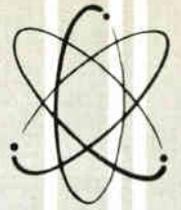




Techni-talk

COMPLETE ELECTRONIC SERVICING INFORMATION
radio • tv • hi-fi



Vol. 17, No. 1

Spring, 1965

The Oscilloscope — Signal Tracing — 6

This is the sixth article on determining the capabilities of an oscilloscope and the servicing techniques which will be helpful when using the oscilloscope in electronic service work.

Signal Sources — TV Station

Some form of signal will be required to shoot trouble in signal circuits containing defects other than the type usually located by voltage or resistance measurements. There are four basic signal sources that can be used, however, each has disadvantages which tend to limit their usage under certain conditions.

A television station signal is by far the most logical signal source to use where signal tracing is required. It contains all the information necessary to trace through I-F, detector and video amplifier circuits. The station pulses can be traced from the video detector through the clipper and into the synchronizing circuits. It has only two limiting factors which may or may not be termed disadvantages. When using the station signal for troubleshooting the main chassis, the tuner and R-F circuits must be in good operational order and, in remote areas where the signal does not come on the air until midday, troubleshooting time will be limited.

Cross Hatch Generator

When the station signal is not available, a cross hatch generator providing dependable synchronizing signals may be used. A unit of this type will be found useful in making point-to-point checks in a manner similar to the procedure followed when using a station signal. Its disadvantage, of course, is the fact that the video information supplied does not correspond to that of a station signal. Also, the synchronizing pulses may be of greater or lesser amplitude or the pulse shapes differ somewhat which might be misleading, while troubleshooting, and must be taken into account during its use.

Sweep Generator

An I-F sweep generator, with appropriate marker system, provides

an excellent source of signal for point-to-point checking through the I-F, detector, video and 4.5 MC amplifier circuits. An advantage in using this type of unit in these particular circuits is the fact that variations, observed in the response curve while making point-to-point checks, may indicate the defect involved. Its use is mainly limited to the above circuits. However, it is the logical unit to use in supplementing the station signal for point-to-point checks and, of course, is essential for making alignment adjustments.

An R-F signal generator, modulated with 1000 cycles, can be used for signal tracing in the I-F, detector and video circuits. It can be used for pre-peaking I-F stages, making trap adjustments and adjustments to audio circuits. It is less flexible in that it cannot be used for response measurements without following a time-consuming procedure. At best, it should be used only as a supplement to one of the other suggested units.

Continued on page 3

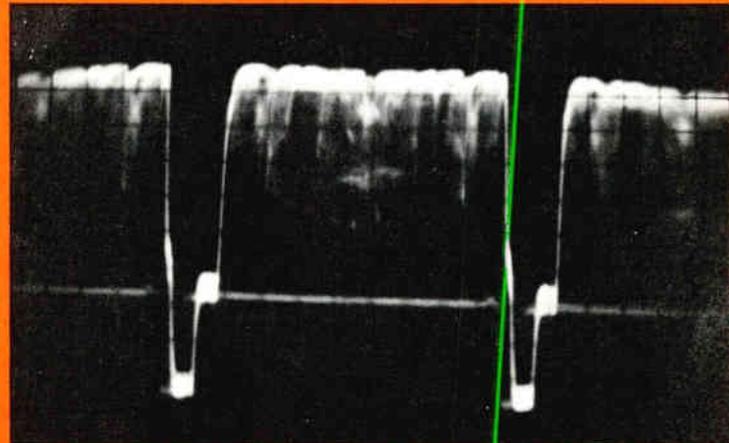


Fig. 1 Video signal at one-half horizontal frequency

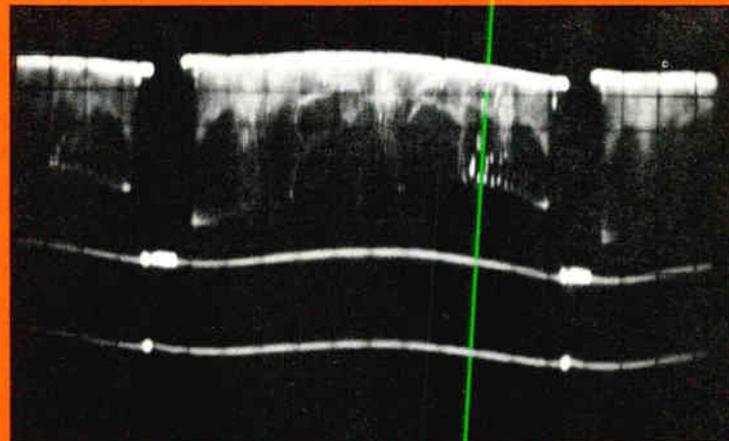
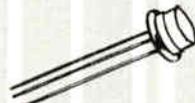
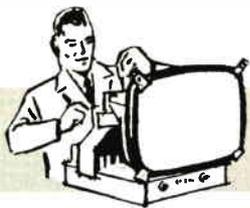


Fig. 2 Video signal at one-half vertical frequency





BENCH NOTES

IMPROVING BUILT-IN ANTENNA

Many TV sets have biconical, fan or other types of antennas painted, with aluminum paint, on the inside of the rear cover for use as a built-in antenna. These can be considerably improved and the gain increased by adding a reflector. This can be done by cementing or taping a sheet of aluminum foil across the outside of the rear cover. Make sure that the entire area of the painted antenna on the inside of the cover has been covered. After installing the foil, push a pencil through the vent holes in the cover so that ventilation will not be impeded. Further improvement can be achieved by connecting a short length of insulated single conductor wire to one of the antenna terminals. Some experimentation may be necessary as to length and position for best results.

