RADIO HI-FI TV
Techni-talk
COMPLETE ELECTRONIC SERVICING INFORMATION

Vol. 19, No. 4 Winter, 1967

COLOR TELEVISION - COLORIMETRY - IV

In the last issue the Chromaticity Diagram, and the use of this diagram was explained. This explanation will be continued in this issue.

Using the chromaticity diagram as a tool, still further investigation into the choice of primaries is possible. One question which arises upon observation of the chosen primaries is whether or not a fourth primary would be desirable. There is quite a large area not covered in the left portion of the chromaticity diagram. To bring in as much of that area as possible, the fourth primary would have to be a highly saturated hue of about 510 millimicrons. The gamut of colors that would then be reproducible is bounded by the quadrangle in Figure 13. At first glance it certainly would seem desirable to have a fourth primary if it is going to add so much to the color fidelity. Further investigation, however, would show that a fourth primary would be economically unwise. The reasons can be most easily seen if a comparison is made between the gamut of colors in the three primary system and other known systems. Figure 14 shows a comparison of the television receiver primaries with the locus of maximum purities of pigments, dyes, and inks for a base of Illuminant C. It is easily seen by this that the television primaries can reproduce, except for a limited range of the blue greens, any object which gains its color from pigments, dyes or inks. The only conclusion that could be drawn from this comparison is that a fourth primary would add little for the increased cost and complexity involved.

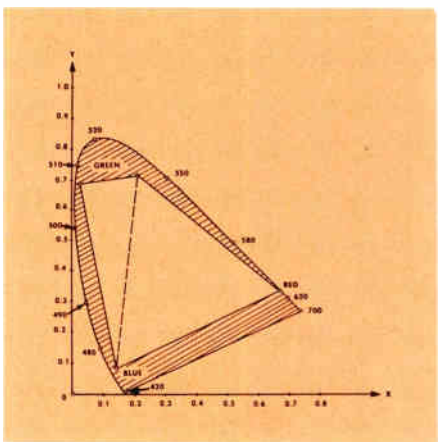

Fig. 13 — Color Gamut With Four Primaries

At this point it has been brought out that the desired color reproduction can be achieved with the use of three pirmary colors. This information must, of course, be transmitted in some manner. It might well be mentioned at this point that the FCC allotment of channel space for color transmission is no more than the allotment for monochrome. That means that the three signals needed for color reproduction must be placed in the same six megacycle band now used to transmit one monochrome signal.

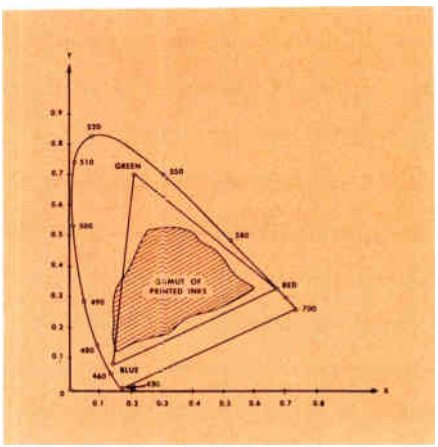

Fig. 14 — Gamut of Printed Inks

COLOR-VISION CHARACTERISTICS

In order to alleviate the problem of transmission as much as possible, it might be advisable to take a further look into human color vision and see if there might not be still other characteristics which might be used to advantage in setting up the system of transmission. It so happens that there is one frailty of the eye which can be used in building up a transmitting system that will use a 6 megacycle band. The eye does not respond to fine detail in color. There are many incidents in everyday life that bear this out. For example, when a person is attempting to match colors, a large sample of the color to be matched is

(Continued on page 2)

X-RAYS IN COLOR TELEVISION RECEIVERS

A characteristic of certain components of all color television receivers is the capability of producing X-rays.

As these X-rays serve no useful purpose, the set is designed to control possible emission of X-rays and to contain them within the receiver by the use of shielding and other techniques. With these normal safeguards, the viewer can use his color TV receiver with complete safety.

