



COLOR TELEVISION--NTSC STANDARDS-III

In the last issue the luminosity response of the human eye was discussed. In this issue the development of chrominance signals are described.

As indicated in Figure 2 in the Volume 20, No. 1 issue, the high definition brightness signal that has been constructed is only step one of a two-step process. Step two is the addition of low definition color information. This will result in the "splashing on" of low detail color to the high detail monochrome picture. The necessary voltages for a color reproduction are as shown at the picture tubes in Figure 7, E_r for the red tube, E_g for the green tube and E_b for the blue tube. In other words, for any fluctuation of the voltage out of the red camera that same fluctuation should be applied to the red picture tube. For reasons cited previously, E_y is being applied to all three receiving picture tubes. Therefore, what color signals must be added to E_y to give E_r , E_g , and E_b ? Apparently, three different signals are needed. One color signal when added to E_y must give E_r . A second signal added to E_y must result in E_g . Finally, a third signal must be used to give E_b .

The next problem is the exact nature of these three signals. Looking at the signal to be applied to the red tube: Color Signal + $E_y = E_r$
so Color Signal = $E_r - E_y$

When this is done for the green and blue tubes also, the resulting color signals take the form:

$$E_r - E_y \quad E_g - E_y \quad E_b - E_y$$

When these color difference signals as they are called, are applied to their respective picture tubes, the results will be:

$$(E_r - E_y) + E_y = E_r \text{ for the red tube}$$

$$(E_g - E_y) + E_y = E_g \text{ for the green tube}$$

$$(E_b - E_y) + E_y = E_b \text{ for the blue tube}$$

A look at Figure 7 shows what the addition does to the color receiver. First, the signals E_y , $E_r - E_y$, $E_g - E_y$, and $E_b - E_y$ are derived from E_r , E_g , and E_b . This is done by applying the outputs of the cameras into a matrix system, which is nothing more than a series of adding and subtracting circuits. The outputs are then fed through cables to the color receiver. The receiver is set up to feed E_y to all three adder circuits equally. In addition the $E_r - E_y$ signal is applied to the red adder, $E_g - E_y$ is applied to the green adder, and $E_b - E_y$ is applied to the blue adder. The outputs which are then fed to the picture tubes are E_r , E_g , and E_b .

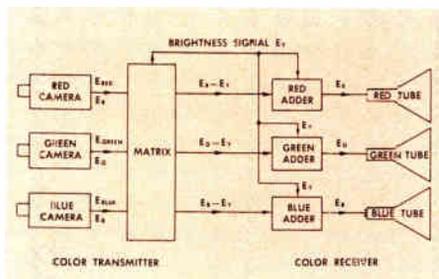


Fig. 7—Simple color transmission system by means of color difference signals.

In order to clarify the exact nature of the brightness signal and the three color difference signals, a look at the make up of the signals for a color-bar pattern (Figure 8) would be advisable. This pattern consists of five vertical bars—White, red, green, blue, and yellow. The last four bars are 100% saturated colors. Figure 8 indicates the waveforms that would be observed with an oscilloscope synchronized at the horizontal scanning frequency. The starting point is the white bar since the initial camera adjustments are made for equal outputs for Illuminant C. Thus, the waveforms for E_r , E_g , and E_b each indicate 1 unit output for white. Because saturated bars are used, notice that there is 1 unit for E_r when scanning the red and yellow bars, the output is zero for the blue and green bars.

In a similar manner, E_g is 1 unit for the green and yellow bars and zero for the blue and red bars.

Also, E_b is one unit for the blue bar only. It is zero for the red, green, and yellow bars.

The next step is the development of the E_y signal.

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

Using the above formula for the white bar, E_y is:

$$E_y \text{ (White)} = (.30 \times 1.0) + (.59 \times 1.0) + (.11 \times 1.0) = 1.0 \text{ units}$$

For the red bar E_y is:

$$E_y \text{ (Red)} = (.30 \times 1.0) + (.59 \times 0) + (.11 \times 0) = .30 \text{ units}$$

For the green bar E_y is:

$$E_y \text{ (Green)} = (.30 \times 0) + (.59 \times 1.0) + (.11 \times 0) = .59 \text{ units}$$

For the blue bar E_y is:

$$E_y \text{ (Blue)} = (.30 \times 0) + (.59 \times 0) + (.11 \times 1.0) = .11 \text{ units}$$

and finally the yellow bar is:

$$E_y \text{ (Yellow)} = (.30 \times 1.0) + (.59 \times 1.0) + (.11 \times 0) = .89 \text{ units}$$

Recalling the purpose of the brightness signal, how would this color-bar

pattern show up on a monochrome receiver? The more signal applied to the picture tube grid, the brighter the bar. Therefore, the bars would have different values of brightness. The brightest would be white, then yellow, green, red, and the dimmest, blue. A glance at Figure 4 in the last issue, will show that these various brightness levels are logical since they correspond approximately to the response curve of the eye.

The remaining signals to be developed in Fig. 8 are the color difference signals. These are achieved in simple adding circuits just as the E_y signal was developed. E_y is put through a phase inverter to give $-E_y$ and added to E_r , E_g and E_b . The resulting voltages are $E_r - E_y$, $E_g - E_y$ and $E_b - E_y$.

