



COLOR TELEVISION -- NTSC STANDARDS-IV

In the last issue the development of chrominance signals was described. This will be continued in this issue.

The color-bar pattern that has just been investigated, showed the values of the color difference signals for two specific cases of saturation, 0% which is white, and 100%. A look at some colors not 100% saturated might be desirable.

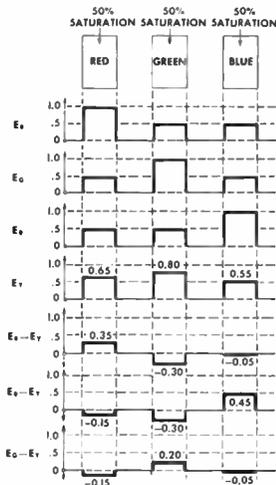


Fig. 9 — Waveforms for 50% saturated color bar pattern.

Figure 9 shows the waveforms observed when scanning three vertical bars—red, green and blue. In this case, however, there is some dilution of spectral colors. Recall the definition of saturation. When a spectral hue is diluted with white light, the saturation of the color decreases. In Figure 9 the saturation is 50%. This means there are .5 units of the other primaries present when viewing a particular hue whose value is 1.0 unit.

For instance, E_r is one unit for the red bar. In this case, however, E_r and E_b are not zero. Both are .5 units. E_r and E_b are .5 units for the green bar, E_r and E_g are .5 units for the blue bar. The predominant hues for each bar can be broken up into two parts. .5 units which contributes to the predominant hue and .5 units which combines with the other primaries to give white.

In this case E_y for the red bar is equal to:

$$E_y = (.3 \times 1.0) + (.59 \times .5) + (.11 \times .5) = .65 \text{ units.}$$

For the green bar, E_y is:

$$E_y = (.3 \times .5) + (.59 \times 1.0) + (.11 \times .5) = .80 \text{ units.}$$

For the blue bar, E_y is:

$$E_y = (.3 \times .5) + (.59 \times .5) + (.11 \times 1.0) = .55 \text{ units.}$$

The waveforms are $E_r - E_y$, $E_g - E_y$, and $E_b - E_y$ for 50% saturated colors are developed in a manner similar to the method applied when developing the same signals for 100% saturated colors. The results of this can be seen in Fig. 9. Comparing these waveforms with those in Fig. 8 it becomes apparent that the amplitude of the color difference signals are dependent upon the saturation of the color being scanned.

NATURE OF COLOR VOLTAGES ABOVE AND BELOW 600KC

There has been developed at this point, the proper signals to give, as an end result; E_r , E_g , and E_b at the grids of the picture tubes. The concept of low definition color information when applied to color television in television means that the bandwidth of the signal is limited. In fact, as was indicated in Figure 2, in the Volume 20, No. 1 issue, the color information, in this case, the color difference signals, is limited to about 600KC. It stands to reason that if a compromise is made in limiting color bandwidth, the voltages at the picture tubes could not be exactly what was put into the system by the color cameras. The resulting compromise can best be explained as forming two separate signals. The first signal is the combination of E_y and the color difference signals. This results in E_r , E_g and E_b at the tube grids. This holds as long as there are color difference signals present, or up to 600KC.

Above 600KC the color difference signals drop to zero, therefore, E_y is the only signal applied to the grids of the picture tube.

ELIMINATION OF $E_r - E_y$

The purpose of the compromise in the first place was to ease the problem of transmission so that the color signal could be sent out within the same bandwidth limits as present monochrome signals, without losing the compatibility feature that is so desirable. The brightness or "Y" signal is to be sent out as a normal monochrome signal. This in itself apparently fills the band rather completely. In addition to this detail signal there are three color difference signals which must be sent out within

the six megacycles. To help alleviate this problem, it would be advisable to look into the possibility of dropping one of the color difference signals. The idea of dropping one signal is not an impossibility. Recall that there are three factors which govern the color of any object: (1) brightness, (2) hue, (3) saturation. The brightness is already taken care of by the "Y" signal. Hue and saturation are all that remain to define the color signal. If only two more pieces of information are necessary for good color rendition; why send three signals?