However, in servicing a color television receiver there are certain precautions that the electronic service technician should observe so that the receiver is always in a safe operating condition when power is applied either in the service shop or in the customer's home.

WHAT IS AN X-RAY?

An X-ray is a type of radiation which is produced when a beam of electrons (typically in a vacuum tube) strikes some material at a relatively high velocity. Generally speaking, accelerating voltages above 10 to 15KV are required before any significant quantity of X-rays is emitted. Due to absorption of X-rays by glass tube envelopes, there is normally no significant escape of X-rays from tubes until voltages are in the range of 20KV or higher.

Measurement of X-rays at relatively low energy levels such as are involved in TV receivers requires instruments which have the capability of making accurate readings at these energy levels. Many radiation measuring instruments do not read accurately in this energy spectrum. Furthermore, the circuitry of many such devices will respond to RF radiation in addition to X-rays. Care should be taken to avoid drawing inaccurate conclusions because of mistaking the two types of radiation.

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BENCH NOTES

BENCH HOOK

When troubleshooting large equipment that can't be set on a bench — or that is permanently mounted in a cabinet — it may be a problem to safely place the multimeter so it can be seen and still have both hands free. A foot length of stiff insulated wire wrapped around the meter handle can be used to hook on a bracket, louvre, or unused terminal to support the meter.

Hugh Lineback
John Brown University (KUOA)
Siloam Springs, Ark. 72761

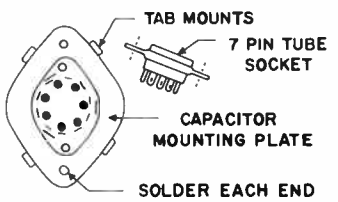
INCREASED SPRING TENSION

When it becomes necessary to tighten-up on the armature spring of a TV remote control relay, especially if it is not easily accessible, merely loop a small piece of wire through several turns of the spring and twist the looped wire until the desired tension is reached. This procedure saves removing the spring for tightening or trying to bend supports holding the spring.

Carlton C. Mills TV
20 Gordon Place
Scarsdale, N. Y.

SOCKET REPLACEMENT

Replace the new Motorola phenolic wafer type tube sockets with the quarter size capacitor mounting plate supplied with replacement metal filter capacitors. Insert a seven pin miniature tube socket with metal flange into the filter mount and solder the flange to the mount. Insert the assembly into the hole where the old socket was mounted. Bend the tabs down against the filter mount. This will secure the plate and socket to the chassis. Tube socket is now ready for wiring.



We have found that a breakdown between pins on the original tube socket occurs frequently, so are reluctant to use original type sockets as replacements.

Richard D. Hughes
Paul A. Carnes
Chism Radio & TV Service
2219 8th Street
Tuscaloosa, Ala. 35401

INEXPENSIVE DISPENSER

A most useful tool for reaching remote TV and radio components is an ordinary medicine dropper with a length of plastic tubing attached to the glass barrel. This tool is handy for dispensing liquid cleaners, lubricants, etc. to out-of-reach places.

Henry Mullen
3274 Fulton Road
Cleveland 9, Ohio

SOCKET HUM

We had a new small table model radio come into the shop for repairs with a low hum as the complaint. It was a sure bet that this was a defective filter, but we were wrong again. Looking the printed board over a little closer, we noticed that a tube socket had been removed and a new one soldered into its place. This socket was the first IF amplifier 12BA6 tube socket.

The socket which was installed was a different type than the one that came in the set. One thing was sure, there was no center grounding pin. By simply pushing a small screw driver down through this hole and into the middle of the new socket, the hum disappeared, the radio played on as it should. There was no metal grounding pin in this new socket and when the screw driver was slipped into it, the screw driver acted as a grounding shield. The replaced socket was removed and a new grounding pin socket was installed in its place. It just goes to show that all troubles that happen to a radio and to the TV receiver are not caused by their own failures.

