way that a tuner or turntable provides a source of periodic or continuously repeated, regular waveforms. They are normally used when distorting a full raster. Frequencies which are multiples of the vertical sync rate of 60 Hz produce the most obvious and symmetrical distortions; examples of such frequencies include 60 Hz which is the vertical sync rate multiplied by 1, 30 Hz which is one half the vertical rate or 60 Hz x .5 and 90 Hz or 60 Hz x 1.5. This range of frequencies is usually found on audio generators. It is possible to use an audio tape recorder, tuner or phonograph as a source for audio signals rather than an audio generator; in this instance the signals which will distort the raster are not necessarily periodic and may contain a wide range of frequencies, same of which may have little or no visible effects on the raster. These non-periodic waveform sources produce more evident distortions if the raster is collapsed first to a horizontal or vertical line. In this case the line will visibly respond to most of the frequencies found in signals derived from audio tape decks, microphones, tuners or phonographs. The lines also respond to audio signals originating in the audio generators. The notions of these lines caused by these types of audio signals have been referred to as 'dancing patterns' by fan June Paik.

All electrical signals have a waveform, indicating changes in voltage measured through time. Some signals have a periodic or repeating, regular waveform while others produce random or non-periodic waveforms An oscillator is a device which produces a regular and periodic waveform; for example, an oscillator may produce a sine, square or triangle wave. A waveform generator usually puts out one defined waveform; an example is a square wave generator. These devices are frequently used for test purposes in the electronics field. An audio or function generator may permit selection of one of several waveforms, for example sine, square and triangle. These devices may also offer control over the frequency or amplitude or they may be capable of locking to an external signal. These devices are available commercially or in kit form. Oscillators may also be constructed from discrete components. Any of these devices may be utilized with the raster manipulation unit, but it is desirable to have at least two different waveforms available.

An oscilloscope is a device which visually displays the waveforms as a change in voltage through time; the shape is diagrammed with the X or horizontal axis representing time and the Y or vertical axis representing changes in voltage. The term periodic refers to a waveform wherein a regular, repeating pattern is observable as the voltage changes through time; sine, square and triangle are all files of periodic waveforms. Figure 1 indicates the shapes of different waveforms.

A waveform may begin at any point but when it returns to the point of origination the waveform has completed one cycle. Cycle refers to the completion of one rise, fall and return of the signal. It is important to note that the waveform may pass through the particular voltage at which it began a number of times before one cycle is completed. For example, in Figure 2 the sine wave begins at voltage = 0 and passes through this point value exactly half way through one cycle before ending at this point one second after beginning. The time in which it takes for one waveform to be completed is referred to as the period of the waveform. The number of times this waveform is repeated in one second is called the frequency of the waveform; frequency refers to the speed of the signal. The umber of cycles the signal completes in one second is measured in cycles per seconds expressed as Hertz or Hz. Figure 3 illustrates this. The range of human hearing is between 15 Hz and 20,000 Hz or 20 KHz; frequencies below 15 Hz are subsonic while those above 20 KHz are ultrasonic. Audio generators commonly put out a range of 310-30,000 Hz approximately those frequencies within the range of human hearing. The amplitude of the signal refers to the peak voltage which the signal attains. It refers to the strength of the signal and is measured by the height of the waveform expressed in volts.

The waveform may consist of a positive and negative voltage dimension; the total voltage of the signal, obtained by the addition of positive and negative extremes is referred to as peak-to-peak voltage and abbreviated Ppv. Figure 2 indicates these components of a waveform. The tern phase refers to the relative timing of one signal in relation to another; if one signal is 'in phase' with another they both possess identical timing and have began at the same instant. Figure 4 shows this relationship. A waveform say also be amplitude and frequency modulated. In amplitude modulation, the amplitude of the signal which comes out of the function or audio generator is determined by the amplitude of a second signal which is fed into the function generator; in this case the frequency of the output remains the same as the normal output. In frequency modulation, the amplitude of the output signal remains the same as the normal output signal but the frequency of the output signal is determined by the frequency of a second signal which is fed into the function generator. Figure 5 diagrams these processes.

A sine wave is a plot of the trigonometric function and is the most basic of waveforms; all other complex waveforms can be constructed from sine wares. A sine wave consists of a fundamental and harmonics shown in Figure 6. In a square wave the voltage is either on or off, both for equal periods of time. A square gave can be constructed by the addition of all odd harmonics to the fundamental; as each odd harmonic is added, the shape of the wave approximates more closely a square wave. All harmonics of the square wave are in phase. A sawtooth wave is built up from both even and odd harmonics; all harmonies of a sawtooth are also in phase. All truly symmetrical waveforms are built only from odd harmonics; a sawtooth wave is not truly symmetrical because it rises linearly with time and then drops to its lowest voltage, but the time increments for rise and fall are unequal. A triangle wave rises and falls linearly with time, and the rate of change for both the increase and decrease periods is equal. Fourier's theorem establishes this primary relationship of all periodic waveforms to a sine wave and states that air periodic waveform is composed of the addition of sine wave harmonics.

Figure 7 indicates the basic configuration of the raster manipulation unit.

Image Vocabulary

The following is a list of suggested procedures for initial use of the raster manipulation unit. It is helpful to charge one control variable while maintaining all other variables constant; this procedure will assist in an orderly investigation of the parameters of the system. It should be noted that this description uses only the sine wave function of three oscillators; if square or triangle waves are available, proceed with each separately axed then combine waveforms.

Initial control settings are as follows:

Oscillators:	waveforn select: sine
	frequency: 60 Hz frequency
	multiplication: 7C1
	output selector: .5V
	output level control: midrange
Amplifiers:	input selector: auxillary
	bass: high range
	treble: midrange
	volume: midrange

The use of one sine wave oscillator connected to the horizontal portion of the large yoke with a frequency of 60 Hz produces an even sine-shaped bending of the raster.

By collapsing the horizontal portion of the raster, a sine cave along the vertical axis is produced.

Two vertically oriented sine waves 180° out of phase are produced if the oscillator frequency is set to 30 Hz Restoration of the horizontal portion of the raster produces two images moving in opposite directions.

The use of one oscillator connected to the vertical portion of the large yoke with a frequency of 60 Hz produces a raster compressed on top and bottom and elongated in the center section.

Increasing the volume on the amplifier will cause the image to fold. Collapsing the vertical portion of the raster will cause the image to roll vertically.

The use of two oscillators, one connected to the horizontal and one to the vertical portion of the yoke, and both with frequencies of 60 Hs, along with collapse of the horizontal portion of the raster produces a cursive "e" shape on its side.

Collapsing the raster to a point and setting both oscillators to 60 Hz will produce a circle which rotates about a 450 angle. Variations in the frequencies will produce a family of patterns called Lissajous patterns which are formed by the application of sine waves to the horizontal and vertical deflection systems of a CRT. These patterns can also be produced on an oscilloscope. The patterns vary depending upon the frequencies of the sine waves, their phase and amplitude relationships. A circle is obtained by applying two sine waves of equal amplitude but 90 degrees out of phase with each other to the horizontal and vertical deflection systems. If the amplitudes of the signals are unequal but the sine waves are 90 degrees out of phase then an ellipse is formed; if the horizontal voltage is greater than the vertical, the ellipse is oriented such that the dimension along the Z axis is greater than the Y. If the vertical voltage is greater than the horizontal, then the orientation of the ellipse is reversed, and the dimension along the Y axis is greater than the X. Inclined ellipses result from two sine waves which are other than 90 degrees, 180 degrees or 360 degrees out of phase. The inclination of the ellipse varies as the phase relationship varies. If the sine waves are in phase or 180 degrees out of phase or 360 degrees out of phase, then a diagonal line is formed. Figure 8 provides a table showing the changes in orientation with variations in phase relationship.

Other patterns are obtained, depending on the frequency ratio of the sine waves applied to the horizontal and vertical deflection systems. For a specific frequency ratio there is a basic pattern formed if the two sine waves are in phase; if the sine waves are not in phase then variations on these patterns are produced. For example, if a 120 Hz sine wave is applied to the horizontal and a 60 Hz sine wave applied to the vertical and both are in phase, then a basic pattern, called the bow tie or figure 8, is produced. This is illustrated in the bottom section of Figure 8. The frequency ratio can be determined by the number of tangent points along the horizontal and vertical axes of the pattern. The table shows that there are two points of tangency along the horizontal and one along the vertical, producing a frequency ratio of 2:1 for the bow tie or figure 8 pattern. If the two sine waves are not in phase, the pattern varies but the ratio remains the same. Frequency ratios of 3:2, 3:1 and 5:1 are also illustrated. To obtain these patterns, the frequency adjustments must be precise; variations in frequency will cause the pattern to change rapidly.

A sine wave oscillator connected to the 'S curve' or continuous wind yoke of the raster manipulation unit with a frequency of 60 Hz produces an image with as S curve containing compression and elongation.

The use of all oscillators simultaneously, the addition of square and triangle waveform capability and adjustment of frequency and amplitude will produce an extensive vocabulary of image treatment.