With that in mind, a close look at the color difference signals might give a clue as to how one might be dropped. Looking at Figure 8, notice that any color difference signal has some variation, no matter what color is being scanned. For instance, the green bar causes a variation of signal level in both $E_r - E_y$ and $E_b - E_y$. This could mean that $E_r - E_y$ could be dropped at the transmitter and built up in the receiver using $E_r - E_y$ and $E_b - E_y$. Mathematically, it is possible to show this:

Take $E_y = .30E_r + .59E_g + .11E_b$. Break up E_y into components:

$$.30E_y + .59E_g + .11E_b = .30E_r + .59E_g + .11E_b$$

Transposing terms:

$$.59E_g - .59E_r = .30E_r - .30E_y + .11E_b - .11E_y \text{ or,}$$

$$-.59(E_g - E_r) = .30(E_r - E_y) + .11(E_b - E_y) \text{ thus,}$$

$$E_g - E_r = \frac{.30}{.59}(E_r - E_y) - \frac{.11}{.59}(E_b - E_y) \text{ or}$$

$$E_g - E_r = -.51(E_r - E_y) - .19(E_b - E_y).$$

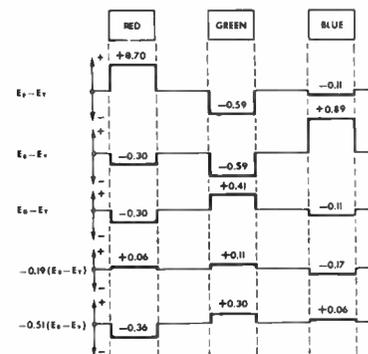


Fig. 10 — Development of $E_g - E_y$ and $E_b - E_y$ signals.

(Continued on page 2)



BENCH NOTES

VIDEO IF QUICK CHECK

If you suspect trouble in the Video IF stages of a TV set this quick check will pinpoint the trouble.

Remove the tubes, one at a time, and bridge from the grid pin to the plate pin with a low value capacitor. (Approx. 100 MMF).

Adjust to see if picture and sound improve: if so, the defect lies in the stage bridged.

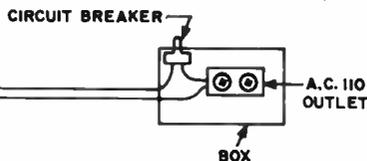
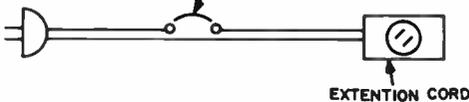
In a series string set, jump the heater pins with a jumper wire: the voltage will not be raised enough to cause trouble.

*Russell V. Book
6803 Navarre Road, S.W.
Massillon, Ohio 44646*

FUSE SAVER

The arrangement shown below of either an EXTENSION CORD or CHEATER CORD, is very useful for any technician regardless of what he repairs. If any item that the serviceman

5 AMP CIRCUIT BREAKER



starts to repair is short circuited, this will save a lot of trips to the main fuse box and fuses, too. Any short will kick out the circuit breaker and it can be reset at any time.

*Charles Jackson
Box 135
Buckner, Illinois 62819*

TRANSISTOR SOCKET

Rather than risk ruining a transistor by soldering directly to the pins, remove connectors from a nine pin tube socket. After soldering the connectors to a wire, they are slipped onto the pins of the transistor.

*H. Muller
Box 6
Danboro, Pa. 18916*

MAKE A PLASTIC NUT

You'll have no shorts across printed circuits; no detuning, with plastic nuts. Make those you need by holding a hot soldering iron against the side of the nut driver (socket wrench), and press the hot drive through a 1/8-inch piece of plastic.

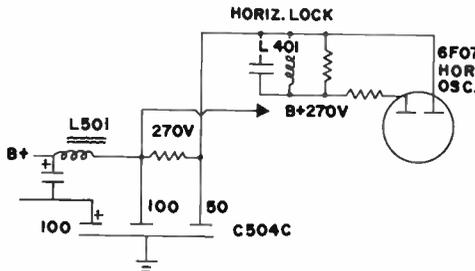
Don't move the wrench as it goes through, but lift the plastic after the wrench sinks through.