Homer L. Davidson
2821 5th Avenue, S.
Fort Dodge, Iowa

BATTERY LEAKAGE

On portable radios when the batteries have leaked on the printed circuits, this can many times cause a noise almost impossible to locate. I use a little clean water, just enough to get the board wet where needed, and some plain baking soda to neutralize the acid. I then scrub lightly with a soft tooth brush. A General Electric power tooth brush works well.

Edward J. Ireland
Saginaw Appliance Service
7633 Hillshire Ct.
Saginaw, Michigan

"C" CLIP SUBSTITUTE

Whenever a plastic retainer ring is needed to hold the turntable on a V-M made changer, I use a short length (about $\frac{1}{16}$") of plastic tubing cut from plastic shaft extension material. I find this is a perfect substitute for the original "C" clip and will work on all V-M changers regardless of age. Be sure and use flexible plastic tubing only.

Robert W. Criswell
Advance Service Center
119 S. Walnut St.
Bloomington, Ind. 47401

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COLOR TV COLORIMETRY IV

(Continued from page 1)

necessary. If a small sample — a piece of thread or a small patch of cloth — is used, matching is practically impossible.

Since a concise method of color determination has been developed, in the chromaticity diagram, it would be desirable to show the eye response on the chromaticity diagram as detail increases. Diagram A in Figure 15 is a chromaticity diagram similar

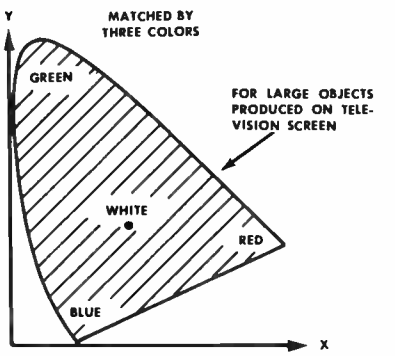

Fig. 15A — Progressive Color Blindness for Small Objects

to the one already discussed. As an indication of the range of colors seen by the human eye, this diagram is useful for only low-detail information. As the objects being viewed get finer in detail, some colors begin to lose their identity. Blue objects begin to become indistinguishable from green objects in color. Red objects and yellow objects begin to have orange appearances. In fact, the chromaticity diagram, for moderately fine detail can be shown as a straight line, as shown in B. The line which represents the hues discernible to the eye for moderately fine detail is called the orange-cyan line.

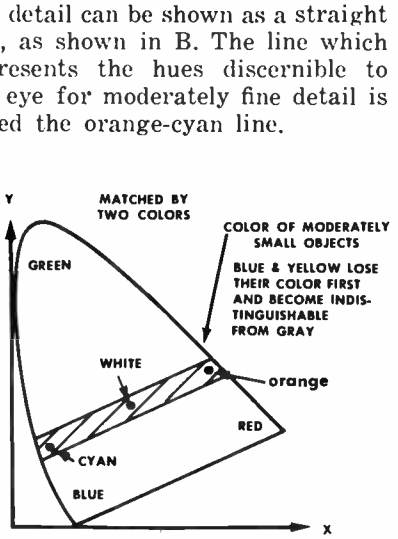

Figure 15B

Because this moderate detail effect exists, plus the fact that the resulting orange-cyan line passes through two important areas of color — white and flesh tone — a two primary color system is feasible. The primaries are, of course, orange and cyan. The resulting color reproduction has flesh tones, which are important. The appearance is not as satisfactory as a three-primary system since there are no reds, blues, or greens. It is more satisfactory than black and white, however, and it has actually been used for some systems of color movies.

For even finer detail the chromaticity diagram deteriorates completely leaving only the perception of variations in brightness. For high detail information, then, the chromaticity diagram could be shown as (C) where Illuminant C represents the only color discernible. Changes in brightness of Illuminant C would be the only change perceptible to the eye.