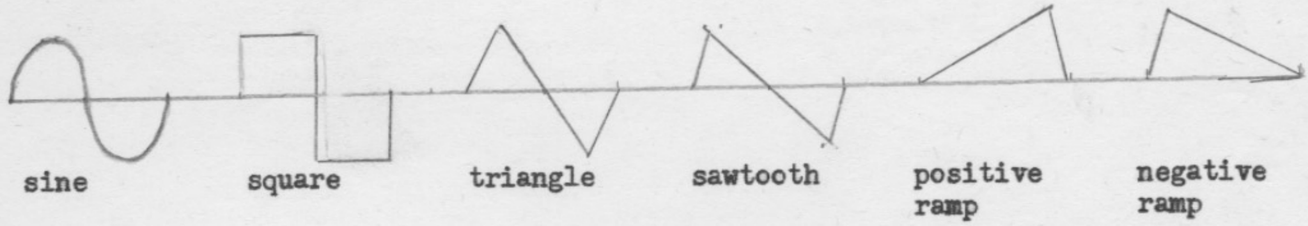


Figure 1

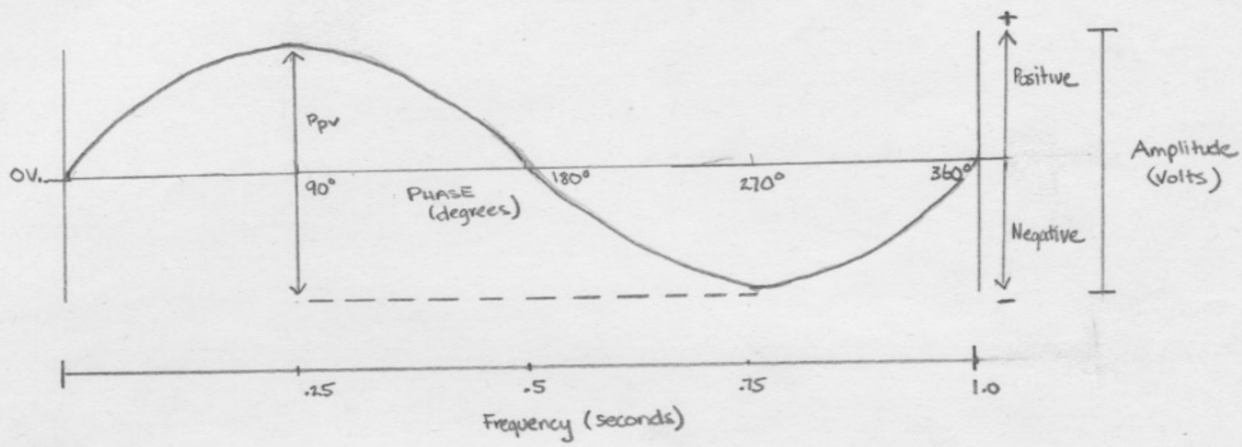


Figure 2

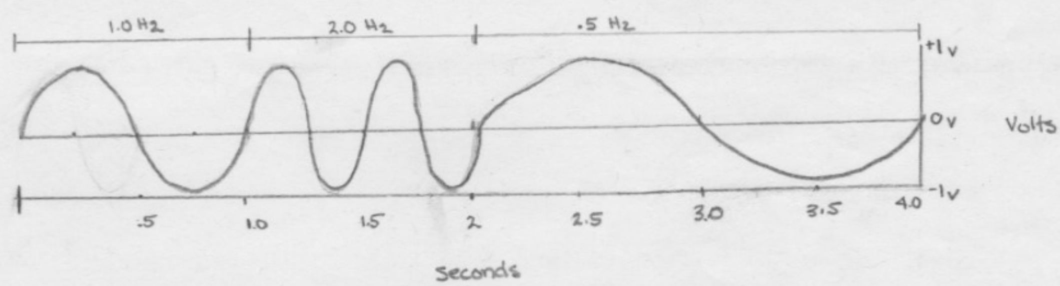


Figure 3

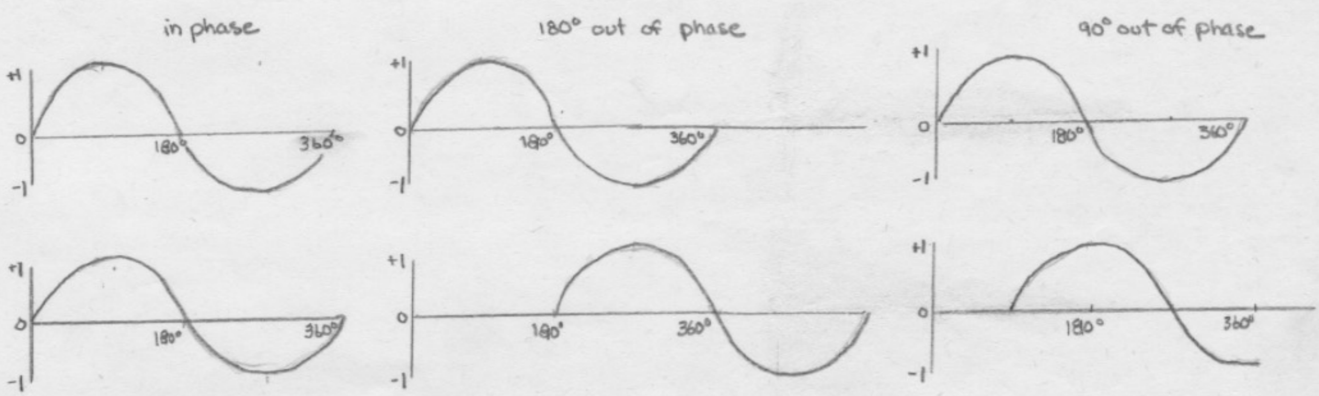


Figure 4

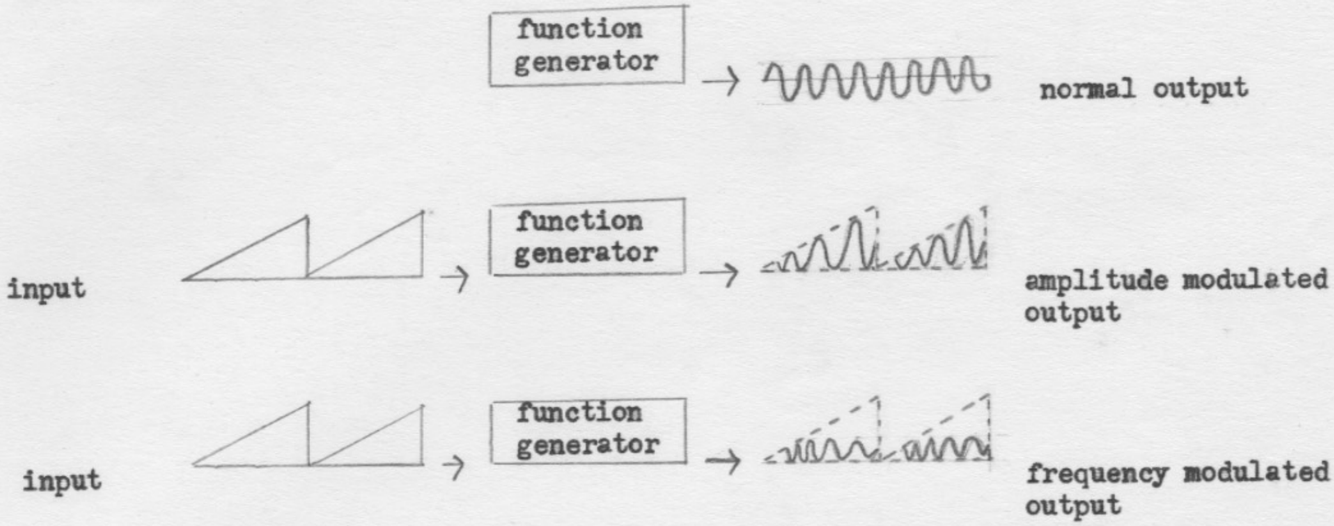
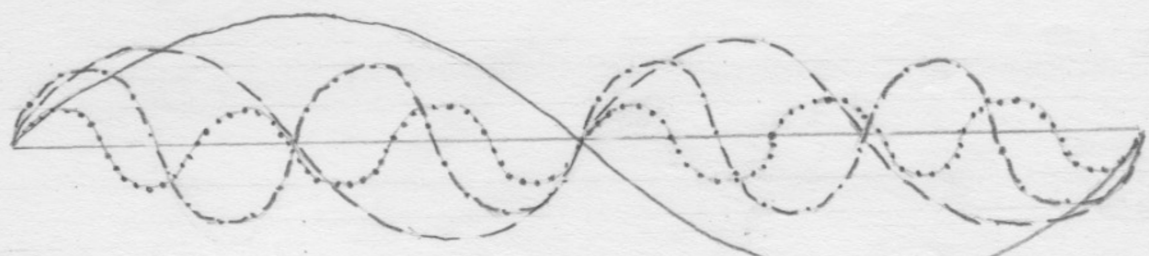
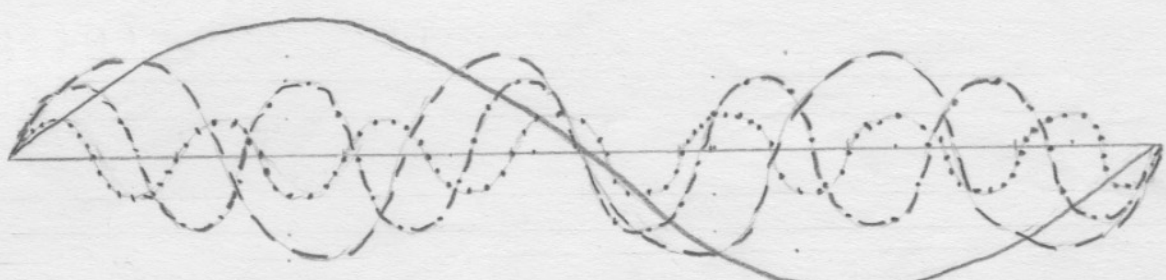