For example, $E_r - E_y$ is formed by taking the waveform E_y , inverting it to give $-E_y$ and adding it to the waveform E_r .

For the white bar $E_r = 1$ unit and $E_y = 1$ unit. $E_r - E_y$ is therefore 0 for white. This is a point worth remembering. There is no color-difference signal for white.

For the red bar $E_r = 1$ unit and $E_y = .30$ units. So, $E_r - E_y = .70$ units.

For the green bar $E_r = 0$ units and $E_y = .59$ units. So, $E_r - E_y = .59$ units for this bar. Notice that, although it is not possible to have negative values of E_r , E_g , E_b or E_y , negative values of color-difference signals do exist and occur quite frequently.

For the blue bar $E_r = 0$ units and $E_y = .11$ units. Therefore, $E_r - E_y = .11$ units for this bar.

The color difference signals, $E_g - E_y$ and $E_b - E_y$, are formed in the same manner. The results of which can be seen also in Figure 8.

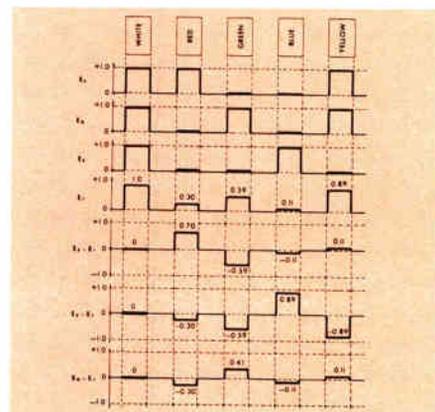


Fig. 8—Waveforms for 100% saturated color bar pattern.

(Continued next issue)

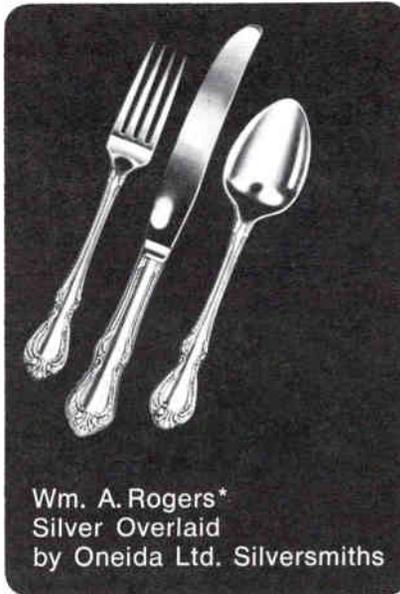
A
♥

DEALER'S CHOICE

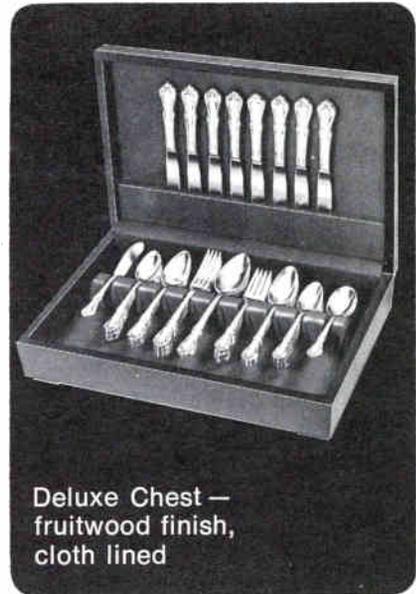
Yours When You Buy GE Tubes



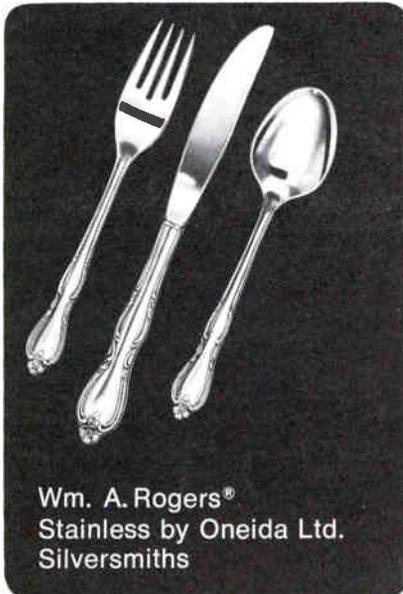
Melmac® Quality
Melamine Dinnerware
by Oneida



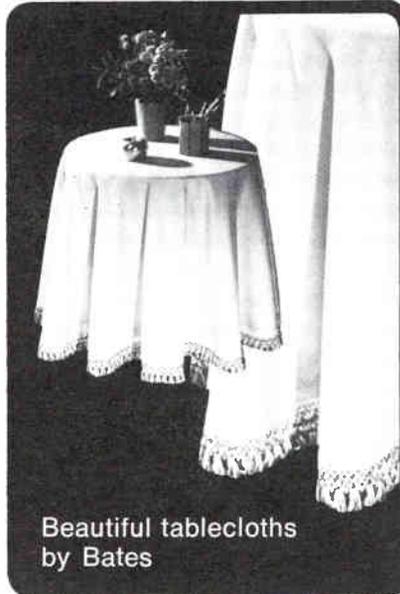
Wm. A. Rogers*
Silver Overlaid
by Oneida Ltd. Silversmiths



Deluxe Chest —
fruitwood finish,
cloth lined



Wm. A. Rogers®
Stainless by Oneida Ltd.
Silversmiths



Beautiful tablecloths
by Bates

Help yourself to these
valuable gifts from
General Electric.
Find out how easily you
can earn the points needed
for the gifts you want.
See your participating
GE tube distributor.