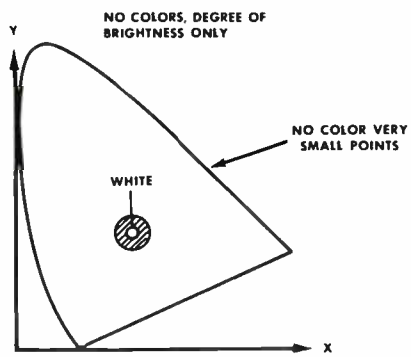

Figure 15C

Since this peculiarity of the human eye has been discovered, the question which now arises is how to use that to advantage. Actually, the facts just described are nothing new and have been used for many years. The example which immediately comes to mind is the process of tinting photographs. A high detail black and white photograph is taken. After development, transparent tints are added using a rather broad brush with no concern given to details. The resulting color photograph, however, creates a very fine impression. The fact that no consideration was given to detail when adding the color took nothing away from the finished photograph in quality. This gives definite proof that the eye requires little color detail. Fine detail had to be there but in black and white only.

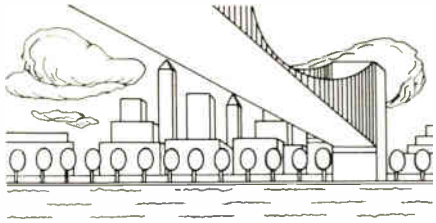

Fig. 16A — Picture Showing Monochrome Information Only

Another good example can be seen in the Sunday papers. The color used in the comic section and many illustrations is applied in the same manner. It is important to keep in mind that detail information is necessary. However, the fine detail need be only in black and white. A high quality color reproduction can be achieved with "splashed" — on color.

Figure 16 is a black and white representation of this process. A is the high detail black and white picture. B represents the color which is going to be added. Notice that there is little detail, For instance, one would have some difficulty making out that those diagonal lines represent trees, or that the vertical lines represent buildings. C shows that when the lower detail color represented in B is added to the monochrome picture, A, the low detail color does indeed blend well and results in a better picture.

This, then, is the approach that was used to build a color television system that was both compatible and satisfactory from a quality standpoint.

Recall that three signals must be transmitted instead of the one signal for monochrome. In monochrome the changes in brightness are all that have to be transmitted. In color television, there are changes in hue and saturation also to be considered. It has now been found that the only wide-band signal needed is that which corresponds to the monochrome signal. The signals which will

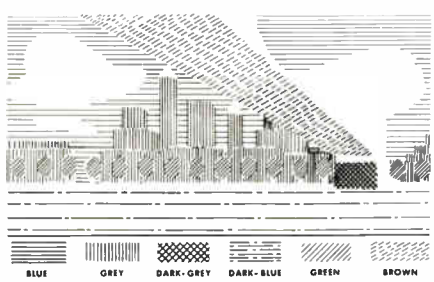

Fig. 16B — Picture Showing Chrominance Information Only

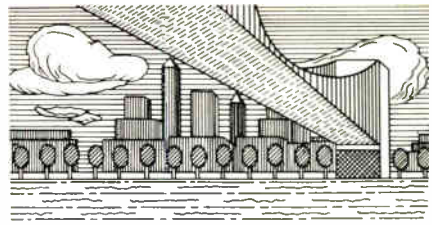

Fig. 16C — Complete Color Picture (Color shown as shading)

determine hue and saturation will be low-detail signals, which means that they can be narrow-bandpass signals and therefore, more easily placed within the six megacycle band.

SUMMARY

Thus, all the facts about colorimetry pertinent to color television for the serviceman have been covered. In conclusion, below are itemized the more important points.

1. Color TV uses an additive color system, using red, green and blue primaries.
2. In additive colorimetry, the individual brightness values of the primaries add. The resultant brightness value is the sum of the individual primary brightness values.
3. If the brightness levels of the primaries are changed proportionately, the color mixture, hue and saturation, will remain constant.
4. Hue = dominant wavelength.
   Saturation = color purity.
   Luminosity = brightness.
5. The eye does not respond to fine color detail. Thus, a monochrome signal can be transmitted. Upon this, low definition color will be placed.

It should be emphasized that the previous paragraphs are by no means meant to be a course in colorimetry. Many liberties were taken for the sake of simplicity. However, the television service technician should have obtained enough knowledge of the subject from this to allow him to understand the next and most important phase of color television — the NTSC Standards for Color Television.