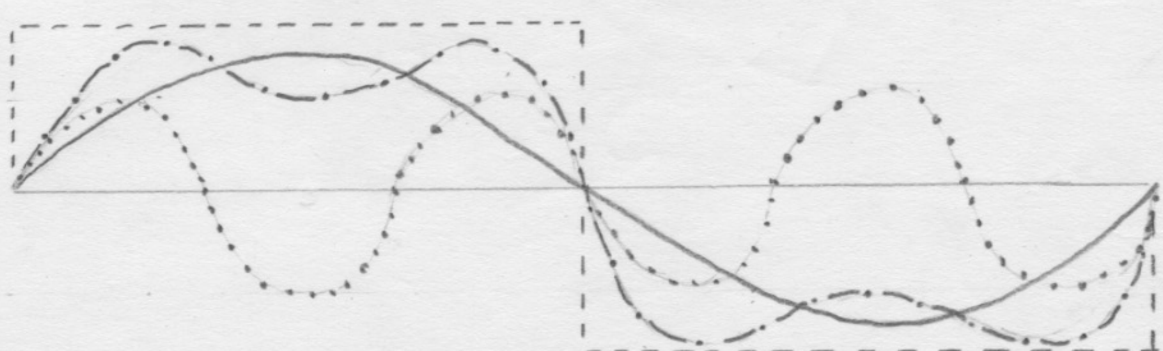
Figure 5



Even harmonics
1st or fundamental —— 2nd – – – 4th –·– 6th ...



Odd harmonics
1st or fundamental —— 3rd – – – 5th –·– 7th ...



Square wave derived from odd harmonics 1 and 3
1st —— 3rd ... 1st+3rd –·–

Figure 6

Raster Manipulation Unit

Top

SONY TV 760

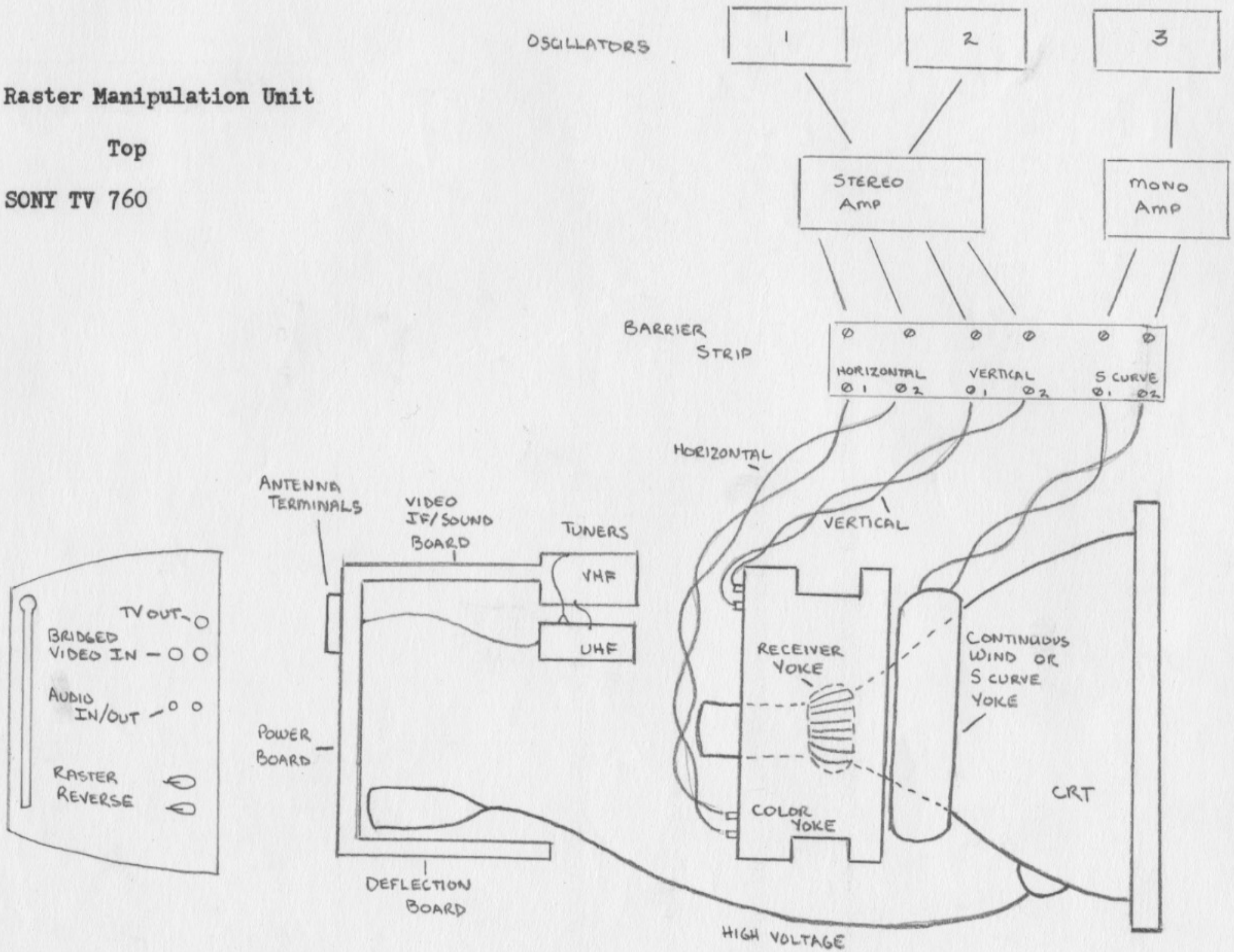
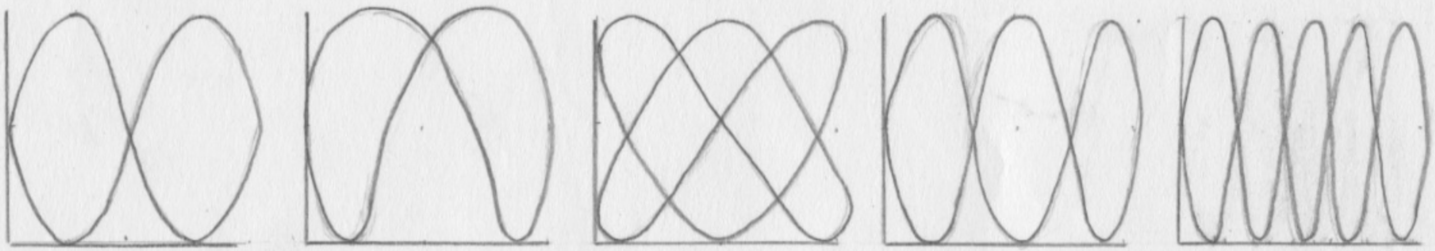


Figure 7

Figure

Horizontal frequency	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz
Vertical frequency	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz
Frequency ratio	1:1	1:1	1:1 if H=V	1:1 if H V	1:1 if H V	1:1	1:1	1:1	1:1	1:1	1:1
Phase relation-ship	in	45° out	90° out	90° out	90° out	135° out	180° out	225° out	270° out	315° out	360° out

Figure



Horizontal frequency	120 Hz	120 Hz	180 Hz	180 Hz	300 Hz
Vertical frequency	60 Hz	60 Hz	120 Hz	60 Hz	60 Hz
Frequency ratio	2:1	2:1	3:2	3:1	5:1
Phase relation-ship	in	out	in	in	in

Figure 8

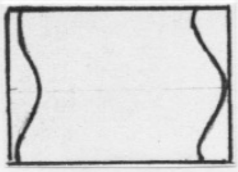


FIG. 9

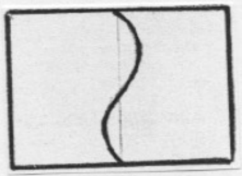


FIG. 10

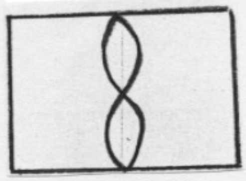


FIG. 11

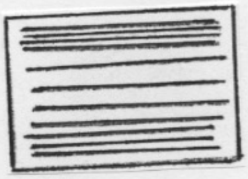


FIG. 12

FIG. 13

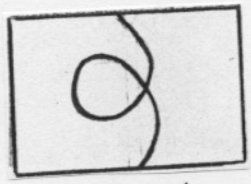


FIG. 14

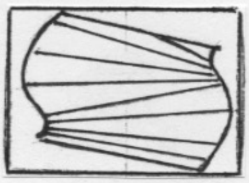


FIG. 15

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Construction of a Raster Manipulation Unit

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Construction of a Raster Manipulation Unit

Introduction

A raster manipulation unit or 'wobbulator' is a prepared television which permits a wide variety of treatments to be performed on video images; this is accomplished by the addition of extra yokes to a conventional black and white receiver and by the application of signals derived from audio or function generator on the yokes. Although the modifications contained here are relatively simple to accomplish, there is a certain danger because of the presence of high voltage in the receiver and the possibility of implosion of the CRT. Damage to the receiver may be sustained if the modifications are improperly done. It is recommended that the directions be read in their entirety before any modifications are made. In the interests of safety, most of the test sections indicate that the chassis should be replaced in the case before the set is plugged in or turned on. In order that wires are not confused, some of the wiring extensions are done in two steps. Depending upon individual knowledge and experience, certain of these steps may be omitted or combined. It is assumed that the individual has a basic familiarity with small format, closed-circuit video systems and electronics, has a thorough knowledge of soldering techniques, the use of a volt/ohm meter and the ability to read schematics. For the purposes of demonstration, the directions given are specific to the SONY TV-760. The modifications described can be made to any black and white or color receiver; if substitution of sets is made, be sure that the concepts of modification are fully understood. With certain receivers, it may not be necessary to add a vertical oscillator or current amplifier circuit; naturally the overall layout and source and destination of signals may vary.