*trademark of Oneida Ltd.

GENERAL  ELECTRIC





Techni-talk

COMPLETE INDEX

Vol. 1, No. 1 through

Vol. 20, No. 4

Winter, 1969



AFC Circuits

"Horizontal" AFC Circuits

AGC Circuits

Addition of A.G.C. to GE 805 series T and S
Correction for Overload "U2" Receivers
Video Detector, A.G.C. and Video Amplifier

Anti-Static Cleaner and Polish

TV Anti-Static Cleaner and Polish ETR-3390

Audio Test and Repair Bench

Construction Details

Bias Supply for TV

Construction Details

Business Builders

A complete selection of various dealer
business aids
Business Identification — Items
Advertising Post Cards
Doorknob Hangers, Book Matches and
Customer Booklets
Outdoor Signs

Capacitor Substitution Boxes

Construction Details

Color Box

Construction Details

Color TV

Part I — Color Reproduction
Part II — Construction of a Color Box
Part III — Visible Spectrum and
Chromaticity Charts
Part IV — Development of Color Signals
Part V — Color Signal Frequencies and
Balanced Modulation
Part VI — Vectors
Part VII — Development of Chrominance
Signal
Part VIII — Color Signal Phase and
Amplitude and Burst Signal
Part IX — Gamma Correction, Delay Lines
and Block Diagram of Transmitter
Part X — Aperture Mask and Post
Acceleration Type Picture Tubes
Colorimetry — (four parts)
Color TV — NTSC Standards (three parts)

Color Receivers

Part I — Tuner and Video I-F Amplifiers
Part II — Video Detectors and Video Am-
plifiers Block Diagram and Schematic for
General Electric "CL" Color Receiver
Part III — Burst Gate, Subcarrier Gener-
ation, Synchronous Detectors and
Chroma Amplifiers
Part IV — Matrixing Circuits and Aperture
Mask Tube
Part V — Mechanical Adjustments on
Aperture Mask Tube
Part VI — Vertical Sweep and Convergence
System
Porta-Color (three parts)

Vol. No.

2 2

2 4

10 6

1 5

14 4

15 2

12 5

15 4

16 1

16 2

16 3

19 3

2 6

6 2

5 6

6 2

6 3

6 4

6 5

6 6

7 1

7 2

7 3

7 3

8 2

19 1,2,3,4

20 1,2,3,4

20 1,2,3,4

Console Phono Service Notes

Buzzing in RC4330 and RC4530 Series
Hum in RC4100, RC4620/30, RC4660 and
RC4850 Series
Noise on AM Function
Rattle in Console Series with Porta-Fi
Trip Failure on VM Changers
Velocity Trip Lever Bent on GE Record Changer

Conversion to Larger Picture Tubes

GE Model 811, Admiral Model 4H16S
GE Model 809, RCA Model 730TV2
GE Model 820, Philco Model 48-1001
GE Model 12C101, Stromberg-Carlson
Model TV-12
GE Model 802, Capehart-Farnsworth
Model 651P
GE Model 10C101, RCA Model KRS-20
GE Model 910, RCA Model 630TS to 14 inch
GE Model 815, Motorola Model VF-102
Motorola Model 12VT16
RCA Model 630TS to 20 inch

D-C Restoration

D-C Restoration and Sweep Circuits

FM Stereo Multiplex

Tuner Modifications

Germanium Diodes

Germanium Diodes in Video Detectors

Hobby Manual Project Components

T1 Autotransformer Form used in Battery Op-
erated Fluorescent Light, project H6, ETRS-4891

Horizontal Circuits

D-C Restoration and Sweep Circuits
Deflection Waveforms and RF Supplies
Excessive Width — "M4"
Excessive Width — "U2"
Horizontal AFC Systems
Horizontal Deflection Circuits and Kickback
Power Supplies
Horizontal Hold — AA and AB
Horizontal Jitter — "M4"
Horizontal Retrace Elimination Circuit
Horizontal Sync Unstable — DB
Intermittent Horizontal Oscillator — SB Chassis
Kill that Retrace — Horizontal
Replacement Sweep Transformers
GE Horizontal Phase Detector (4 Parts)

How Electronic Components Are Made and Tested

Reduce Call-Backs with New GE 6AX4
Birth of a TV Bulb
How GE 110° Picture Tubes are Made
How GE Picture Tube Phosphors are Made
How GE Receiving Tubes are Tested
How GE Semiconductors are Made
How GE Service Designed Tubes are Made
How GE Transistors are Made
GE Tubes are 3 to 4 Times Better
New GE Copper Core Anode Material
New GE 23" Picture Tube
New GE Sandwich Cathode
New GE Electron Gun
No More Loose Top Caps
GE Develops New Heater Wire

Vol. No.