X-RAYS IN COLOR TELEVISION RECEIVERS

(Continued from page 1)

UNITS OF MEASUREMENT

The Roentgen (R) is the international unit used in measuring X-rays.

One milliroentgen (mR) equals one thousandth (.001) roentgen. X-ray measurements in the area of a color TV receiver would be measured in the milliroentgen range.

HOW X-RAYS ARE PRODUCED

When electron particles bombard material such as a metal target, some of the energy of these electrons is converted to X-rays. Unless shielded or otherwise absorbed, these X-rays are emitted from the target in all directions. The energy of an X-ray is proportional to the voltage which has accelerated the electron. The quantity of X-rays produced is very sensitive to voltage and a given increase in voltage produces a much greater proportional increase in X-rays. Therefore, it is important that *the high voltage in color TV receivers should not be set above specified levels.*

ATTENUATION OF X-RAYS

X-rays are attenuated or reduced by any material placed in the X-ray field. Materials used as X-ray shields include metal, glass, ceramic, etc., all of which are used in the chassis of television receivers. The degree of attenuation is determined by the type, density, and thickness of the material and the energy of the X-rays involved.

X-RAYS IN COLOR TELEVISION RECEIVERS

In color television receivers, X-rays may be emitted from three possible sources: 1) the high voltage regulator tube; 2) the high voltage rectifier tube; 3) the picture tube.

Emission of X-rays from the regulator tube will vary with voltage and tube current. Maximum X-radiation from the regulator tube will occur when the picture tube is dark.

The emission of X-rays from the rectifier tube occurs during the portion of the cycle when small reverse currents occur.

X-ray radiation from the picture tube depends upon beam current and voltage. Maximum emissions at rated tube voltage will occur when there is a bright picture on the screen. These emissions may be further increased if a condition exists where the picture does not completely fill the screen.

As noted previously, high voltage in excess of that specified creates even greater quantities of X-radiation. *Conditions such as an excessive high voltage setting, certain types of regulator tube failures or unusually high line voltages can increase the potential of X-rays very significantly.*

PRECAUTIONS IN SERVICING COLOR TELEVISION RECEIVERS IN THE SERVICE SHOP

When servicing a color TV receiver in the service shop, precautions should be taken to provide protection from X-ray radiation for the electronic technician and for his co-workers in the adjacent work area.

A color television receiver presents no X-ray hazards if it is operated at the specified power line voltage and has all the original factory installed shields and equipment in place. Therefore, the following precautions should be taken to provide maximum protection for the technician and his co-workers:

1. Never apply power to the receiver unless the high voltage compartment is completely assembled with the door closed and with all other originally factory-installed shields in place. These shields may be additional shields on the outside of the high voltage compartment, a shield surrounding the high voltage rectifier tube or the barrium ferrite shield inside the plastic tube cap. If a shield is missing from a set, it should be replaced at once as standard servicing procedure. (To effect a repair it is sometimes necessary to disassemble the high voltage compartment or remove certain metal shields.)
2. The high voltage must never be adjusted to exceed the specified kilovolts with the brightness and contrast adjusted to minimum (no illumination of picture tube screen). Refer to the manufacturer's service manuals for specific instructions.

   If the high voltage check indicates a malfunction or improper adjustment, this fault must be corrected before any other service procedure such as picture tube set-up, yoke adjustment or trouble shooting is performed.
3. Whenever tube replacement is necessary, replace the regulator tube, picture tube and high voltage rectifier tube only with the tube types specified for the particular receiver.

   The correct tube type to use should be determined either from the tube location label attached to the inside of the receiver or from the information in the receiver service manual, since the tube being replaced may be an incorrect type previously installed by someone else.
4. To locate a suspected but difficult trouble, it is the practice of many technicians to apply a line voltage to the set which often exceeds the manufacturer's specifications. The excessive line voltage is derived from a variable step-up transformer. With the voltage applied, the set is allowed to "cook" until the suspected component fails completely. Never resort to this practice when servicing a color television set.