*Frank Damico
86-75 Midland Pky.
Jamaica, N. Y. 11432*

SOLDER HOLDER

I always had some trouble with the cardboard box disintegrating before the one pound roll of solder was used up. Then I began using a small glass jar with a $\frac{1}{8}$ " hole drilled through the middle of the lid from which to draw the solder, I find a 3" x 3" glass jar works best. It doesn't tip as easily as the paper box or a taller glass. Kept in such a jar the solder will never kink or knot because it doesn't get bent out of shape even if it happens to fall off the bench.

*G. W. Schroeder
East Side Grov. and
Appliance Service
Paonia, Colorado*

DECEIVING SYMPTOM

Within the last few years I have serviced several General Electric sets including models 21C137, 17C110, 21C3567, 21C2535. The screen shows all the symptoms of the horizontal section of the yoke being shorted, keystoneing, dull raster, not enough width, poor linearity and a slight bit of foldover. Further tests revealed the B+ boost filter capacitor to be leaky. Replacement of this one part solved the problem. One of the amazing things about this is that the B+ boost supply voltage was only 50 volts below normal.

*William Rickinson
84 Chelsea Street
Hawthorne, N. Y.*

LOCATING ANTENNA

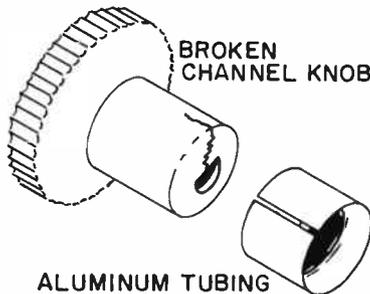
Confronted with the task of locating an apartment house dweller's antenna through a maze of rooftop antenna wires, we disconnected the antenna at the TV set, and connected the lead-in to the low-voltage side of a bell ringing transformer plugged in an outlet.

Then by tapping the various lines on the roof with a bell we were able to readily locate the antenna we sought.

*Henry Mullen
3274 Fulton Road
Cleveland 9, Ohio*

KNOB PROTECTOR

Many channel selector knobs have extended center hubs of approximately $\frac{3}{8}$ to $\frac{1}{2}$ inch in diameter and of various lengths. As they are invariably made of plastic and invariably crack from repeated stress of turning the channel selector I have discovered a method of repairing these knobs which has proven very satisfactory. Most TV shops have some old antenna rods around from old outdoor antennas.



ALUMINUM TUBING

These aluminum rods come in various sizes and if you are very lucky you may find one whose inside diameter provides a snug fit for the hub of the broken knob. Of course generally you won't be that lucky but the method still works: Cut a piece of tubing that is closest to the correct size but smaller and then slit it lengthwise with a hacksaw. This can then be forced over the knob's hub and will provide a strong reinforcement.

*Bill Fisher
Fisher TV
Mt. Vernon, N. Y.*

SOCKET IDENTIFICATION

If you have trouble finding the right size socket for your wrench or nut-driver, try painting them different colors. This not only makes them easier to see on the work bench but also will let you see at a glance which socket is which.

*William Schoech
1133 Oak Street
W. Palm Beach, Fla.*

TESTING SERIES SETS

We save a variety of bad tubes that have good filaments, then clip off all except the heater pins. They can then be used in series sets to kill various stages while testing and trouble shooting.

*Stan Clark
Box 2162
East Bradenton, Fla.*

CY — INTERMITTENT BRIGHTNESS

Intermittent brightness on a CY chassis was caused by an open ground connection on capacitor C738 (.01) on the grid of the 6FQ7 blanker. Correction was made on the printed board by soldering a piece of wire from capacitor to ground.

*Leon Szajna
523 Wunder St.
Reading, Pa.*

RADIO SERVICE KIT

A small plastic tool case is ideal to store one each of nearly all tubes used in small radios and what little parts you will need to repair radios in home — except major repairs.

This way the T. V. Caddy is not overburdened. This can always be left in truck or car.

*Francis L. Schiel
Schiel Radio & TV
615 Glenwood St.
Waterloo, Iowa*

GUN SIGNAL

Our soldering gun serves handily in circuit and component defect analysis. Plug the gun in, then use the energized tip as a substitute for a signal generator to find defective components in both audio amplifier section and the picture circuit. This quickly uncovers thermal intermittance trouble.