I. Parts and Supplies

1 SONY 9" black and white television receiver, Model 760
1 SONY TV-760 SAMS schematics, set 1494, folder 3
1 deflection yoke from color television receiver; yoke must be large enough in diameter to fit over the small yoke on the SONY, approximately 2" inside diameter and 3" deep; any extraneous parts should be removed.
1 200' roll of 20 guage enameled copper wire or magnet wire; since this type of wire is insulated, bare wire cannot be substituted.
2 double pole, three position switches, non-shorting wafer type
3 panel mount video connectors, either UFH or BNC
2 mini-phone jacks, female
1 6" length of high voltage hook-up wire
1 36" length of miniature coaxial cable (RG 174) or any shielded cable
1 50' roll of 20 guage stranded hook-up wire
1 6 terminal barrier strip
1 roll electrical tape
1 10" X 24" piece of plywood for base, painted flat black, 1/2" thickness
1 4 3/4" X 7" piece of plywood for yoke support, painted flat black, 1/2" thickness
1 1" X 1" X 12" section of foam
6 1" X 1" angle brackets with screws
#4 or #6 hardware
rosin core solder
2 100 ohm 5 watt resistors

Tools

screwdrivers: flat blade and phillips
electric drill with assorted bits from 1/16" to 3/8"
adjustable open end wrench
needle nose pliers
wire cutters
25 watt soldering iron
volt/ohm meter

Cables

1 6-8" BNC-BNC or UHF-UHF cable to connect TV Out to Video In
1 6-8" mini-mini cable to connect Audio Out to Audio In
3 3' lengths of speaker wire or AC cord to connect amplifiers to unit; length dependent on final configuration of all components
3 3-6' male RCA to tinned leads or male phone jacks to connect audio generators to amplifiers

Components

3 audio generators
1 mono amplifier
1 stereo amplifier

Current Amplifier: Output Buffer

This circuit is optional; see Appendix I for circuit and parts list

Vertical Oscillator

This circuit is necessary; see Appendix II for circuit and parts list

II. Dismantling the Receiver

Perform all of the following operations only when the receiver is unplugged. Use caution when handling the CRT and do not place undue pressure on the neck of the tube. If the receiver is placed CRT face down, place a soft protective material underneath the face to protect from scratches and prevent breakage.

1. Remove the five screws from the plastic cabinet back and slide chassis partially from case; retain the screws for later reassembly. Unplug the 3 pin speaker plug and remove back completely.

2. Separate the front panel which contains the CRT from the chassis. The following remain with the front panel: on/off volume control, contrast control and brightness control. The following remain with the chassis: UHF and VHF tuners.

III. Wiring Extensions

Certain of the wires on the receiver must be lengthened because of the final layout of the raster manipulation unit. A schematized view is presented in Figure 1; the chassis may be replaced in the case if desired. Perform all of the following operations only when the receiver is unplugged. This set of wire extensions should be performed a wire at a time or each wire carefully labeled before clipping to reduce liklihood of incorrect reconnection. When unstringing the wires from the Deflection Board, release the wire clips on the bottom of the chassis. Unsolder the wire from the point of origination and extend with 12" lengths of 20 guage wire unless otherwise noted. Tape each solder connection.

A. Disconnect high voltage lead from CRT by clipping the wire just behind the cup on the CRT or remove the cup terminal from the CRT. See Figure 1.

B. If the UHF tuner is not desired, unsolder or disconnect the following:
   1. orange wire to VHF tuner
   2. RCA plug and gray shielded wire to VHF tuner
   3. antenna wire to antenna terminals on back of case

Working with the chassis upside down, extend the following wires. Figure 2 provides approximate locations; for exact locations refer to schematics.

C. On/Off Volume Switch
   1. On/Off switch: see also Figure 2A
      a. brown wire to VHF tuner: location 6 on Figure 2
      b. brown wire to Deflection Board: location 5 on Figure 2
      c. brown wire to Power Board: location 7 on Figure 2
      d. brown and white wire to Power Board: location 8 on Figure 2
   2. Volume control: see also Figure 2A
      a. gray and orange wire to Video IF/Sound Board: location 10 on Figure 2 This extension will eventually go to the Audio Input connector. The extension wire must be shielded; use 18" length of mini-coax cable.
      b. gray and white wire to Deflection Board: location 9 on Figure 2 Extend with 8" length of mini-coax cable.

D. Contrast Control
   1. white wire to Deflection Board: location 1 on Figure 2

E. Brightness Control: see also Figure 2B
1. black wire to Deflection Board: location 2 on Figure 2
2. purple wire to Deflection Board: location 3 on Figure 2
3. orange wire to Deflection Board: location 4 on Figure 2

F. Yoke
1. green wire to Deflection Board: location 11 on Figure 2
2. gray wire to Deflection Board: location 12 on Figure 2
3. blue wire to Deflection Board: location 13 on Figure 2
4. red wire to Deflection Board: location 14 on Figure 2

G. CRT: see also Figure 2C
1. yellow wire to Deflection Board: location 15 on Figure 2
2. red wire to Deflection Board: location 16 on Figure 2
3. brown wire to Deflection Board: location 17 on Figure 2
4. black wire to Deflection Board: location 18 on Figure 2

H. Ground Wire to CRT: see also Figure 2D
This black wire extends from a metal clip located on side of CRT
1. solder a terminal lug to the clip, screw lug to the front panel and extend to location 19 on Figure 2

I. High Voltage
This wire has already been cut.
1. extend with 6" length of high voltage wire
2. twist ends together and solder connection
3. slide ½" piece of insulation cut from the end of a piece of high voltage wire over each connection and tape securely.

IV. Chassis Remounting

In this set of operations the case and front panel of the receiver are mounted on the 10" X 24" plywood base. The smaller section of plywood will serve as a support for the color yoke and will be notched along the 7" side; this will be performed at a later time although Figure 3 shows the final configuration. Section X provides further explanation of the yoke support.

1. Set the plastic case at the back end of the base and mark locations of the linearity and height adjustments on the bottom. If access to these controls is desired, cut a retangular hole; these controls will probably need adjustment at a later point.

2. Mount the case to the base. Remove several plastic slats from the bottom of the case in 3 locations; screw the case to the base using wood screws and washers.

3. Slide chassis back into the case, being careful not to break any solder connections. If extended wires are tied together the danger of breakage is minimized; at this point the wires should not be permanently harnesses together.

4. Mount the front panel with the CRT to the front end of the base, using the 1" X 1" angle brackets to bolt the bottom edges ot the plastic frame to the brackets. Before mounting be sure that the CRT face is perpendicular to the base.

5. Attach the terminal barrier strip to base.

V. Test

1. Recheck all extended wires to make sure all connections are secure.
2. Plug in the receiver and turn it on; it should function normally.
3. If set does not function, unplug and check all solder connections and continuity. Do not proceed until the receiver functions normally.

VI. Monitor Modification

This set of operations modifies the receiver so it will accept a video input and also function as a normal receiver, providing the UHF tuner is kept intact. Two Video Inputs are bridged; in addition one TV Output, one Audio Input and one Audio Output are supplied. The video connectors may be either UHF or BNC; the audio connectors are miniature phone plugs. When the TV Out is connected to the Video Input with a short video cable and when the Audio Out is connected to the Audio In with a short cable , the set will function as a normal receiver. When functioning as a monitor the Video Input will accept a signal from a video camera, deck or processing system. This modification is a useful one for converting black and white receivers to receiver/monitors, regardless of whether the unit is a raster manipulation device.

1. Unplug the receiver and separate the chassis from the case.
2. Mount the two audio and three video connectors on the top of the case as shown in Figure 4

A. TV Out

1. locate the TV out cable on the Video IF/Sound Board: location 20 on Figure 2
2. follow this cable to video in on the Deflection Board: location 19 on Figure 2
3. disconnect the cable from the Deflection Board and reconnect cable to the TV Out connector on the top of the case. Label the connector TV Out.

4. Current Amplifier Circuit
   This circuit provides for proper termination of the TV output with 75 ohms at the input of whatever external monitor/device used. It is constructed on a small piece of perf board and located between the TV output from the Video IF/Sound Board and the TV Out connector. The schematic is included in Appendix I: Output Buffer. This circuit is optional.

B. Video In

1. connect a 12" length of mini-coax cable from video in on Deflection Board to either of the Video In connectors on the top of the case.
2. bridge the two Video In connectors as shown in Figure 4A; label the connectors Video In.

C. Audio

1. see also Figure 4B
2. locate the gray and orange wire from the Volume control to the Video IF/ Sound Board: location 10 on Figure 2; this was extended with 18" length

of mini-coax cable

3. unsolder the extension connection
4. connect the end of the coax cable to Audio In jack
5. label connector Audio In
6. connect the gray and orange wire from the SIF out, location 10 on Figure 2 to the Audio Out connector
7. label connector Audio Out

VII. Test

1. recheck all wiring in this section
2. slide chassis back into case
3. connect TV Out to Video In and Audio Out to Audio In
4. plug in receiver and turn it on; it should function normally
5. if the set does not function normally, recheck soldering and continuity. Do not proceed until the set functions normally.