IN THE CUSTOMER'S HOME

When servicing a color television receiver in the customer's home, always take the precautions and perform the tests listed below.

1. All factory installed *shields* must be in place.
2. The high voltage compartment door must be closed and captivated.
3. Before applying power to the receiver, check the power line voltage at the wall outlet to make sure that it does not exceed the input voltage rating of the receiver (the power company may have increased the voltage since your last service call). If the power line voltage is excessive ask the power company to adjust the line voltage to the proper level, or set transformer tap as specified by the set manufacturer so that the receiver is operating within the manufacturer's specified ratings.
4. Check and if necessary adjust the high voltage to make sure that it does not exceed the kilovolts at specified power line voltage and with the brightness and contrast adjusted for minimum (no illumination on the picture tube screen).

   If the high voltage check indicates a malfunction or improper adjustment, this fault must be corrected before any other service procedure such as picture tube set-up, yoke adjustment or trouble shooting is performed.
5. Replace the regulator tube, high voltage rectifier tube and picture tube only with the tube types specified on the tube location label inside the receiver or in the manufacturer's service manual.
6. Make any other safety checks as instructed in labels attached to the receiver or in the service manual.

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UNIVERSAL REPLACEMENT TRANSISTORS

Highly dependable low-cost transistors especially designed as general replacements for most types of transistors used in Radio and TV Sets and other home entertainment devices.

Catalog No.	Outline Drawing	Use	Application
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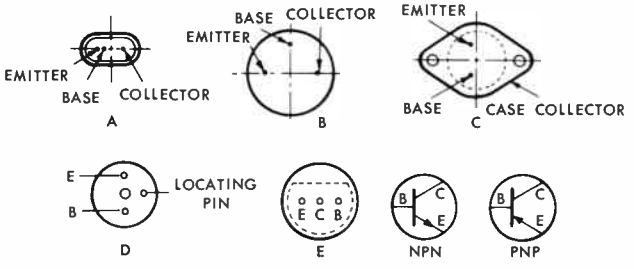
GE-3	C	PNP	AF Power Amplifier
GE-4	D	PNP	AF High Power Amplifier
GE-5	B	NPN	Mixer/Oscillator Converter • RF and AF Amplifier
GE-6	A	NPN	Mixer/Oscillator Converter • RF Amplifier
GE-7	A	NPN	IF Amplifier
GE-8	B	NPN	AF Amplifier
GE-9	*8	PNP	Mixer/Oscillator Converter • RF and IF Amplifier
GE-10	E	NPN	AF Amplifier-Driver-Output
GE-11	E	NPN	FM and RF Amplifier, FM Converter, UHF Oscillator

*GE-9 Smaller size than GE-1 (GE-9 .209 diameter — GE-1 .335 diameter)



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These supplement the Universal Line above. Characteristics conform to JEDEC specifications.

Type or JEDEC No.	Type	Use
2N107	PNP	AF
2N170	NPN	IF
2N188A	PNP	AF OUT
2N190	PNP	AF
2N324	PNP	AF
2N404	PNP	SW
2N508	PNP	AF OUT
2N1415	PNP	AF SW
2N2160	SILICON UNIJUNCTION	OSC
2N2868	NPN	SW

NEW GE GE-504A UNIVERSAL RECTIFIER

A silicon rectifier with a 60-amp surge rating. Recommended as a replacement for all selenium, germanium and silicon rectifiers used in TV receivers. The 60-amp surge rating eliminates the need for the surge limiting resistors normally required when silicon rectifiers are used.

PIV is 600 volts; max. I_{DC}, 1 amp. Shipping weight: 2 oz.

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This top hat, hermetically sealed rectifier is designed for general-purpose applications requiring maximum economy.

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Miniature double diodes for TV horizontal phase detector, replacement and other applications. $\frac{7}{16}$ x $\frac{9}{16}$ x $\frac{3}{16}$". Shipping weight: 2 oz.