*E. Mayover
1601 - 14th St. W.
(U.S. 41)
Bradenton, Fla.*

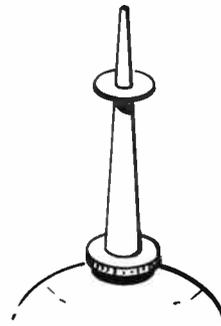
COLOR RESTORATION

In the absence of a schematic and when it is necessary to know the values of resistors that are faded, greasy, etc., rubbing with some speaker service solvent will often restore color band brightness for easy identification.

*Harry J. Miller
991 - 42nd St.
Sarasota, Fla.*

OIL CATCHER

To catch drips of oil that run down over the spout and over the sides of an oil can, solder on a washer near the top of spout or force over it a faucet washer. The washer will intercept oil



drips and keep them from messing the can, your fingers or components, since you can wipe away the oil before it has a chance to do damage.

*H. Josephs
P. O. Box 22
Gardenville, Penna.*

Note:

Those desiring to have letters published in this column should write the Editor, Techni-Talk, Electronic Components Division, General Electric Company, Owensboro, Kentucky. 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.

Raster Visible Without Damper Tube

An operational peculiarity has been observed on a General Electric Model 21C3440 with an M5 chassis. Because of the peculiar nature of this condition some explanation is required to understand the reason.

In some models of General Electric television receivers, a polarized type filter capacitor was used between B+ and B+ Boost. In these receivers it is possible to develop enough high voltage to see a visible raster on the face of the CRT with a defective damper tube or with it removed from the socket. The question has been asked why and how is this pos-

acteristics allow it to pass B+ current quite freely. In the circuit in Fig. 1 it can be seen that the plus side of the capacitor is more positive than the minus side when the high voltage circuit is operating properly. However, in the case when there is no B+ Boost present the minus side of the capacitor becomes positive from the low voltage B+ supply. In this condition the capacitor is charged in the reverse direction which allows the B+ current to flow through the capacitor, through the transformer T350 to the plate of driver tube V11.

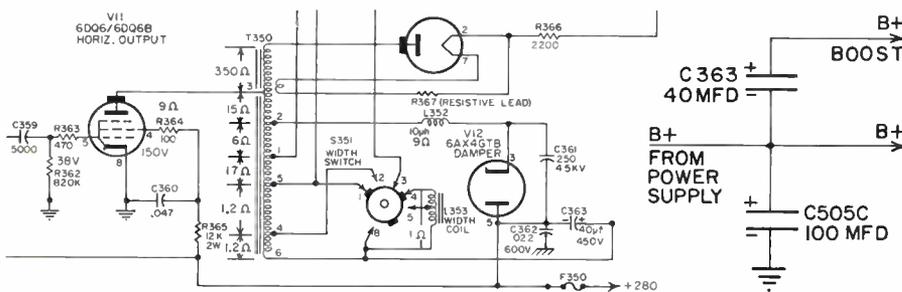


Fig. 1 Position of Capacitors C363 and C505C in circuit.

sible. Before we go into the reason why, let us first take a look at the circuit diagram of this high voltage system. In Fig. 1 it will be noted C363 is in series with the low B+ filter electrolytic capacitor. It will also be noted that there is no obvious path for the B+ current to reach the plate of the driver other than by the way of the damper tube. But there is a path that may not be too obvious unless one is aware of the characteristics which a polarized electrolytic capacitor exhibits. The B+ current path is through the 40MFD-450V capacitor, C363.

The electrical and mechanical design of the polarized electrolytic capacitor cause it to exhibit somewhat the characteristics of a semiconductor type of diode. It will be seen by looking at Fig. 2 that the capacitor will only pass a small amount of current in one direction while in the other direction its diode char-

In Fig. 3 is shown the non-polarized type of electrolytic capacitor. It is essentially two capacitors connected back-to-back; therefore, it does not exhibit the same characteristics as the polarized

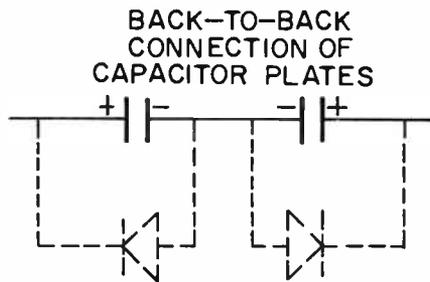


Fig. 3 Rectifier action of back-to-back connection of plates.

type capacitor. For cost and mechanical size considerations this type of capacitor is seldom used in this type of circuit configuration.

The regular type of polarized electrolytic capacitor cannot pass much current in the reverse direction without overheating and opening up. Therefore, the particular capacitor used in the General Electric TV receivers is of special design. It must be able to stand a current flow of .070 amps for a period of two hours without failing. It is advisable, therefore, that the direct replacement be purchased by part number.

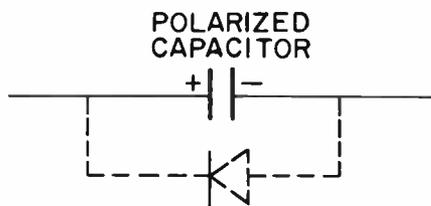


Fig. 2 Rectifier action of one way dielectric operation.