Drill and tap the hardened nut while it is still in the wrench, then turn the screw into it and pull the plastic nut out.

Quick-drying cement locks it.
*Mr. H. Josephs
Box 22
Gardenville, Pa. 18926*

CHASSIS: Admiral 21B5 B&W

Symptom: After the set warmed up the picture would pull horizontally. At first the picture was normal and would slowly begin to tear.



Tip: Check filter capacitor C504C for possible trouble. This capacitor section appeared dried up and the circuit goes directly to the plate of the horizontal oscillator tube.

*Homer L. Davidson
Davidson Radio and TV
2821 - 5th Avenue South
Fort Dodge, Iowa*

TV SERVICE TIP

On some TV receivers, the external aquadag coating on the picture tube is not grounded when the chassis is removed from the cabinet. This coating can be connected to the chassis by folding a piece of aluminum foil into a one by two inch rectangle and taping half of it to the external coating of the picture tube; a clip lead is then attached from the protruding end of the foil to the chassis.

Upon completion of work, clip off the protruding piece of aluminum foil and leave the tape on the tube as removing the tape will peel off some of the aquadag coating.

*William E. Odom
Box 9487
Asheville, North Carolina 28805*

PORTABLE TABLES

For easy accessibility to color TV chassis while servicing in the shop, I have built a number of portable, waist high tables. They can be built from a very small amount of lumber and a set of portable TV stand wheels. They should be made long enough to support an average size table model, yet thin enough to straddle larger sets. Add an AC receptacle, and you have a movable work bench.

I keep my color generator, scope and tools on a separate bench and save a lot of time hunting for each item as I need it. You can cover the tables with spare sections of carpet to save customer complaints about scratches and also keep track of small parts while working.

*Mr. Frank Fisher III
Television Engineers
1359 N. Lake Avenue
Pasadena, California 91104*

NTSC STANDARDS-IV

(Continued from page 1)

This says that if 51% of $(E_r - E_y)$ and 19% of $(E_b - E_y)$ are added together, $E_r - E_y$ would be the result. This would mean that only $E_r - E_y$ and $E_b - E_y$ need be transmitted.

A look at Figure 10 will show that, in the practical case, the dropping of $E_r - E_y$ is possible.

The first three waveforms show the color difference signals derived in Figure 8.

By reversing the phase of $E_r - E_y$ and taking 51% of it, $-.51 (E_r - E_y)$ is obtained. $-.19 (E_b - E_y)$ is achieved in the same manner. Now, if the two waveforms are added together, notice that $E_r - E_y$ is the result. The problem of transmission has thus been alleviated by the omission of one color difference signal.

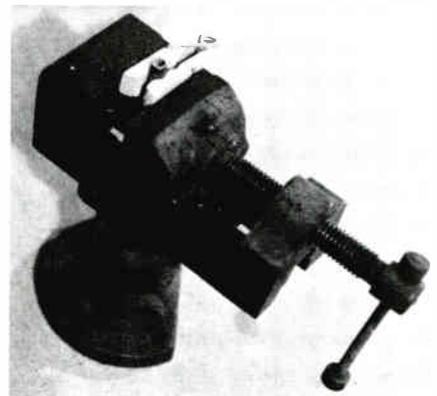
(Continued next issue)

SCREW HOLDER

You'll have no trouble holding Phillips screws when trying to reach into cramped places, if you slip a pocket pencil clip over the shaft of the Phillips screwdriver so the bottom end of the clip presses against the head of the Phillips screw, which will then stay put during handling.

*Mr. Harry J. Miller
Advance Television-Radio
991 Forty-Second Street
Sarasota, Florida 33580*

WISE DEVISE



When you have filing or other work to do on a fragile, small shaft, tubing, etc; hold it in a springtype clothespin clamped in a vise.

