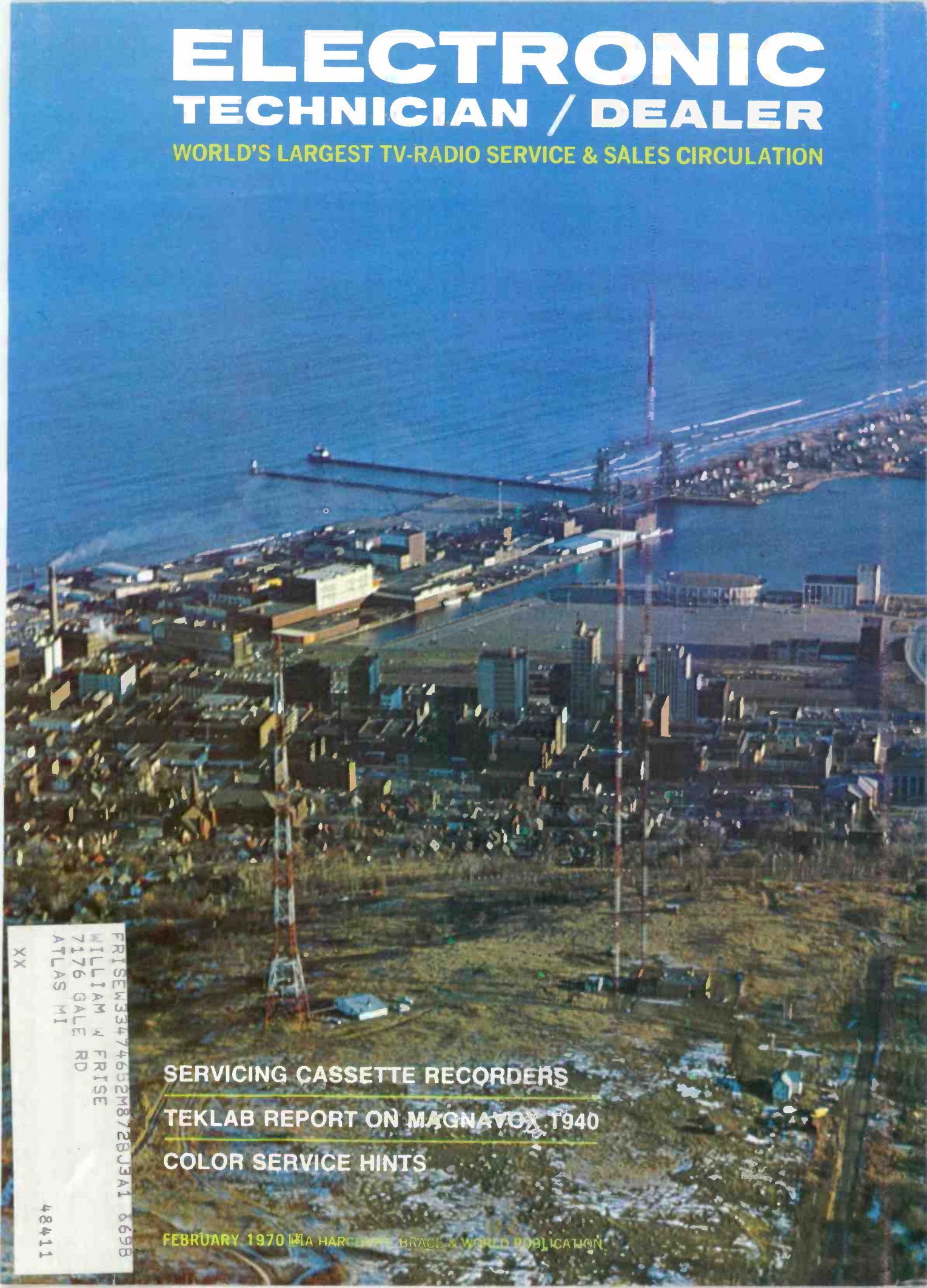
ELECTRONIC TECHNICIAN / DEALER

WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION



SERVICING CASSETTE RECORDERS

TEKLAB REPORT ON MAGNAVOX T940

COLOR SERVICE HINTS

FEBRUARY 1970 A HARCOURT BRACE & WORLD PUBLICATION

The first and only solid-state test equipment guaranteed for 5 years.

Now EICO, because of its emphasis on *reliability* in engineering and manufacture, offers the industry this breakthrough.

EICO's new line of solid-state test equipment comes with an unprecedented 5-year guarantee of performance and workmanship. (Send for full details of this EICO 5-year GUARANTEE on factory-assembled instruments.)

Additional advanced features include: new functional design, new color-coordinated esthetics, new PC construction, new easier-to-build kit designs.

New EICO Solid-State Test Equipment

EICO 240 Solid-State FET-VOM $59.95 kit, $79.95 wired.
One all-purpose DC/AC OHMS Uniprobe®. Reads 0.01V to 1 KV (to 30 KV with optional HVP probe). 7 non-skip ranges, in 10 dB steps. AC or battery operated. RMS & DCV: 0-1, 3, 10, 30, 100, 300, 1000V P-P ACV: 0-2.8, 8.5, 28, 85, 280, 850, 2800V. Input Z: DC, 11 M; AC, 1 MΩ. Response 25 Hz to 2 MHz (to 250 MHz with optional RF probe). Ohmmeter reads 0.2 to 1 MΩ in 7 ranges. 4½" 200 μA movement. HWD: 8½", 5¾", 5". 6 lbs.

EICO 242 Solid-State FET-TVOM $69.95 kit, $94.50 wired.
All the versatility of the EICO 240 plus: AC/DC Milliammeter, 1 ma to 1000 ma in 7 non-skip ranges; single all-purpose DC/AC-Ohms — MA Uniprobe®; and large 6½" 200 μA meter movement.

EICO 150 Solid-State Signal Tracer $49.95 kit, $69.95 wired.
Multi-purpose troubleshooter for TV/FM/AM & Audio Equipment. Independent RF Audio inputs. Speaker and meter output indicators. 400 mW continuous power output. Substitution amplifier, output transformer, speaker. Input for rated output: 1 mV RF, 63 mV audio. Hum 60 dB below 400 mW, 105-132 VAC, 50/60 Hz, 5VA. HWD: 7½", 8½", 5". 6 lbs.

EICO 330 Solid-State RF Signal Generator. $59.95 kit, $84.50 wired.
5 fundamental bands 100 kHz to 54 MHz. Vernier control 0-100%. Output 300,000 μV into 50-Ohm load. External signal modulation or internal 400 Hz, 0 to 100%. 105-132 VAC, 50/60 Hz, 1.7 VA. HWD: 7½", 8½", 5". 5 lbs.

EICO 379 Solid-State Sine/Square Wave Generator. $69.95 kit, $94.50 wired.
5 sine wave and 4 square wave bands. Low distortion Sultzer feedback FET circuit. Sine: 20 Hz to 2 MHz; 0-7.5V rms into hi-Z, 0-6.5V into 600 ohms Max. distortion 0.25%. Square: 20 Hz to 200 kHz; 0-10V p-p into hi-Z, pos. direction, zero ground. Rise time at 20 kHz less than 0.1 μ sec. 105-132 VAC, 50/60 Hz, 10VA. HWD: 7½", 8½", 8½". 9 lbs.

New EICO High Performance Instruments

EICO 385 — Solid-State Portable Color Generator $79.95 Kit, $109.95 Wired.
EICO 465 — Wideband Vectorscope/Oscilloscope $179.95 Kit, $249.95 Wired.
EICO 1025 — Solid-State Power Supply $34.95 Kit, $49.95 Wired.
EICO 443 — Semiconductor Curve Tracer $79.95 Kit, $119.95 Wired.
EICO 633 — CRT Tester & Rejuvenator $79.95 Kit, $119.95 Wired.
EICO 635 — Portable Tube Tester $44.95 Kit, $69.95 Wired.

New EICO Probes for the Pros

Hi-Voltage Probe HVP-5, Wired $19.95.
Convenient built-in voltmeter. Barrier sections isolate HV tip from handle and meter. Measures up to 30 KV. Lightweight, compact.

Solid-State Signal Injector Probe PSI-1, Kit $5.95, Wired $9.95.
Pen-size, 1-ounce, self-powered signal generator. Frequency range from 1kHz to 30MHz, with harmonics. Clip it to your pocket — ideal for signal tracing in the field.

Solid-State Signal Tracer Probe PST-2, Kit $19.95, Wired $29.95.
Flashlight-size, 2.2oz, self-powered. Hi-gain amplifier, 50Hz to 200MHz with demod tip. Input Z: 3500Ω, 35KΩ, 350KΩ; Output: 0.3 p-p volts. Noise −45dB. Distortion <5%. Complete with earphone, all probe tips, AA battery, pocket clip.

SEND FREE 1970 CATALOG

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EICO

® EICO Electronic Instrument Co., Inc.
283 Malta Street, Brooklyn, N.Y. 11207
EICO Canada Ltd.
20 Millwick Drive, Weston, Ontario

. . . for more details circle 115 on Reader Service Card

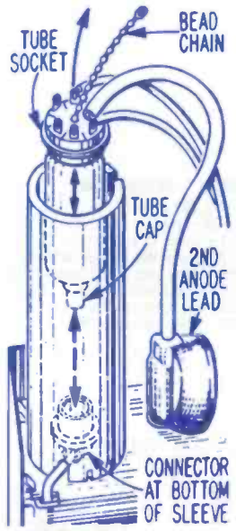
1281

ADMIRAL
TV Chassis T7H2-1A, T9H1-1A

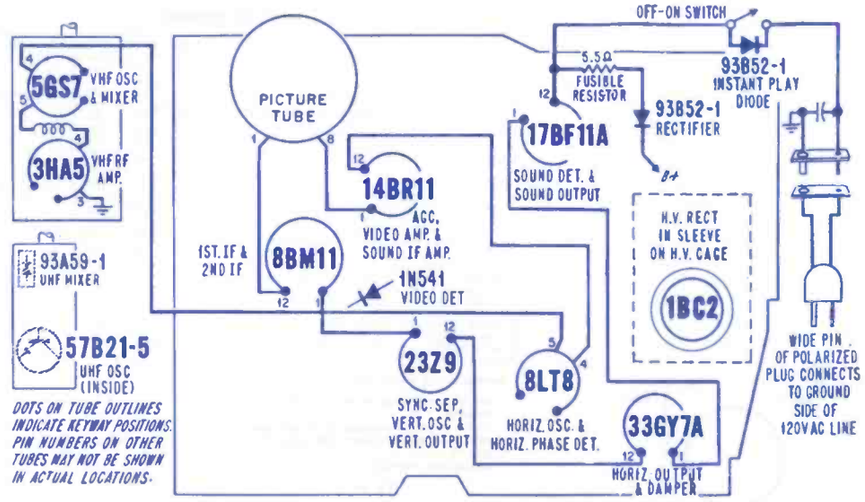
ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

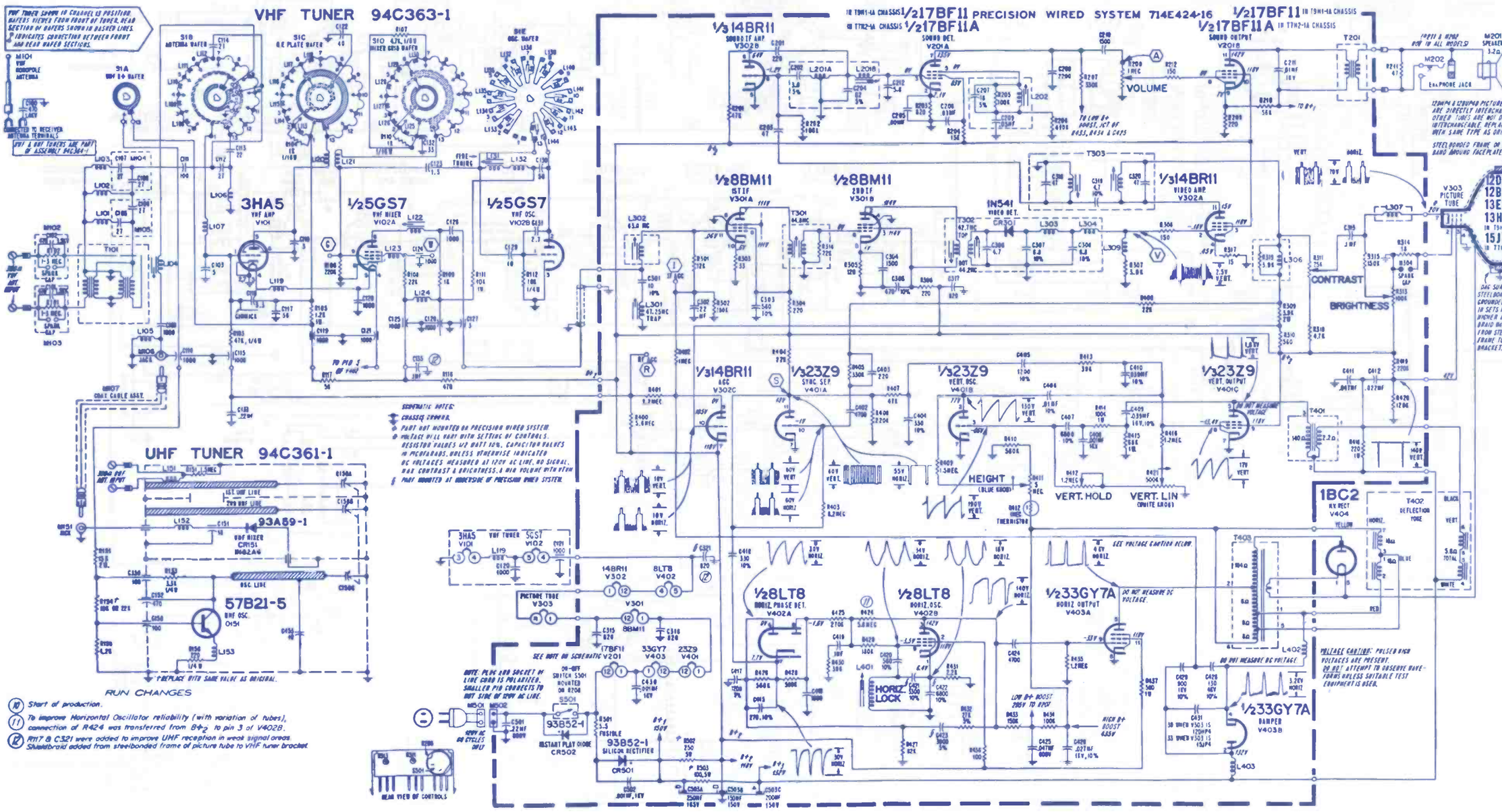
FEBRUARY • 1970



HIGH VOLTAGE RECTIFIER HOUSING



TUBE LOCATION DRAWING



ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

1280
EMERSON
TV Model 12P60/ 12P61W

FEBRUARY • 1970

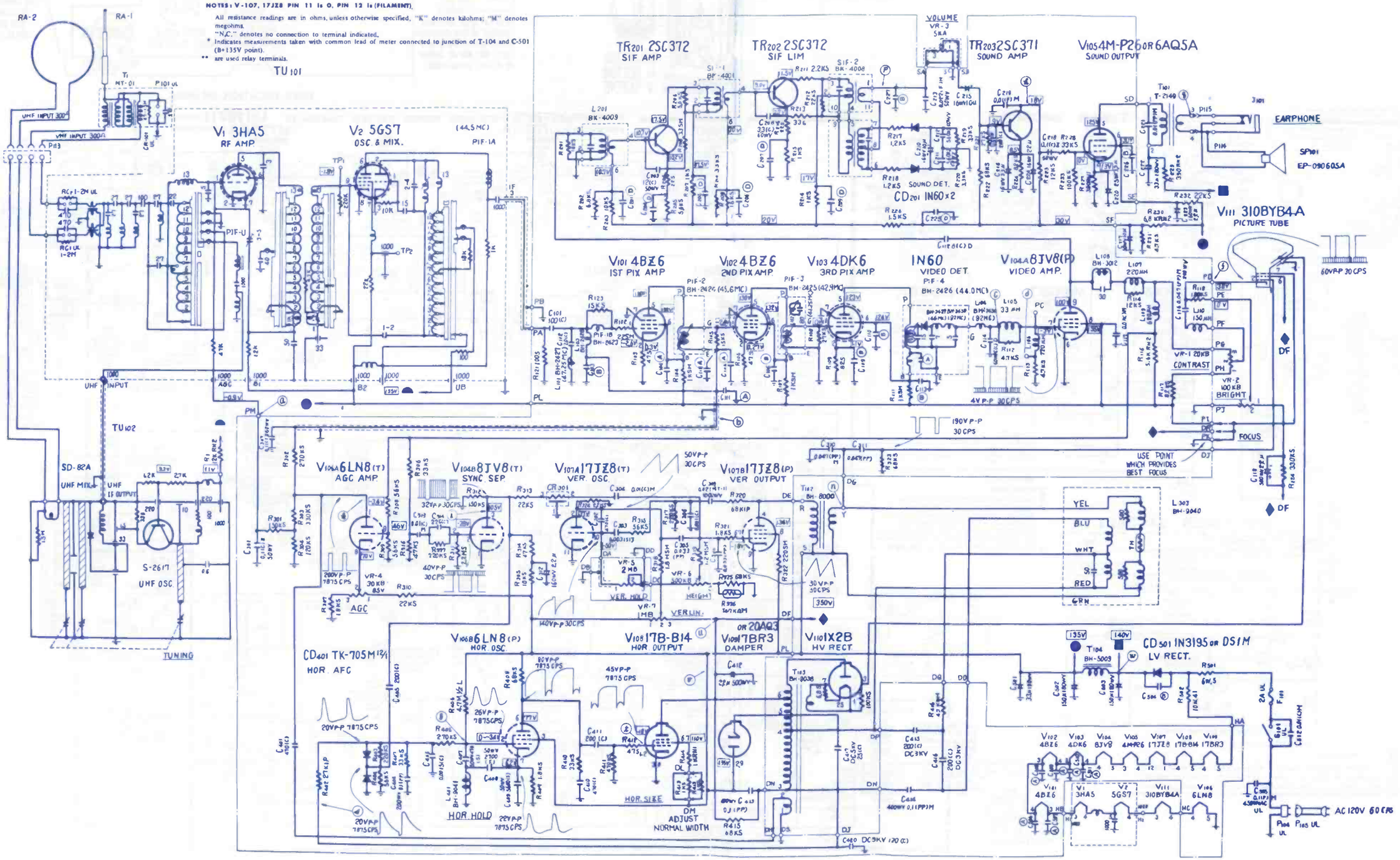
RESISTANCE READINGS

SYMBOL NO.	TUBE TYPE	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9	PIN 10
V-1	3HA5	280K	0	(FILAMENT)		*1.2K	0	0	...	...	...
V-2	5GS7	10K	250K	0	(FILAMENT)		*1K	0	0	220K	...
V-101	4BZ6	700K	47	(FILAMENT)		*1K	*1K	0	...	...	...
V-102	4BZ6	700K	47	(FILAMENT)		*1K	*1K	0	...	...	...
V-103	4DK6	0	82	(FILAMENT)		*1K	*1K	0	...	...	...
V-104	8JV8	0	3.9M	26K	(FILAMENT)		0	120	*0	*4.7K	...
V-105	4M-P26 or 6AQ5A	100K	390	(FILAMENT)		*620	*2.2K	NC	...	...	...
V-106	6LN8	450K	330K	*0	(FILAMENT)		*68K	1.8K	18K to 68K	56K	...
V-107	17JZ8	(FIL)	1.8M to 2.8M	NC	*150	NC	1.2M to 1.7M	*1.2M to 1.7M	*220	0	500K to 2.5M
V-108	17B-B14	470K	470K	0	(FILAMENT)		*1K to 2K	*1K to 2K	0	NC	...
V-109	17BR3	NC	*0	NC	(FILAMENT)		NC	NC	NC	*0	...
V-110	1X2B	INF	INF	INF	INF	INF	INF	NC	INF	INF	(CAP) 1.2M
V-111	CRT 310BYB4A	68K	180K to 280K	(FILAMENT)		67K	260K	...	...	...	...

NOTES: V-107, 17JZ8 PIN 11 is 0, PIN 12 is (FILAMENT).

All resistance readings are in ohms, unless otherwise specified. "K" denotes kilohms; "M" denotes megohms.
"N.C." denotes no connection to terminal indicated.
* Indicates measurements taken with common lead of meter connected to junction of T-104 and C-501 (B+135V point).
** are used relay terminals.