THE OSCILLOSCOPE SIGNAL TRACING

Continued from page 1

Tracing Signal

Either of two methods can be used for tracing a signal through the video I-F stages. The first method utilizes a station signal, oscilloscope and a crystal diode probe as the pick-up device. The circuit diagram for a crystal diode probe was described in the Vol. 15 No. 4 issue. The station signal is connected to the antenna input as in normal operation. Contact to various points in the I-F section is made with the probe. The probe output is fed directly to the vertical input terminals of the oscilloscope. Comparative measurements can then be made by checking the signal present in the various stages. Start with the I-F input link, then observe the signal present at the grid and plate of each stage progressing toward the video detector. This results in a very practical method of detecting the presence or absence of the signal in any section of the I-F system. It is not, however, desirable for checking stage gain as errors may be introduced due to loading effect and variations in signal content. The signals observed when this probe is used are illustrated in Figs. 1 and 2.

The second method utilizes an I-F sweep signal and an oscilloscope. Comparative measurements can be made by checking the signal present in the various stages. Start with the stage just preceding the video detector, then observe the signal injected at the grid and plate of each stage progressing toward the I-F input link or mixer grid. During these checks, the scope remains connected to the output of the video detector.

This method holds a distinct advantage over the first method described. With markers added to the sweep, the signal present on the scope contains information that enables the user to determine the frequency response of the circuit under test. Quite often, this can aid in the identification or localization of the fault present in the I-F section. Figures 1 and 2 illustrate the type signal observed in a typical I-F section when using this method of signal tracing.

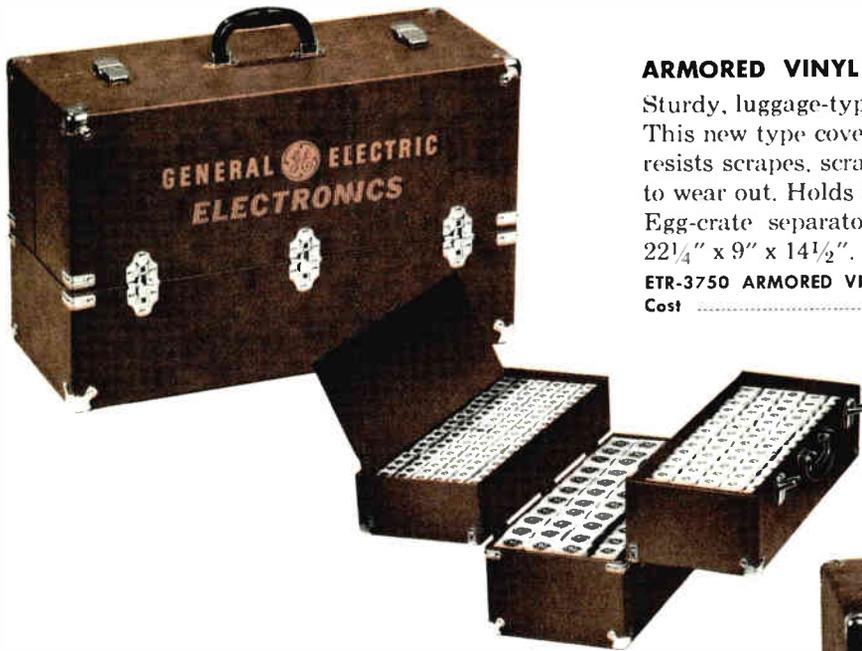
COMPLETE LINE OF GENERAL ELECTRIC SERVICE CASES

ARMORED VINYL SERVICE CASE

Sturdy, luggage-type case covered with armored vinyl. This new type covering is a heavy laminated vinyl that resists scrapes, scratches and stains. Almost impossible to wear out. Holds at least two hundred and fifty tubes. Egg-crate separators hold tubes in position. Size is 22 $\frac{1}{4}$ " x 9" x 14 $\frac{1}{2}$ ". Color is a rich rust.