VIII. Raster Reversals

This set of operations reverses the raster left to right around the vertical axis and up to down around the horizontal axis; it also permits collapse of the raster to a vertical or horizontal line. The brightness control should be kept very low when collapsing the raster, otherwise the CRT may be burned. This modification may be made to any receiver or receiver/monitor to provide additional options for tape viewing or rescan regardless of whether the set is a raster manipulation unit. This modification can also be made to video cameras to provide versatility of spatial orientation during recording. If this modification is made to a camera, extreme caution must be used to avoid burning the vidicon tube.

1. unplug the receiver and slide chassis from case
2. install the two double pole, triple position switches on the top of the case as indicated in Figure 5
3. locate the extended wires from the yoke of the receiver, locations 11-14 on Figure 2. Take the horizontal wires (blue, location 13, and red, location 14) and the vertical wires (green, location 11, and gray, location 12) and one by one unsolder the joints made in extending the wires. Connect each wire to its proper position on the switches and install 100 ohm 5 watt resistors, as shown in Figure 5A.

IX. Test

1. recheck all wiring in this section
2. slide chassis back into the case
3. plug in receiver and turn it on; turn down the brightness and contrast. Flip the switches and label horizontal and vertical, normal, reverse and collapse positions
4. if the set does not function normally, recheck all solder connections and continuity. Do not proceed until the set functions normally and the raster reverses horizontally and vertically and collapses.

X. Color Yoke and Continuous Wind Yoke Installation

1. If not already done, remove all extraneous components from the large color yoke. This yoke will produce the horizontal and vertical distortions.

2. Wind the continuous yoke; this yoke produces the 'S curve' pattern. Take 200' of magnet wire and wrap it around a cylindrical form with a minimum diameter of 3". This yoke will be positioned over the yoke on the SONY set; if you are using a larger set, make sure that this continuous yoke will slide over the normal yoke on the set. Use all of the wire and do not break it at any point. Cover entire yoke with electrical tape except for the terminal connections.

3. Slide chassis from case

4. Check the original yoke on the set. Bend the terminals out of the way, being careful not to create any shorts. Cover with electrical tape.

5. Slide the continuous yoke over the CRT neck so it fits snugly against the CRT and over the original yoke. Secure the continuous yoke to the top of the front panel with cord.

6. Position the color yoke behind the continuous yoke. Figure 6 shows the final configuration. The color yoke is supported by the 4 3/4" X 7" plywood support. The location of the support in relation to the front panel, distance A in Figure 3, depends on the size of the color yoke used. Cut a V shape from the 7" side of the support and put in the two screws half way. The precise shape of the V depends on the size of the yoke; it should be large and deep enough to support the color yoke at a height which allows the color yoke to slide behind the continuous yoke but does not allow the color yoke to rest on the neck of the CRT. After the V has been cut, place the foam on top to protect the yoke. Slide the color yoke on behind the continuous yoke, position the V support and fasten support to the base by gluing.

7. Connect the yokes to the terminal barrier strip as shown in Figure 6A. Use 20 guage wire to extend the leads to the barrier strip; loosely braid the two horizontal wires from the color yoke together, the two vertical wires from the color yoke and the two wires from the continuous wind yoke.

XI. Vertical Oscillator Circuit

Appendix II consists of two different circuit diagrams, a description of the operation and associated parts lists; one of the two circuits must be used for proper functioning of the unit.

XII. Extended Wire Harnessing

It is suggested that all the extended wires be harnessed together in groups by taping or tying the wires together. This may help to prevent the wires from becoming caught or tangled on the chassis and detached. It also makes it easier to slide the chassis from the case.

XIII. Test

1. slide chassis back into case
2. plug in and turn on receiver
3. recheck vertical size and linearity

XIV. Final Test

It is suggested that the section on theory of operation be read before attempting the final test.

1. connect the audio amplifiers to the terminal strip as shown in Figure 1
2. connect the audio oscillators to the amplifiers as shown in Figure 1
3. turn on the set and verify normal operation
4. turn on amplifiers and oscillators
5. label the amplifiers and oscillators as appropriate

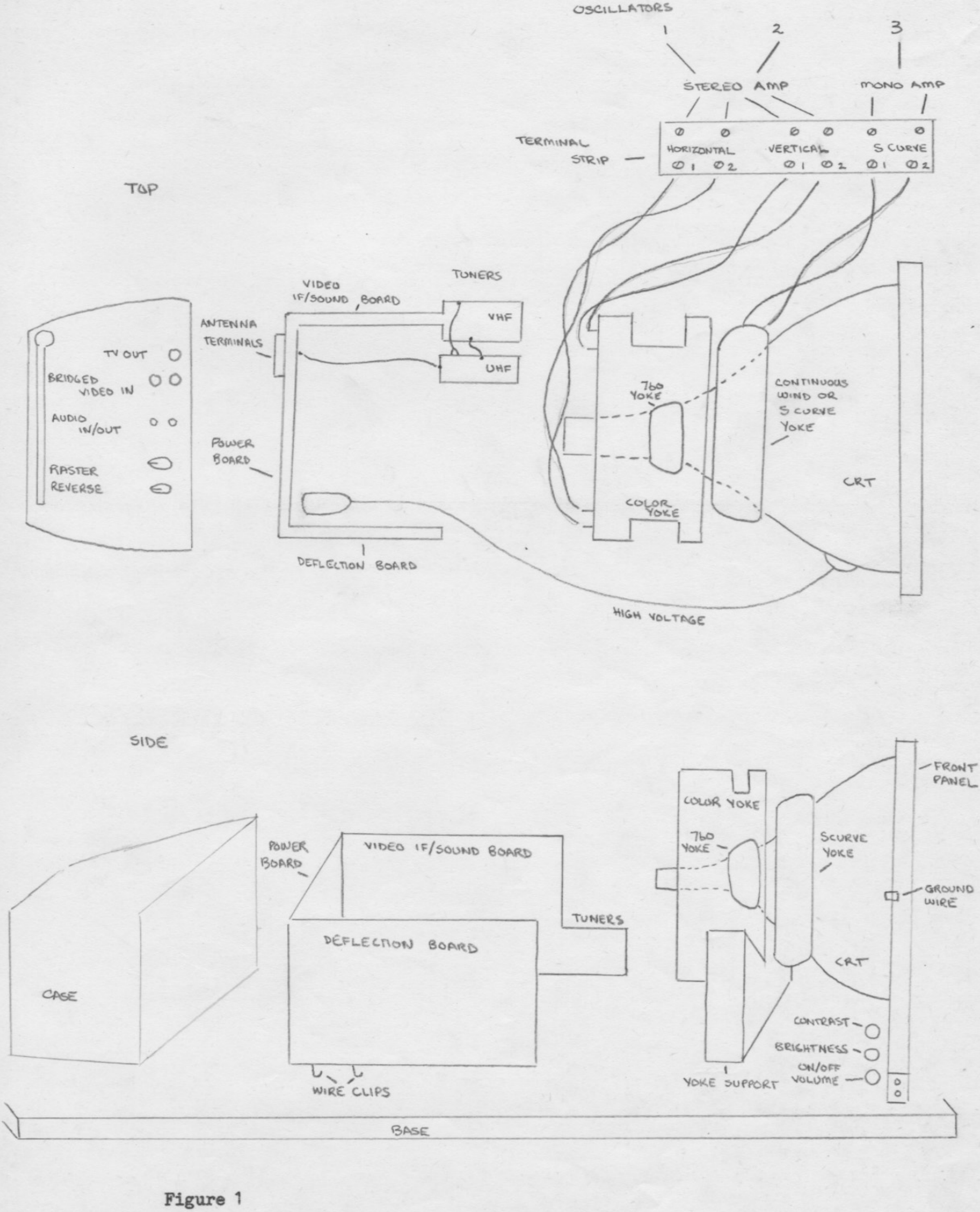
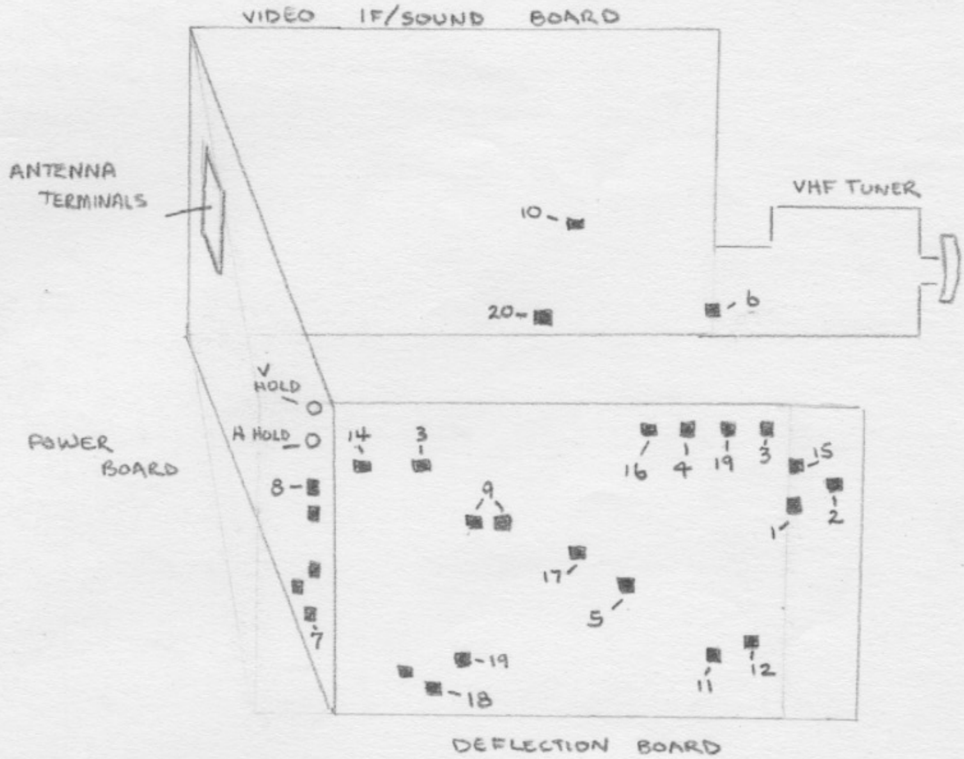