*S. Clark
Box 2162
East Bradenton, Fla.*

Note:

Those desiring to have letters published in this column should write the Editor, Techni-Talk, Electronic Components Sales Operation, General Electric Company, Oak Brook Executive Plaza, Oak Brook, Illinois 60521. For each such letter selected for publication you will receive \$10.00 worth of General Electric tubes. In the event of duplicate or similar items, selection will be made by the Editor and his decision will be final. The Company shall have the unlimited right without obligation to publish or otherwise use any idea or suggestion sent to this column. Caution: The ideas and suggestions expressed in this column are those of the individual writers. These ideas and suggestions have not been tried by the General Electric Company and therefore are not endorsed, sponsored or recommended.

**GE redesigns tubes
to satisfy
these tough customers
before you get them!**



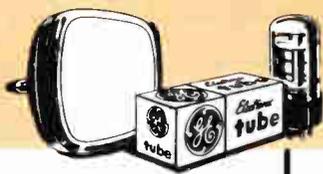
Reach for this when you ask,
"What else needs fixing?"

Tube designers at General Electric work for a real *tough customer*. He's our design chief Chris McCool — a stickler for longer life and greater reliability in tubes for replacement use. If a production type can be made better, he'll see to it. His GE designers found a way to dissipate plate heat for less operating fatigue . . . resulting in longer life. They pioneered an improved cathode coating that resists flaking which used to cause shorts. Microphonics in horizontal output tubes were eliminated in another design. These are just a few examples of tubes redesigned by GE for your replacement needs. They're part of the "service designed" line — dependable tubes you can stake your reputation on. Stock up now at your GE distributor.

288-25

GENERAL  ELECTRIC





GENERAL ELECTRIC



EXPERIMENTER HOBBYISTS KIT

Easy to assemble and wire simple electronic circuits.

Some typical Hobby circuits can be found in the new G E Hobby Manual, ETR-3960.

Rubber feet (4) — fasten with self-tapping screws to each corner.

Push-In terminals (15) — fit board holes. Serrated slots go on top.

3 1/2" x 4 1/2" terminal board will fit many small metal boxes or can be cut to size.

ETR-4288 Cost \$.98



SOLDERING GUN OR ELECTRIC DRILL HOLDER

This G E Soldering Gun or Electric Drill Holder prevents burns and damage to instruments, wires and service manuals. Holds an electric drill in a safe, ready-to-use position. It can be easily mounted to any surface with clamps and screws supplied with units.

ETR-2582 Cost \$0.75



COLOR DOT MAGNIFIER

Adequate magnification makes individual color dots visible on Color Picture Tube. Dot visibility makes more accurate "purity" adjustments possible.

Focus adjustable for complete screen coverage. Inner tube may be removed whenever necessary.

Compact and easy to use. Two color protective storage cylinder assures long life. Can also be used to check phono needles for wear.

Use to check and locate minute cracks in printed circuit boards.

ETR-4530 Cost \$ 0.75



TRANSISTOR CIRCUIT TROUBLE-SHOOTING COURSE

Contains three volumes with over 80 pages in each volume. This course is designed especially to meet the on-the-job needs of the electronic service technician who will be servicing transistorized, radios, stereos, TV, and other home entertainment products yet to come.

ETR-4423 Cost \$14.25



twist around insulation



pull off insulation

WIRE STRIPPER

Four cutting edges for most wire sizes. Select cutting edges slightly smaller than outside dimension of insulation.

Press insulated wire fully into cutting channel.

Rotate wire stripper completely around wire and pull.

ETR-2376 COST \$0.65

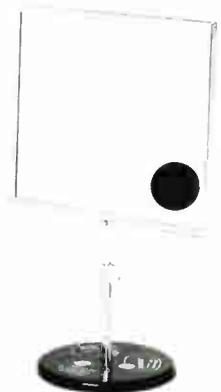
BENCH MIRROR

A mirror that saves you valuable time because it's designed specifically for the TV workbench. Adjusts quickly to any desired height.

ETR-1275 Cost \$3.75

REPLACEMENT MIRROR

ETRS-4615 Cost \$2.30



TUBE PULLER

Never be without it on your workbench or in your service case. It protects you against burns, cuts and shocks — no matter how firmly the tubes may be wedged in their socket. Fits all regular glass types, all metal tubes, plus seven- and nine-pin miniatures, and compactrons.