SYMBOL	DESCRIPTION	EMERSON PART NO.
TR-201,202	trans	983742
TR-203	trans	983743
SIF-1	sound IF xformer	983749
SIF-2	sound det xformer 4.5MHz	983750
L108	video amp sound trap 4.5MHz	983758
L201	sound take off coil 4.5MHz	983759
L303	def yoke ass'y w/clamp	983760
L401	horiz osc coil w/knob	983761
T101	sound output xformer	983762
T102	vert output xformer	BH-8000
T103	horiz output xformer	983763
T104	filter choke power supply	983764
C222,501,502,503	elect cap – 150+150 +33+33µf@ 180v	983771
CR301	couplate-vert integlator	039001
CR302	couplate-sync, separator	039004
VR1	control-cont	983778
VR2	control-bright	983779
VR3	control-on volume	983780
VR4	control-AGC	983781
VR5	control-vert hold	983782
VR6	control-height	983783
VR7	control-vert lin	983784
TU101	VHF tuner 762BL-A	983785
TU102	UHF tuner U-1001TM-A	983786



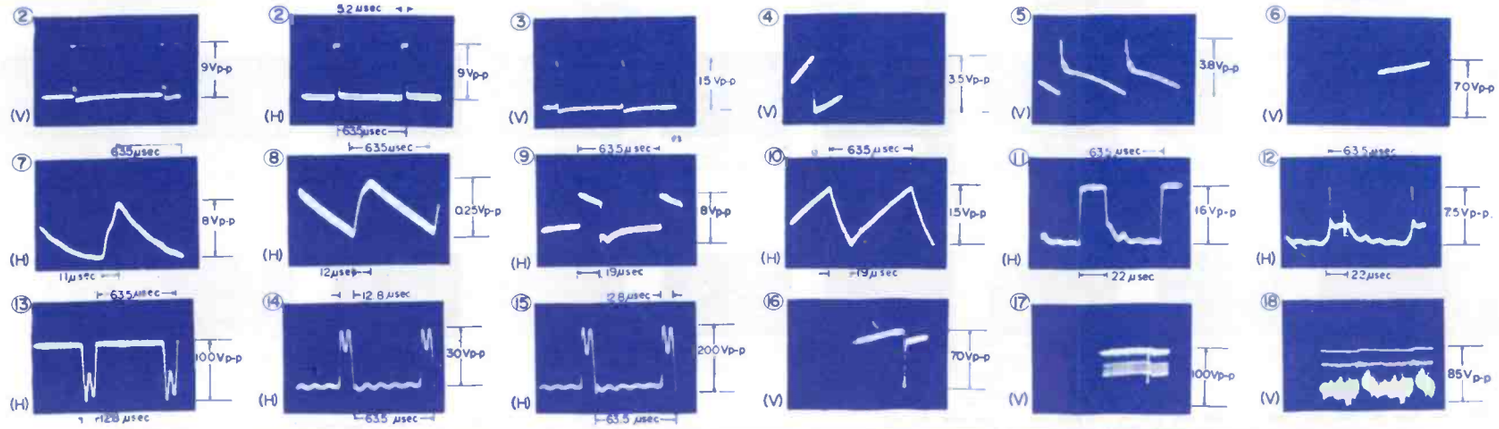
1279

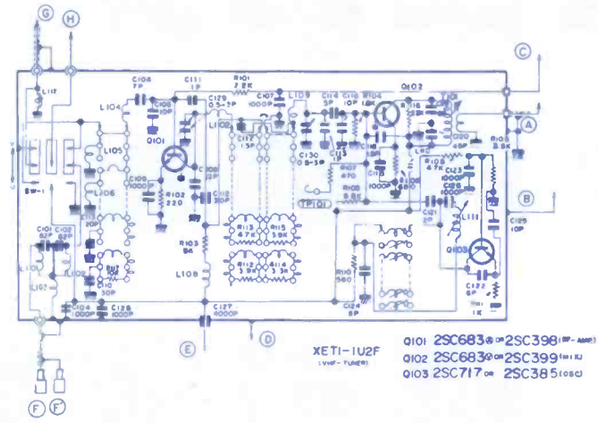
AIRLINE
TV Model GEN-11760A

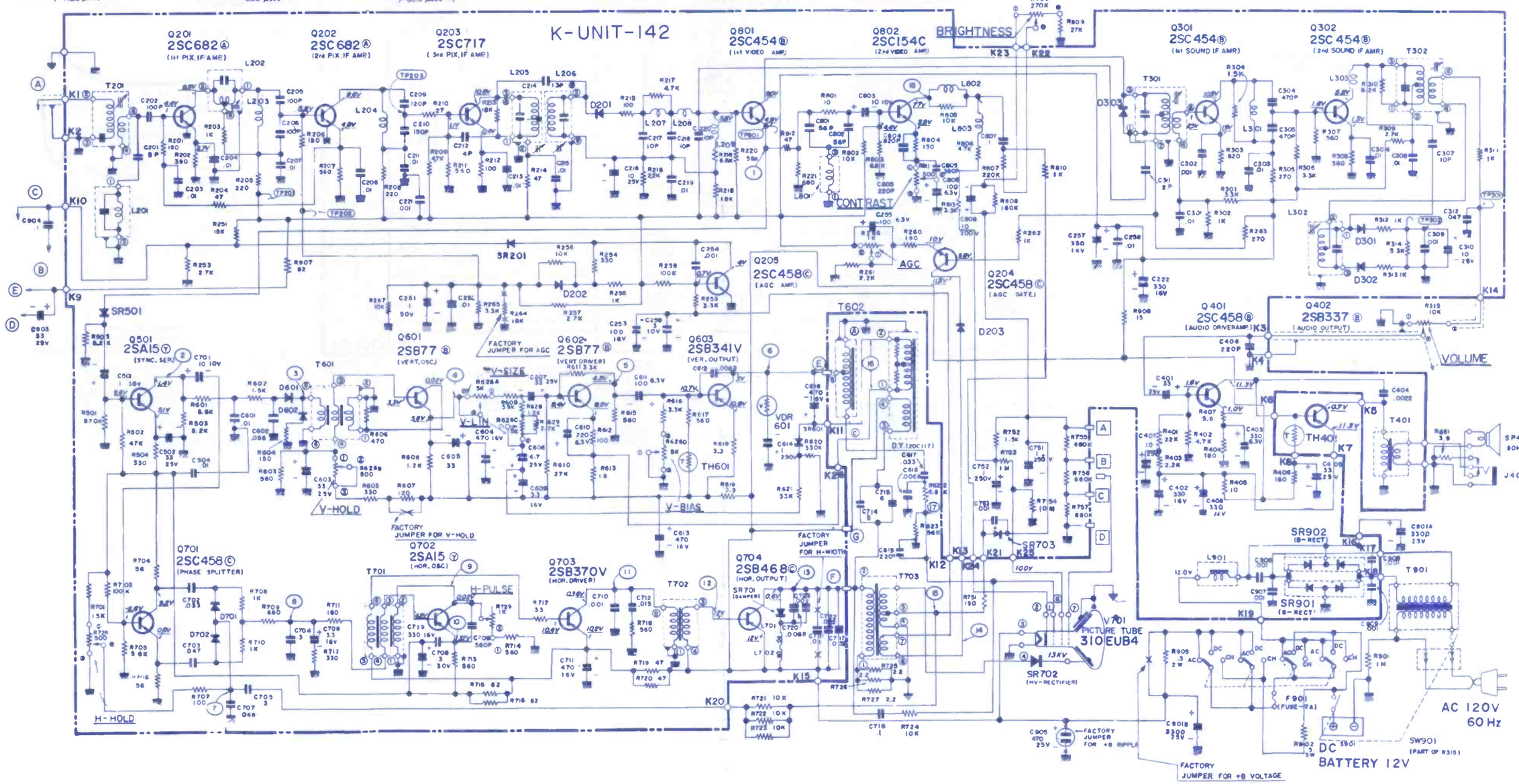
ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

FEBRUARY • 1970

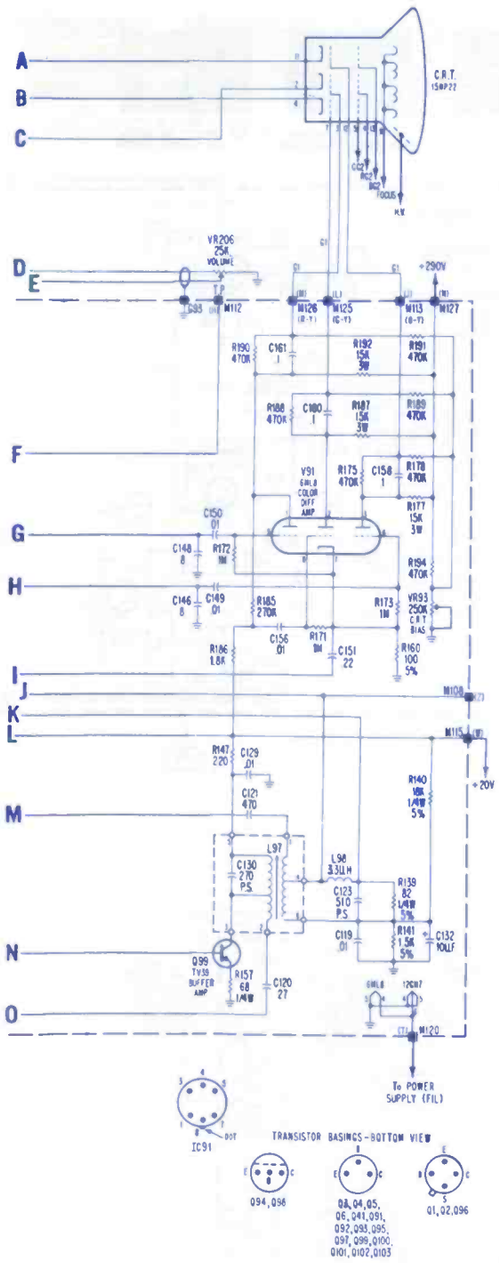
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS







PHILCO-FORD
Color TV Chassis 19FT60B



TRANSISTOR MEASUREMENTS (USE X100 SCALE)

	Coll. to Gnd.		Emit. to Gnd.		Base to Gnd.		Coll. to Emit.		Coll. to Base		Base to Emit.	
	+	–	+	–	+	–	(–) +	(+) –	(–) +	(+) –	(+) –	(–) +
Q1	880		230		970		(800) 1.1K		(950) 1.1K		(970) 1.6K	
Q2	750		430		1.4K		(820) 1.2K		1K 5.8K		1K 5.5K	
Q3	580		120		1K		(700) 710		(900) 2.2K		(920) 1.9K	
Q4	1.1K		500		1.3K		(2.2K) 1.2K		(3K) 870		(1.2K) 880	
Q5	INF.		1.2K		1.2K		(2.3K) INF.		(750) INF.		(800) 1.9K	
Q6	260		1.1K		790		(1.4K) 1.3K		(800) 4K		(760) 4.9K	
Q41	30K		0		860		(21K) 23K		(760) 100K		(850) 100K	
Q91	550		2K		525		(2.5K) 880		(30) 30		(900) 2.5K	
Q92	690		790		925		(1.5K) 1.5K		(850) 1.6K		(900) 1.8K	
Q93	1.2K		300		1K		(1.4K) 1.4K		(770) 3K		(2.2K) 840	
Q94	2.2K		100		1.1K		(16K) 2.4K		(850) 90K		(870) 50K	
Q95	13K		11K		4.5K		(810) 8.5K		(1.1K) 1.2K		(830) 2.4K	
Q96	1.4K		70		1.3K		(840) 1.3K		(1K) 5K		(1K) 3.7K	
Q97	1.4K		2.4K		2.5K		(4.1K) 4.3K		(760) INF.		(850) INF.	
Q98	810		6.7K		2.2K		(8K) 1.9K		(850) 16K		(870) 45K	
Q99	530		80		800		(620) 620		(810) 1.4K		(820) 1K	
Q100	3.9K		540		800		(2.2K) 4.5K		(640) 5.1K		(690) 2K	
Q101	3.8K		540		800		(2.2K) 4.4K		(640) 5.1K		(690) 2K	
Q102	1.3K		180		1.3K		1.4K 1.5K		(890) 9K		(930) 7.2K	
Q103	2.2K		78		790		(1.8K) 2.3K		(650) 8K		(690) 6K	
Q200	1.4K		290		950		(1K) 860		(550) 2.2K		(580) 3K	
Q201	INF.		200		740		(2.9K) INF.		(690) INF.		(710) 10K	

Resistance measurements of transistors in circuit (power off).

All measurements are in ohms and taken with a B & K Model 175 VTVM with an allowable tolerance of ±20%.

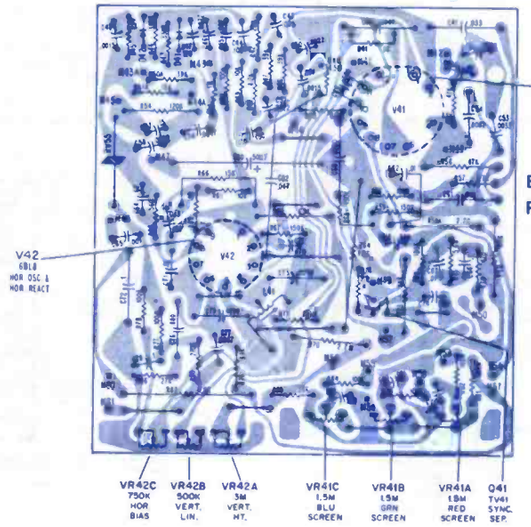
TRANSISTOR VOLTAGES

	E	B	C
Q1	.45V	1.15V	18.8V
Q2	1.16V	1.86V	18.5V
Q3	1.79V	2.41V	14.5V
Q4	17.9V	18.2V	1.1V
Q5	17.5V	15V	21.4V
Q6	10V	4.9V	4.2V
Q41	0V	.5V	23V
Q91	10.4V	11V	14V
Q92	6.3V	7V	9.8V
Q93	3.9V	4.5V	14.3V
Q94	0V	.55V	9.2V
Q95	3.2V	–.025V	36V
Q96	.18V	.88V	17.5V
Q97	.1V	–.6V	20V
Q98	7.1V	9.2V	19V
Q99	.68V	1.34V	18V
Q100	1.05V	1.37V	13V
Q101	1.08V	1.37V	13V
Q102	.43V	.15V	20V
Q103	.43V	–.33V	9V
Q200	20.2V	21V	28.2V
Q201	.56V	1.18V	112V

I.C. 91	
1	11V
3	1.52V
4	0V
5	1.52V
7	11V
8	11.45V

TUBE VOLTAGES

PIN NO.	V41	V42	V91	V92	V200	V201
	6JZ8	6BL8	6ML8	12GN7	6JS6	6CG3
1	0V	84V	185V	26V	FIL	FIL
2	88V	–36V	153V	24V	0V	–
3	0V	145V	183V	0V	110V	–
4	278V	FIL	FIL	FIL	0V	295V
5	0	FIL	FIL	FIL	–59V	–
6	58V	172V	0	FIL	–	–
7	58V	.17V	2.5V	248V	–	DO NOT MEASURE
8	282V	4.3V	.35V	145V	–	–
9	93V	.15V	.3V	0V	–59V	–
10	–19V	–	–	–	0V	295V
11	0V	–	–	–	110V	–
12	0V	–	–	–	FIL	FIL



BOTTOM VIEW
P1 DEFLECTION PANEL

1277

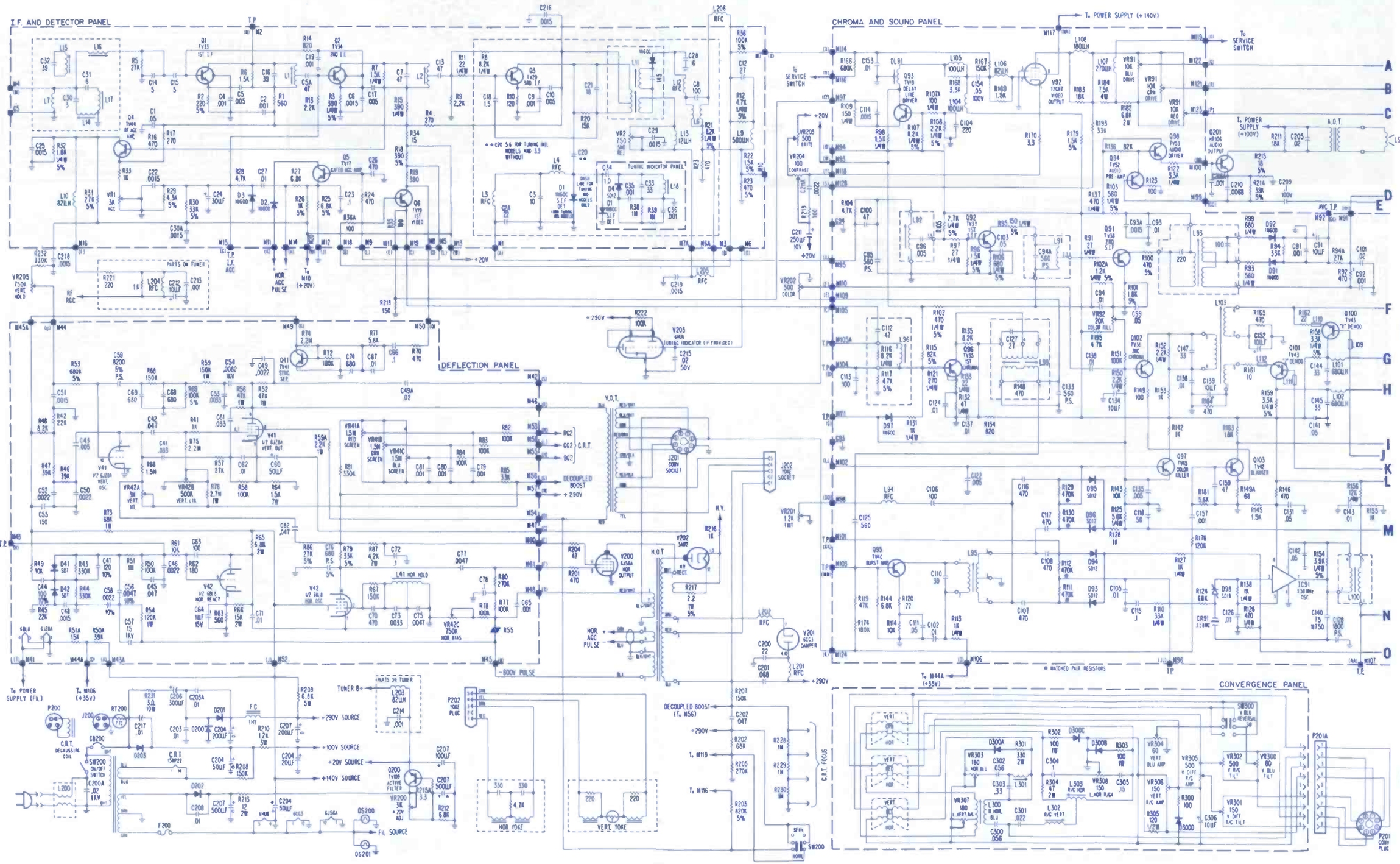
PHILCO-FORD
Color TV Chassis
19FT60B

FEBRUARY • 1970

ELECTRONIC TECHNICIAN / DEALER **TEKFAX**

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

SYMBOL	DESCRIPTION	PHILCO-FORD PART NO.
C204	200μf, 50μf, 50μf, 20μf	30-2616-15
C207	500μf/500μf/200μf/100μf	30-2616-14
CB200	circuit brkr	42-2136-6
IC91	3.58MHz osc	46-5002-4
J202	def yoke	41-4385-4
L9	peaking det	32-4762-13
L10	RF AGC	32-4762-3
L41	horiz hold	32-4891-2
L91	snd interstage	32-4936-2
L92	S.T.O.	32-4936-1
L93	snd det	32-4928-1
L94	tint control	32-4942-1
L95	burst	32-4931-1
L96	chroma take-off	32-4878-3
L99	bandpass	32-4929-1
L301	horiz blu shape	32-4881-4
P200	degaussing coil & cable ass'y	32-4896-13
PS200	degaussing	33-1388-1
RV55	horiz bias	33-1379-2
VR1	3K, RF AGC emit	33-5628-7
VR2	750Ω, 41.25MHz trap	33-5628-3
VR41A-C	1.5M, CRT screens	33-5595-20
VR42	A-vert, ht., B-vert. lin., C-horiz bias	33-5627-3
VR93	250K, CRT bias	33-5628-12
VR201	750K, vert hold	33-5631-14
VR202	25K, volume	33-5634-1
VR203	1.2K, tint	33-5631-5
VR204	100Ω, contrast	33-5631-7
VR205	500Ω, bright	33-5631-22
VR206	500Ω, color	33-5631-3
VR303	180Ω, L horiz blu	33-5609-13
VR305	500Ω, V diff R/G amp	33-5609-14
VR307	180Ω, L vert R/G	33-5609-13
A.O.T.	Audio out	32-10119-1
F.C.	filter choke	32-10095-2
H.O.T.	horiz out	32-10092-2
P.T.	power	32-10096-1
V.O.T.	vert out	32-10117-2
	chroma ass'y, w/comp	38-10478
	defl ass'y, w/comp	38-10569
	tuner, VHF (TT-181)	76-14100-1
	tuner, UHF (TT-152C)	76-13827-4



ELECTRONIC TECHNICIAN / DEALER

TEKFAX

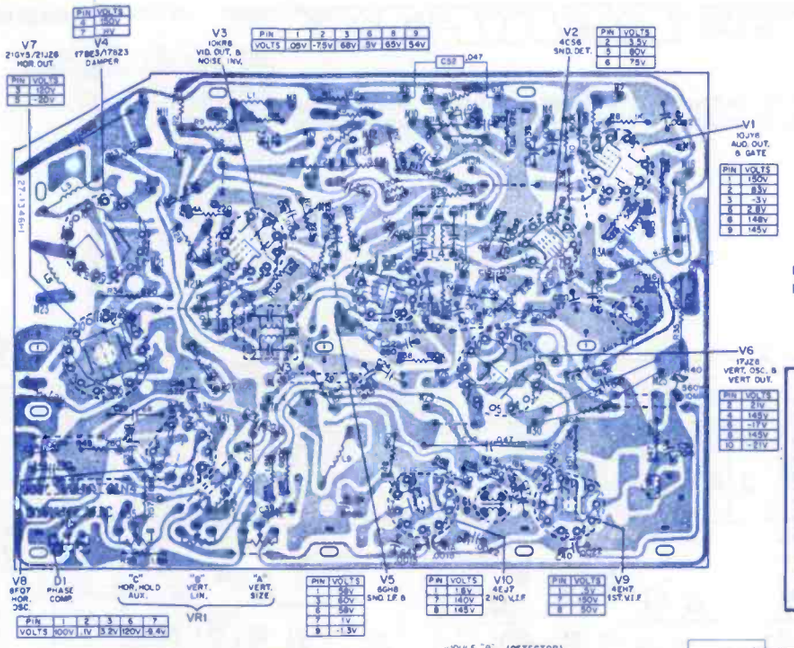
COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 6 NEW SETS

GROUP 210

	SCHEMATIC NO.		SCHEMATIC NO.
ADMIRAL TV Chassis T7H2-1A, T9H1-1A	1281	**PHILCO-FORD** Color TV Chassis 19FT60B	1277
AIRLINE TV Model GEN-11760A	1279	**PHILCO-FORD** TV Chassis 20R27	1276
EMERSON TV Model 12P60/12P61W	1280	**RCA VICTOR** Color TV Chassis CTC47	1278