Type No.	Ifwd	Imr	Description	Max. Case Temp.
6GC1	1.1 @ 2.5V	4 @ 20V	Common cathode	85°C
6GD1	1.1 @ 2.5V	4 @ 20V	Series connected	85°C
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Type	Description	Average Forward Current (ma)	Peak Reverse Voltage (Volts)
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‡Resonant frequency 3579.545 kc.

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Each electronic component in this series is blister packaged with circuit diagrams showing how educational, practical, and interesting electronic devices can be built. They can also be used in many other applications mentioned in hobby magazines and articles such as are found in the General Electric Components Hobby Manual.

Component	Application
SILICON CONTROLLED RECTIFIER GE-X1	For Plug-in speed control for general-purpose applications
LIGHT-ACTIVATED SILICON CONTROLLED RECTIFIER GE-X2A	For "Slave" photoflash for flashbulbs
SILICON CONTROLLED RECTIFIER GE-X3	For 12-volt regulated battery charger
SILICON RECTIFIER GE-X4	For HIGH-LOW-OFF control for heater, lamp, motor, etc.
SILICON CONTROLLED RECTIFIER GE-X5	For enlarger phototimer
PHOTOCELL GE-X6	For light flasher, night control
REED SWITCH GE-X7	For light flasher, burglar alarm
TRANSISTOR GE-X8	For light flasher, light target, triggered light source
TRANSISTOR GE-X9	For light flasher, light target, triggered light source
UNIJUNCTION TRANSISTOR GE-X10	For high-precision tachometer for automotive-type ignition systems with 12-volt negative ground
ZENER DIODE GE-X11	For high-precision tachometer for automotive-type ignition systems with 12-volt negative ground
TRIAC GE-X12	For remote control for lamp in appliance
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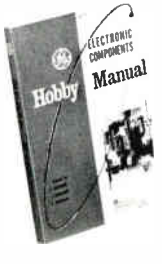

Every engineer, experimenter, hobbyist, student, and technician can learn new applications for electronic components with the simple but interesting and useful circuits in this manual. Price $1.50

SERVICE NOTES

TELEVISION

KC CHASSIS — SERVICE HINTS

1. Horizontal Foldover Cure

Change R512 from 82K to 62K. This is most easily done by shunting a 240K ½W resistor across the existing 82K unit. The extra resistor may be added on the under side of the circuit board. Following this change, the horizontal oscillator should be re-adjusted for proper operation. See Page 7 in the Volume 19, Number 3 issue of Techni-Talk.
This is not intended as an instruction to rework sets, but is to be used as a cure if this complaint is encountered.

2. B– Fuse — F101

Some early production receivers used a ⅜ amp. slo-blo fuse in the B– line. This was found to be unnecessary and deleted early in production. If a fuse failure occurs, it should be bridged with a plain buss wire. This will avoid call backs resulting from fuse failure.

3. Filament Fuse — F103

If a failure of filament fuse F103 should occur, it is important that it be replaced properly. Use either an ET10-X33 fuse or a length of No. 22 bare copper wire. The most important point is to be sure that it is run inside the 3-inch fiber glass tubing. This fuse is intended to burn off in the event of a filament circuit short in the chassis. The fiber-glass tubing contains the heat of a burn off and prevents other receiver damage. Therefore it is important that the proper gauge of wire be used and that it is run inside the tubing.

KC CHASSIS — Use of Wide Blue Convergence Corrector (ET42X59)

If a wide blue raster exists, we now have available a unit to correct this condition.

Before any correctors are installed it should be determined that a wide blue problem actually exists. This is identified as follows:

1. Adjust for proper center convergence.
2. Observe the vertical lines of a cross hatch pattern. If blue fringing shows mainly on the outside as illustrated in Fig. 1, this is defined as a wide blue raster.