ETR-3750 ARMORED VINYL SERVICE CASE

Cost\$16.95

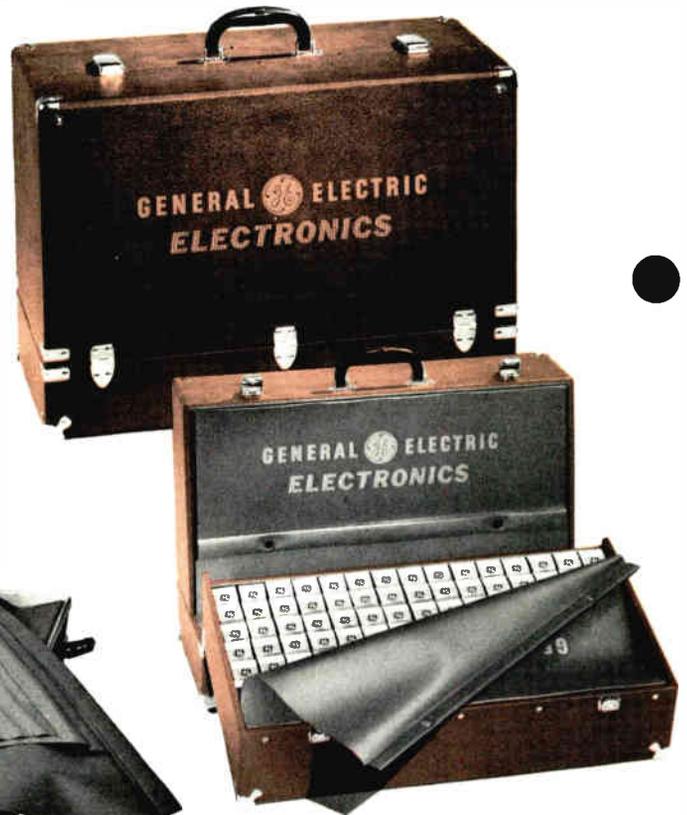


LUGGAGE TYPE SERVICE CASE

Egg-crate separators hold at least 365 tubes in position. Flexible curtain holds job tickets, alignment tools, and characteristics booklet. Separate covered tool compartment. Laminated armored vinyl is almost impossible to wear out. Nickel plated hardware and snap locks are used. Bakelite handle is guaranteed against breakage.

ETR-3915 ARMORED VINYL SERVICE CASE

Cost\$22.50



LIGHTWEIGHT PLASTIC

PLASTIC SERVICE CASE

Rugged... built of tough Royalite® plastic. Plenty of space to carry tubes and tools. Has egg-crate tube holders, separate tool compartment and a plastic curtain which holds job tickets, alignment tools, drop cloth, etc. Size—22 $\frac{3}{16}$ " x 8 $\frac{1}{16}$ " x 15" high. A real featherweight at only 8 lbs. And that's about 4 lbs. less than most cases of comparable capacity. Colors—red-orange and grey.

ETR-2700 PLASTIC SERVICE CASE

Cost\$24.95

© T.M. U.S. Rubber Co.





MATCHED PLASTIC TOOL CASES

Here is an assortment of plastic tool cases that will fulfill your complete requirements. Top section is orange-red and bottom grey as shown.

All three cases are made of high-impact polystyrene and are practically indestructible under normal usage. These cases are warp-free, impervious to grease, oil, salt water and even battery acid.

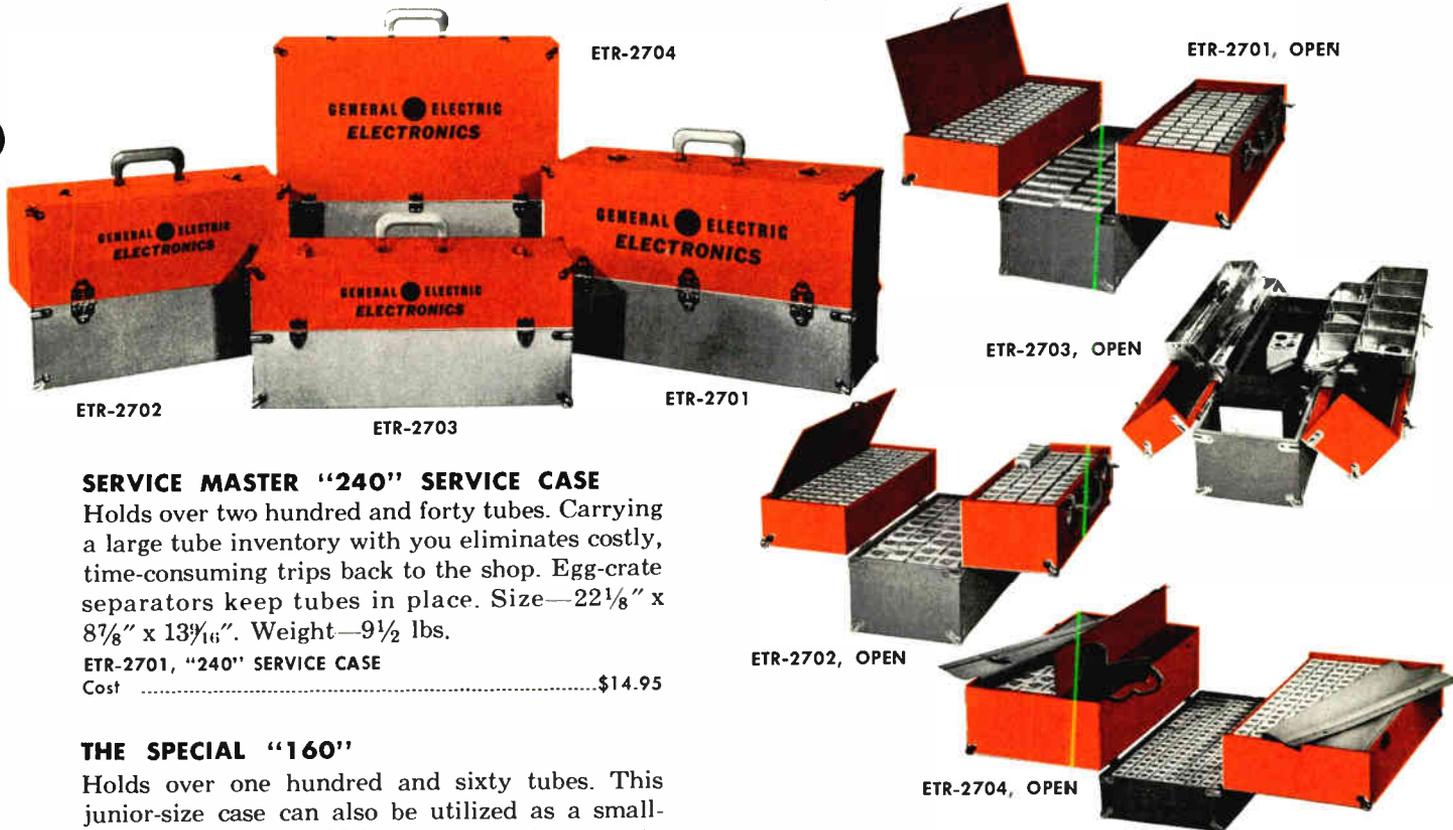
The top cover has overlapping edges which prevents water from dripping into case. ETR-3517 and ETR-3280 have two cantilever trays which open automatically as the cover is opened.