1276
PHILCO-FORD
TV Chassis 20R27

FEBRUARY • 1970



BOTTOM VIEW
PERMA CIRCUIT PANEL

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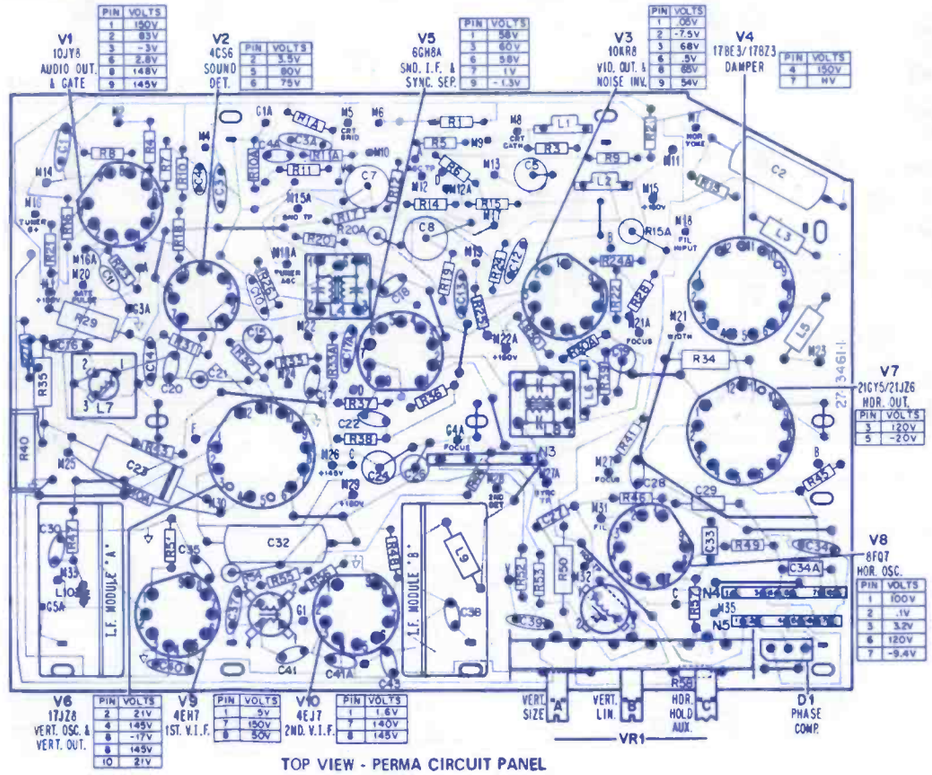
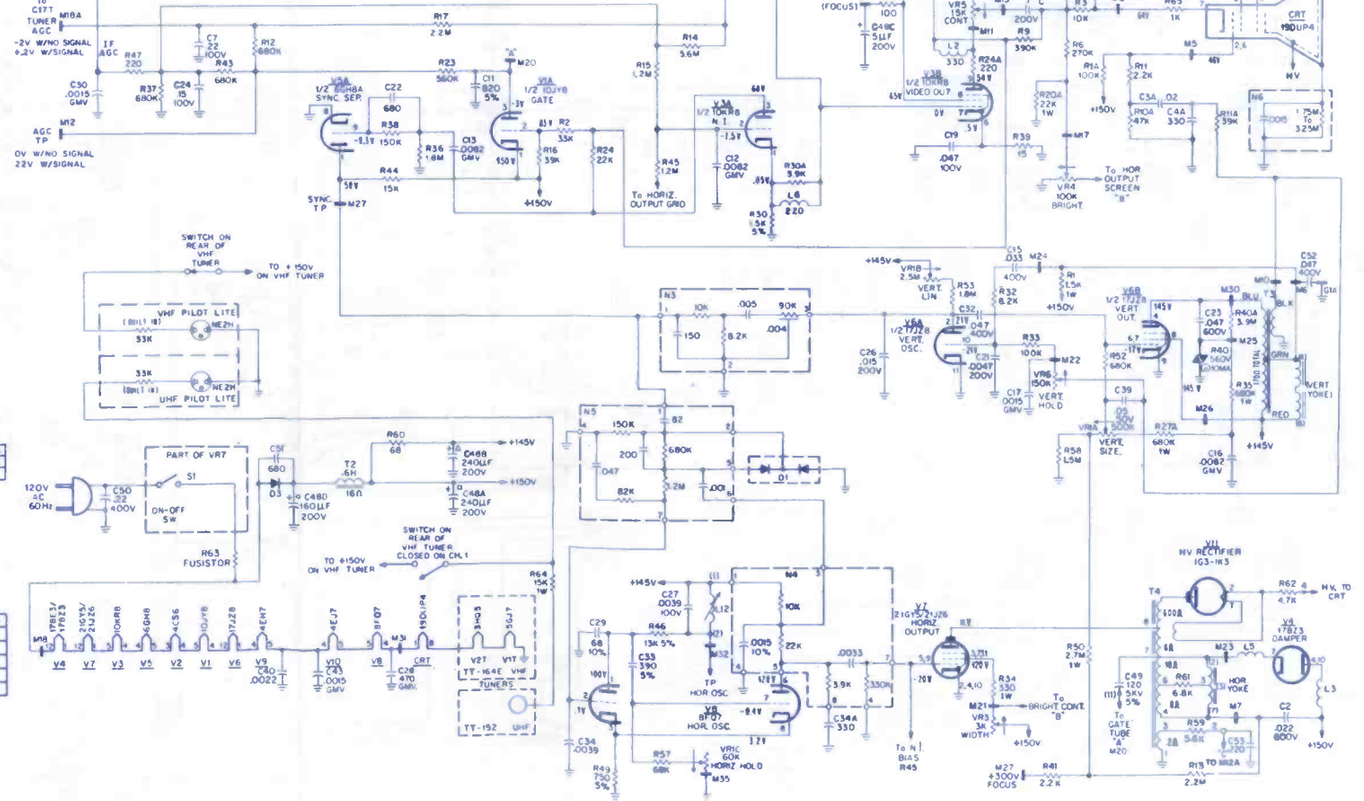
POSTMASTER: Send Form 3579 to ELECTRONIC TECHNICIAN/DEALER, Harbrace Building, Duluth, Minnesota 55802.

SYMBOL	DESCRIPTION	PHILCO-FORD PART NO.
C48	240/240/160/5µf @200v, B+ filter	30-2601-33
D1	phase comp	34-8037-1
D2	2nd det	34-8022-6
D3	rect, silicon	34-8054-7
L1	180µh, plate series	32-4762-7
L2	330µh, plate shunt	32-4762-20
L7	quad, snd det	32-4876-1
L8	4.5MHz trap & S.T.O.	32-4688-13
L10	tuner cplg	32-4652-96
L12	horiz stab	32-4754-3
L13	47.25MHz trap	32-4652-78
L15	47.25MHz trap	32-4652-79
L18	video det	32-4652-79
N3	vert int	30-6030-12
N4	horiz osc	30-6057-1
N5	phase comp	30-6035-2
N6	isolation, CRT	30-6058-2
R40	varistor, 560v @10ma	33-1373-6
R63	3Ω, fusistor	33-1383-5
S1	on-off (part of VR-7)	
T1	audio otpt	32-10013-2
T2	B+ filter otpt	32-10118-1
T3	vert otpt	32-10012-5
T4	horiz otpt	32-10008-7
VR1	500K, vert size, 2.5M, vert lin, 60K, horiz hold	33-5595-8
VR3	3K, width	33-5620-1
VR4	100K, bright	33-5605-36
VR5	15K, contrast	33-5605-38
VR6	150K, vert hold	33-5605-37
VR7	1M, on-off vol	33-5634-7
	panel, fusistor	76-11072-11
	tuner, UHF, TT152E	76-13872-2
	tuner, VHF, TT162A	76-13579-6
	yoke ass'y	76-14170-1



TOP VIEW - PERMA CIRCUIT PANEL



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TSC

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EAST . . . . . 547-49 TONNELE AVE., Jersey City, New Jersey . . . . . TEL: 201-792-3730

SOUTH-EAST . . 938 GORDON ST., S. W., Atlanta, Georgia . . . . . TEL: 404-758-2232

WEST . . . . . SARKES TARZIAN, Inc. *TUNER SERVICE DIVISION*
10654 MAGNOLIA BLVD., North Hollywood, California . . . TEL: 213-769-2720

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"QT" keeps you ahead with the fastest moving RCA parts.

"QT" is a Quick Turnover Inventory system that brings you a steady supply of the fastest-moving RCA Home Instrument replacement parts. It practically guarantees you'll have the parts you need for most of your servicing jobs.

This means you get the jobs done, without backlogging and last-minute dashes to your distributor for essential "QT" parts.

A "QT" inventory helps you cut down on those stacks of dusty boxes and trays of unused parts—and the dollars you have tied up in them.

The entire system is incredibly handy and efficient . . . lets you find parts quickly while you're working . . . reminds you to reorder when your supply is low . . . makes inventorying and reordering so fast that it's almost automatic.

Suddenly you'll find yourself with a lot more time to devote to additional servicing jobs.

Check it out with your RCA "QT" Parts Distributor. He'll discuss the different "QT" inventory plans with you and help you select one tailored to your operation.

After that, things go very smoothly.

Parts and Accessories, Deptford, New Jersey.

RCA

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ELECTRONIC TECHNICIAN / DEALER

WORLDS LARGEST ELECTRONIC TRADE CIRCULATION

FEBRUARY 1970 • VOL. 91 NO. 2

41 TEKLAB REPORT

The new Magnavox 23 inch console with automatic color gets the 'fine-tooth' treatment from our ET/D lab technicians as they give you a complete rundown on circuit operation of the new T940 chassis.

46 COLOR SERVICE HINTS

By William I. Spero, Field Service Engineer, Sylvania Electric Products, Inc. Technicians will find this feature of special interest as it outlines a novel diagnostic technique using only the TV receiver as the test instrument and offers a better understanding of color reception.

48 SERVICING CASSETTE RECORDERS

By Homer L. Davidson. Here is a timely discussion of practical procedures for the maintenance and circuit repair of the popular cassette recorders.

53 COLOR SERVICE CASE HISTORIES

By Paul Goldberg. Some of color television's toughest service problems are described in this article along with practical guidelines to help you find the defective parts and solve the problems.

55 TESTLAB REPORT

This month's report offers a schematic diagram, operating characteristics, specifications and an evaluation by our lab technicians of the new Sencore Model TC154 Tube Tester.

24 EDITOR'S MEMO
26 NEW PRODUCTS
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COVER

On this month's cover the aerial camera captures the bevy of television towers that cap the highest hill overlooking the city of Duluth and coincidentally the editorial offices of ET/D.

TEKFAX • 16 PAGES OF THE LATEST SCHEMATICS • **Group 210**

ADMIRAL: TV Chassis T7H2-1A, T9H1-1A
AIRLINE: TV Model GEN-11760A
EMERSON: TV Model 12P60/12P61W
PHILCO-FORD: Color TV Chassis 19FT60B
PHILCO-FORD: TV Chassis 20R27
RCA VICTOR: Color TV Chassis CTC47

A HARCOURT, BRACE & WORLD PUBLICATION
Harbrace Publications, Inc.

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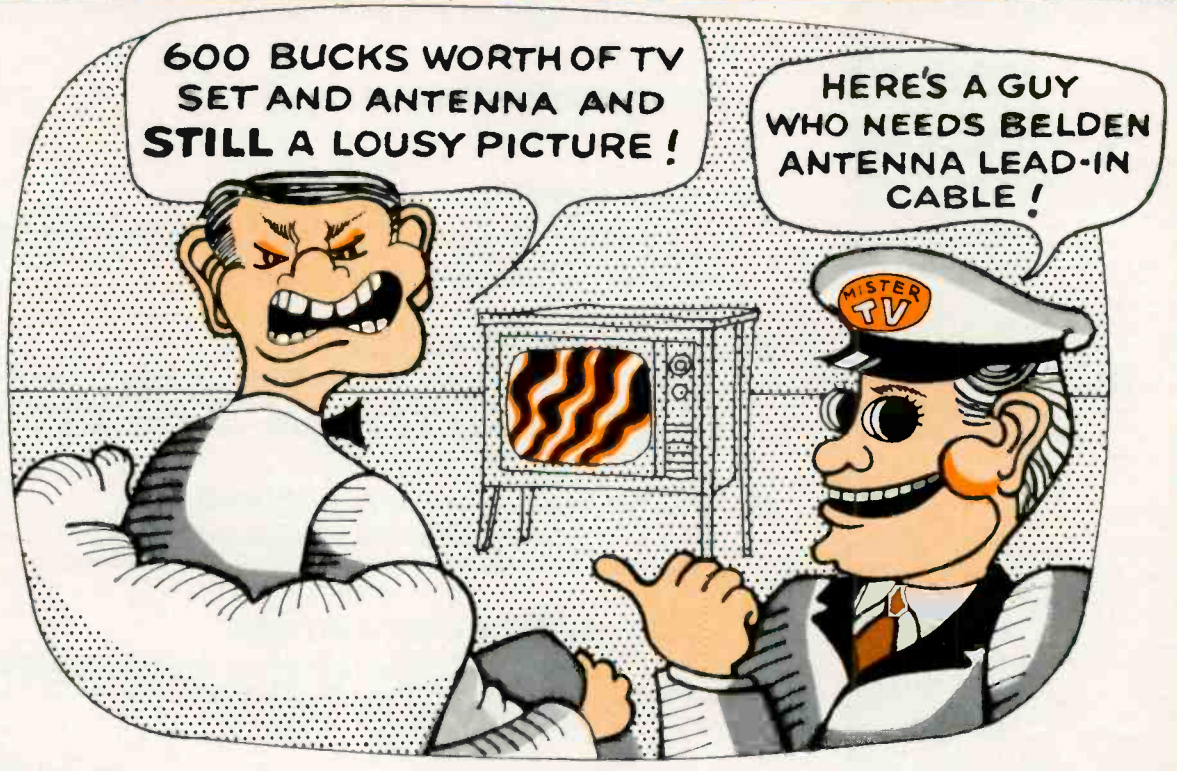


Color or UHF set perfect? Antenna perfect? Then obviously there's a missing link. Check that antenna lead-in cable. Old, worn-out, weather-beaten cable, or the ordinary flat ribbon kind designed for black and white VHF, causes more fuzzy, distorted pictures than you can count. It's your opportunity to upgrade these customers to a cable matched to their particular signal reception situations. One of Belden's Big Four—the link to perfect reception.

FOR CONGESTED AREAS...

8290 SHIELDED PERMOHM®

In congested, in-city areas, stray electrical interference and noise are at their worst. For perfect, all-82 channel reception—color or B/W—replace old cable with Belden's 8290 Shielded Permohm. Its aluminum Beldfoil® shielding prevents pickup of ghost signals and electrical noise by the lead-in. Weather-proof and water-proof. You can tape it right to the mast. Or install it underground, in conduits—even in rain gutters.

AWG & (Stranding)	Color	Nom. O. D. (inch)	Nom. Velocity of Propagation	Nom. Capacitance (mmf/ft.)	Nom. Attenuation per 100' mc	db	Standard Package Lengths in ft.
22 (7 x 30)	Brown	.305 x .515	69.8%	7.8	57 85 177 213 473 671 887	1.7 2.1 3.2 3.5 5.4 6.6 7.7	50', 75', 100' coils have terminals attached. Available in counter dispenser. 250', 500' spool.

Copperweld, 2 conductors, orange polyethylene insulation and web between conductors, cellular polyethylene oval insulation, Beldfoil shield, stranded tinned drain wire, polyethylene jacket.

FOR FRINGE AREAS...

8285 PERMOHM®

Antenna cable in uncongested or fringe areas picks up little electrical interference. But does get a lot of weathering, which degrades an already weak signal. These customers need encapsulated cable. Belden 8285 Permohm. Its special polyethylene jacket protects the energy field, regardless of weather conditions. It delivers the strongest signal of any unshielded twin lead under adverse conditions. Requires no matching transformers and connectors. For all 82 channels, color or B/W.

AWG & (Stranding)	Color	Nom. O. D. (inch)	Nom. Velocity of Propagation	Nom. Capacitance (mmf/ft.)	Nom. Attenuation per 100' mc	db	Standard Package Lengths in ft.
22 (7 x 30)	Brown	.255 x .468	73.3%	5.3	100 300 500 700 900	1.4 2.8 3.8 4.8 5.6	50', 75', 100' coils have terminals attached. Available in counter dispenser. 250', 500' coils and 1000' spool.

Copperweld, 2 conductors parallel, orange polyethylene insulation and web between conductors, cellular polyethylene oval jacket.

FOR LOCAL BLACK AND WHITE...

8275 CELLULINE®

Cracked, corroded, weathered cable, full of dirt and moisture, loses signal strength; prevents any TV set from delivering a quality picture. Upgrade B/W VHF and local UHF customers to Belden 8275 Celluline. Performance is improved because all possible moisture between conductors has been eliminated. Abrasion-resistant and weather-resistant for a long, long service life. And, it requires no end sealing.

AWG & (Stranding)	Color	Nom. O. D. (inch)	Nom. Velocity of Propagation	Nom. Capacitance (mmf/ft.)	Nom. Attenuation per 100' mc	db	Standard Package Lengths in ft.
20 (7 x 28)	Brown	.300 x .400	80%	4.6	100 200 300 400 500 700 900	1.05 1.64 2.12 2.5 2.98 3.62 4.3	50', 75', 100' coils in counter dispenser. 250', 500', 1000' spools.

Bare copperweld; 2 conductors parallel, polyethylene jacket with inert gas filled unicellular polyethylene core.

FOR MATV AND CATV...

8228 DUOFOIL® COAX

Got an apartment or townhouse complex in your area? Motels or hotels? Or is CATV coming? Use Belden's new 75 ohm coaxial cable—8228 Duofoil. Shielding is 100%—sweep tested 100%. Spiral wrapped drain wires provide long flex life. Small diameter saves space in conduit installations. Use Duofoil for all coaxial color and B/W VHF, UHF and CATV applications.

AWG & (Stranding)	Color	Nom. O. D. (inch)	Nom. Velocity of Propagation	Nom. Capacitance (mmf/ft.)	Nom. Attenuation per 100' mc	db	Standard Package Lengths in ft.
18 Solid, Bare	Black	.242	78%	17.3	50 100 200 300 400 500 600 700 800 900	1.5 2.1 3.1 3.8 4.5 5.0 5.5 6.0 6.5 6.9	100', 500', 1000' spools.

Don't forget to ask them what else needs fixing.

See your local Belden distributor for full details or to order. For a free copy of the recent reprint article, "Electronic Cable," write: Belden Corporation, P.O. Box 5070-A, Chicago, Illinois 60680.

BELDEN

8-6-8

. . . for more details circle 106 on Reader Service Card

ET/D EDITOR'S MEMO

Sencore Visit

I recently took a tour of the Sencore manufacturing facilities at the kind invitation of Mr. Herb Bowden, president of Sencore and his senior field engineer, Jim Smith. Sencore, as you know, is one of the major manufacturers of electronic test instruments for use by TV and radio technicians. Their plant is located in Addison, Illinois, not far from O'Hare field. I was impressed with Sencore's quality control system in which purchased components are given a thorough check out prior to being used in a circuit. Completed instruments are 100 percent tested.

This means that any recurrent trouble could be nailed down to a defective component or design problem before it gets to you the customer, thus preventing any inconvenience. As technicians, we can all appreciate what that means. The Sencore plant was also about as crowded for space as ten men on a skate board. Herb Bowden happily announced they would soon be moving into large new quarters. He also told me of their large new factory recently completed in Sioux Falls, South Dakota. I didn't have time to see the new plant, which was not in use at the time, but I hope to soon. We did get a chance to talk about how a test instrument is born. Jim Smith tells me that one of the toughest design problems is to make a unit as obsolescence proof for as long a time as possible. One way to do this is to make provision for up-to-date modifications. I guess it's no secret that we need new and better tools to keep up with the consumer electronic market. Since the tools we need are also electronic in most cases, we need and appreciate the concern of the test instrument manufacturers to keep us well equipped. But they also need our help. Let them know of your likes and dislikes about an instrument's capabilities.

Paul J. Rivenes

The absolute end of an old fear.

The new B&K Sweep/Marker Generator does for TV sets what no other instrument or instruments can do. It makes alignment of color, as well as black & white TV, simpler and easier than ever.

Remember all your old fears about TV alignment (especially color)? Well, now you can forget them!

In the past, a marker generator and a separate sweep generator were used with a marker adder and a bias supply. All four of these now are combined in one easy-to-use instrument.

(We've made benchwork so much simpler by doing away with the need for hooking together a lot of cables and costly instruments.)

The Sweep/Marker Generator is both an instrument and a guide. As a guide, the bandpass and chroma bandpass curves are visually reproduced and the individual markers are clearly indicated by lights—right on the front panel—for quick, easy reference.

As an instrument, the Sweep/Marker Generator not only generates the marker frequencies (all crystal controlled), but also sweeps the chroma bandpass, TV-IF, and FM-IF frequencies.

See it soon at your B&K distributor or write us for advance information on the product that makes TV alignment procedures of old a fearless operation: simple, fast, accurate. The new Sweep/Marker Generator, Model 415. Net: $399.95

B&K

PRODUCT of DYNASCAN CORPORATION
1801 W. Belle Plaine · Chicago, Illinois 60613
Where electronic innovation is a way of life.

New B&K Sweep/Marker Generator.

. . . for more details circle 104 on Reader Service Card

ET/D NEW AND NOTEWORTHY

INVERTERS 700

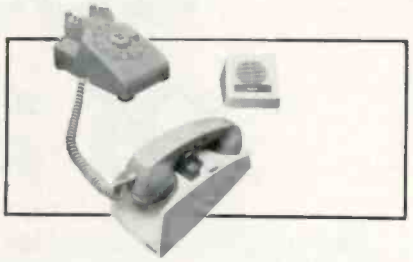
Stability allows for the operation of CCTV

Announced is the production of two new frequency stable inverters for closed circuit television operation. The Continental Model 50-191-3 (275-300w cap) and the Dual Continental Model 50-202-3 (550-600w cap) provide 117vac power from standard 12vdc battery input. The claimed frequency stable feature of both these units, 60 ±1/2Hz, provides the type of power for the operation of sensitive TV cameras, recorders and monitors. Units come complete with convenient remote control and heavy-duty 15ft copper leads. Both units are ideal for operating many pieces of peripheral equipment within wattage, capacity of unit, used in direct conjunction with CCTV systems. Other higher wattage 24v units are available at additional cost. Terado Corp.

STEREO TAPE DECK 701

Features crossfield bias head

Introduced is the Series 1600X, three-speed, all solid-state stereo tape deck, featuring a crossfield (bias) head to assure better frequency response and signal-to-noise ratio. The Model 1600X may be used with high output, low noise tape and offers these important features: V. U. meter; new, automatic tape stop assembly; pushbutton record/playback control; channel selector switch; "joy-stick" four-way tape motion lever; four digit illuminated revolution counter; instantaneous start-stop control; and a new tape arrester assembly for low wow and flutter. Heads include record/playback, erase and crossfield (bias); tape speeds are 1 7/8, 3 3/4 and 7 1/2ips. For FM multiplex recording, an FM multiplex filter must be added. Specifications are: frequency response—7 1/2ips - 40-20,000Hz (±2dB); 3 3/4ips 40-16,000Hz (±2dB); 1 7/8 ips - 40-9,000 Hz (± 2dB); wow and flutter - 0.1% (7 1/2); 0.2% (3 3/4); 0.4% (1 7/8). Signal-to-noise ratio is 60dB weighted; microphone input - 200Ω; speed tolerance is ± 1.5 percent absolute; transistors - 36. Weight is approximately 19 1/2 lb. Approximate dimensions are 15 3/8 L x 11 7/8 W x 6 3/4in. H. Retail is $249. Tandberg.