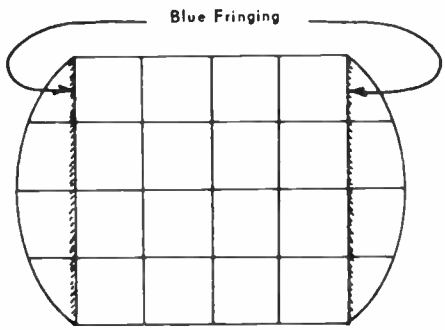

Fig. 1

Correction:

1. This condition may be due to improper vertical positioning of the yoke, which must be corrected by tipping up the front of the yoke, to obtain a coaxial relationship with the tube neck. This may be done by loosening the wing nuts on the yoke clamp and tilting the yoke upward at the front. If this does not result in a coaxial condition with the tube neck, it may be necessary to raise the yoke retaining ring slightly on the bell of the tube.

2. If wide blue condition still exists, install corrector ET42X59.

   a) Slide the corrector down vertically over the rear face of the deflection yoke as shown in Fig. 2. This is to be positioned directly above the blue gun (Fig. 3) and the top clip is to be pressed down firmly on the yoke body for the entire length of the clip.

   b) If excessive correction is encountered (narrow blue), the clip should be raised slightly above the yoke body.

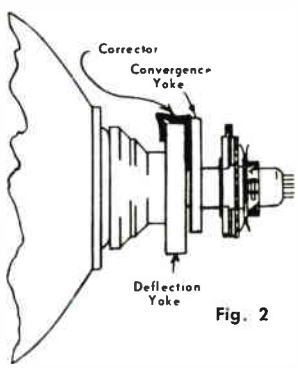

Fig. 2

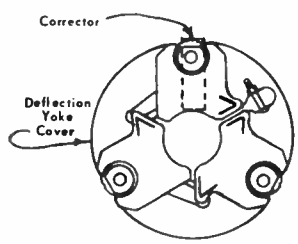

Fig. 3

Caution:

1. If the final position of the corrector results in any looseness on the yoke which might permit it to fall off and thus create a short hazard, the degree of correction required is not sufficient to warrant use of the corrector. Therefore, it should not be used.

2. The corrector must not be used in any other position or for any other purpose than that outlined above.

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ELECTRONIC COMPONENTS

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AN ADAPTER SOCKET FOR MEASURING HORIZONTAL AMPLIFIER CATHODE CURRENT IN COLOR TV RECEIVERS

When servicing the horizontal and high voltage circuits in color receivers, it occasionally becomes necessary to measure the horizontal driver current. In most instances the receiver chassis must be removed to make this measurement.

For compactron equipped receivers, an adaptor is described below that will make chassis removal unnecessary.

The adaptor is constructed from two compactron sockets, ETR-2976, and provides the necessary "open" cathode circuit for meter connection.

Pins for the male end of the adaptor are cut from ordinary No. 1 (.036" dia.) paper clips.

After accumulating parts, the assembly procedure will take less than 10 minutes, a fraction of time required to remove and replace one chassis.

ASSEMBLY:

1. Cut 12 lengths of wire $\frac{5}{16}$ inches long from paper clips. These are used for the male pins of the adaptor.
2. Select one of the compactron sockets and insert the 12 lengths of wire into top of socket as far as they will go.
3. Flow a drop of solder in each pin to hold pin securely in place on top of socket.
4. Straighten all terminals on each socket except the cathode pins which should be bent away from the socket as shown in Fig. 1.
5. Place sockets back-to-back so terminals can be soldered as shown.
6. Except for the cathode lugs that correspond to the compactron for which the adaptor is built, solder all socket lugs together. If the adaptor is built for a 6JS6, Pin 2 would be left unsoldered and for a 6JE6 it would be Pin 3.
7. Solder a length of wire to each cathode tab for meter connection. Wrap tape around the completed adaptor to cover the exposed lugs.
8. Straighten pins by inserting into a pin straightener such as the General Electric Multi-Tube Pin Straightener, ETR-3200.

Compactron Sockets, ETR-2976 and the General Electric Multi-Tube Pin Straightener, ETR-3200 are available from your local General Electric Electronic Components Distributor. Price for ETR-2976 (two sockets) is only $.39 and ETR-3200 is only $.60. If you are unable to obtain these from your distributor, you may want to use the order coupon on page seven.

RADIO HI-FI TV
Techni-talk
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