17 1

17 1

19 1

17 1

17 2

18 3

2 5

2 6

3 1

3 2

3 2

3 3

3 4

3 5

3 6

4 1

4 2

1 6

14 2

2 3

20 4

1 6

2 3

11 3

10 5

2 2

2 4

18 2

11 4

4 2

18 3

17 3

2 6

11 1

14 5,6

15 1,2

15 3

11 2

10 6

12 2

11 6

11 3

11 1

10 5

15 3

13 3

12 5

12 6

13 2

14 6

14 1

How to Build

	VOL.	No.
Adapter Socket for measuring horizontal amplifier Cathode current	19	4
Bias Supply for TV Servicing	12	5
Capacitor Substitution Boxes	2	6
Color Box	6	2
Complete Service Shop	8	4
Picture Tube Tester	5	1
Resistor Substitution Boxes	2	5
SCR and Silicon Rectifier Tester	18	4
Service Bench	3	1
Speed Control for Portable Electric Drills	17	3
Transistor Radio Power Supply	13	2
Transistor Tester	10	6
HV Rectifier Filament Voltage Tester	15	1
Stereo/Audio Test and Repair Bench	15	2

Hum or Buzz

Hum or Buzz in TV Receivers I	11	6
Hum or Buzz in TV Receivers II	12	1
Stereo Hum Problem (5 Parts)	11	1-5
Sync Buzz — "U-2"	11	1

Indian Head Test Pattern

Tele-Clues No. 181 thru 188	6	3
-----------------------------	---	---

Noise Canceller Circuits

"EE", "H", "J" and "O" Receivers	10	5
"G" and "K" Receivers	10	6
"S", "ST", "U" and "U2" Receivers	11	1

Oscilloscopes

A Valuable Service Tool — 1	15	4
Determining Usability — 2	16	1
Checking Square Wave Response — 3	16	2
Calibrating — 4	16	3
Use in Troubleshooting — 5	16	4
Signal Tracing — 6	17	1
Determining Accuracy of Sweep Generator — 7	17	2
Cathode Ray Oscillograph (2 Parts)	2	3,4
Selecting an oscilloscope for TV servicing	1	3

Picture Tubes

Reliability Improved	15	3
Open Heaters Due to Arc-over	7	5
Picture Tube Tester — Construction Details	5	1
New General Electric 21FLP4 Replaces 13 Popular Type Picture Tubes	13	5
Porta-Color TV Picture Tube (three parts)	18	1,2,3
Protecting Picture Tube Replacement Guide	14	5
Testing Newer Type Picture Tubes	17	1
9-Inch Picture Tube for TA and TB	13	6
	18	3

Portable Phonograph Service Hints

RP-2150 — Distorted Audio	16	4
RP-2150 — Buzz and Hum	16	4
RP-2160 — Dead Set	16	4

Power Tuning

TV — "U-2" Power Tuning Repairs	10	6
---------------------------------	----	---

Printed Circuits

Servicing Procedures and Tools	11	3
Cracked Boards and Arc-over	11	4
Servicing and Servicing Aids	11	5

Publications for the Service Technician

Catalog and Interchangeability Guide for Service Designed Capacitors ETR-4340	19	3
Entertainment Semiconductor Almanac ETR-4311	20	2
Essential Characteristics ETR-15 — Receiving Tubes, Picture Tubes, Reed Switches and Photocells	20	4

VOL. No.

Glow Lamp Manual ETR-3710	19	3
Hobby Manual ETR-3960	19	3
Picture Tube Replacement Guide ETR-702	19	3
Radio Service Guide ETR-2975 (1946-1961)	19	3
Radio Service Guide ETR-3733 (1961-1962)	19	3
Radio Service Guide ETR-4406 (1963-1965)	19	3
Radio Service Guide, ETRS-4529 (1965-1967)	19	4
Receiving Tube Interchangeability Encyclopedia ETRS-5006	20	2
SCR Manual ETR-3875	19	3
Subscription Plan "A" ETR-3845 for Radio and Portable Phonograph	20	4
Subscription Plan "B" ETR-3846 — Includes Radio Service Guides	20	4
Techni-Talk Back Issues ETR-2579 (Vol. 1, No. 1 thru Latest Issue) and Binder	19	3
Techni-Talk Binder ETR-2000	19	3
Tele-Clues in Three-Ring Binder ETR-1095	19	3
101 Tele-Clues ETR-3700	19	3
Transistor Circuit Trouble-Shooting Course ETR-4423	19	3
Transistor Manual ETR-3296	19	3
TV & Phono Subscription Plan "E" ETR-3790	20	4
TV & Phono Subscription Plan "F" ETR-3791 — Includes Plan "E" for current year and previous year	20	4
TV Service Manual ETR-1765, Vol. 1, Years 1946-1953	19	3
TV Service Manual ETR-1766, Vol. 2, Years 1953-1955	19	3
TV Service Manual ETR-1767, Vol. 3, Years 1955-1957	19	3
TV Service Manual ETR-2892, Vol. 4, Years 1958-1960	19	3
TV Service Manual on GE "A" Line 1965 Receivers ETR-4491	19	3
TV Service Manual on GE "B" Line 1966 Receivers ETR-4800	19	3
TV Service Manual on GE "W" Line 1961-1962 Receivers ETR-3906	19	3
TV Service Manual on GE "X" Line 1963 Receivers ETR-3907	19	3
TV Service Manual on GE "Y" Line 1964 Receivers ETR-4411	19	3
Tube Inventory and Order Guide ETR-2162	19	3