TELEPHONE AMPLIFIER 702

Solid-state battery powered

Announced is a solid-state, battery powered telephone amplifier, Model TA100. The portable device allows "no-hands" telephone conversation between individuals or groups. The telephone amplifier set is composed of two units, the amplifier unit and the speaker unit, and is simple to operate. Just place the telephone handset on the cradle of the telephone amplifier with the mouthpiece of the telephone handset in the "well" at the front of the amplifier unit. With the amplifier unit arranged so that the user talks toward the mouthpiece of the telephone as it rests in the well of the amplifier unit, his voice is picked-up enabling the listener at the other end of the line to hear him. The voice of the party on the other end of the line comes through the speaker unit which is positioned by the user for easy listening. The speaker volume can be raised or lowered by turning the volume control on the amplifier unit. After a call is completed, the amplifier shuts off automatically, when the phone is lifted off the device. RCA.

FOR MORE NEW PRODUCTS SEE PAGES 58 & 78

Guns are her business... SHE'S GOT TO BE TOUGH!

She makes the final inspection of every tri-mount electron gun we manufacture for Channel Master Color CRTs ...and she's tough about it!

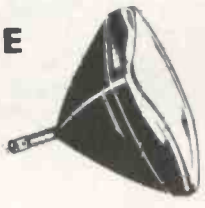
The six different tests for spacing, alignment, angle of deflection and convergence of each gun...hand-crafted to micro-inch tolerances in our dust-free arsenal...guarantee precise aiming at the rare earth target. All of her guns must meet OEM specs. Any that don't are fired on the spot.

The tests she makes are just part of the 117 inspections that each Channel Master Color CRT must pass before it's final OK for shipment. Just part of the reason why there's no finer color CRT you can recommend. The Rest? We use only the finest materials, and assemble them to higher-than-industry specifications.

Color is our specialty...that's why so many people are watching Channel Master!

At Channel Master YOUR Reputation is OUR Business.

OPTI-CHROME
OPTI-VUE
COLORLUX



CHANNEL MASTER®

DIVISION OF AVNET, INC., ELLENVILLE, NEW YORK 12428

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ET/D LETTERS TO THE EDITOR

Antennas for Sale

I have been a subscriber to ELECTRONICS TECHNICIAN/DEALER for about 10 years and find it very interesting.

A few years ago I used to install many more outside antennas than I do now and I still have to stock approximately 50 Conicals, 50 FM Turnstile and 50 Single Channel 5 & 10 element Yagis. I would be willing to sell these for approximately half cost.

AL SVIRMICKAS

2512 West 69 Street
Chicago, Ill.

Closing Shop

After 20 years of honest TV and radio servicing, I will be closing shop. I am giving it all up for a cleaning job at $2 an hour which I find is more profitable in the long run. As I see it, all future sets will be solid-state and a free for all in circuit design. Technicians will have to waste a great deal of time repairing these fine printed circuit boards and ruining their eyesight. The only way for future electronic equipment to be profitable is to standardize the circuits and have better quality control. But now I can stop worrying about it. I have a paid vacation, bonus, sick benefits and plenty of overtime. Also plenty of time to sail and fish. Now I can read your fine magazine and learn besides. I can repair TV and radio on the side with no big overhead and no more long hours.

ANTHONY AMMELLI

Overwhelming Response

This is to express my appreciation for printing my letter of last October regarding the Japanese made radio and our want of Rider Manuals.

We have had an overwhelming reply to the letter. A total of 33 answers thus far from all over the United States, including offers to sell us antique radios, tubes, etc.

A subscription of ELECTRONIC TECHNICIAN/DEALER is one of our musts each year. The many fine articles relative to service and keeping abreast of the new innovations warrants highest praise.

Our most heartfelt appreciation for your assistance.

W. O. (BURNIE) WATKINS

Reader's Aid

Can any of your readers help me locate service information on a Freeman Model 600 stereo tape recorder? Any assistance will be greatly appreciated.

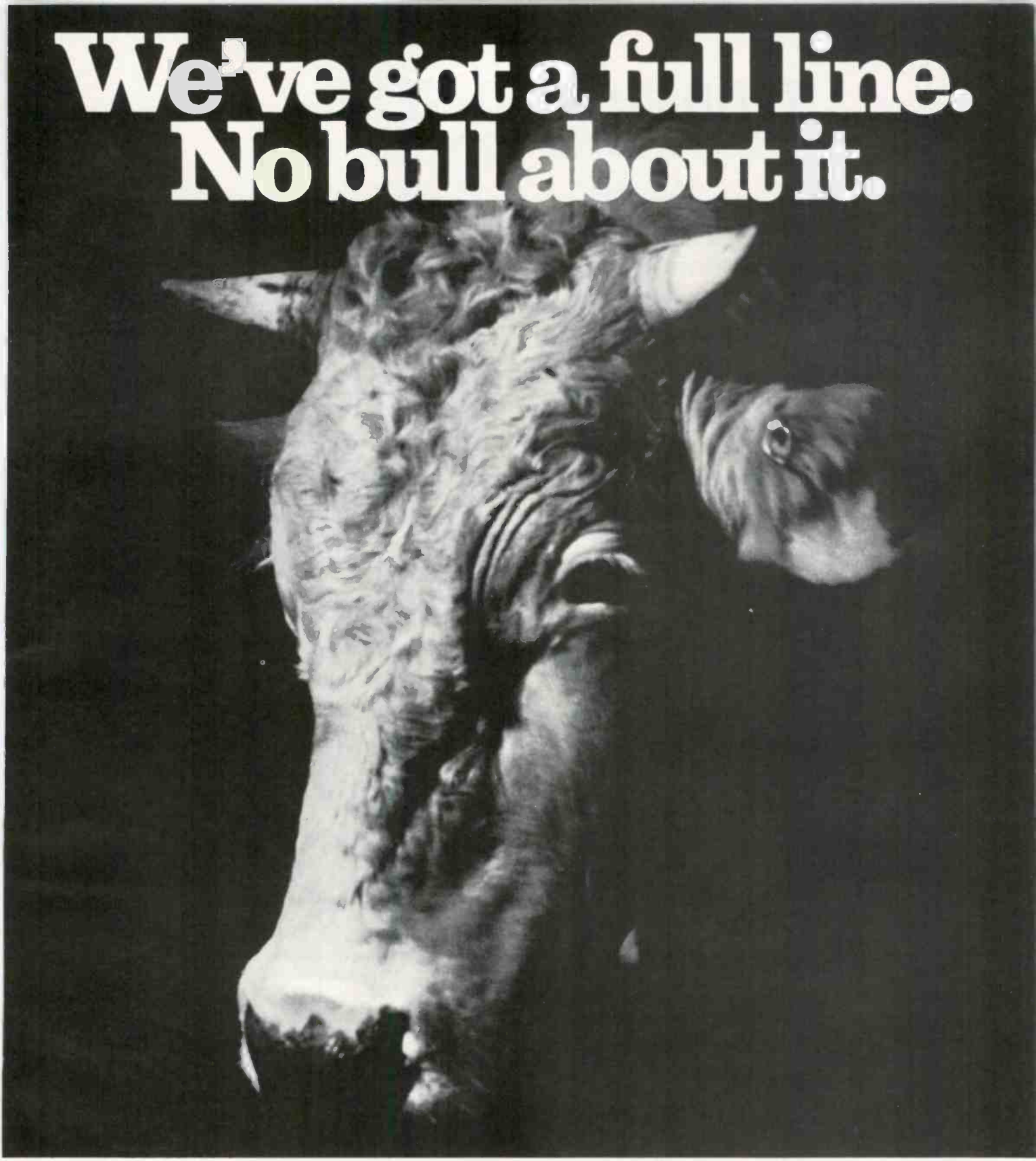
MICHAEL RICE
1595 Blountstown Street
Tallahassee, Florida 32304

We would like to obtain Schematics for the following equipment. If someone will loan them to us, we would photo copy the drawings or manuals and return them within 48 hours.

The schematics we need are for a Paco Model V-70 Vacuum Tube Volt Meter and for a Hickok Oscilloscope Model 195B.

G. M. BOYES
127 W. Limestone Street
P.O. Box 557
Carthage, Missouri

We've got a full line. No bull about it.



When it comes to wire and cable, we've got the works: TV wire, control cable, inter-com and audio cable, coaxial cable, hook-up wire, cord sets, antenna wire, lead wire, power cord and cable, rotor cable.

And not only do we have them all, we make them all easy for you to get. There's a full supply of every one of the items we offer, ready and waiting to be delivered to you, in every one of our warehouses.

What's more, all our products are in distinctive, new packages that make them easy for you to find when you put together an order and easy for you to check when you take an inventory.

Why buy wire and cable helter-skelter? Get it from one source, get it from us! For complete information on Columbia wire, cable and cord sets write Columbia Electronic Cables, 150 Hamlet Ave., Woonsocket, R.I. 02895; Warehouse, 4045 North Rockwell St., Chicago, Ill. 60618; West Coast Sales Office and Warehouse, 1950 Naomi Ave., Los Angeles, California 90011.

COLUMBIA

Columbia Electronic Cables

a division of AVNET, INC.

. . . for more details circle 113 on Reader Service Card

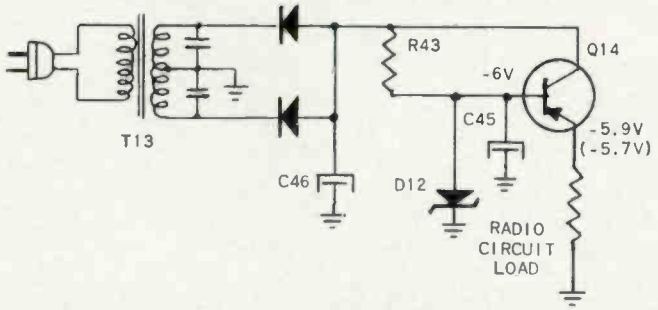
ET/D TECHNICAL DIGEST

The material used in this section is selected from information supplied through the cooperation of the respective manufacturers or their agencies.

ADMIRAL

Radio Models PRF121/PRF131—AC Power Supply

These radios include a separate ac power supply which allows them to be operated from an ac line without battery drain for home use and from the 6v battery pack for portable use. When the set is operating with the switch in the



dc position, the ac power supply circuit is opened so it does not recharge or affect battery operation.

The full wave ac power supply for the PRF121 is illustrated in the simplified circuit diagram. The power supply for the PRF131 is the same but different symbol numbers are used in the schematic diagram for identification.

Transistor Q14, connected as a reverse common base amplifier (signal applied between collector and base and taken off at the emitter), functions as a voltage regulator and electronic filter. The emitter load resistor for Q14 consists of the radio circuits. Zener diode D12 provides a −6v reference for the power supply.

The avalanche characteristic of D12 prevents Q14 base voltage from exceeding −6v. The characteristic of the forward biased PNP Germanium transistor Q14 maintains the emitter voltage within 0.1v and 0.3v of the −6v base reference. Since Q14 functions as a reverse amplifier, any voltage fluctuations at the collector will be even less in the emitter circuit. Therefore, any ripple will practically disappear at the emitter. A constant, well filtered power will be provided at all volume and signal levels.

RCA VICTOR

Cassette Tape Player Models YLB18/YZB525—Cassette Cartridge Ejection

A recent design change in the assembling of cassette tape cartridges provides for the two halves of the cartridge to

SYLVANIA

FM Stereo Automatic Mode Switch

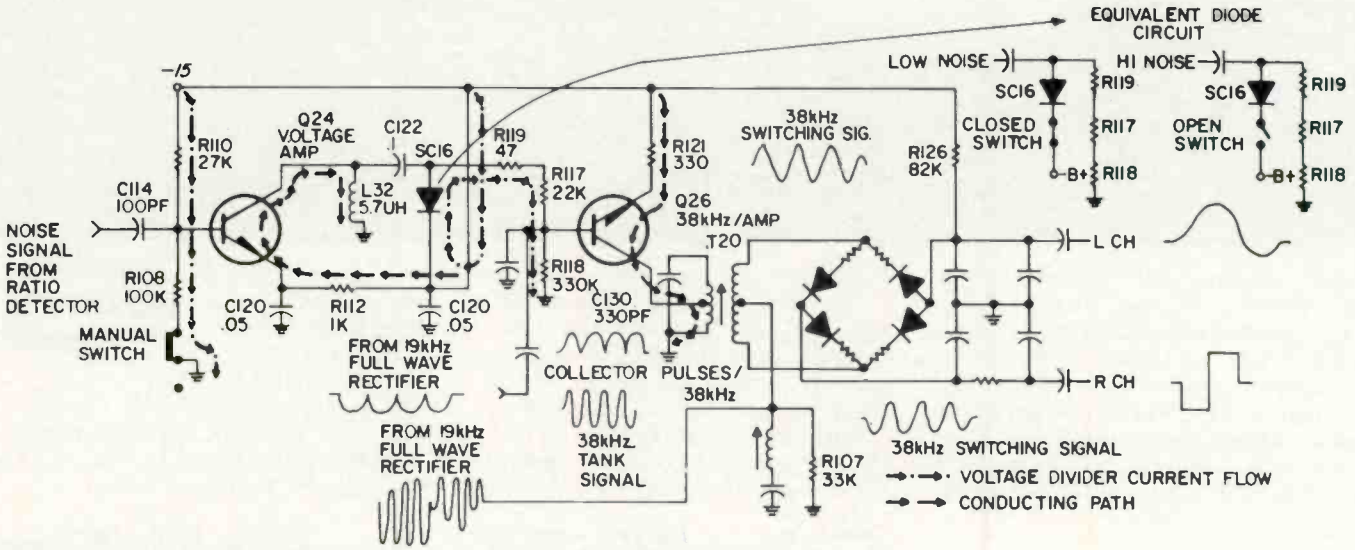
The automatic mode switching circuit is made of a high pass filter C114, a noise voltage amplifier transistor Q24, a diode rectifier switch SC16 and the 38kHz amplifier transistor Q26.

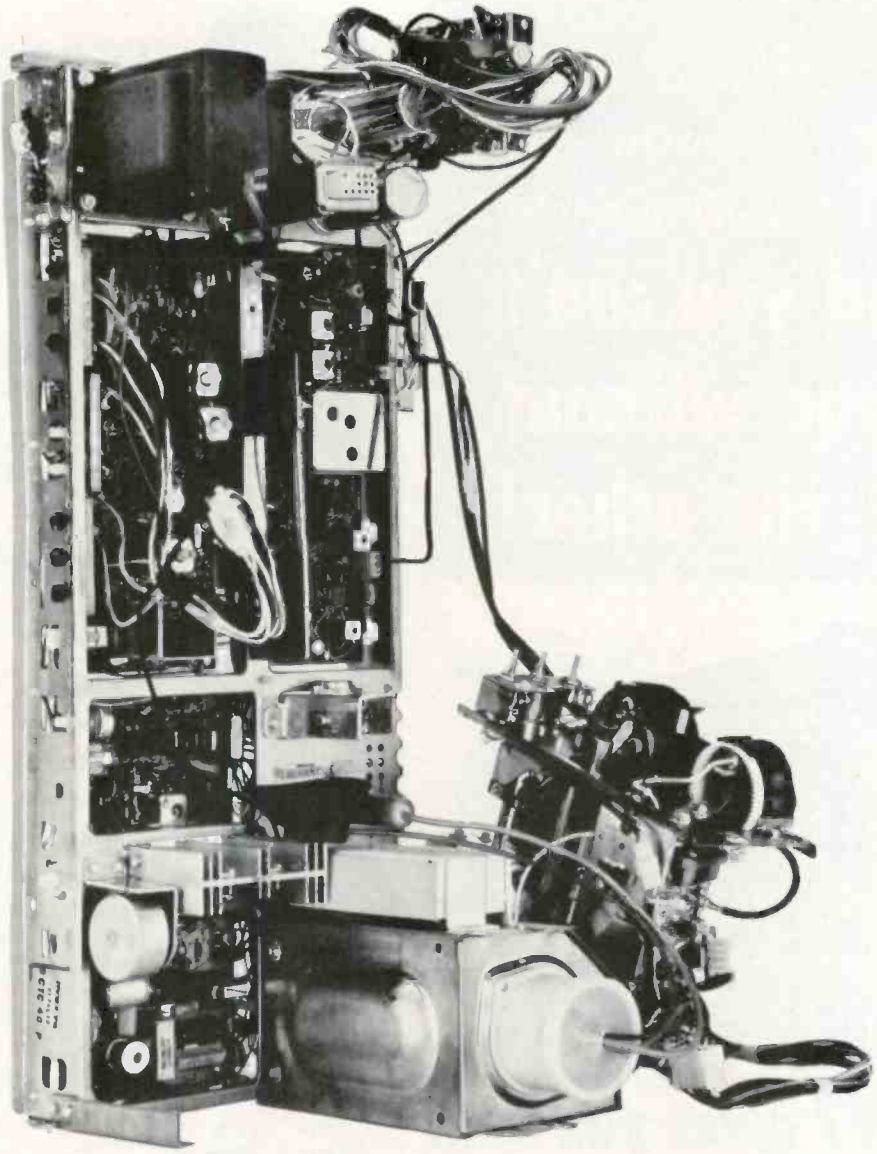
The purpose of this circuit is to switch to monaural when the stereo FM signals get objectionably noisy. A manual "Auto" switch on the front panel defeats the decoding circuit when the noise level holds the switching circuit at the threshold level, switching the decoder in and out of its operating mode.

Under normal conditions the noise level is low allowing the 38kHz amplifier to maintain conduction. The 38kHz sine-wave energy is injected into the time division multiplex switch for left and right channel signal recovery.

When the FM stereo signal level drops, the noise level rises. The high pass filter, C114, feeds the noise voltage to the base of Q24. Q26 base is forward biased by the voltage drop across R117 because of the voltage divider current flowing through SC16, R119, R117, R118. L32, a high impedance collector load for Q24, develops the noise signal SC16 rectifies.

SC16 becomes reverse biased by the noise signal rectification producing a negative dc potential at its anode. The current through the resistance network R119, R117 and R118 is switched off and the forward bias removed from Q26. The 38kHz sine wave is removed turning off the multiplex switch. Only monaural sound is recovered.





There's more here than meets the eye.

What you are looking at is RCA's solid-state color chassis—the CTC-40. A whole lot went into that chassis. Like fifteen years of technical research. Pioneering in the development of Solid State. And the backing of a national workshop program like nobody else's.

That's where you come in.

We've written a technical manual on the CTC-40 especially for Electronic Service Technicians. It has color diagrams, pictures, and everything there is to know about our CTC-40.

You can buy it from your RCA Consumer Electronics Distributor, but there's a better way.

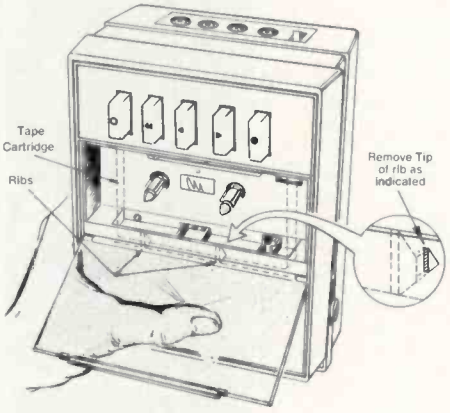
Attend the next RCA Consumer Electronics Distributor CTC-40 Workshop and get the manual free. Our distributor can tell you when it will be held next in your area. See you there.

RCA

. . . for more details circle 132 on Reader Service Card

ET/D TECHNICAL DIGEST

be sealed together by an ultrasonic process resulting in a much more rigid cartridge. The more rigid cartridge will undoubtedly become universal.



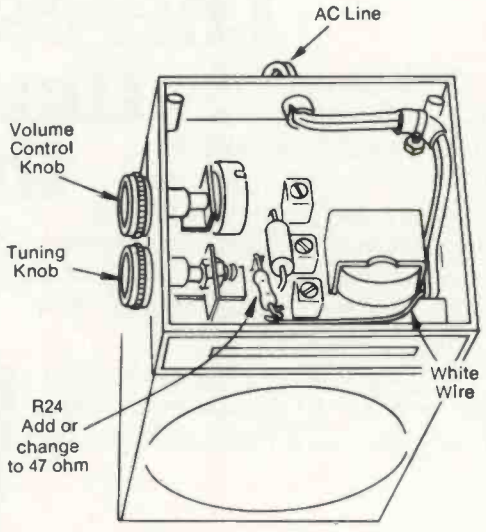
While steps have been taken to make the cartridge compatible in the YZB525, there may be instances where this new type cartridge will not eject freely from the YLB18. If this difficulty is encountered, the following procedure should be followed.

In some manner remove a small amount of each tapered rib as illustrated (only enough to allow cartridge to fit snugly against back edge of compartment).

Note: This could be accomplished by using a sharp knife, end cutting chisel or wire tipped soldering iron.

Radio Models RLD30/RZD435/RZD946—Hum Modulation

There is a possibility of hum in these radios when a strong signal is received.



Under conditions where the radio may be in the vicinity of a strong AM transmitter, hum modulation may be evident.

In these isolated instances requiring correction, add or change R24 to 47Ω1/2w, as illustrated.

continued on page 34

Don't sell a color picture tube unless its been on a test ride.

Down at the bottom of the page, you have a major advance in space-age homeliness.

And a major advance in color tube testing as well.

That machine squatting down there is our beloved Iron Horse, the fully-automated, revolving carousel we use to test our color bright 85® tubes for emission, gas leakage, shorts, arcing and screen uniformity prior to shipment.

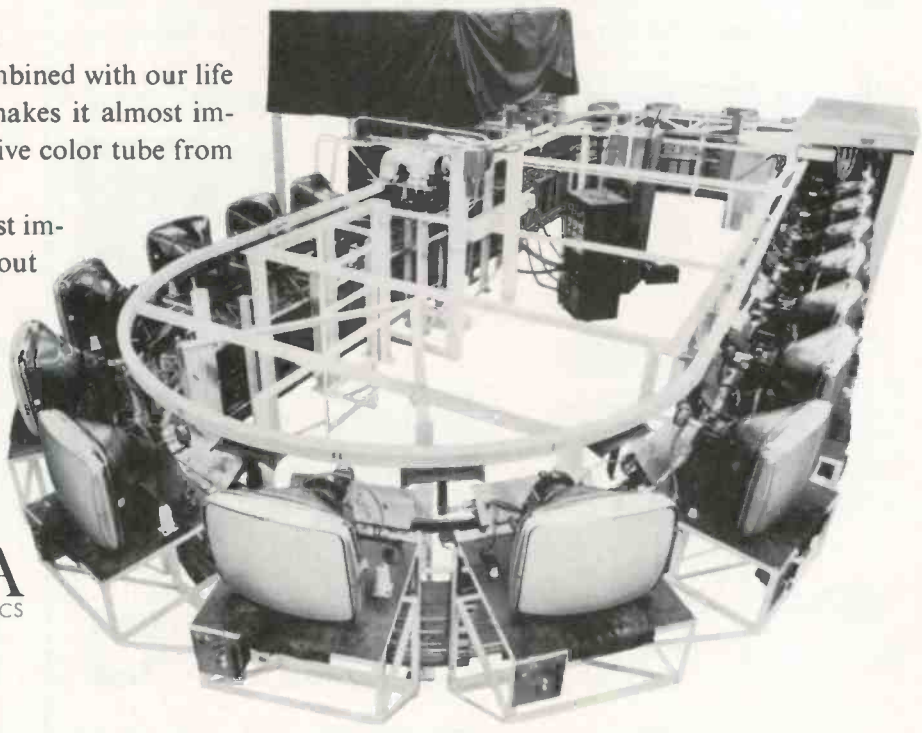
Now we don't intend to go into a song and dance on how total automation reduces testing error.