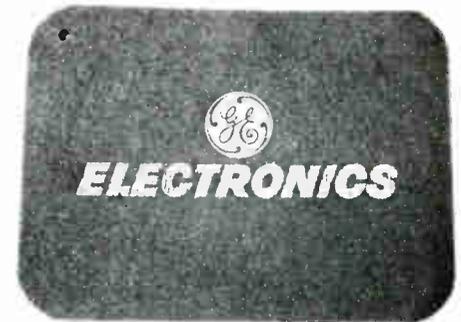
ETR-1094 Cost \$0.35



SAFETY GLASS PULLER

It's exactly what you need to remove safety glass quickly, easily — and safely! Prevents cracking, chipping and other damage while you remove the glass. The three-inch suction cup holds firmly, is easily removed from the glass by unique vacuum release tip. Won't leave marks on glass.

ETR-1592 Cost \$0.95



PICTURE TUBE PILLOW

This 1/2" thick foam-plastic cushion provides the surest possible protection against scratches on the tube face and edges. Order at least one for every technician in your shop. Never lay a picture tube on anything else.

ETR-1469 Cost \$0.75

SERVICE AIDS

specifically engineered and field-tested
for the TV/radio service dealer

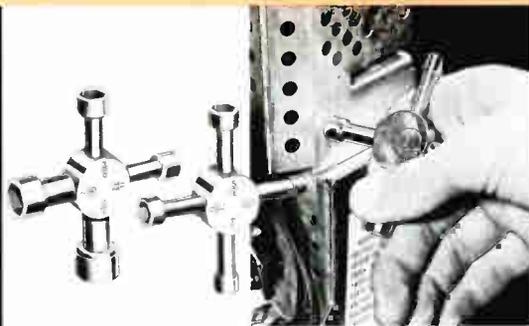


SERVICE DROP CLOTH

A rugged, hard-wearing plastic sheet that does double duty: It protects furniture and floor coverings, even against hot solder. It serves as a protective cover for radio and TV cabinets when moving them to or from the home.

ETR-1021

Cost \$1.95

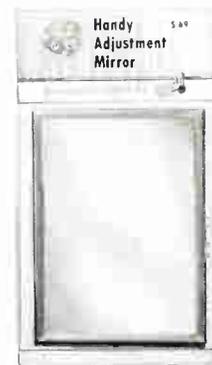


TWIN-X-WRENCH SET

The two wrenches in this set actually do the work of eight hex-head socket wrenches, save plenty of space and weight in your repair kit. They're designed especially for TV and radio service work, where you need to get maximum leverage, often in very close quarters.

ETR-752

Cost \$3.45



HANDY ADJUSTMENT MIRROR

Here is a high quality glass mirror which is very useful when servicing or adjusting television receivers. It is a convenient size (5" x 7") for carrying in a service case. Easel-type back makes mirror self-supporting.

ETRS-4886

Cost \$0.69



FUSE AND HEATER CHECKER

Pocket-size — yet it will check virtually all tubes used in series-string TV sets and radios (AC, DC, and portable), including compactrons, novars and picture tubes. Also tests pilot lamps and fuses. Rugged construction. Battery powered. Actual size — 4" x 2 3/4" x 1 3/4".

ETR-981

Cost \$2.95



COMPACTRON SOCKETS

Two 12-pin sockets for compactron devices in each package. New feature — a raised "key" ridge between pins 1 and 12 to help when inserting the compactron in hidden locations. The pins are numbered on the bottom of each socket.

ETR-2976

Cost \$0.39



CAPACITOR TAB ADJUSTER

Simplifies removal and installation of twist-prong electrolytic capacitors and also some types of variable controls. Hollow tip fits perfectly over mounting tabs. With a twist you break off old tab . . . lock in new.