Radio Service Notes

Radio — Fading and Intermittents	13	1
Radio — GE "Silent Partners" Save Service Time	13	3
Radio — Motorboating in Transistor Radios	12	2
Radio — Removing Large Components	15	1
Radio — Repeated Silicon Rectifier Failure	15	3
Radio — C435 and T125 No Audio	12	5
Radio — P115, P165 Loose Tuning Knobs	14	3
Radio — P675 and P720 Current Readings	10	6
Radio — P710, P711-A Circuit Revisions	12	4
Radio — P715, P765 Antenna Support	11	5
Radio — P715, P765 Intermittents and Motor Boating	13	2
Radio — P715, P765 Loose Leatherette	11	5
Radio — P745 — Low Sensitivity	11	5
Radio — P745 and P750 Circuit Changes	10	6
Radio — P755 Oscillation and Distortion	11	3
Radio — P755 and P805 Voltage Readings	12	3
Radio — P780 Troubleshooting	14	4
Radio — P820A, P821A, P822A Trouble-shooting	14	5
Radio — P835A, P840A, B and P870A Isolation	15	1
Radio — P870 Dial Slippage	15	2
Radio — 925 Spurious Signal Reception	16	2
Radio — RP1120 and AS2 Tone Improvement	11	4
Radio — P1820, P1830 Shorted Speaker	17	1
Radio — T105, C405, 875, 930 Excessive Volume	14	3
Radio — T120 Dial Cord Breakage	12	1
Radio — T120 No AM	11	2
Radio — T120 No AM on l.f. End of Band	11	1

Raster

Visible Without Damper Tube	17	1
-----------------------------	----	---

	VOL.	No.
Receiving Tube		
Popularity Listing	20	3
Record Changer Service Hints		
GE RD 100 Series — Cycles to off position	16	3
GE RD 100 Series — No automatic shut off	16	3
GE Record Changer — Bent Velocity Trip Lever	18	3
All VM — Changer shuts off	16	3
All VM — Trip Failure	17	2
CH10 Speed Control	14	1
Repair Support	14	2
Remote Control Systems		
Adjusting Reed Relay Contact Points	14	2
GE Wireless Remote Control System (6 Parts)	12	1-6
GE Sonic Remote Control System (5 Parts)	13	5,6
	14	1,3,4
Replacement of 21AP4 with 21ZP4-B		
Replacement of 21AP4 Metal with 21ZP4-B Aluminized Glass Picture Tube	7	6
Resistor Substitution Boxes		
Construction Details	2	5
Retrace Elimination		
Horizontal Retrace Elimination Circuit	4	2
Kill that Retrace — Horizontal	2	6
Kill that Retrace — Vertical	1	4
Semiconductors		
New Service-Designed Entertainment Types	19	4
Service Aids		
Bench Mirror ETR-1275	20	2
Replacement Mirror, ETRS 4615	20	2
Capacitor Tab Adjuster ETR-2968	20	2
Color Dot Magnifier, ETRS 4530	19	3
Compactron Sockets ETR-2976	20	2
Door Clock Sign, ETR-3826	20	2
Experimenter/Hobbyist Kit ETR-4288	20	3
Five-In-One Combination Tool, ETR-3910	20	2
Fuse and Heater Checker ETR-981A	20	2
Magnetic Swing-Beam Service Light ETR-1593	20	2
Multi-Tube Pin Straightener ETR-3200	20	2
Paper Bags—2, 4, 10 and 14 Lb. Sizes	15	4
Picture Tube Pillow ETR-1469	20	2
Part Holder, ETR-3851	20	2
Pocket Tool, ETR-3594	20	2
Printed Circuit Board Cutting Tool, ETR-3896	20	2
Rear Control Extension ETR-2089	20	2
Safety Glass Puller ETR-1592	20	2
Service Call Board ETR-2144	20	2
Service Drop Cloth ETR-1021A	20	2
Soldering Gun Holder ETR-2582	20	2
Soldering Iron Holder ETR-2790	20	2
Tube and Parts Cabinet, ETR-3803	20	2
Tube Puller ETR-1094	20	2
Twin-X Wrench Set ETR-752	20	2
Vacuum Spark Tester ETRS-5198	20	3
Wire Stripper ETR-2376	20	2
Service Cases		
Armored Vinyl Covered — Small Size	19	1
Armored Vinyl Covered — Medium Size	19	1
Armored Vinyl Covered — Large Size	19	1
Matched Service Cases	19	1
Plastic Tool Cases	19	1