But we will tell you one thing.

Our Iron Horse test ride, combined with our life testing and 100% set testing, makes it almost impossible for you to get a defective color tube from us.

Which in turn makes it almost impossible for you to get chewed out by a customer.

Next time you need a color replacement tube, remember the great thing about the color bright 85. We don't send it to you till it's been around.



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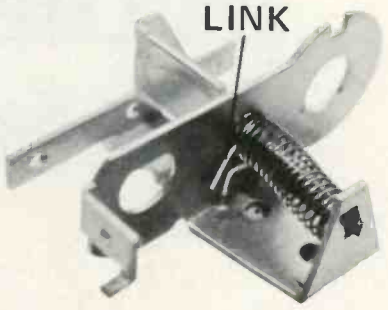
ET/D TECHNICAL DIGEST

DELCO RADIO

Tape Player T400—Twist Lug Breaking Off On Push Bar Assembly

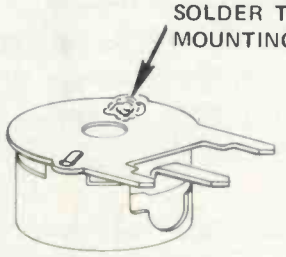
When removing the volume or fader controls from the tape player, it becomes necessary to remove the push bar assembly to acquire access to the two screws that hold the control bracket. When bending the twist lug first up then back, the twist lug may break off.



If the lug breaks off, drill a small hole in the shaft at the point where the metal changes its width. See illustration. Place a small piece of wire through the hole and bend so the wire will not fall out.

Tape Player 69T-4—Intermittent Bias Pots

Condition: Some shops have found some 7294878 bias pots being intermittent.



Cause:
This bias pot is of a two-piece constructions as shown in the illustration. The mounting plate is effectively ground in all mounting applications. If it doesn't get a "good stake" in the manufacturing process, the pot becomes intermittent. Cure: Solder at least one of the tabs to the mounting plate. (This is being done in the manufacturing process at this time.)

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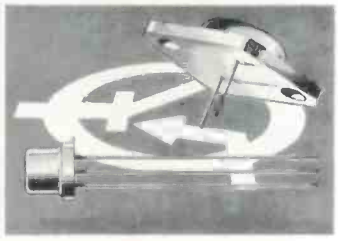

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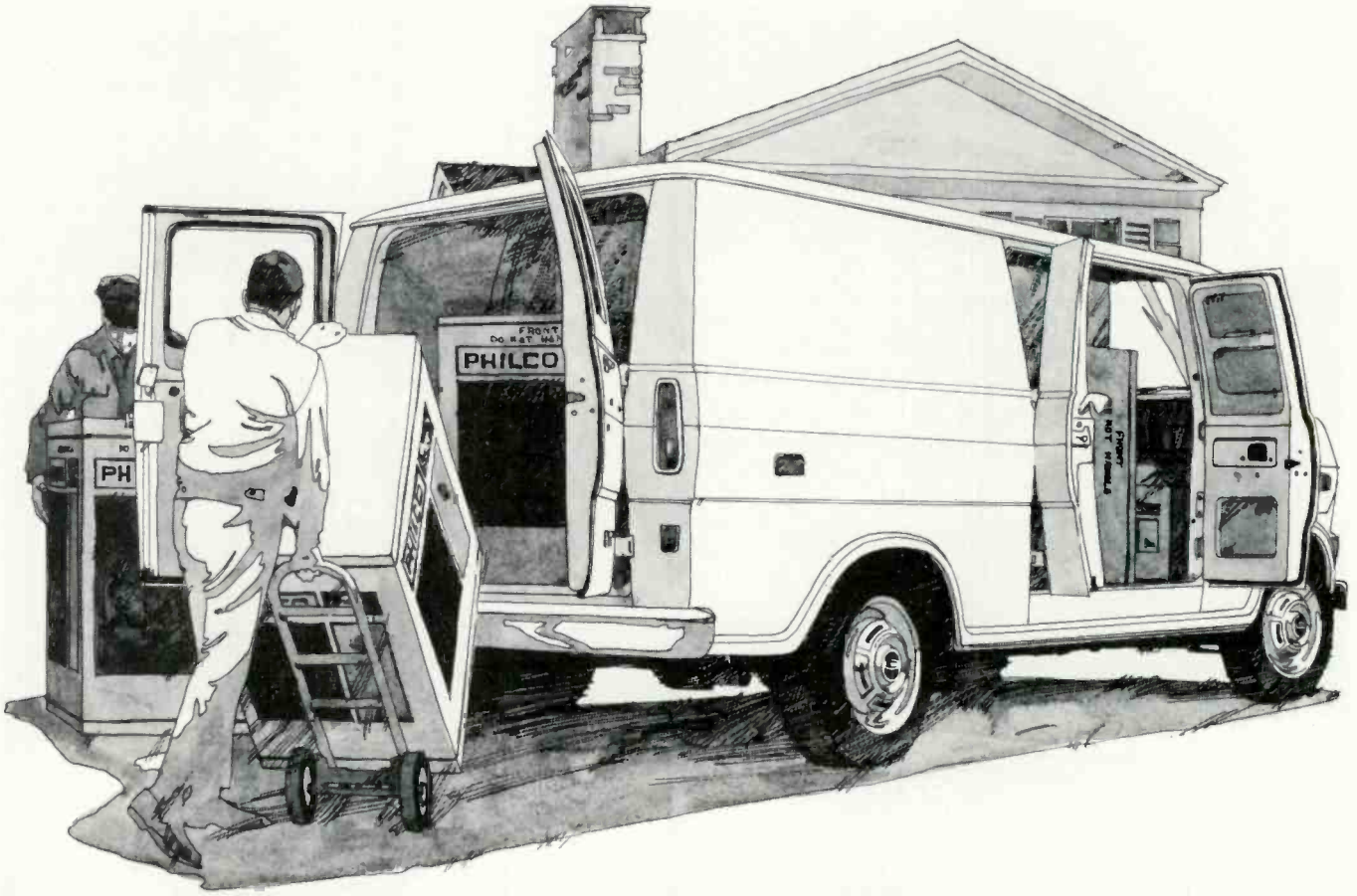

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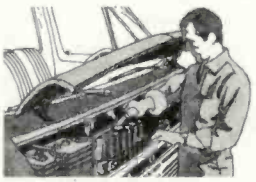

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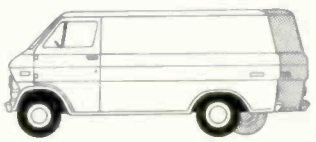

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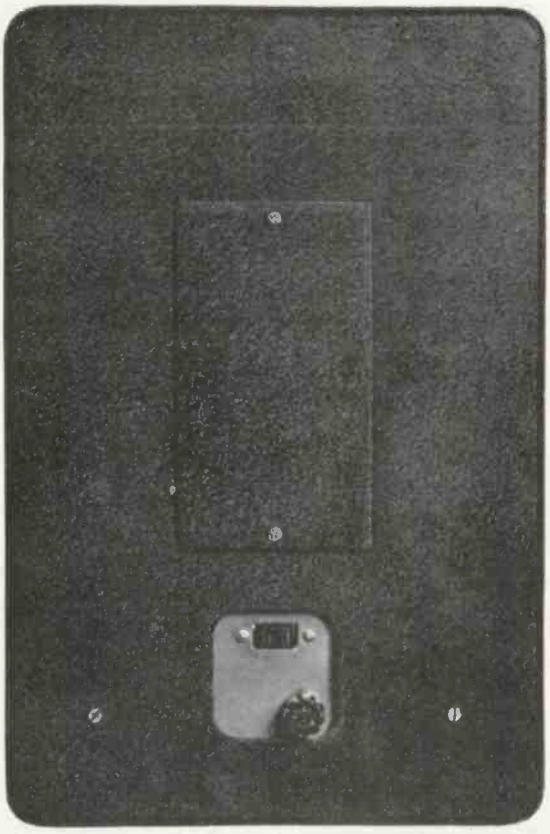
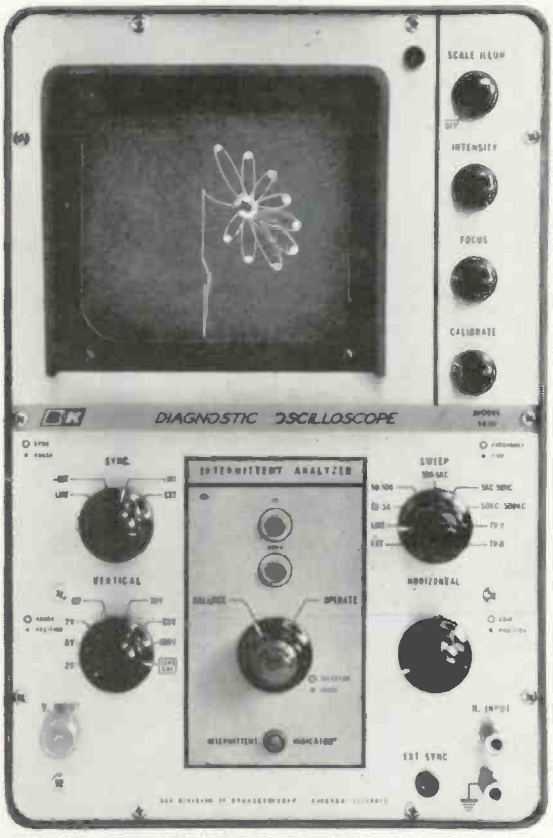
The back. The front.





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And all patterns are locked in at any signal level or frequency by *automatic synchronization.*

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Of course, we've tried to show you our good side—both of them. Now it's up to *you* to side with *us.* See your B&K distributor soon—or drop us a note for more detailed information.

Model 1450. Net: $299.95.

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B&K puts an end to test equipment. We've developed "Silent Partners."

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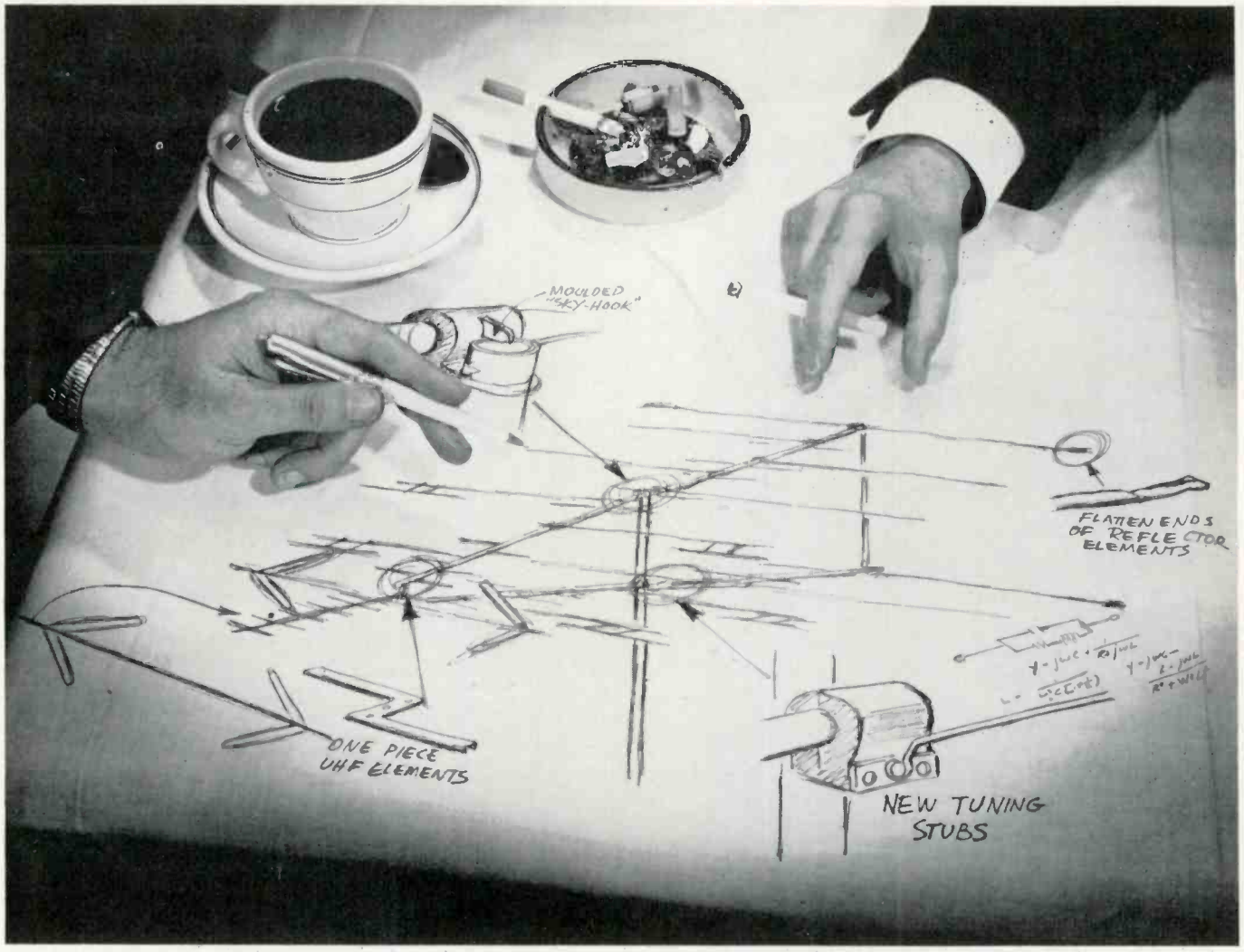

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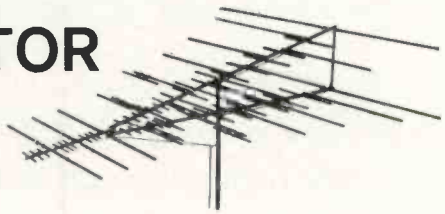

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ET/D TEKLAB REPORT

Magnavox's Total Automatic Color Chassis T940

This interesting automatic tint circuit electronically performs one of the most annoying adjustments of the television set

■ Color television has advanced a long way toward simplifying customer control adjustments. Automatic fine tuning employed for a number of years practically eliminated fine tuning between channels; then the automatic chroma control was introduced. Until now perhaps the most annoying part of the adjustments still remained, the tint control. If we switched from one source to another (such as different channels, studio cameras, film cameras, video taped network programs, etc.), variations of color in the fleshtone region and small phase errors are noticeable.

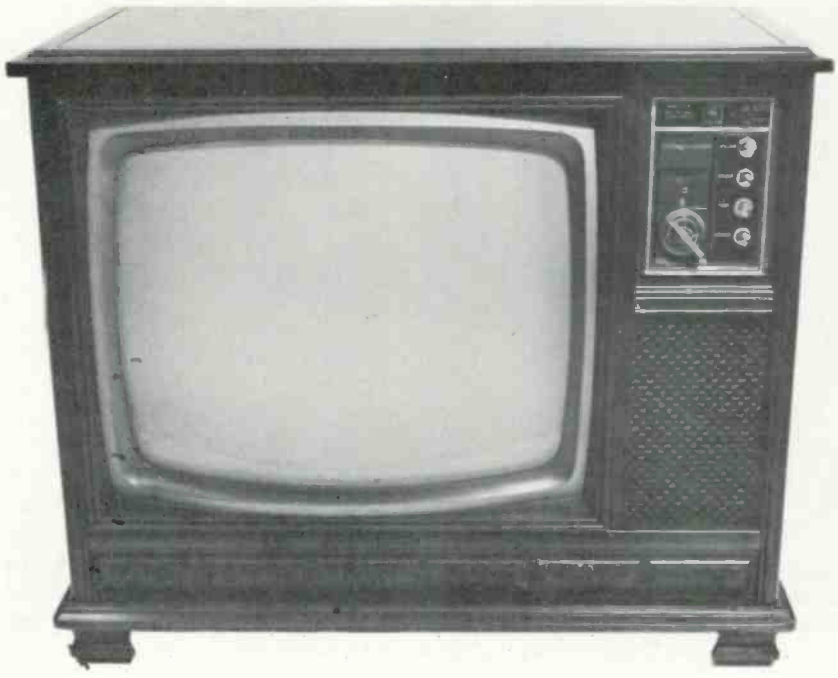
We recently received the Magnavox Model 2C6927 employing the T940 chassis with total automatic color (TAC) automatic fine tuning, color and now automatic tint.

We found the chassis, tuner, and the power tuning units easy to remove and other features simplifying chassis servicing. The tuner and control cluster was pulled by removing two bolts on the mounting bracket and two on the control shafts from the front. Plug-in sockets are used on all wire connections. Chassis hold down bolts can be removed from the top of the chassis without the need to get under it or to tilt the cabinet. The power rectifiers and large wattage resistors are mounted on an upright panel making these components more accessible and eliminating a number of terminal strips as shown in Fig. 1.

This chassis employs a new HV cage and flyback transformer. After removing one screw the back cover lays down to expose the rectifier tube and transformer. The cover may be taken off completely by removing two additional screws from the bottom of the cover.

Fewer components are mounted on the flyback transformer and the 1V2 focus rectifier tube is replaced with a stick type di-

Magnavox Model 2C6927 Color TV employing the T940 Total Automatic Color Chassis.



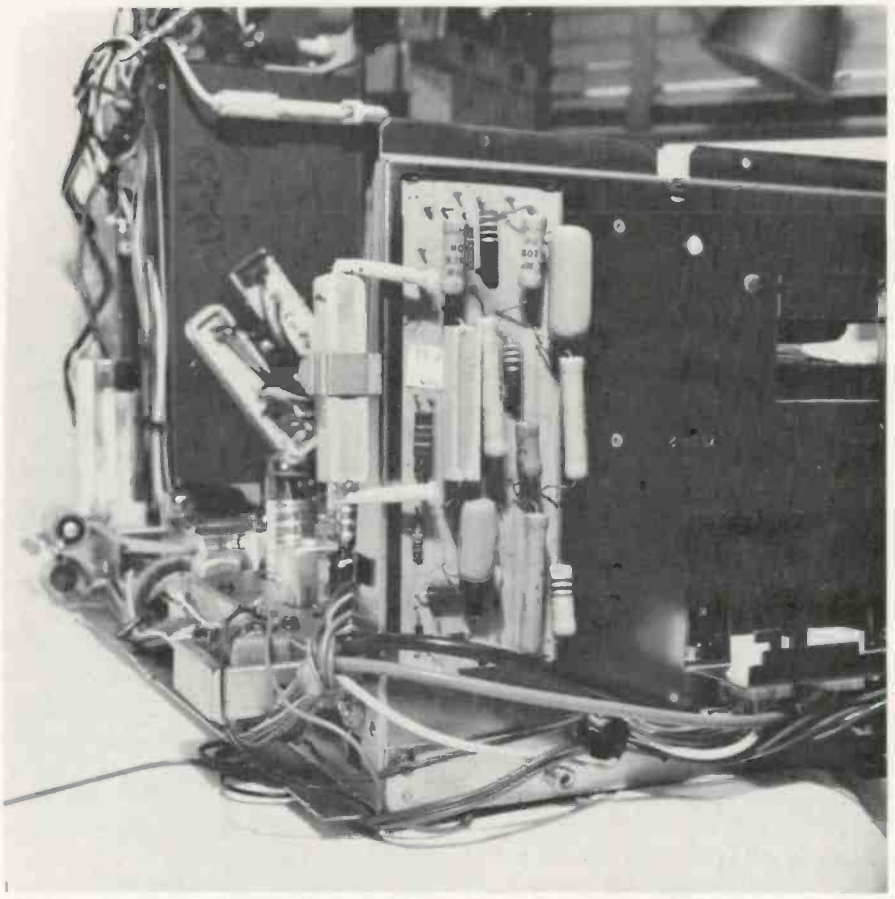


Fig. 1 — Power rectifiers and large wattage resistors are mounted on an up right panel making components more accessible and eliminating a number of terminal strips.

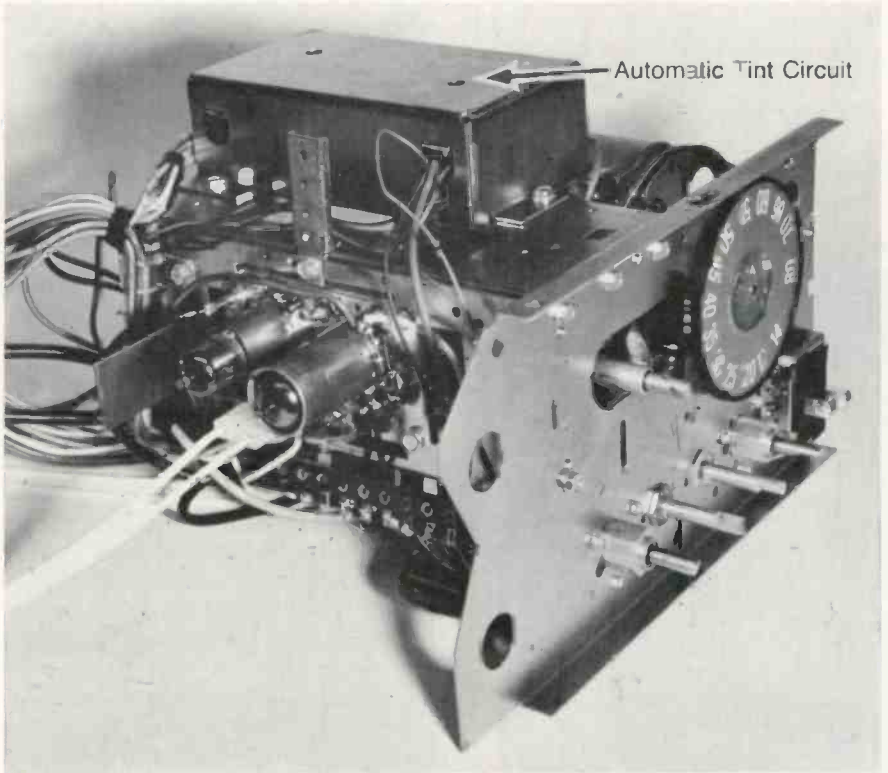


Fig. 2—The power tuning cluster which includes all front adjustments and is pulled by removing four retaining bolts and all wire harnesses have plug-in connectors reducing service time. The automatic tint circuit is also placed on tuner bracket.