ETR-2968

Cost \$1.00

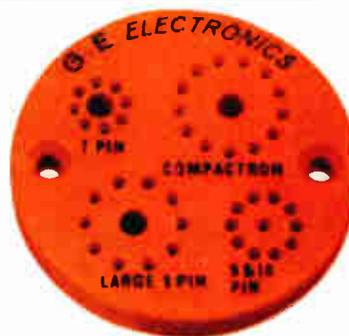


REAR CONTROL EXTENSION

Permits quick, sure adjustment of TV controls without removing back of set. One end tapered to fit snugly over knurled control shafts. Pin in other end fits slotted shafts and, unlike screwdrivers, cannot slip off.

ETR-2089

Cost \$0.35

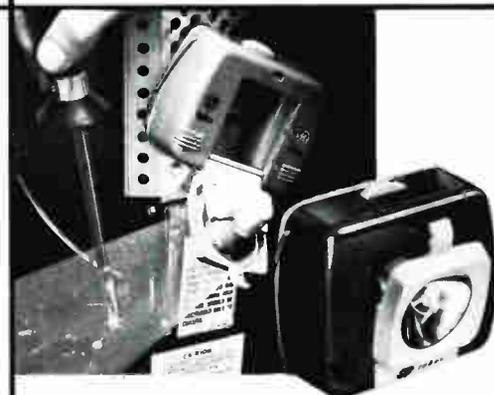


MULTI-TUBE PIN STRAIGHTENER

Straightens pins in a jiffy. Helps to eliminate tube damage caused by bent pins. New small size just right to slip into trouser or shirt pocket. Red-orange color makes it easy to find.

ETR-3200

Cost \$0.60

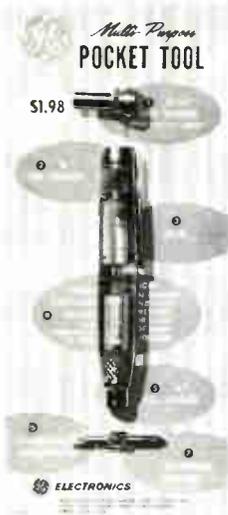


MAGNETIC SWING-BEAM SERVICE LIGHT

This TV Service Light has a magnet that holds it firmly to the chassis, leaving both hands free for work. The front of the lamp swings out to any desired angle, allowing you to aim the beam exactly where you need it.

ETR-1593

Cost \$2.25



POCKET TOOL

Here is a practical and useful tool that will make servicing easier and faster. This new pocket tool will enable you to remove the back of any receiver regardless of the type of fastening without opening your tool or service case.

Lightweight pocket tool clips to a shirt pocket and contains Phillips and standard screw driver; 1/4", 5/16" and 3/8" hex sockets; high voltage tester and level.

Use screwdriver end as prod, neon bulb in handle indicates presence of high peak voltage at plate of horizontal output tube or high voltage rectifier.

Lay unit flat with G E monogram down to use as a level when installing phonographs, air conditioners, etc.

ETR-3594

Cost \$1.98



PRINTED CIRCUIT BOARD CUTTING TOOL

This new G E Service Aid is a real time saver when servicing printed circuit boards. This versatile tool makes Printed Circuit trouble shooting easy. Use tool to cut through — make test — then flow solder across cut.

Blade slides horizontally — adjusts to cut "paper thin." In this position tool cuts only the printed circuit and does not weaken board.

Handy for opening packages and numerous other daily tasks. Blade retracts — safe to carry in pocket or service case.

Uses standard single-edge blade.

ETR-3896

Cost \$0.25



VACUUM SPARK TESTER

The Vacuum Spark Tester is used to check dud picture tubes to determine whether the tube has lost its vacuum.

A dud under vacuum will not show arcing between the metal parts within the neck of the tube while a tube that has lost its vacuum ("down to air") will have obvious arcs occurring between these metal parts (just as you observe when the probe is brought in close proximity to any metal object in the air).

CAUTION—THE VACUUM TESTER SHOULD NOT BE USED TO CHECK GOOD PICTURE TUBES AS IT IS POSSIBLE TO DAMAGE THE TUBE'S CATHODES WITH THIS HIGH INTENSITY SPARK.

ETRS-5198

Cost \$10.95



FIVE-IN-ONE COMBINATION TOOL

Here is a new lightweight tool that will save time either on the bench or on home service calls.