OSCILLATORS
1
2
3
STEREO AMP
MONO AMP
TERMINAL STRIP
HORIZONTAL
VERTICAL
S CURVE
1 2
1 2
1 2
TOP
VIDEO IF/SOUND BOARD
TUNERS
VHF
UHF
ANTENNA TERMINALS
TV OUT
BRIDGED VIDEO IN
AUDIO IN/OUT
RASTER REVERSE
POWER BOARD
DEFLECTION BOARD
760 YOKE
COLOR YOKE
CONTINUOUS WIND OR S CURVE YOKE
CRT
HIGH VOLTAGE
SIDE
CASE
POWER BOARD
VIDEO IF/SOUND BOARD
DEFLECTION BOARD
TUNERS
WIRE CLIPS
COLOR YOKE
760 YOKE
SCURVE YOKE
FRONT PANEL
GROUND WIRE
CRT
CONTRAST
BRIGHTNESS
ON/OFF VOLUME
YOKE SUPPORT
BASE

Figure 1



	DESTINATION		
ORIGINATION	Board	Color	Location
Contrast	Deflection	white	1
Brightness	Deflection	black	2
		purple	3
		orange	4
On/Off	Deflection	brown	5
	VHF Tuner	brown	6
	Power	brown/white	7
	Power	brown/white	8
Volume	Deflection	gray/white	9 (1)
	Video IF/Sound	gray/orange	10 (1)
Yoke	Deflection	green	11
	Deflection	gray	12
	Deflection	blue	13
	Deflection	red	14
CRT	Deflection	yellow	15
	Deflection	red	16
	Deflection	brown	17
	Deflection	black	18
Picture Tube Ground Wire	Deflection	black	19
CRT	high voltage		

(1) use shielded wire

Figure 2

On/Off Volume
Control

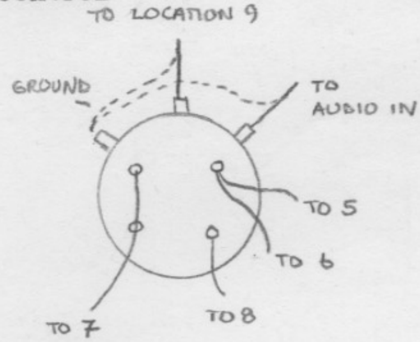


Figure 2A

Brightness
Control

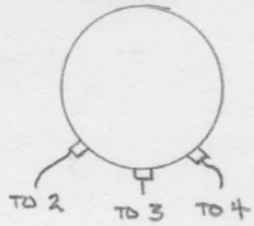


Figure 2B

CRT

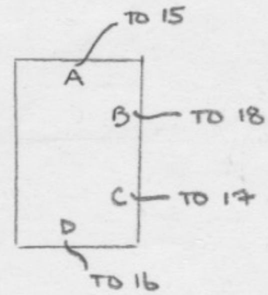
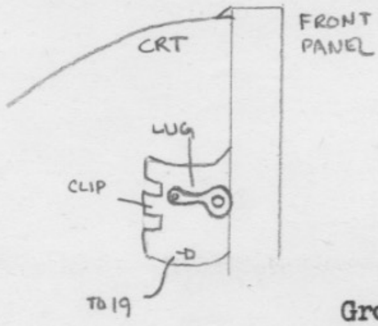


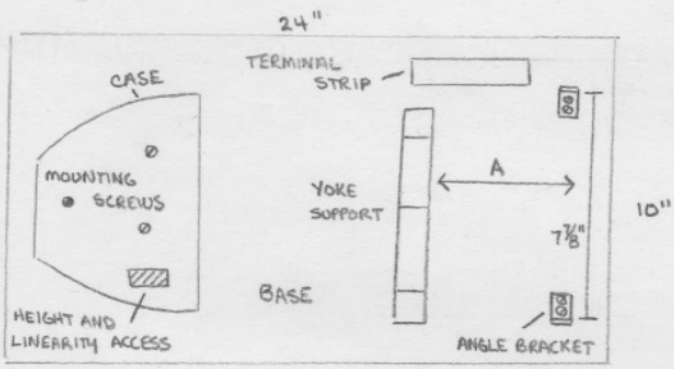
Figure 2C



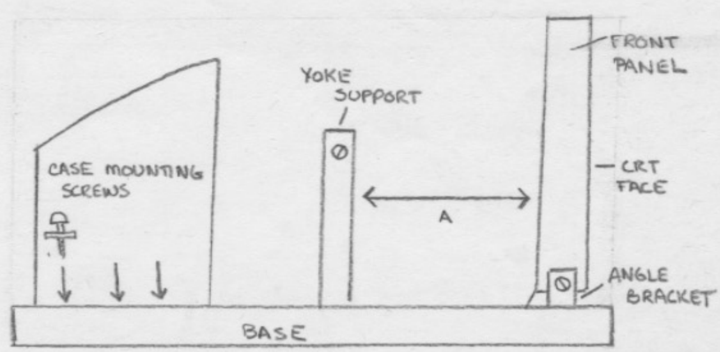
Ground Wire

Figure 2D

Top



Side



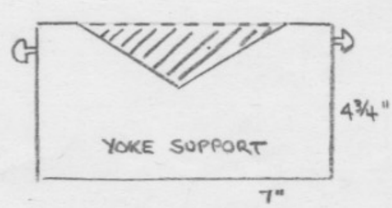


Figure 3

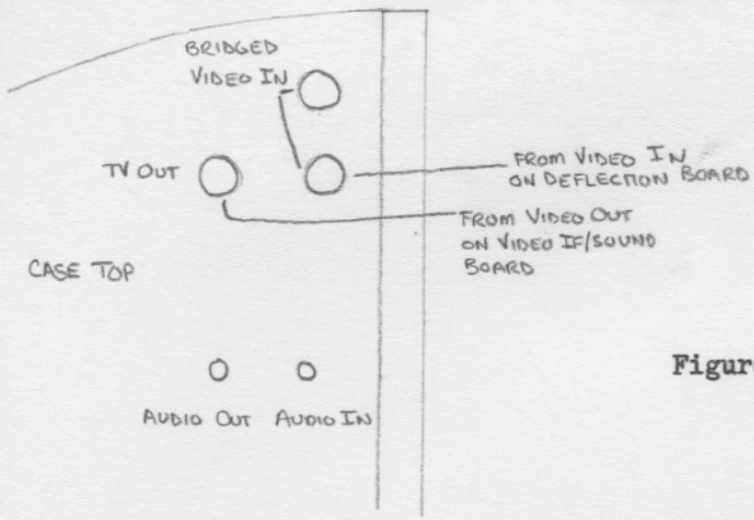


Figure 4

Figure 4A

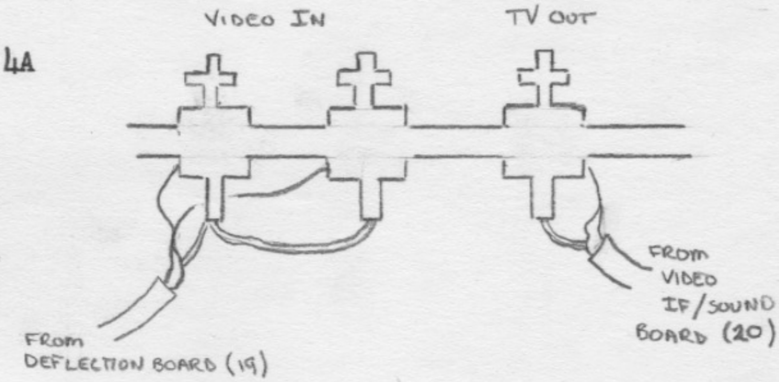
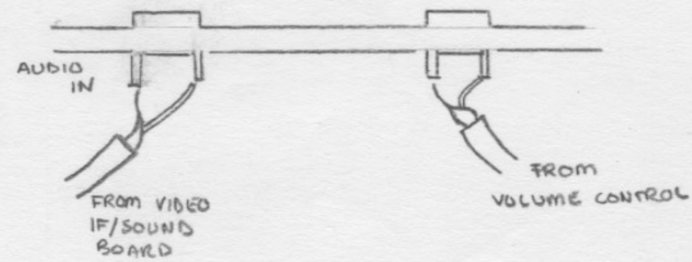