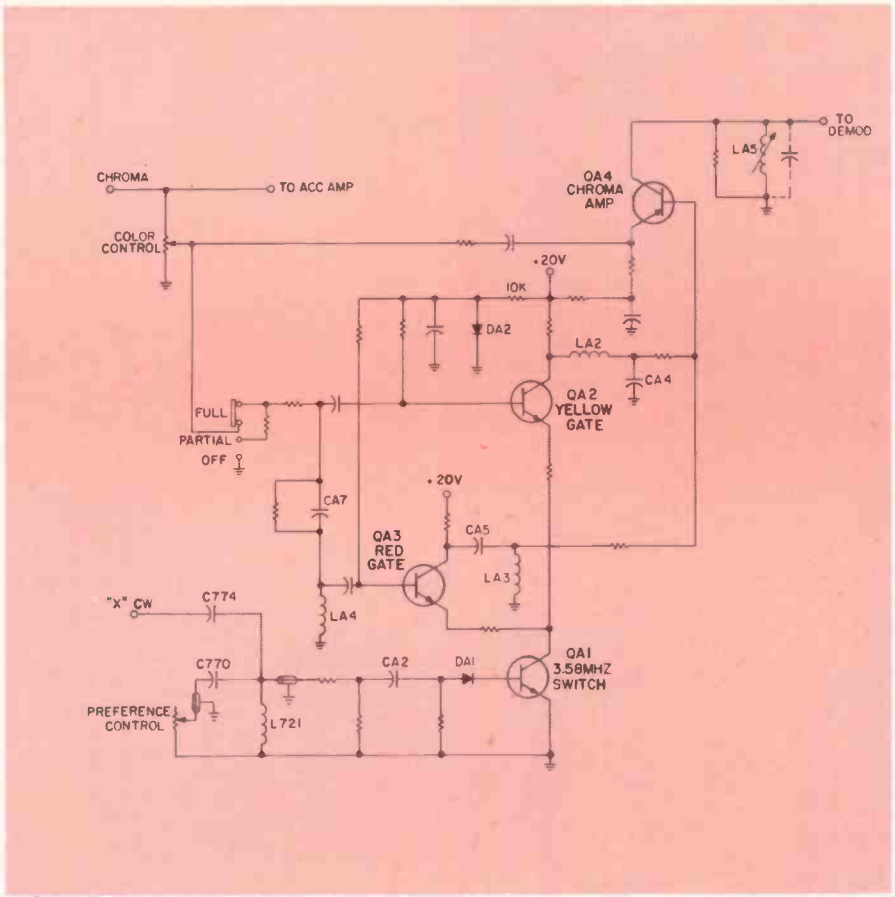
ode which fits in a special holder on the side of the HV cage. A slide switch is located on the rear apron of the chassis to simplify changing the high line voltage tap on the transformer. A 6MU8 tube is used as the sync and video amp replacing the 6LM8. This new tube has better linearity, more gain and is not so prone to "slump." Do not use the 6MU8 as a substitute for the 6LM8 without making appropriate circuit changes. With the exception of the 6MU8 and the focus rectifier change, the tube lineup is identical to the later versions of the T933 chassis.

Also employed in this chassis are a number of new and modified circuits which are worthy of review.

AUTOMATIC TINT CIRCUIT

The new automatic tint control employed in this chassis senses fleshtone errors and automatically corrects them to the desired hue. The ATC circuit is located in a metal box attached to the tuner mounting assembly. See photo, fig. 2. Viewing the set from the front panel you will notice an additional slide switch, the automatic tint. This switch has three positions: OFF, PARTIAL and FULL correction. The FULL position is used when variations of fleshtones are extreme; the PARTIAL position is used when only minor correction is needed. Located at the back of the set on the secondary control panel we found the PREFERENCE control which determines the hue of fleshtones produced after correction by the ATC. This control allows the customer to set fleshtones to his personal likes; more red or green may be added as desired.

To overcome error in fleshtones, the ATC employed in this chassis is designed to sense phase errors in the chroma signal in and around the fleshtone region of the color spectrum and add phase correction to produce correct fleshtones. This correction is developed by two transistors called the Red and Yellow Gate which sample chroma informa-



Schematic of the automatic tint control (ATC) circuit.

tion coupled to the base of each. Each gate is sensitive only to certain chroma phases on either side of the correct fleshtone phase, a transistor switch is used to complete the emitter circuit of both gates. This 3.58MHz switch is turned on by a CW signal from the 3.58MHz oscillator which

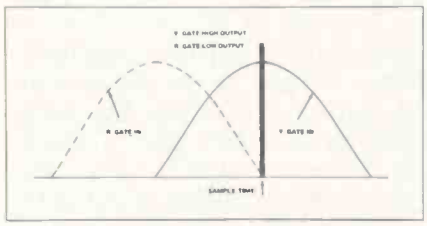


Fig. 3—The 3.58MHz switch is switched on by a CW signal from the 3.58MHz oscillator which is very near the phase of a yellow chroma signal.

is very near the phase of a yellow chroma signal. (See Fig. 3)

The switch is biased so that conduction occurs during the interval that the CW sine wave is passing through its positive peak. Similarly, both gates are biased to conduct only when the chroma signal applied to the base of each is positive going. From this it can be seen that the yellow gate will conduct heavily when a yellow chroma signal is present on the base of the stage at the same time the switch is completing the emitter circuit.

The chroma signal applied to the red gate is phase shifted so that red chroma information is also near peak positive during conduction time. See Fig. 4. If it were possible to transmit both yellow and red chroma phas-

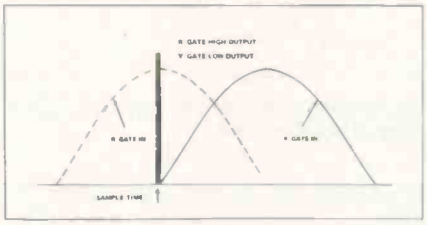


Fig. 4—The chroma signal applied to the Red Gate is phase shifted so that red chroma information is also near peak positive during switch conduction time.

es simultaneously, it could be seen by observing the two chroma phases that the switch conduction time is equal distance from the peak of each chroma sine wave (see Fig. 5) when correct flesh-

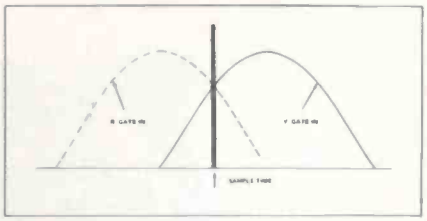


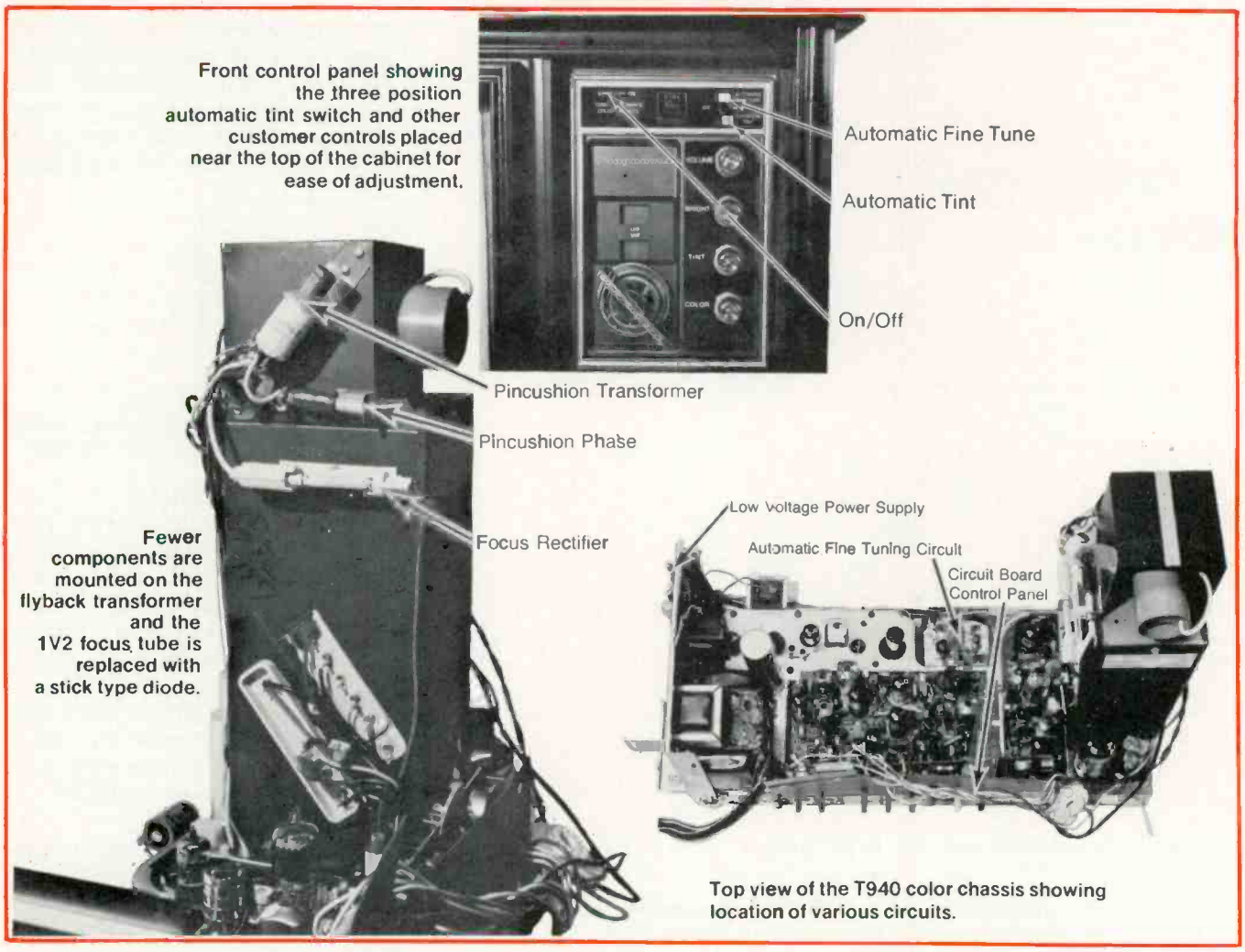
Fig. 5—Switch conduction time is equal distance from the peak of each sinewave.

tones are transmitted. A deviation in chroma phase from that shown in Fig. 5 will cause one or the other of the gates to increase conduction while conduction of the alternate gate is reduced. The gates are then able to distinguish an error in fleshtones with the red gate conducting more when red errors are transmitted and the yellow gate conducting more when yellow errors are transmitted.

The combined correction signal from both gates is added to the original chroma signal by the chroma amplifier transistor. This stage is emitter driven by the same chroma information which is applied to the base of both gates. The base bias of the chroma amplifier is developed by the individual phase shift network in the collector circuit of each gate to develop a correction towards yellow and the yellow gate to develop a correction towards red. The combined output of both gates will mix with the chroma signal being fed to the emitter of the chroma amplifier to produce a resultant at the chroma amplifier collector having the proper phase to produce correct fleshtones.

Since chroma phases other than those capable of producing yellow through red are negative going during the time the 3.58MHz switch is turned on, the gates are sensitive to only fleshtone hues and the remainder of the color spectrum is unaffected by the correction circuit.

The troubleshooting proce-



Top view of the T940 color chassis showing location of various circuits.

dure for the ATC circuit can be found in the December issue of ELECTRONIC TECHNICIAN/ DEALER on page 64.

AUTOMATIC COLOR CONTROL

The automatic color control (ACC) shown in Fig. 6 functions

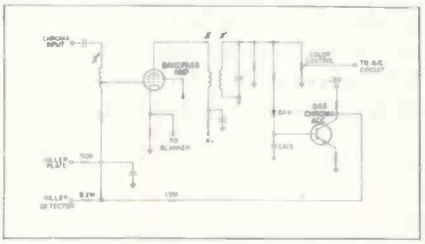


Fig. 6—Schematic of the automatic color control (ACC) circuit.

to minimize large variations in chroma amplitude so that frequent adjustment of the color control becomes unnecessary. This circuit is a new and improved version over previous years.

Control is accomplished by changing the gain of the bandpass amplifier with a dc voltage. The ACC circuit utilized in the T940 chassis uses two signals to develop the control voltage—the Burst signal and the Chroma signal. An increase in either or both of these signals causes a negative-going voltage to be applied to the control grid of the Bandpass amplifier to reduce gain. A reduction of either signal causes the gain of the amplifier to increase.

The Burst signal is rectified by the Killer Detector diodes to produce a positive and a negative dc voltage. The negative voltage is coupled through an 8.2M resistor to the control grid of the Bandpass amplifier to establish a certain amount of gain. When the Burst amplitude increases, the amount of negative voltage produced becomes larger and causes the gain of the

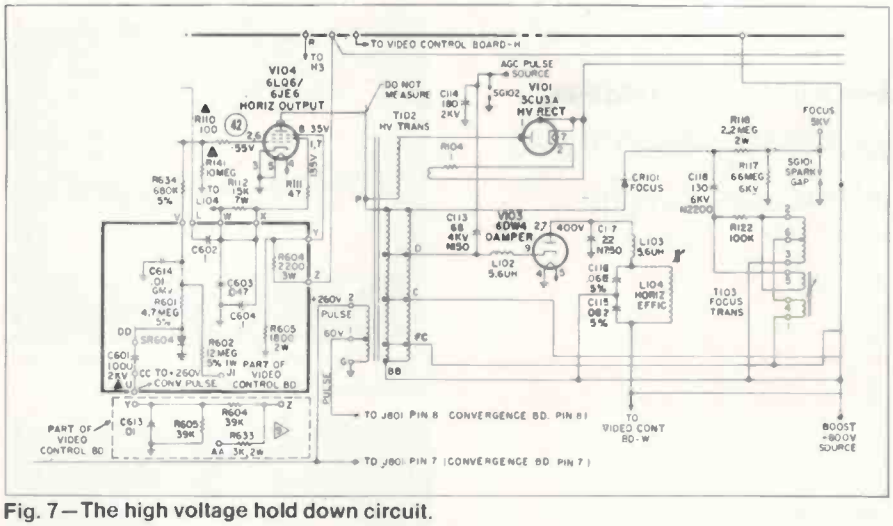
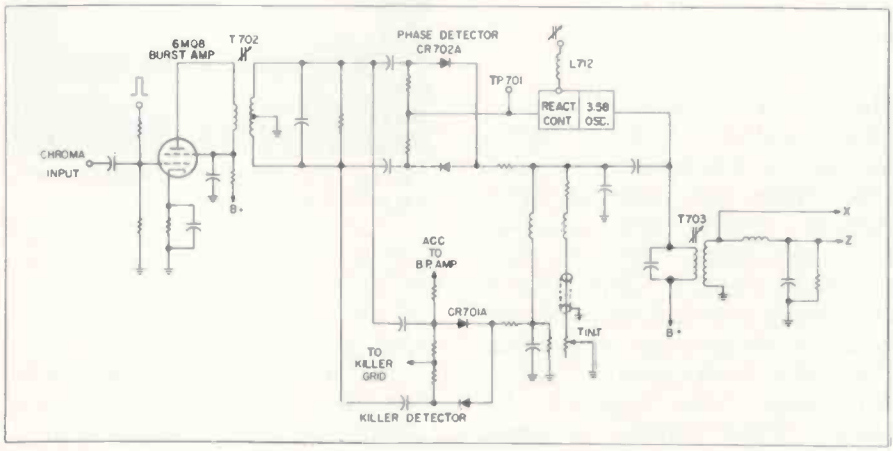


Fig. 7—The high voltage hold down circuit.

Fig. 8—A simplified schematic of the Burst amplifier and 3.58MHz oscillator.



Bandpass amplifier to decrease.

The amplitude of the received chroma signal varies with changes in color saturation. A Chroma ACC amplifier, located on the ATC board, is used to minimize extreme level changes. The chroma signal at the top of the COLOR control is coupled to DA4. The positive peaks of the signals forward bias the diode and charge CA13. The charge on the capacitor follows the amplitude variations of the Chroma signal. The positive dc voltage on the capacitor is used to control the conduction of QA5. As the chroma signal increases in amplitude, more collector current flows. The collector voltage decreases and allows the grid of the bandpass amplifier to become more negative and reduce gain. Low level chroma signals provide less forward bias for the chroma ACC amp and the collector voltage moves toward the positive supply. The grid of the bandpass amp becomes less negative and gain is increased. In this manner, the gain of the bandpass amplifier is adjusted automatically to minimize extreme variations in chroma amplitude.

HV AND SHUNT REGULATOR

This chassis incorporates a high voltage hold down circuit as shown in Fig. 7 which reduces the output of the horizontal output tube in the event that the high voltage increases above the desired limits. The correction circuit consists of resistors R634, R601 and a voltage dependent resistor, VDR601. A 405v reference from the cathode of the shunt regulator is applied through a 12M resistor to the junction of R634 and R601. A flyback pulse from the HV transformer terminal FC is capacitively coupled to the VDR. Since the resistance of the VDR decreases as the voltage across it increases, the VDR presents a low resistance path to ground to the flyback pulse and the rapid current flow through the circuit places a negative charge on the pulse coupling capacitor proportional to the amplitude of the flyback pulse. The reference voltage and the negative capacitor discharge balance when the high voltage is within normal tolerances. With an increase in high voltage however the greater capacitor charge becomes sufficient to overcome the positive reference voltage and adds reverse bias to the output tube thus reducing conduction of the stage to hold the high voltage at the correct level.

The shunt regulator is used to regulate the high voltage, being applied to the CRT. This regulation prevents changes in the high voltage from affecting the over-all convergence of the beams on the face of the CRT. In addition to the usual boost voltage, an additional boost voltage is developed by a selenium rectifier. This is designated as boosted boost and measures approximately 1200v.

BURST AMPLIFIER AND 3.58-MHz OSCILLATOR

As shown in the simplified schematic Fig. 8 a potentiometer is used as a tint control to change the phase of the oscillator signal applied to the phase detector and killer detector. The dc voltage developed by the phase detector correct the phase of the 3.58MHz oscillator signal. The significant change to be noted is that the field AFPC adjustments for this circuit have been modified. The oscillator transformer T103, is adjusted more precisely than in earlier chassis. It is important that this transformer be tuned so that its response curve is centered at 3.58-MHz.

In next month's Teklab report we will cover the eight-function remote control system used in this chassis. ■

The color television service technician today has the responsibility of facing a more knowledgeable customer. This demands that the technician continually upgrade his efficiency and understanding of color reception

Color Service Hints

by WILLIAM I. SPERO,
Field Service Engineer- Sylvania Electric Products Inc.

Fig. 1—Vertical Interval Test Signals as observed on television receiver.

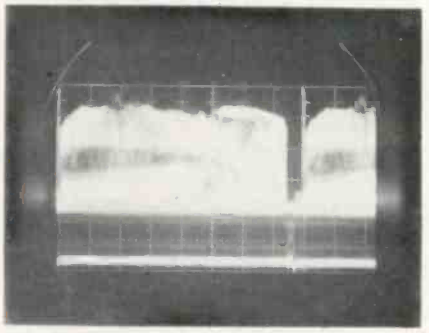


Fig. 2—Composite Video-Vertical, showing VITS pulse.

■ Color television servicing has problems that technicians working with monochrome TV never dreamed possible. It is an entirely new dimension which must be treated and evaluated with extreme proficiency. Service managers who refuse to accept this fact are missing out on the facts.

After all, the average purchaser of a color television is purchasing one item—entertainment, truly an intangible. His magic color box can't cook, clean the house or physically transport him from one place to another. It can, however, take him to the opera, to a movie or to the four corners of the world—without ever leaving the surrounding comfort of family and home—and in the living kaleidoscope of breathtaking color. All this, of course, is predicted on the assumption that the color TV receiver is operating satisfactorily. By satisfactorily, I mean that it is performing to manufacturer's specifications, and reproducing color as close to the original as the state of the art will allow.

The service community has a responsibility to the consumer. And since color is a whole new dimension, color receivers cannot be serviced entirely with monochrome techniques. A wideband oscilloscope and a good sweep/marker generator are mandatory. Modern solid-state circuits require modern thinking and analysis to intelligently troubleshoot them. One trend of development which color receivers have been taking is towards more automatic control. This type of circuitry goes under various names (you are all familiar with them, I'm sure!)—Remote Control, Automatic Color Control, Automatic Fine Tuning, Automatic Frequency Control, Signal Searching UHF, TAC, etc.

With the rising costs of labor and materials, the average shop can't afford to stumble through its service. Someone must take the initiative and responsibility of upgrading the technical personnel.

Many manufacturers now provide field service training seminars to help technicians understand the product and its operation. Some also have instituted training schools to improve the technical competency of service people. Fortunately, those service managers who are looking to the future of the television service industry and for ways to increase their business profits see that their personnel take advantage of these programs.

NOVEL DIAGNOSTIC TECHNIQUE

One of the most important requirements of a satisfactorily operating color television receiver is its alignment status—RF, IF and Chroma. If one were to view a monochrome picture only, RF or IF misalignment would not greatly detract from the video content. Some degree of misalignment can be tolerated. However, poor alignment or poor high frequency response in a color receiver will destroy its aesthetic value. A color receiver lacking in good high frequency response will not pass adequate chroma information through the IF stages. After all, people do buy color TV to watch color programs—in color.

How do you recognize that alignment is needed? There are some ways, by observing a picture: a classic one being the tuneable ghost. While this gives some indication of a problem, it does not visually describe the whole RF-IF frequency capability of the color receiver. A quick way to assess this frequency-response is by utilizing the video test signals transmitted by the broadcasters.

Perhaps a short description of these signals is in order. Vertical Interval Test Signals (VITS) are generated and transmitted

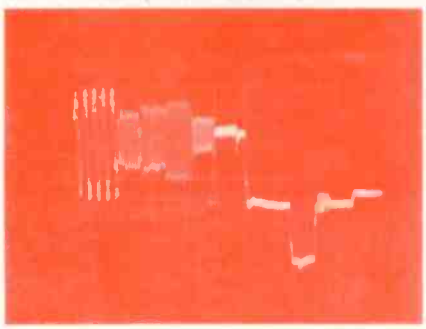
along with the composite video. They are keyed into lines 18 and 19 of both fields and transmitted with the picture signal. This can be seen on home receivers as a light horizontal line in the vertical blanking interval. To see it, just off set the vertical hold control to move the vertical blanking to the center of the screen. (Fig. 1)

The network people utilize VITS to establish a continuous quality control of television signals. These signals are monitored on an oscilloscope and can be observed and photographed. The network use is beyond the scope of this article; however, we can conveniently use these signals to establish proper (or improper) receiver performance.