It is five tools in one with a pocket clip. Contains No. 1 Phillips screwdriver and standard screwdriver; 1/4", 5/16" and 3/8" hex sockets.

ETR-3910

Cost \$0.98



DOOR CLOCK SIGN

Let your customers know when — you are OPEN, you are CLOSED, you will be BACK.

It can be used to hang on front door or in a visible location. Hands movable to time of return when leaving for lunch — for the day — for service calls — for emergencies. Sign turns around so OPEN is visible when you return.

ETR-3826

Cost \$0.50



PROMPT • EFFICIENT SERVICE

OPEN

ELECTRONICS
Best for any set!

GENERAL ELECTRIC



NEW G E TUBE AND PARTS CABINET

Here is the answer to your tube and parts storage problem. Dress up your store with one or more for over-the-counter stock. Save time by having another at the bench to hold servicing supplies.

Six shelves provide over twelve feet of storage space. The pegboard hanger holes on each side give additional capacity for numerous items such as capacitors, semiconductors, tape, etc.

Cabinets can be mounted side by side or stacked one above the other.

Designed for shipping via parcel post. Can be assembled in a few minutes. All parts snap into place without use of nuts or bolts.

ETR-3803

Cost \$13.75

SERVICE NOTES

USE YOUR FINGER TO FIND SHORTED YOKES

Although there are certain instances when the chassis has to be removed and taken to the service shop, most technicians prefer to repair a television set in the customer's home whenever this is possible. One of the service techniques which works very well without removing the chassis is determining whether the horizontal windings of the deflection yoke are defective.

Quite often a television set will be encountered which has little or no high voltage. Through routine checks it is discovered that the set has no B+ boost voltage. Through experience you know that this can be caused by a shorted horizontal winding in the deflection yoke. Now if you could only determine in the customer's home that the yoke is the culprit, you wouldn't have to pull the chassis.

There is a sure fire way to tell if the yoke is defective. Remove the yoke from the neck of the picture tube and with it still electrically connected to the set, lay it down beside the chassis where it will not accidentally short against the chassis or some component. Plug the power cord into the chassis and let it warm up for two or three minutes. Remove the power plug from the chassis and feel around on the inside of the yoke windings. If a definite hot spot is found, the yoke has internal shorted turns and needs to be replaced.

CAUTION! Never touch the yoke or any high voltage component with power applied to the chassis.

Now you may wish to go one step further to definitely prove that the yoke is defective. Disconnect one of the wires going to the horizontal yoke windings to remove these windings from the circuit. Measure the B+ boost voltage and you will find that it has returned to normal or possibly higher since the deflection yoke has been removed from the circuit and normally is a load on the high voltage transformer.

The above is just another simple method of performing service in the customer's home with the least inconvenience to the customer and a minimum of work for you, the service technician.

HC CHASSIS, RESISTOR R402

We have found that some 680 ohm resistors were used in place of the 300 ohm 3-watt resistor which is the correct value for R402. It is also possible that some incorrect resistors may have been used in HB Chassis production.

Use of the 680 ohm resistor results in lowering the B+ 135 volts to 100 volts. This is known to produce an audio beat in the picture which varies with modulation.

We suggest that you measure the B+ line for 135 volts whenever an HB or HC Chassis is serviced.

TB CHASSIS—AUDIO DISTORTION

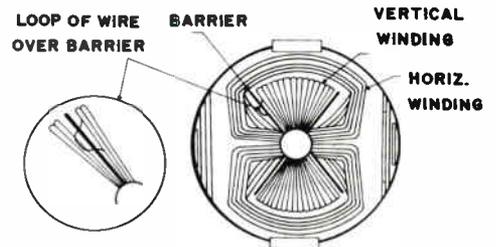
An audio distortion, resembling a raspy speaker, has been reported from some areas. This has been traced to crossover distortion occurring in Q15 and Q16 due to component tolerance buildup.

The correction is to replace R322 180 ohm $\pm 10\%$ with a 220 ohm $\pm 10\%$ 1/2 watt resistor. If a 10% tolerance resistor is not readily available, select the proper value using an accurate ohmmeter.