	VOL.	No.
Service Shop Plans		
A Plan for Success (Complete Service Shop)	8	4
Make Your Own Service Bench	3	1
Signal Generators		
AM Signal Generator in Place of Cross-Hatch Generator	4	2
GE ST-16A Color Alignment Generator	8	6
I-F Alignment I	1	6
I-F Alignment II	2	2
Stereo / Audio Test and Repair Bench		
Construction Details	15	2
Snivets		
Description and Photos	7	3
Snow		
TV Receiver Noise	4	1
Sparker		
Sparker to Check for "Gas" or "Air Leaker"	5	1
	20	3
Speakers		
TV — Speaker Phasing	11	4
Stereo Hum Problem		
Description and Correction (6 Parts)	11	1-6
Subscription Plans		
Radio Plans A and B	18	4
TV Plans E and F	18	4
Sweep Transformer Replacement		
TV — "EE" Sweep Transformer Replacement	11	1
Sync Signals and Circuits		
Synchronizing Pulses and Circuits	2	1
Tape Recorder		
Threading	17	1
Techni-Talk Index		
Complete Index of Techni-talk Vol. 1, No. 1 thru Vol. 20, No. 4 — by subjects	20	4
Test Equipment		
AM Generator in Place of Cross-Hatch	4	2
Capacitance-resistance Bridge	1	3
Cathode Ray Oscillograph (2 Parts)	2	3,4
GE ST-16A Color Alignment Generator	8	6
Oscilloscope — Use in Servicing (7 parts)	15	4
	thru	
	17	2
Signal Generator — 1	1	6
Signal Generator — 2	2	2
Tube Tester	1	2
Vacuum Tube Voltmeter	1	5
Transistors		
How to Make a Transistor Tester	10	6
Listing of Entertainment Types	16	3
Power Supply	13	2
Transistor Theory	8	1

Transistor Tester

GE Transistor Tester	8	1
How to Make a Transistor Tester	10	6

Tube Testers

How to Get the Most Out of Your Test Equipment — Tube Tester	1	2
--	---	---

Tuners

GE Model FA-10 and FA-12 Hi-Fi Tuner	11	3
The GE UHF 103 Tuner (2 Parts)	5	3,4
The Head-End (2 Parts)	1	3,4
UHF Converter or Tuners	5	2
Servicing TV Tuners (5 Parts)	12	6
	13	1-4,6
Tuner Repair Service Hints from Standard Kollsman	20	3

TV Antennas

Television Reception (2 Parts)	1	1,2
UHF Antennas	5	2
UHF Antenna Installations	6	4

TV Circuit Description

D-C Restoration	1	6
Deflection Circuit Waveforms and RF Power Supplies	2	3
Horizontal AFC Systems	2	2
Horizontal Deflection Circuits and Kickback Power Supplies	2	4
Synchronizing Pulses and Circuits	2	1
The Head-End (2 Parts)	1	3,4
Video Detector, A.G.C. and Video Amplifier	1	5
Vertical Sweep Circuits	1	6

TV Picture Tubes

Part I — Phosphor Specifications and Implosions	4	4
Part II — Electron Gun and Gun Defects	4	5
Part III — Gun Defects continued and Cathode Images	4	6
Part IV — Construction of a Picture Tube Tester	5	1
Open Heaters Due to Arc-Over	7	5
Replacement of 21AP4 Metal with 21ZP4-B Aluminized Glass Picture Tube	7	6

TV Receiver Noise or Interference

TV Receiver Noise	4	1
TV — “U-3” Apparent Ignition Interference	11	2

TV Reception

The Antenna (2 Parts)	1	1,2
UHF Antenna Installations	6	4

TV Service Notes

Alignment of quadrature grid	16	1
Apparent Ignition Interference on “U3”	11	2
CB-23” Chassis — Insufficient width	19	2
Chassis Ventilation — “QX”	15	3
Clock Replacement — DB	18	3
Color Receiver — Models: 21T500, 21C700 & 1	11	5
Color Generator — Modification for ST-16	16	2
Color TV Demagnetizing Coil	15	2
Color TV Service Hints	16	3
Correction for Overload on “U2”	10	6
Damage to Semiconductor Power Rectifiers	15	3
DC-DD Chassis Arc-Over and 8LT8 Failure	20	2
Electrical Safety Test	12	2
Excessive Width — “M4” Sets	11	3
Excessive Width — “U2” Receivers	10	5
G-1 Chassis — CRT Socket Spark Gap	20	3
G-1 Chassis — H.V. Regulation	20	3
H-1 Chassis — Intermittent Hum Bar	20	3
Horizontal Hold — AA and AB	18	2
Horizontal Jitter in “M4” Receivers	11	4

VOL. No.

Horizontal Pull or Weave — “QX”	15	3
Horizontal Shrinkage — AY Chassis	16	4
Horizontal Syn. Unstable — DB	18	3
HV Rectifier Failures SB	17	3
Identifying Dual Diodes	13	1
Intermittent Brightness — “CW” Color	15	3
Intermittent Horizontal Oscillator — SB Chassis	17	3
Inoperative Fine Tuning — “M6” and “U5”	14	1
Intermittent Channel Selection “M6”	12	5
KC-KD Chassis — Raster Defects	20	3
KC Chassis Servicing HV Power Supply	19	3
KC Chassis — Service Hints	19	4
KD Chassis — Thermostat Added	20	3
Neon Bulb Failure — CB	18	3
Phasing on 2 and 3-Speaker Models	11	4
Pincushioning Correction	13	3
Power Tuning Repairs — “U2” Receivers	10	6
Protecting Picture Tube	14	5
Production Changes — “MW”	15	1
Quadrature Coil Tuning Capacitor	20	3
Removal of the Metal Back on “M4”	11	2
Removing Scratches and Static Electricity	14	4
Replacement Sweep Transformers	11	1
Replacing Compactron Sockets on Etched Circuit Boards	17	1
Rolling Bright Line — “CX” Color	15	3
SB-SC Chassis — Lightning Protection	20	2
Servicing the “M6” Contrast Control Circuit	13	2
Slippage in Fine Tuning Control	11	3
Special Components in TV Receivers	12	4
TC Service Hints	19	1
Testing Horizontal Phase Detection Diodes	14	3
Transistorized UHF Tuner — Intermittent Operation	16	1
Troubleshooting the “DB”	17	2
Vertical Retrace Lines — AY	18	2
Vertical Sync Buzz Trouble — “U2” Chassis	11	6
VHF Tuner — Lead Dress	20	2
X-Rays in Color TV Receivers	19	4
6CD6 Horizontal Output Tube Failures	12	3
6GH8 Replaces 6EA8 in Remote Receivers	12	6