A photograph of how the VITS appears on the composite video is shown in Fig. 2. Figure 5 is a simplified drawing of the VITS signal as transmitted. Figure 4 is a photograph of the same signal as it appears at the 1st video amplifier of the television receiver. The relevant part of the VITS signal which we will use for our receiver evaluation is the multiburst signal. This consists of six sine wave bursts of

Fig. 3—Multiburst and 3.58MHz modulated staircase-horizontal.

Fig. 4—Multiburst signal-Blanking with burst on back porch-horizontal.



constant amplitude at 0.5, 1.5, 2.0, 2.9 and 4.2MHz respectively. (Fig. 5)

As shown in Fig. 4, the 4.2MHz signal is attenuated. This is normal. We are looking after the output of the video detector and the 4.5MHz traps, when properly tuned, will attenuate this frequency. Attenuation of any other burst frequency would indicate poor frequency response

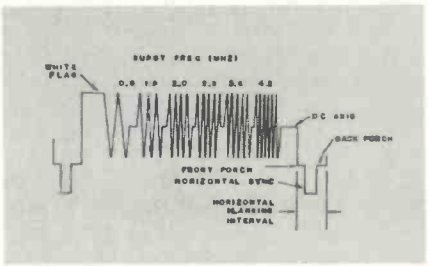


Fig. 5—Multiburst signal-horizontal.

at that particular frequency. A shift of the burst frequencies about the dc axis would indicate frequency-selective harmonic distortion. This could be due to overpeaking—which may be deliberate to obtain a "sharp" picture. If one were to visualize the response curve obtained using video sweep modulation techniques, the similarity between VITS and VSM is apparent.

To set up the receiver for VITS waveform observations, one has only to tune in a channel transmitting this signal, adjust the fine tuner for best picture (just out of the 920kHz beat in a color receiver), and connect the low capacitance scope probe to the emitter of the 1st video amplifier transistor or to the plate of the 1st video amplifier tube. By centering the VITS waveform (Fig. 2) on the oscilloscope and changing the horizontal sweep frequency, the signal can be expanded to that shown in Figs. 3 and 4. The one catch, of course, is that your oscilloscope must be wideband, triggered and capable of displaying the frequency burst to 4.2MHz without attenuation. However, any up-to-date service shop equipped for color servicing should have no trouble here as there are a number of relatively inexpensive service oscilloscopes which fit this category and do the job.

The advantage of using the multiburst signal should be apparent by now. It takes less than one minute with no special shop test equipment to assess the RF-IF alignment status of a color receiver by observing the *amplitude* of several critical video frequencies. Certainly a worthwhile procedure for any conscientious service shop. And since service time is money, make the best use of it.

Figure 6 is a waveform of the multiburst when the fine tuner is set approximately one-half turn past the 920kHz beat (towards smear). In Fig. 7 the fine tuner was adjusted just past the point of color threshold (towards the smear portion). Note how the response drops off at 2.9MHz and the burst on the back porch of the horizontal blanking pulse is attenuated. (Compare Figs. 6 and 7 with Fig. 4)

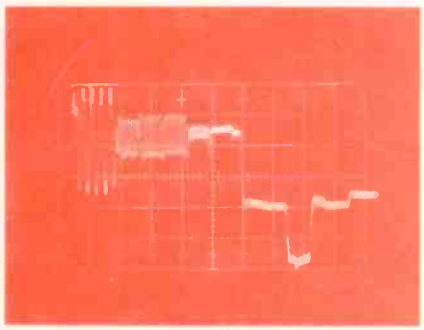


Fig. 6—Multiburst signal-horizontal, Fine tuner adjusted approximately one-half turn past 920kHz beat.

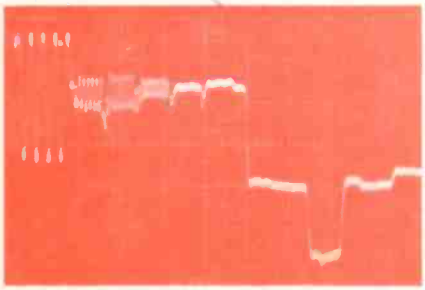


Fig. 7—Multiburst-horizontal, Fine tuner adjusted just past color threshold.

Remember, this technique is not meant to be used to align a receiver—no short cuts here—you still have to refer to the manufacturers' service literature for proper bandwidth vs. frequency data. It is only meant to be a tool, helpful in increasing diagnostic efficiency. ■

Servicing Cassette Recorders

by HOMER L. DAVIDSON

Portable cassette tape recorders are the "in thing" with today's young crowd and learning to service these units can help you earn a piece of this booming business

■ Today's cassette tape recorders are produced for mono and stereo track cartridges. The deluxe recorder will tape in four track stereo and mono positions. Small portable units record and play two track mono on easy-loading, drop-in cartridges. Many of these units will record up to two hours at 1 7/8 lps, on both tracks.

The typical portable cassette may be only a player or a combination recorder and player. Most units have a frequency response from 80Hz to 10 kHz. Some units are battery operated or operate from ac power line.

The new cassette tape units have many features: level meter, input for radio and output for external amplifier, automatic level control to reduce distortion caused by overloading, convenient "pop-up" cassette loading, remote control mike or built-in mike and speaker, and some deluxe cassette home systems have push-button controls with a digital counter for indexing. Still others may have satellite speakers and can be used as a PA system.

CIRCUIT DESCRIPTION

The portable cassette recorder or player amplifier may have from five to ten transistors and only one tape head while a larger stereo recorder may have up to thirty transistors and diodes. Most cassette recorder circuits are comparable to the reel tape recorder.

The unit shown in Fig. 2 has a separate erase head and oscillator stage. In the playback position, the record/play head is switched to the input circuit of a pre-amplifier stage. Three pre-amplifier stages are used in this particular model with a volume control located between second and third pre-amp stages.

The audio driver, Q4, is directly coupled to the third pre-amp circuit with the driver output signal transformer coupled to a push-pull output circuit. An eight ohm PM speaker is switched into the voice coil circuit.

The portable cassette recorder may be either battery operated or ac operated. Most ac power supply circuits employ a step-down power transformer and silicon diode fullwave rectification (Fig. 2). Large electrolytic capacitors and choke or resistance filtering networks are also found in the ac power supply circuits. Capacitor C27, and choke L2 are the filter components (Fig. 2).

Fig. 1—Cassette tape recorder has pop-up feature for easy loading.

SPEED PROBLEMS

If the speed of a player varies, always re-check player operation with a new cartridge. Listen to the pitch of the recording to see if the cassette player is running fast or slow. In most cases the tape is running too slow.

Since it is possible to have a defective cartridge, substitution is the fastest test. Also, when some cartridges are played for a number of hours, the small tape roller inside the cartridge may become sluggish. A drop of oil on each side of the rubber roller will cure the slow or erratic tape cartridge.

Tape speed problems can also be caused by a defective belt and capstan pulley assembly. Check the drive belt for stretching or for oil spots. Clean the belt and drive assembly with alcohol or a non-toxic cleaner. See if the belt is properly aligned with the capstan drive pulley. In some cases the capstan drive assembly mounting screws may become loose and move the pulley out of proper alignment. A cracked or broken belt should be replaced with an exact part. In some of the small players the motor drive belt looks like a small rubber band (Fig. 3). We don't suggest a rubber band as a belt replacement.

CLEANING AND LUBRICATION

Tape heads should be cleaned periodically to keep them in tip-top shape. Anytime a cassette recorder comes in for repair, a complete clean up job should be made. Clean the tape head and guide assemblies with alcohol and a "Q" tip. A can of tape head spray will remove most tape dust residue. Also clean any tape oxide from under the pulleys, flywheel and tape heads. Remove the motor and pulley drive belts and wipe them with alcohol and a clean cloth. (A special tape head cleaning cartridge is also available which is simply run through the player like an ordinary cartridge.)

Remove the capstan flywheel and clean the top bearing. A "Q" tip or round brush are useful for removing oxide dust from inside the capstan bearing. Wipe the bottom nylon bearing clean and apply a coat of lubriplate grease. A spot of oil on small motor and pulley bearings is sufficient. Small motors found in portable cassette recorders are normally self-contained and do not require lubrication.

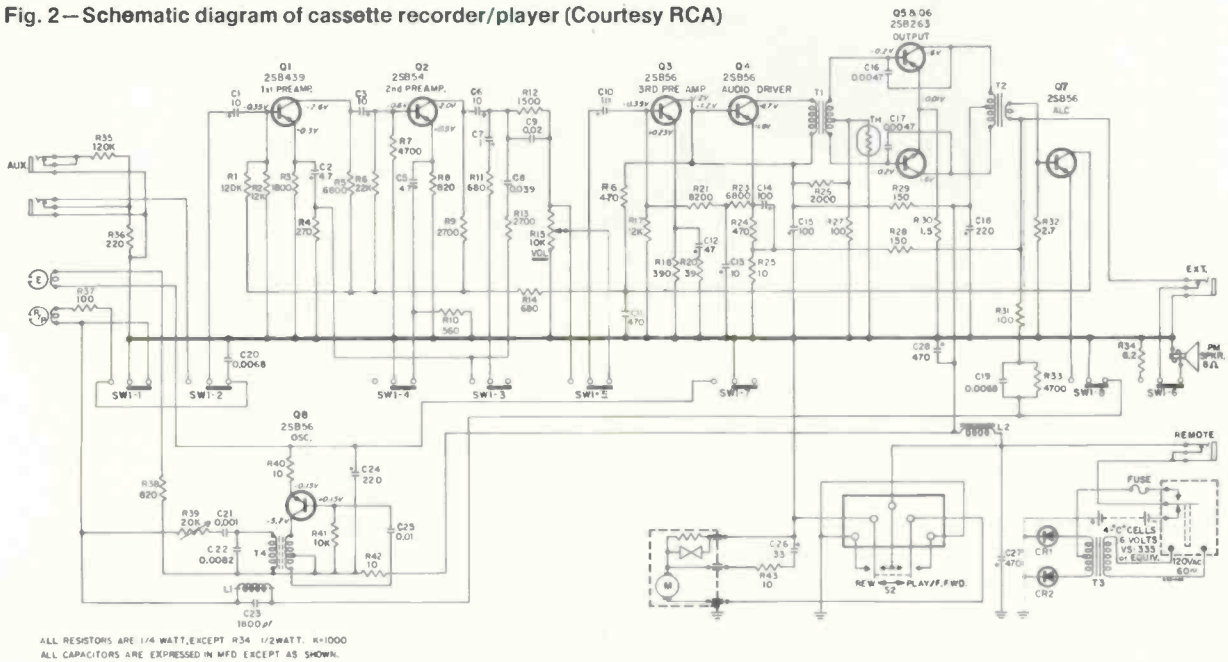
Complete the cleaning operation by spraying the operating switches and relay points. A thin piece of cardboard will also help to clean up those dirty relay points, but do not use an abrasive material such as sand paper on the contacts.

CHECKING THE AMPLIFIER

A cassette recorder that will not record or playback is possibly the victim of a defective tape head or amplifier. First, try a new recording and make sure the cartridge is properly seated. If the recorder will playback a new cartridge but will not record, suspect a defective microphone and cable. You can assume the play/record tape head is functioning.

Check the amplifier by injecting a signal from an audio generator at the tape head terminals. Signal trace the defective amplifier by going from the base to collector terminal of each transistor and make voltage and transistor tests of the circuit (Fig. 4) where signal is lost. When signal tracing from stage to stage notice the loss or gain of each stage. Compare the injected signal at each end of a suspected electrolytic capacitor. Remove it and take a leakage reading. A good electrolytic capacitor will cause the meter hand to charge upward and slowly decrease. Leaky capacitors will show a lower resis-

Fig. 2—Schematic diagram of cassette recorder/player (Courtesy RCA)



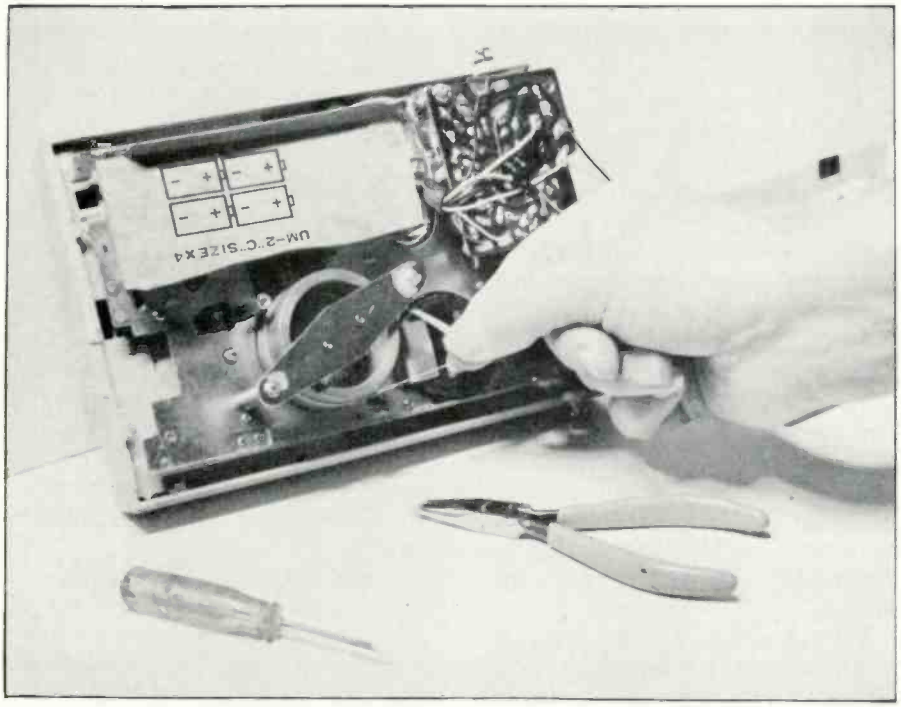


Fig. 3—Some of the smaller tape players have motor drive belts the size of a rubber band.

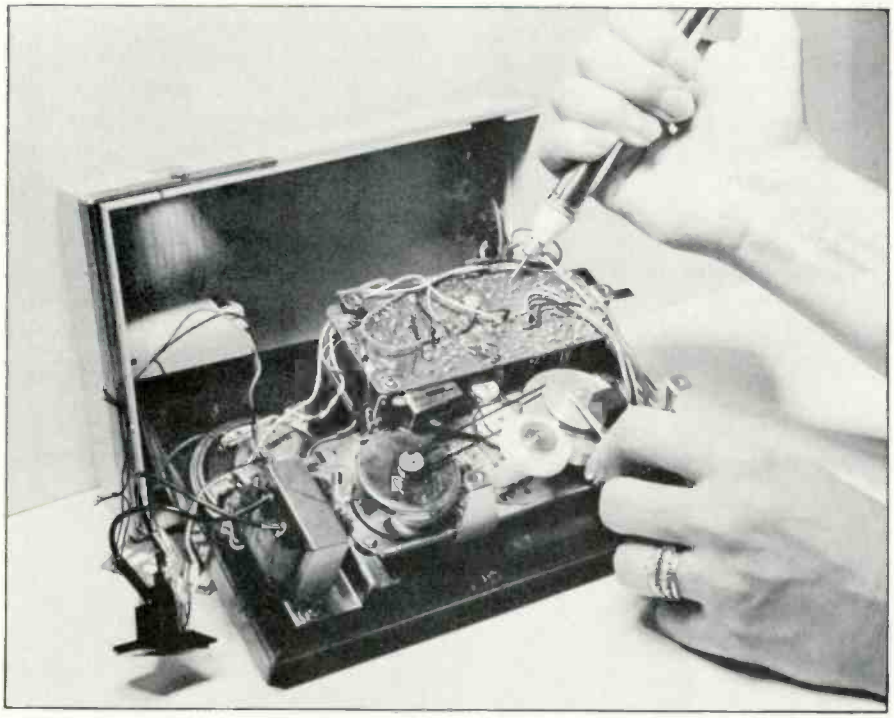


Fig. 4—A defective audio amplifier stage can be located with a pencil type signal tracer.

tance reading and should be discarded (Fig. 5).

Always signal trace the audio circuit by starting at the output stage and work towards the input when the amplifier appears intermittent. Start at the collector circuit and then apply the signal to the base terminal. If the signal "pops on and off," a transistor is intermittent. A freeze can be used on suspected transistor to see if it becomes intermittent. Several applications of freeze spray may be needed to obtain the intermittent condition.

A defective transistor may also be located with voltage measurements. When the collector voltage is higher than normal, suspect a transistor that is not conducting or has open emitter bias resistor. With all voltages close to the same potential suspect a leaky transistor. A low collector voltage also can indicate a leaky transistor or improper bias. When the collector voltage is the same as the supply voltage the transistor is open. Use a meter with a high input impedance to make voltage tests.

Another way to check a suspected transistor is with an in-circuit transistor tester. Remember that an open transistor will not indicate a beta reading and in directly-coupled circuits, it is best to remove the collector lead for more accurate leakage tests. If in doubt, remove the transistor from the circuit and make your tests. The record/play tape head can be checked for opens or shorts by taking a resistance reading. These readings will vary from 50 to 500Ω and should be checked against the schematic. When in doubt substitute a new head. In stereo units, a defective head in one channel can be checked by swapping heads.

HUM AND DISTORTION

Hum appearing on a portion of a cartridge that has normally recorded material ahead of it can be caused by a bad mike cable or connection. Check the cable for possible breaks at the plug or close to the microphone case. Flex the mike cable while making resistance measurements from plug to mike connections. Excessive hum can also be produced by a worn spot in the volume control, a poor ground terminal or a broken foil on the ground section of a circuit board.

Distortion conditions are often caused by leaky output transistors or improper bias resistors. "Crosstalk" distortion can be removed with proper height adjustments upon the tape head. Excessive recording volume, with excessive bass response, will also produce a distorted recording as will a tape head caked with oxide dust. Excessive tape

noise may be caused by a magnetized tape head.

Check the audio output transistors for possible distortion by taking accurate voltage readings across the base and emitter bias resistors. Be sure to replace any bias resistors with the exact values. Power output transistors should be removed from the circuit to make a beta leakage test. Often it will save valuable service time to replace both output transistors. Make sure the base and emitter resistors are the correct value before replacing the power transistors (Fig. 6).

Leaky directly-coupled preamplifiers or interstage transistors are also candidates for distortion. Make careful voltage measurements at the transistor and remove the collector terminal to test with in-circuit beta transistor tester. Make in-circuit beta leakage tests on both output transistors in a push-pull stage.

HEAD ADJUSTMENTS

Excessive crosstalk and poor frequency response can result from improper tape head alignment as previously indicated. Height adjustment screws are usually located on each side and to the rear of the record/play tape head. Many of the small cassette tape player heads are stationary and adjustment requires that the tape head be bent or twisted into position. Some of the low priced cassette players have a piece of rubber underneath the tape head and one side screw that will allow for the azimuth adjustment.

In the higher priced models side tension springs with adjustment screws are provided for both height and azimuth adjustments. The height adjustment is made to eliminate crosstalk while the azimuth adjustment is set for the best frequency response. The tape head adjustment screws in higher priced cassette units are similar to those used in regular tape recorders. The following is a handy list of checks you can make to insure the overall operation of the cassette unit.

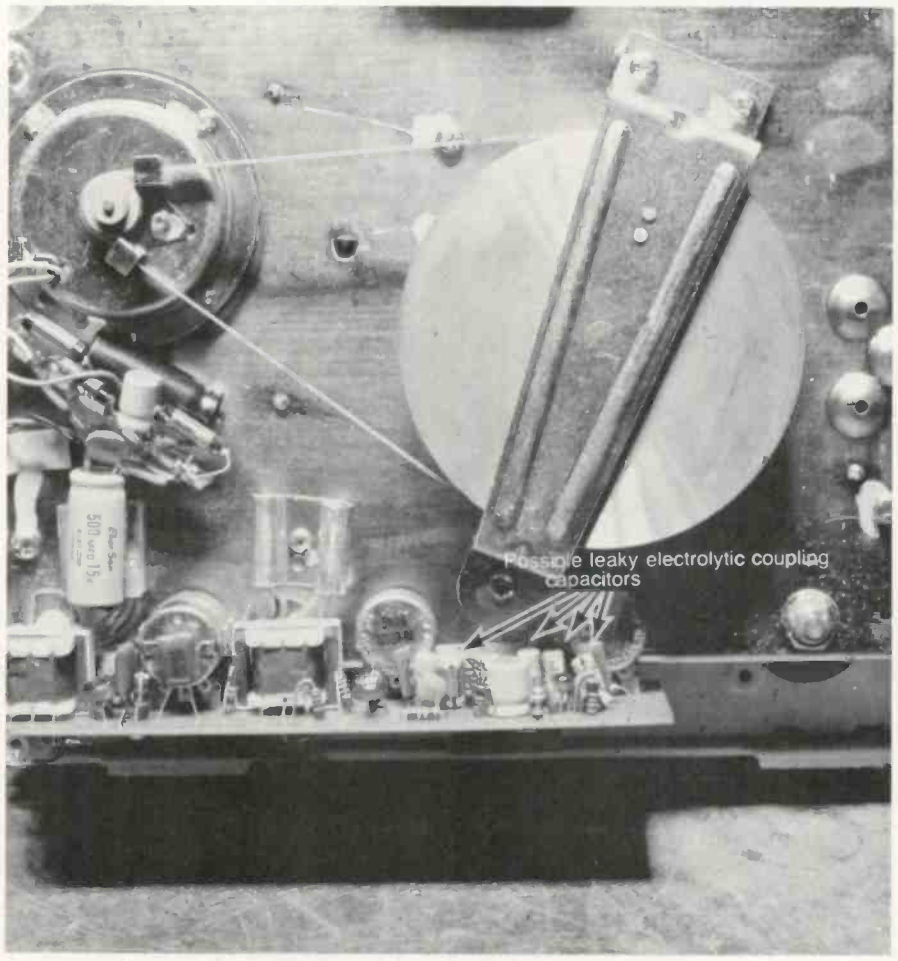


Fig. 5—Leaky electrolytics can cause loss of signal at the input of the amplifier.

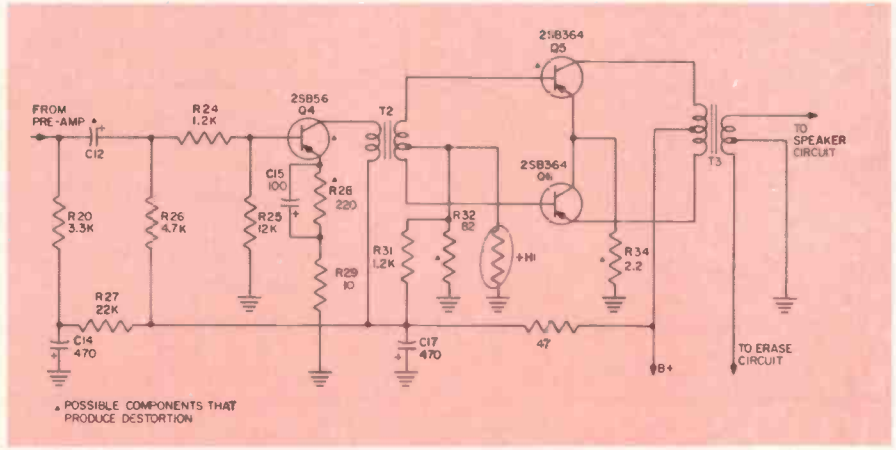


Fig. 6—Distortion can be caused by a number of components in the audio driver and output stages as shown in the schematic.