Figure 4B



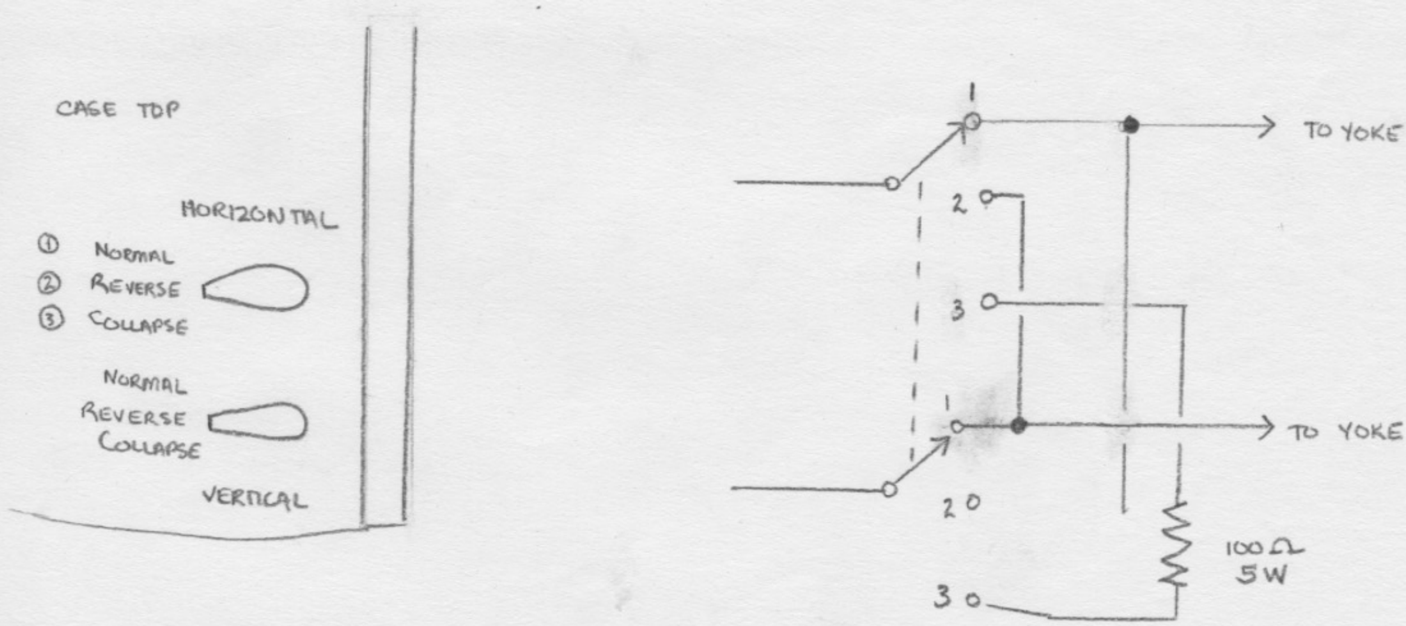
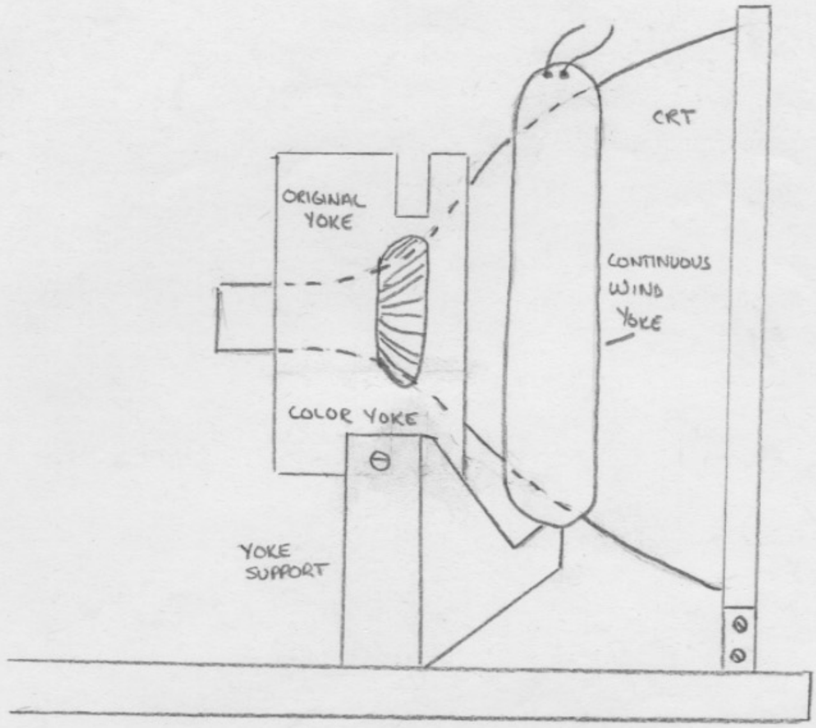


Figure 5



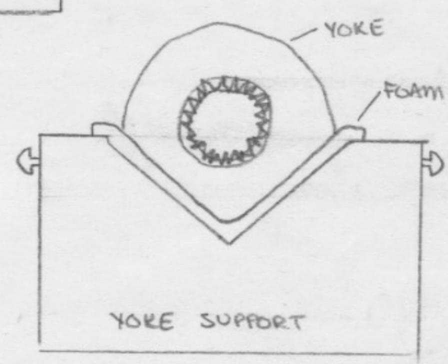


Figure 6

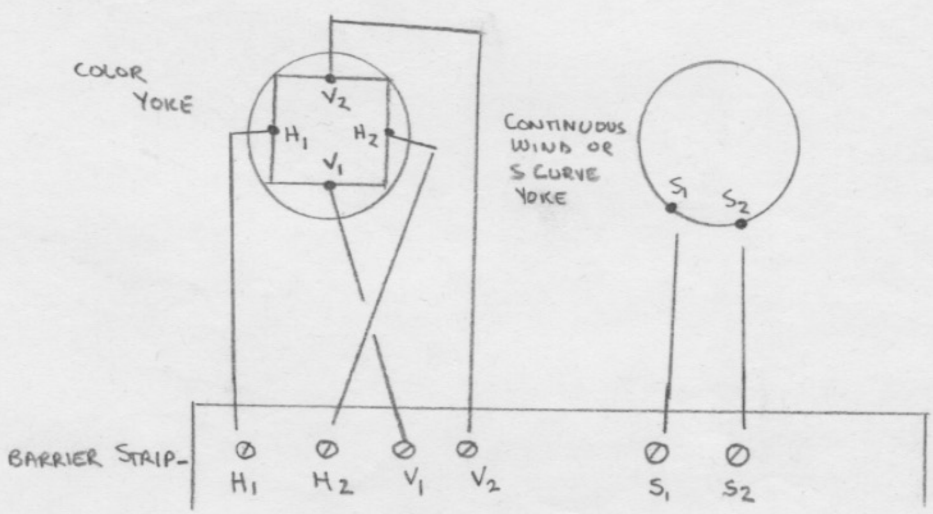
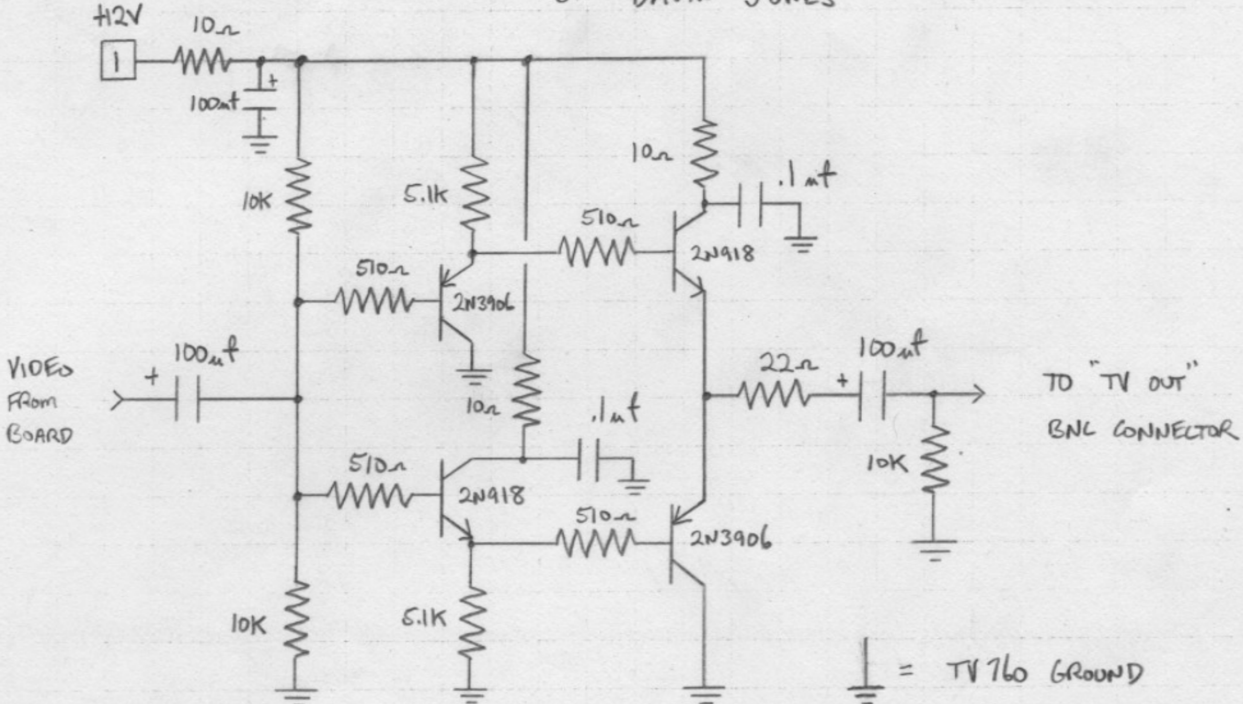


Figure 6A

APPENDIX I.