TV Signal Description

Synchronizing Pulses and Circuits	2	1
-----------------------------------	---	---

TV Sound Systems

Delta Sound System	10	3
Repair of Ratio Detector Transformers	10	5

UHF Reception

UHF Antenna Installations	6	4
---------------------------	---	---

Vertical Circuits

Kill that retrace — Vertical	1	4
Vertical Sweep Circuits	1	6

Video Amplifiers

Video Detector, A.G.C. and Video Amplifier	1	5
--	---	---

Video Detectors

Germanium Diodes in Video Detector	2	3
Video Detector, A.G.C. and Video Amplifier	1	5

What's Wrong with This Picture?

What's Wrong With This Picture?	11	2,3,4
---------------------------------	----	-------

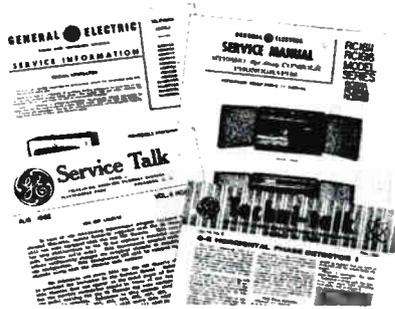
Copies of all issues are still available. If you are missing any copies and cannot obtain them from your distributor, send ten cents for any one issue and five cents for each additional issue to: Techni-Talk Cashier, General Electric Company, Oak Brook Executive Plaza, 1301 W. 22nd Street, Oak Brook, Illinois 60521. A complete set of all back issues in Techni-Talk binder including Vol. 1, No. 1 through latest issue can be ordered as ETR-2579 for \$6.25.

TELEVISION

RENEWAL PLAN E \$10.50, ETRS-3790

Factory Service Manual Coverage for Latest Solid-State Television Circuits
Color and Monochrome TV • Console Phonographs
AM-FM Tuners • Record Changers • Porta-Fi System
Tape Recorders • Binders for TV and Audio Service Manuals

YOU WILL RECEIVE . . .



- Up-to-date Parts Price Listings
- "Service Talk"
- "Techni-Talk"
- "Audio Notes"
- Servicing Hints
- Portafax
- Alignment Charts and Waveforms
- Replacement Parts List
- Schematic Diagrams
- Circuit Board Layouts
- Exploded Views

PLAN F \$14.50 ETRS-3791 FOR NEW SUBSCRIBERS

1. Includes Plan E for 1969
2. PLUS TV Service Manuals and Binder for Current Line Models (1968 Mailings)
3. PLUS All Console Phonograph, Tuner, Tape Recorder & Record Changer Coverage and Binder for 1968

USE ORDER COUPON BELOW

ORDER COUPON

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

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

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

Quantity	Price
Plan A for 1969, ETRS-3845	\$ 6.50
Plan B for 1969, ETRS-3846	14.95
Plan E for 1969, ETRS-3790	10.50
Plan F for 1969, ETRS-3791	14.50
ETRS-2975 Radio Service Guide 1946-1961	1.95
ETRS-3733 Radio Service Guide 1961-1963	1.45
ETRS-4406 Radio Service Guide 1963-1965	2.95
ETRS-4529 Radio Service Guide 1965-1967	3.95
ETRS-4892 Radio Service Guide 1967-1969	5.95
ETRM-15N Essential Characteristics	1.00
ETRS-2579 Techni-Talk Back Issues (Vol. 1 No. 1 thru Latest Issue) and binder	6.25
ETR-3960 Electronic Components Hobby Manual	1.50
ETR-4288 Experimenter Hobbyist Kit	.98
ETRS-4891 Autotransformer Form	.80
Include applicable state and local tax \$	TOTAL \$

NAME.....
 STREET ADDRESS.....
 CITY, STATE and ZIP CODE.....
 (Please Print)

RADIO

PLAN A \$6.50 ETR-3845

These plans provide you with complete information on GE RADIOS, SHOW'N TELL, PORTABLE PHONOS, PORTABLE TAPE RECORDERS and CITIZEN'S BAND TRANSCEIVERS. Subscription runs from January-December 1969. You will receive every 1969 manual, regardless of when you subscribe during 1969. Plan B will include 5 Radio Service Guides containing service information for every set manufactured from 1946 to 1969.

Plan A Includes

1. SERVICE MANUALS

Keep completely current with service information on the latest radios, portable phonos, portable tape recorders, show'n tell, and citizen's band transceivers as they go into production. Each manual contains all necessary servicing data, such as schematics, wiring diagrams, alignment procedures, electrical specifications and parts lists.