ETR-3516 also has two cantilever trays which are easily opened manually. Each individual tray has various size compartments to keep tools, parts, fuses, etc. separated and easy to locate and remove.

ETR-3517 TOOL CASE
 18 1/4" long, 9 1/2" wide, 9 1/2" high
 Cost\$8.75

ETR-3280 TOOL CASE
 15 3/4" long, 8" wide, 8 1/4" high
 Cost\$7.35

ETR-3516 TOOL CASE
 14" long, 6" wide, 5 1/2" high
 Cost\$3.75



SERVICE MASTER "240" SERVICE CASE

Holds over two hundred and forty tubes. Carrying a large tube inventory with you eliminates costly, time-consuming trips back to the shop. Egg-crate separators keep tubes in place. Size—22 1/8" x 8 7/8" x 13 1/16". Weight—9 1/2 lbs.

ETR-2701, "240" SERVICE CASE
 Cost\$14.95

THE SPECIAL "160"

Holds over one hundred and sixty tubes. This junior-size case can also be utilized as a small-parts case. Tubes held in position with egg-crate separators. Size — 18" x 8 3/8" x 11 7/16". 8 lbs.

ETR-2702, "160" SERVICE CASE
 Cost\$11.95

THE GIANT "365"

Combination tube and tool case... holds 365 tubes plus tools to get the job done. Egg-crate separators keep tubes in position. 22 1/8" x 10 5/8" x 15 1/16".

ETR-2704, GIANT "365"
 Cost\$18.95

HOME SERVICE TOOL CASE

Here, you've got the tools at hand for almost any home service job. Case is divided into compartments to provide an orderly arrangement of service tools... they're easy to see and right at your finger tips. Separate compartment for VOM. Size — 20 1/16" x 6 7/8" x 9 3/16". Weight — 5 1/2 lbs. Colors — red-orange and grey.

ETR-2703 HOME SERVICE TOOL CASE
 Cost\$11.95

What's new!

New G-E Electronic Components Price List

Carry in pocket
or use on wall



LIST PRICES
May 9, 1965

ENTERTAINMENT COMPONENTS
YOUR G-E DISTRIBUTOR

- RECEIVING TUBES
- SEMICONDUCTORS
- PICTURE TUBES

Programs & Our Most Important Product
GENERAL ELECTRIC



Pocket size 3" x 5"

Here is the new versatile price list of General Electric Electronic Components. ETR-4239 contains prices for Receiving Tubes, Picture Tubes and Entertainment Semiconductors including transistors, rectifiers, color rectifiers, vac-u-sel diodes and crystal diodes.

LIST PRICES
May 9, 1965
ENTERTAINMENT COMPONENTS
YOUR G-E DISTRIBUTOR

Programs & Our Most Important Product
GENERAL ELECTRIC

Wall size 21" x 10"

This 21"x5" publication folds down to a convenient pocket size, 3"x5". Two can be used side by side as a wall chart with all electronic component prices clearly visible.

Ask your local General Electric Electronic Components distributor for copies of the new price list, ETR-4239.

"W" and "X" Line Service Manuals

To accomplish improved availability and ease of use, Television Service Manuals are now published in consolidated form, shortly after the expiration of the model year (not year of manufacture). Current releases during production years will remain in loose leaf form.

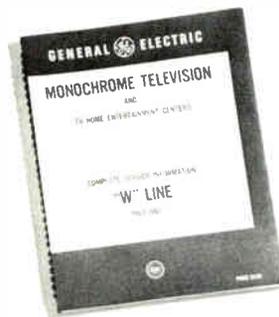
These Consolidated Service Manuals will contain complete Service Information for all chassis built in a given model year. They will be 8½" x 11" in size with full foldout schematics, and

in spiral or plastic binding similar to the Service Guides. No more Service Guides will be published since the consolidated manual will serve the same purpose.

ETR-3906 "W" Line Manual (Monochrome only) \$3.00 each

ETR-3907 "X" Line Manual (Monochrome & Color) \$4.50 each

Available from your distributor — or if he is unable to supply you, use order coupon on page 7.