Do not increase the value of R322 over 240 ohms or the ratings of the output transistors will be exceeded.

SB CHASSIS—YOKE FAILURE

Evaluation of several yokes returned from the field indicate that most SB yoke failures occur due to a turn of the vertical winding looped over the barrier and touching a horizontal winding.



This may show up as a loss of high voltage or a trapezoidal raster.

A visual inspection of the inside of the yoke may reveal a loop of wire from a vertical winding looped over the barrier and touching the horizontal winding. Regressing the wire to the correct side of the barrier will restore normal operation. See illustration below.

Any SB yokes which appear to be defective, should be inspected and re-dressed rather than replacing.

USE ORDER COUPON BELOW

ORDER COUPON

Order from your local G E electronic components distributor or mail this form to:

Enclosed is money order or check payable to General Electric Company for:

General Electric Company
Department "B"
3800 N. Milwaukee Ave.
Chicago, Ill. 60641

Quantity		Price
.....	ETRS-752 Twin-X Wrench Set.....	\$ 3.45
.....	ETRS-981 Fuse and Heater Checker.....	3.15
.....	ETRS-1021 Service Drop Cloth.....	1.95
.....	ETRS-1094 Tube Puller.....	.35
.....	ETRS-1275 Bench Mirror.....	3.75
.....	ETRS-1469 Picture Tube Pillow.....	.75
.....	ETRS-1592 Safety Glass Puller.....	.95
.....	ETRS-1593 Magnetic Swing-Beam Service Light.....	2.25
.....	ETRS-2089 Rear Control Extension.....	.35
.....	ETRS-2376 Wire Stripper.....	.65
.....	ETRS-2582 Soldering Gun or Electric Drill Holder.....	.75
.....	ETRS-2968 Capacitor Tab Adjuster.....	1.00
.....	ETRS-2976 Compactron Sockets.....	.39
.....	ETRS-3200 Multi-tube Pin Straightener.....	.60
.....	ETRS-3594 Pocket Tool.....	1.98
.....	ETRS-3803 Tube and Parts Cabinet.....	13.75
.....	ETRS-3826 Door Clock Sign.....	.50
.....	ETRS-3896 Printed Circuit Board Cutter.....	.25
.....	ETRS-3910 Five-in One Combination Tool.....	.98
.....	ETRS-3960 Electronic Components Hobby Manual.....	1.50
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AUDIO ALIGNMENT PROCEDURE

The following procedure is suggested as a quick, accurate method for aligning the audio section in receivers which contain SB, SC, or S-1 Chassis and VB, VC, or V-1 Chassis. *Do not attempt to use this procedure on other chassis types.*

- 1) Connect the VTVM between C309/R309 junction and chassis ground. This point is the low end of the Quadrature Coil (L302).
- 2) Set the VTVM on the 0-5 Volts Negative DC range.
- 3) Properly tune in a strong local signal and set the volume control to a low audible level.
- 4) Adjust L302 Quad. Coil for maximum meter indication. There are two possible peak indications when tuning this coil. Starting with the core at the top of the coil form (away from the circuit board) tune down through the coil for the second peak indication.
- 5) Reduce the signal level by tuning in a weak station, or fine tuning away from audio until the picture "smears".
- 6) Adjust L301 Audio Interstage Transformer for maximum indication.
- 7) Tune L157 Sound Take-Off Coil for maximum meter indication.
- 8) Disconnect the VTVM leads from the receiver. The audio section is now aligned for optimum operation.



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HOBBY COMPONENTS

The General Electric warehouse at 3800 North Milwaukee Avenue in Chicago now has available some of the "hard to get" items used in some of the Hobby Manual, ETR-3960, projects.

Two such items are listed below:

Description	Used in Project No.	Order No.	Price Each
T1 Autotransformer Form	H-6 Battery Operated Fluorescent Light	ETRS-4891	\$.80
35ZM923 Pulse Transformer	H-5 Time Dependent Lamp Dimmer W-5 Precision Temperature Regulator	ETRS-4898	5.95

These items may be purchased from your local General Electric electronic components distributor—or if he is unable to supply you, use order coupon on page 7.



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