OUTPUT BUFFER FOR JEEPING SONY TV760

BY DAVID JONES



PARTS LIST:

2 2N3906 PNP TRANSISTORS

2 2N918 OR EN918 NPN TRANSISTORS (MAY SUBSTITUTE 2N3904 FOR 2N918)

3 100μf AT 15 VOLTS OR HIGHER ELECTROLYTIC CAPACITORS

2 .1μf DISC CAPACITORS

THE FOLLOWING 1/4 OR 1/2 WATT RESISTORS:

3 10 OHMS

1 22 OHMS

4 510 OHMS (SUBSTITUTE 470. OHMS)

2 5.1K OHMS (SUBSTITUTE 4.7K OHMS)

3 10K OHMS

THIS BUFFER WILL ALLOW THE "TV OUT" SIGNAL FROM THE TV760 TO BE SENT TO ANOTHER MONITER AND BE TERMINATED. THERE WILL BE A SLIGHT LOSS IN GAIN; HOWEVER THE IMAGE WILL BE FREE FROM POSSIBLE NOISE RESULTING FROM AN UNTERMINATED LINE.

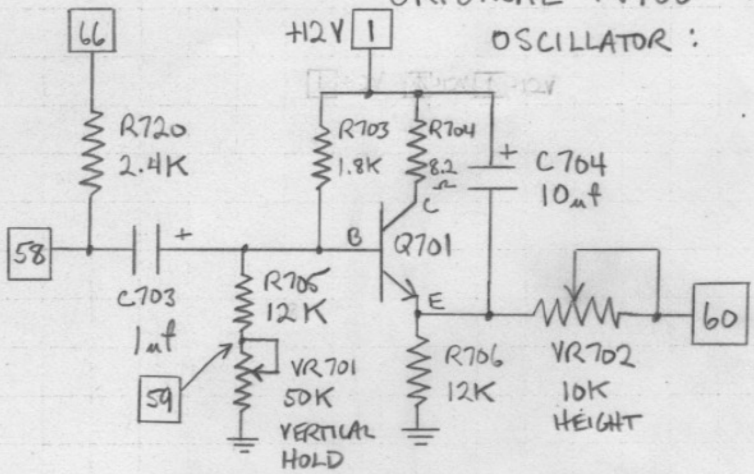
THIS CIRCUIT IS <u>OPTIONAL</u> WHEN BUILDING A WOBULATOR.

Experimental Television Center Ltd.
RASTER MANIPULATION UNIT CIRCUITS
RICH BREWSTER

APPENDIX II

SONY TV760 MODIFICATION

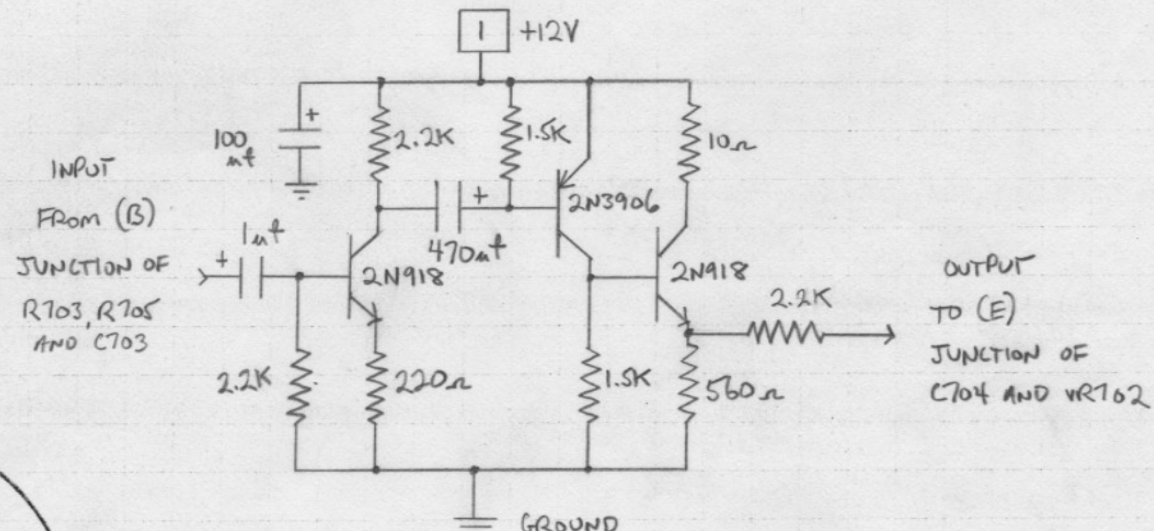
ORIGINAL TV760 VERTICAL OSCILLATOR:



REMOVE

Q701
R706
R720

SUBSTITUTE THIS CIRCUIT FOR THE Q701:

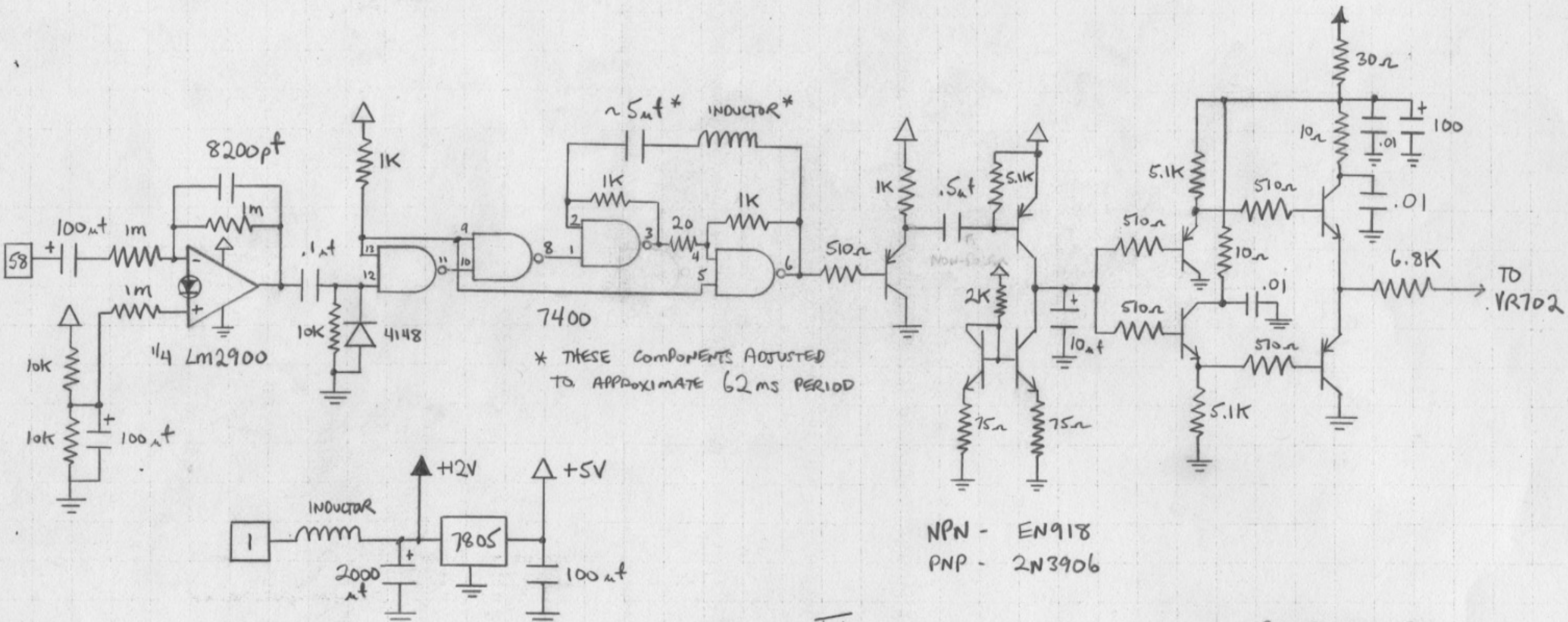


THIS CIRCUIT IS BUILT ON A SMALL CIRCUIT BOARD BY ITSELF AND HAS FOUR WIRES CONNECTING TO THE TV-760: INPUT, OUTPUT, +12 VOLTS (POINT 1) AND GROUND.

THIS MODIFICATION ALLOWS RASTER MANIPULATION BY WOBULATOR COILS WITHOUT INTERFERENCE TO THE VERTICAL OSCILLATOR. ITS DISADVANTAGE IS THAT WITHOUT A COMPOSITE VIDEO SIGNAL FROM A TUNED TV SIGNAL OR A JEEPED VIDEO INPUT, THE RASTER WILL COLLAPSE.

THIS CIRCUIT IS <u>NECESSARY</u> FOR PROPER OPERATION OF THE WOBULATOR UNLESS THE MORE COMPLICATED CIRCUIT ON PAGE #2 OF THESE SCHEMATICS IS USED INSTEAD.

DAVE JONES TV-760 MODIFICATION



THIS CIRCUIT IS A VERTICAL RAMP GENERATOR WHICH FREE RUNS, MAINTAING A RASTER EVEN WITHOUT A VIDEO INPUT. WHEN VIDEO IS PRESENT, THE CIRCUIT LOCKS TO THE VERTICAL SYNC OF THE VIDEO SIGNAL.

REMOVED FROM TV-760:

- Q701
- R706
- R720
- C703
- C704

IT IS NOT ADVISED THAT THIS CIRCUIT BE DUPLICATED BY ANYONE WITH LESS THAN A COMPLETE UNDERSTANDING OF ITS FUNCTION, AS CONSIDERABLE TWEEKING IS NECESSARY TO ARRIVE AT PROPER OPERATION.

-R.B.

Experimental Television Center Ltd.

RASTER MANIPULATION UNIT CIRCUITS

RICH BREWSTER