NEW GENERAL ELECTRIC TUBES AND COMPACTRONS LISTED BY RECEIVER

tubes



Here is a list of *NEW* General Electric receiving tubes and compactrons and the manufacturers using these types in their receivers. Be ready to service the new model re-

ceivers by having at least one of each type on hand. They are now available from your General Electric tube distributor. Asterisk indicates compactron types.

TYPE	SET MANUFACTURER	FUNCTION
3HQ5	Standard-Kollsman TV	RF Amp.
5GX7	Standard-Kollsman TV	Osc. Mixer
6BN11*	Admiral-Color	1st Video and sound, IF
6EA4*	G. E. Color	Regulator
6GT5	RCA TV	Horizontal Output
6GX7	Standard-Kollsman TV	Osc. Mixer
6JB6	RCA, B&W TV	Horizontal Output
6JT8	Zenith TV	Video Amp.
6LE8	Admiral & Motorola Color TV	Color Demodulator
6LF8	GE & RCA Color TV	1st Video Amp.
6LY8	Motorola TV	Video Amp.
8BM11*	Admiral — 16" and 19" B & W	1st & 2nd IF
8LT8	G.E. — 19" B & W	Horizontal Oscillator
9BJ11*	G.E. — 19" B & W	1st " 2nd IF
10LW8	Admiral 19"	Video, IF
11KV8	Curtis Mathis 11" and 19"	Video, IF
12HE7*	Muntz B & W TV	Horizontal Output & Domper
14BL11*	G.E. — 19" B & W	Video, AGC
21KA6*	Emerson — 19"	Horizontal Driver

*Compactron types

SERVICE NOTES

TELEVISION

REPLACING COMPACTRON SOCKETS ON ETCHED CIRCUIT BOARDS

Compactron sockets can be removed easily from an etched circuit board with a piece of #12 wire and a soldering gun.

Fashion a 9" length of #12 bare copper wire to encircle the pins of a compactron socket on the solder side of an etched circuit board. This formed wire can then be used as the "tip" of a soldering gun.

When the soldering gun is energized, the solder is melted at all socket pins simultaneously and the socket is easily removed from the circuit board.

If the compactron has a center ground post, remove as much solder as possible from the post. Then apply the loop to the socket pins and place a General Electric pencil iron with a 30 watt chisel tip against the ground post. When the solder in both areas is melted, the chisel tip is then used to gently push the socket from the board. If the socket is of the type with thin terminals, the terminals should all be perpendicular to the board before socket removal is attempted.

Of course, any tube shield should be removed from the circuit board before unsoldering the socket.

After removing the socket, clean all rosin and sludge from the board before soldering the new socket in place.

A variety of "tips" can also be made to facilitate removal of smaller sockets, coils, etc.

CONSOLE PHONO

MODEL: Tube Amplifier RC4100, RC4620/30, RC4660, RC4850 Series.

SYMPTOM: Hum.

CAUSE: High Ripple Current in Ground Run on Circuit Board.

CORRECTION: When analyzing or replacing parts, make sure that the following three leads of the power transformer and filter capacitor are soldered to the same solder pad on the circuit board. (1) The black ground lead of filter capacitor C9. (2) The high voltage secondary winding center tap lead of power transformer T4. (3) The ground lead of the filament winding of power transformer T4.

MODEL: RC4330 and RC4530 Series.
SYMPTOMS: Buzzing sound at certain frequencies.

CAUSE: Loose Spade Lugs On The Tweeter Signal Terminals.

CORRECTION: Remove woofer, dress and tape (or staple — with caution) the tweeter signal lead securely to the baffle.

MODEL: All console series with Porta-Fi option.

SYMPTOM: Rattle sound intermittently or at certain frequencies or loud passages of sound.

CAUSE: The Porta-Fi Signal Leads And/Or Plugs Vibrating Against The Cabinet Bottom Panel.

CORRECTION: Dress and secure the leads and plugs to the cabinet center panel.

TAPE RECORDER

THREADING TAPE RECORDER

The TD100 Tape Recorder used in the Model 5040 Module Units and the RC4341 Stereo Sound Center Console Series, incorporates an automatic shut-off device. This is a small white nylon lever that rides against the tape when the recorder is in operation. The shut-off lever is located to the right of the capstan.

The nylon shut-off lever is retracted when the stop button on the tape recorder is pushed firmly, all the way down. When changing or re-threading tape, the nylon lever must be fully retracted and on the correct side of the tape (shiny side) so that automatic shut-off will operate properly.

However, if the stop button is only pressed part of the way down, the tape reels will stop but the nylon lever will not be fully retracted. When the tape is changed or re-threaded in this condition the shut-off lever will be on the wrong side of the tape and in the OFF position. When the Play or Record button is pushed the reels will not turn.

Many times when this has happened, the customer reports that as they turn the tape recorder on, the pilot lamp lights but the reels will not turn. It is a good idea to point out this lever to the customer, whenever you work on one of the tape units. This will alert the customer to check its position if the tape reels fail to turn. The stop button should always be depressed fully, so that it is latched and held in the down position. This will prevent nuisance calls caused by improper threading of the tape recorder.