2. REPLACEMENT PARTS CATALOG

You receive up-to-date parts listings and prices of all radio, portable phono, portable tape recorder, show'n tell, and citizen's band transceiver replacement parts. You will also receive all appropriate interchangeability information on out-of-stock parts.

PLAN B \$14.95 ETR-3846



FIVE RADIO SERVICE GUIDES

In FIVE volumes, you will have at your fingertips a wealth of information covering GE products mentioned above manufactured from 1946 to 1969. In addition to fully-detailed schematics, each guide includes part lists and a special picture-guide section to assist you in making positive set-identification when the model number is unknown. The new 1967-69 guide also includes conductor patterns of every set with components superimposed, for quick and easy location identification.

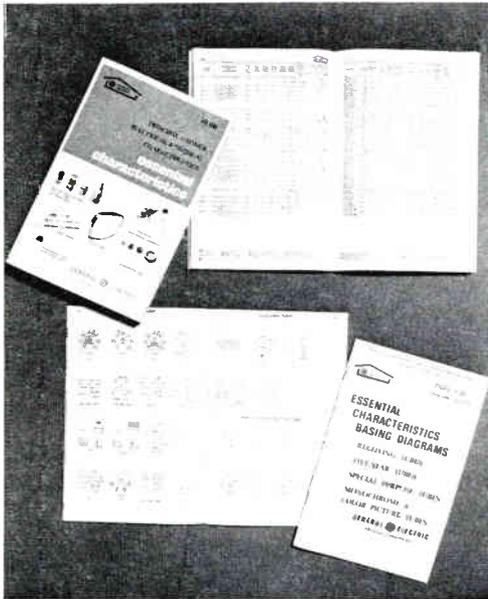
ETRS-2975 Radio Service Guide 1946-61	\$1.95
ETRS-3733 Radio Service Guide 1961-63	1.45
ETRS-4406 Radio Service Guide 1963-65	2.95
ETRS-4529 Radio Service Guide 1965-67	3.95
ETRS-4892 Radio Service Guide 1967-69	5.95

Radio Service Guides can be ordered separately. Ask your distributor or use Order Coupon.



**LEADERSHIP IN ELECTRONICS!
LEADERSHIP IN SERVICE AIDS**

1969 EDITION OF "ESSENTIAL CHARACTERISTICS" NOW AVAILABLE



The 369 page thirteenth edition of "Essential Characteristics" (ETRM-15N), the General Electric handbook on receiving, five-star, special-purpose tubes, compactrons, thyratrons, planar and ceramic tubes, television picture tubes, reed switches, photoconductive cells, photoconductive cell-lamp combinations and entertainment semiconductor components is now available from your General Electric electronic components distributor.

New tube characteristics added to this edition bring to over 3500 the total number of tubes, including 901 monochrome and color picture tubes.

The new edition contains a number of improvements which will make this booklet easier to use and even more practical in electronic servicing.

One such improvement is the arrangement of base diagrams in a separate 64-page booklet which is included with each "Essential Characteristics." All tube types using the same base drawing are listed with each diagram.

The listing of all tube types using the same basing diagram should be of

considerable value, particularly when servicing older model receivers. If a tube type is not available, a check of the electrical characteristics for other tubes with the same basing will enable the technician to determine whether or not a substitute can readily be made with another type.

As before, the book includes typical characteristics curves, tube outline drawings, circuit diagrams showing typical applications of receiving tubes and construction data for speaker enclosures.

Tube classification charts have been expanded to facilitate reference to similar types. Cross-reference listings of prototypes for five-star and special-purpose types and a new comprehensive listing of Foreign Types and American near-equivalents are included.

New additions include outline drawings and characteristics for Entertainment Semiconductors.

Get the new ETRM-15N from your distributor—or if he is unable to supply you, use order coupon on page seven. The price has been reduced from \$2.00 to \$1.00.

We now have available the T1 Autotransformer Form used in the Battery Operated Fluorescent Light, project H6, in the General Electric Hobby Manual, ETR-3960. Use the order form on page 7. Order ETRS-4891. The price is \$.80 each.



Vol. 20, No. 4 Winter, 1968-69

In this issue:	Page
Color Television-NTSC Standards-III.....	1
General Electric's "Dealer Choice".....	2
Complete Index of Techni-Talk, Vol. 1, No. 1—Vol. 20, No. 4.....	3
1969 Subscription Plans.....	7
Radio plans A & B.....	7
Television plans E & F.....	7
1969 Edition of "Essential Characteristics" Now Available.....	8

Techni-talk on AM, FM, TV Servicing, published quarterly by ELECTRONIC COMPONENTS DIVISION, GENERAL ELECTRIC COMPANY, OAK BROOK EXECUTIVE PLAZA, OAK BROOK, ILLINOIS 60521. In Canada: Canadian General Electric Co., Ltd., 189 Dufferin St., Toronto 3, Ontario. R. G. Kempton, Editor. Copyright 1969 by General Electric Company.



NOTE: The disclosure of any information herein conveys no license under any General Electric patent and, in the absence of an express written agreement to the contrary, the General Electric Company assumes no liability for patent infringement (or any other liability) arising out of use of such information by others.

This copy of **Techni-talk** comes to you through the courtesy of your General Electric tube distributor.