Use Order Coupon Below

ORDER COUPON

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

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

Quantity	SERVICE CASES	Price
.....	ETR-2700 Lightweight Plastic	\$24.95.....
.....	ETR-2701 Service Master "240".....	14.50.....
.....	ETR-2702 Special "160".....	11.95.....
.....	ETR-2704 Giant "365".....	18.95.....
.....	ETR-3750 Luggage Type — 250 tube size.....	16.95.....
.....	ETR-3915 Luggage Type — 365 tube size.....	22.50.....
.....	TOOL CASES	
.....	ETR-2703 Home Service.....	11.95.....
.....	ETR-3280 Medium Plastic.....	7.35.....
.....	ETR-3516 Small Plastic.....	3.75.....
.....	ETR-3517 Large Plastic.....	8.75.....
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.....	ETR-3906 "W" Line.....	3.00.....
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.....	ETR-2579 Complete set of TECHNI-TALK back issues Vol. 1 No. 1 — Vol. 16 No. 4 with 3-ring vinyl covered binder (includes all Tele-Clues and Tele-Clue Schematics).....	6.25.....
.....	(Include applicable state and local tax) \$.....	TOTAL \$.....

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RADIO

P1820, P1830 SHORTED SPEAKER

Complaints from the field indicate that, on a number of early production sets of radio model P1820 and P1830, the receiver is dead when the battery is inserted; or that the battery tube cannot be properly inserted into its compartment preventing closing of the back cover.

Both conditions are usually caused by the same problem. The speaker terminals are bent upright and interfere with proper insertion of the battery tube. When the terminals are bent down to allow for sufficient clearance, the hot terminal sometimes shorts to the speaker frame, killing the audio output.

To prevent shorting, insert a piece of electrical tape under the hot (ungrounded) terminal on the speaker frame. Then both terminals can be bent down flat, allowing enough room for the battery tube to fit. The back cover should now close properly.

Be sure to inspect all P1820's and P1830's you may receive for repair to be sure there is no chance of this short occurring.



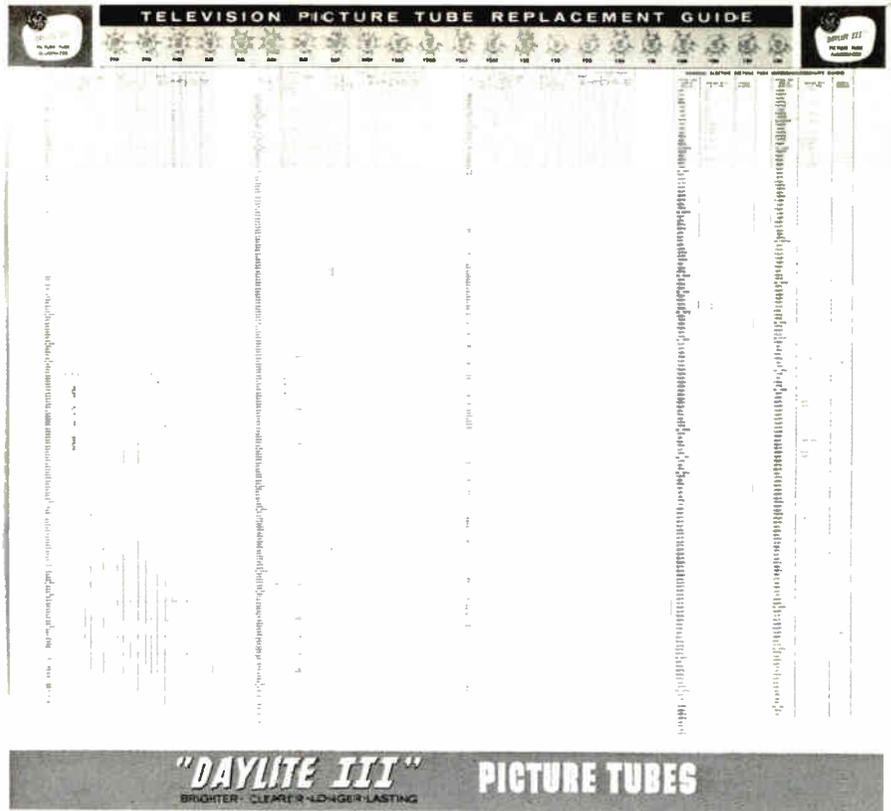
NEW TV PICTURE TUBE INTERCHANGEABILITY AND REPLACEMENT GUIDE

Most complete in industry

A three-foot square wall chart, ETR-702J, illustrates the various pin configurations and shows the deflection angle, whether the tube is glass or metal, the shape of the faceplate, the type of implosion protection, the type of faceplate treatment, external coatings, focus data, ion trap information, overall length, neck length, basing, heater information, anode information, and typical operating conditions for more than 650 picture tubes.

The handy interchangeability guide not only indicates which tubes may be substituted for others currently in use, but also shows that changes are required in making such a substitution.

Ask your distributor for a copy of ETR-702J Picture Tube Replacement and Interchangeability Guide.



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