1. Completely demagnetize the tape head after servicing the unit.

2. Automatically clean the tape head and guide assemblies with a "Q" tip and alcohol or audiotex blast off head cleaner.

3. Give the cassette recorder a complete operation test with test tape or a known recording. Check out each phase of operation.

4. Clean up the entire cabinet and plastic parts with foaming window spray. A convenient troubleshooting chart is provided on the next page. ■

Cassette Recorder/Player Trouble Chart

FAILS TO PLAY	Check batteries Check battery terminals Faulty power switch Defective ac cord and plug Broken drive belt Frozen capstan bearing
TAPE PLAYS SLOW OR ERRATIC (WOW)	Belt too large Belt partially off track Misaligned capstan assembly Glazed belt and pulley Oil on belt or capstan pulley Defective motor Defective cartridge
NO SOUND	Check batteries Check power supply on ac operation Check for defective play/record head Check for proper cartridge seating Check the audio section
DISTORTION	Locate distortion in particular stage Check power output transistor On difficult distortion problems use a square wave generator and scope.
NOISY RECEPTION	Isolate noisy transistor Check all common ground terminals Resolder whole circuit-board Demagnetize record/play tape head
CROSSTALK	Incorrect height adjustment Height mechanism binding Defective erase head and circuits

Color Service Case Histories

by PAUL GOLDBERG

Some of the toughest service problems in a color TV chassis are caused by the most easily over-looked components; as you will learn in the following case histories

WEAK COLOR-NORMAL B/W

■ The first problem dealt with a Zenith color receiver 20Y1C50. The complaint was that the black and white picture appeared normal, but the color was weak. We replaced all tubes affecting color amplification (refer to Fig. 1); V6B, 6KT8, first color amp., V11B, 6KT8, second color amp. and V12 and V13, 6ME8's color demodulators. The tubes had no effect on the trouble. The color level control was then varied to check it for bad spots but it too, checked normal. The tuner selector was then rotated from station to station and no color sync bars appeared on stations with a color picture. Thus, the color sync section seemed to be functioning normally. The HUE control varied properly from magenta to green and the flesh tones also seemed within tolerance. At this point we decided to make a few voltage checks of the 1st and 2nd color amplifier sections which seemed to be a logical approach to the problem. Voltage measurements at the plate, screen and cathode of V11B, 2nd color amp checked normal. We varied the color killer control, R40, and measured the voltage variation at the control grid, pin #7, of V11B to see if the color killer was biasing the chroma down. This also seemed to be functioning properly. The plate and screen of the 1st color amp, V6B, had a difference of potential between the plate and screen of about 20 volts. The manufacturer's notes indicat-

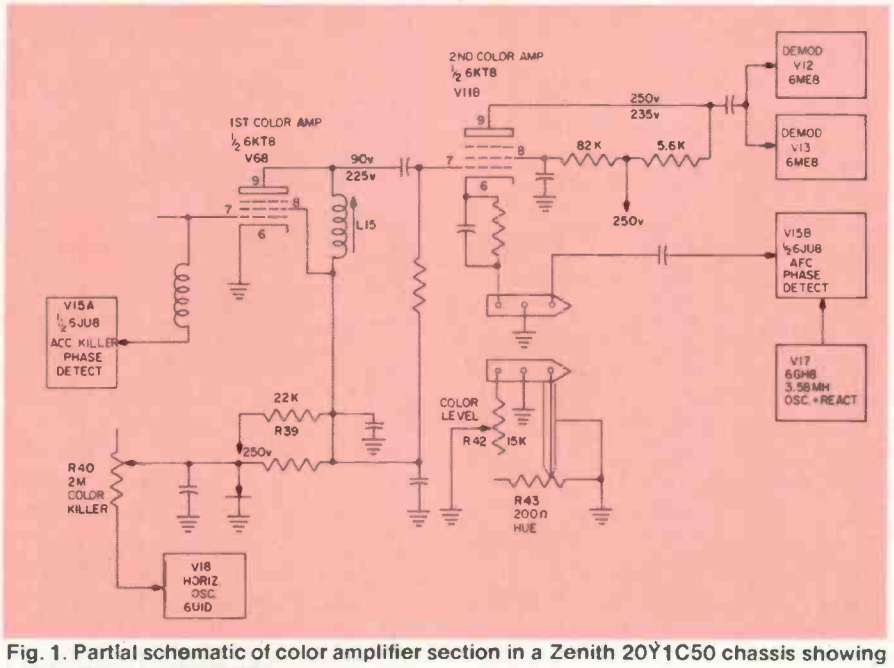
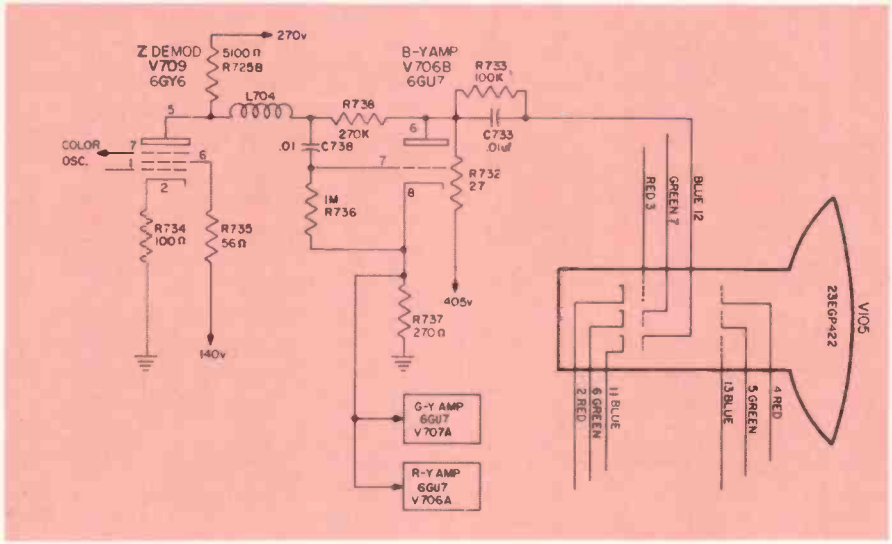


Fig. 1. Partial schematic of color amplifier section in a Zenith 20Y1C50 chassis showing L15 in plate circuit of V6B.

Fig. 2. Partial schematic of Z demodulator and B-Y amplifier in Magnavox T904 series chassis showing L704.



ed that the plate and screen were connected by L15, the chroma plate coil, which measured the correct value at a couple of ohms. Reflecting awhile, we remembered that sometimes these coils develop cold solder connections at their pigtail terminals and develop a high resistance under current flow. We resoldered the pigtails of L15 at its terminals and turned the receiver on. The color popped in beautifully and as we rotated the color level control, the quality of chroma seemed to be fine.

LOST BLUE

Another problem was with a Magnavox T904 series color receiver (Fig. 2). The complaint was no blue in the B/W or color picture. The picture remained a reddish green. The blue screen grid control had practically no effect, but the red and green screen grid controls worked properly. The red and green drive controls also seemed to function normally. Replacing the B-Y amp, R-Y amp and the G-Y amp tubes had no effect on the problem. We then removed the CRT socket and measured voltages at the screens, cathodes and grids of the CRT. The red screen, pin #4, measured properly. The green and blue screens also measured correctly. However, the blue control grid, pin #12, measured low. It read in the area of 100v, while the red and green control grid measured about 195v. This reduced voltage on the blue control grid would effectively bias the grid to cutoff. The manufacturer's instructions indicated that voltage is "effectively" applied to pin #6 of the B-Y amp from two sources through R738. The plate current of V706B passes through the plate load resistor R732, and the plate current of V709 passes through R725B. These voltages are applied to each side of R738. A voltage measurement at pin #6 of V706 measured low at 100v. A resistance measurement of R732 proved that the resistor was normal, but what was causing the low voltage at the plate? A resistance

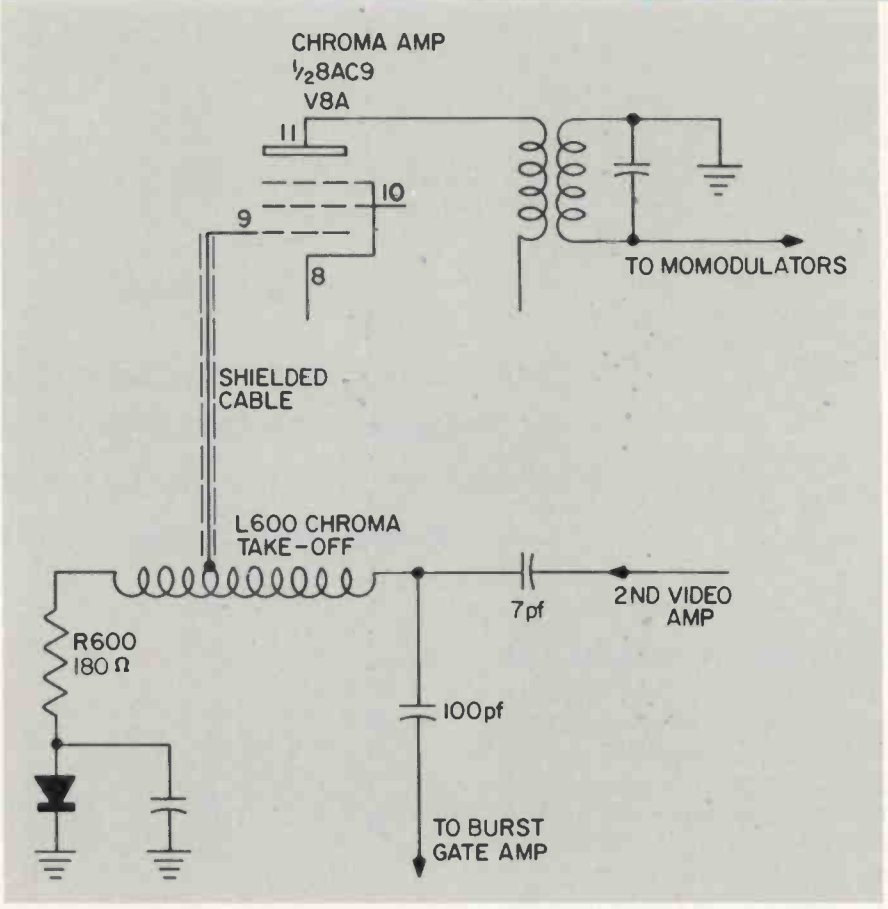


Fig. 3. Partial schematic of chroma stage in Sylvania DO3-2 chassis showing coaxial cable which was causing intermittent color sync.

check of the cathode resistor, R737, also proved fruitless and replacing V709 had no effect on the problem. In order to see if the trouble could be caused by something in the V709 circuit, we measured the plate voltage of this tube at pin #5 and found it to read normal at about 240v. By consulting the manufacturer's schematic again, we noticed that the signal was transferred from V709 to V706B by L704 and C738. Measuring the voltage on each side of L704, we found that on one side we read 100v and on the other side about 240v. A resistance measurement of L704 proved it to be open. We resoldered the pigtails of this coil and it did the trick. After turning the receiver on, the blue screen worked properly. We next adjusted the screen and drive controls for a normal black/white picture and checked out the receiver on a color program—all was functioning like new.

INTERMITTENT COLOR SYNC

The next problem is one of intermittent color and color sync. A Sylvania DO3-2 chassis would function normally for a few minutes, then the color level would drop and the color sync would become intermittent (Fig. 3). Tapping the tubes in the solor section in an attempt to localize the trouble turned up an intermittent chroma amp, V8A, but the problem corrected itself only for a short time after the tube was replaced. Using a plastic probe we jiggled the pin connections of V8A. At pin #9 the color would correct itself the moment it was touched. A shielded cable connected L600, the chroma take-off coil, to pin #9. We examined the cable and its connections at both ends and found what appeared to be a cold solder connection. The connection was resoldered and the color popped in beautifully, but then dropped to a low level again. The color sync was also irratic. Using a plastic probe we jiggled the shielded cable and the color again corrected itself. At this point we decided the best bet was to replace the cable. The new cable solved the sync problem. ■

ET/D TEST LAB REPORT

Sencore Model TC154 Tube Tester

A tube tester can speed servicing of electronic equipment and make your service business more profitable

■ Most technicians may feel that the best test for a possible defective tube is substitution with a known good tube and observing circuit functions. This approach may be the best but not always the most practical considering the number of new tubes needed for substitution.

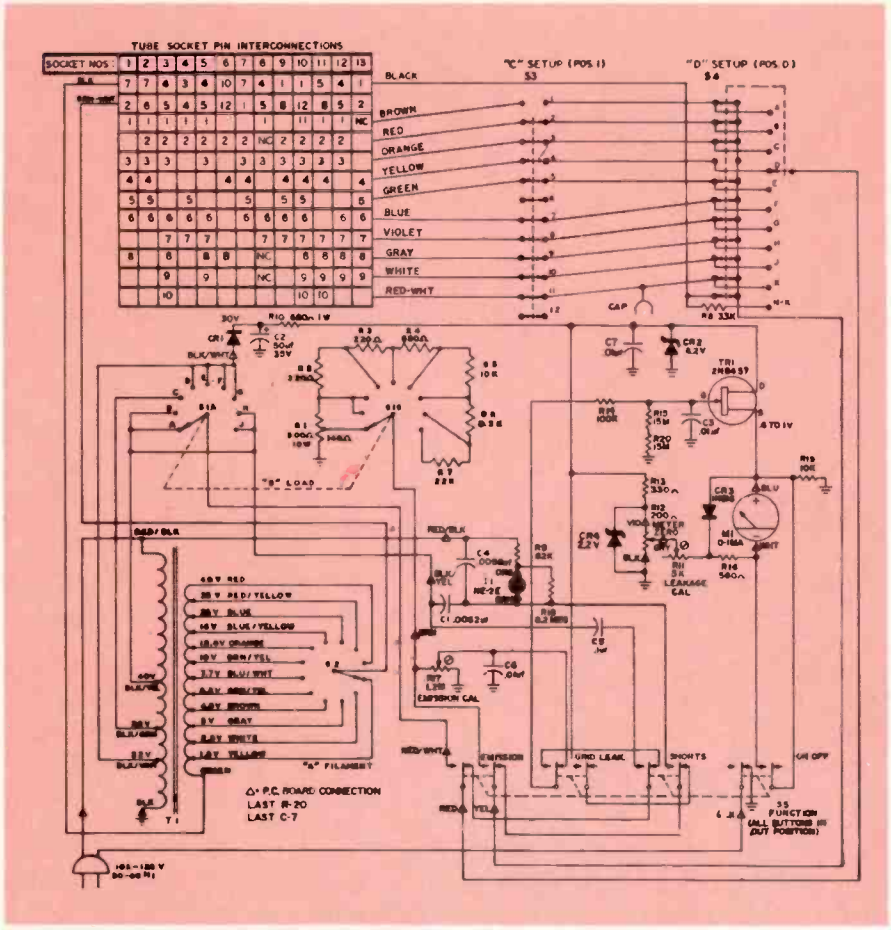
We recently received the Sencore Model TC154 tube tester for evaluation.

From the portability standpoint, the tester is easily carried on home service calls as it weighs about nine pounds and is housed in a vinyl-clad brushed chrome trimmed steel case.

The instrument is completely solid-state and employs an FET in a balanced bridge circuit. It operates instantly without waiting for warm up and stabilization.

The tester is quick and fairly easy to use with four setup controls and four push button switches. The four controls use marked A-Filament, B-Load, C-Setup and D-Setup and are set according to the set-up chart. The tube

Sencore's Model TC154 Tube Tester.



Schematic of the Sencore Model TC154 Tube Tester.

is inserted into one of thirteen sockets numbered from one to thirteen. The desired function is selected by depressing the button corresponding with the test desired, EMISSION, SHORTS or GRID LEAKAGE. We found the push buttons easy to use and they speed setup time.

By depressing the SHORTS button, then rotating the "D" switch through all its positions, the short light will glow if a short of 300K ohms or less is present. If the shorts light glows on a point other than that marked in the setup book, a short is present.

Tests can be made in any order without damage to the tester even if the tube is shorted.

When the EMISSION button is depressed, the emission quality of the tube is read on the top scale of the meter. If the tube emission reads in the GOOD area of the meter, then depress the GRID LEAKAGE button and read the leakage of the tube on the bottom scale.

The shorts light may flicker indicating a high resistance short in the tube. The applied voltage is kept below the 50v maximum to prevent damage to frame grid tubes and nuvistors or the possibility of introducing a short.

The setup chart which is secured to the inside of the cover, has large print and appears to be quite up to date on new tube types.

As new tubes appear they could be a problem by not being listed in the setup chart. But with an understanding of the setup controls on this unit, you can set up to test new tubes by following specifications listed in the tube manual.

If a tube manual is not handy, then use Ohms law to compute the cathode current. Simply divide the voltage drop by the value of the cathode or plate load resistor in the circuit from the schematic.

CIRCUIT DESCRIPTION

This instrument is reported

as being the first completely solid-state tube tester. It uses the new FET or Field Effect transistor in place of the usual tube providing instant operation for faster and more accurate testing.

The basic circuit of the tester is a balanced bridge meter amplifier consisting of FET TR1 and diode CR4. The zener diode represents a constant current source and takes the place of the second FET needed for the bridge circuit. The METER ZERO control on the front panel is just like the zero control of a VTVM and balances the circuit so during a no signal input, the bridge is unbalanced and the meter will read in proportion to the applied signal.

The cathode emission test puts an ac voltage between the control grid of the tube under test and the cathode with a load resistor in series to develop a pulsating dc voltage. The B LOAD switch selects the different size load resistors and applied voltage so that a full range of current from less than .5ma to 120ma is available. The tube under test rectifies the applied ac voltage and develops across the load resistors R1 through R7. The pulsating dc voltage is coupled through the filter network of R17 and C6 to smooth it to a pure dc voltage. This voltage is applied to the gate of TR1 through an additional isolation and filtering network of R14, R15, R20 and C3. The resultant dc voltage upsets the balance of the circuit causing the meter to read upscale in proportion to the emission quality of the tube.

In the grid leakage test, the control grid of the tube under test is made negative to all other elements in the tube by connecting the grid to ground through the 30M gate resistor consisting of R15 and R20 and applying a positive 8v to all other elements in the tube.

If the tube has grid leakage or contamination causing the tube grid to emit electrons, the flow of electrons will be through the gate resistor. Any current flow through the resistor will cause a voltage drop across the resistor and, in turn cause an unbalance in the bridge circuit. The meter will then read in proportion to the amount of grid current in the tube under test. A leakage of 100M or less will cause the meter to read into the BAD area. A leakage of 100 to 200M will cause a meter reading in the questionable area and a leakage of 200M or more will read in the GOOD area. A leakage of 100M represents a grid current in the tube under test of .5μa.

The shorts test uses the Sencore Stethoscopic approach in which every element in the tube is checked against all other elements. A capacitive voltage divider consisting of C1 and C4 is placed across the upper winding of the primary of the filament transformer. The ac voltage at this point is 75 volts and capacitor C1 drops this to approximately 34 volts RMS which is applied across the tube elements. This voltage is below the maximum that can be applied to nuvistors and frame grid tubes to prevent arc over and breakdown in these devices. Capacitor C5, a .1μf, is in series with the shorts test to prevent any dc action of the tube from turning on the shorts light. A true short will cause both elements of the neon bulb to light. If the short is higher in resistance, the shorts light may only flicker. ■

SPECIFICATIONS

Cathode Emission Tester: Full load current drawn through tube up to 120ma. Max applied voltage, 40vac RMS. Grid Leakage Test: Good area, infinity to 200M, ? area, 200 to 100M and the Bad area 100M or less. Shorts Test: 300K or less will cause shorts light to come on. Maximum applied voltage, 40vac RMS. Power: 105 to 125vac, 50/60Hz at 32w maximum. Price: $89.50.

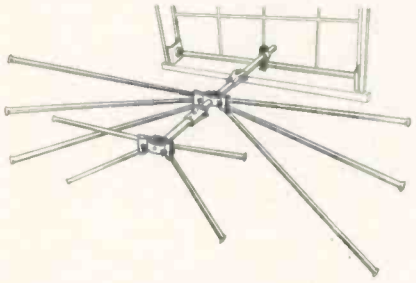
ET/D DEALER SHOWCASE

For additonal information on products described in this section, circle the numbers on Reader Service Card. Requests will be handled promptly.

WINDOW TV ANTENNA 703

Permits orientation for best reception

An 82-channel swiveling window antenna for VHF, UHF and FM is introduced. The antenna features sep-



arate swivels for the UHF and VHF antenna elements. The Model C119-82 window antenna is ideal for apartment buildings, hotels, institutions and wherever it is impractical to install a rooftop antenna. Mounting is simplified by a spring-loaded bracket that expands to fit any window frame up to 42in. wide, and is locked into place by a single bolt. Extension bars are available to accommodate windows up to 5ft or 6ft wide. The antenna is constructed of a golden-colored alodized heavy-duty aluminum. All elements are held securely in place with snap-out spring contacts, assuring excellent electrical and mechanical contact. Gain is provided by six VHF elements and four UHF elements. The C119-82 window antenna lists for $14.95. JFD.

CCTV SYSTEM 704

Designed for continuous operation

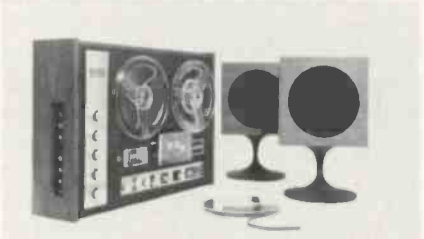
A closed-circuit television system designed for continuous operation is announced. The 616/617 Cam-

era System is a split (camera-camera control) system employing solid-state circuitry throughout with the exception of the one-inch vidicon tube. The Model 616 camera utilizes integrated circuits and offers adjustable delay-line type aperture correction; adjustable gamma and white clipper; and FET hybrid cascode input amplifier for the maximum obtainable signal-to-noise ratio. All controls are located in the Type 617 Camera Control Unit, including focus, beam, target and blanking, with pan-tilt and zoom functions as an integral part of the control unit. The electronic circuitry is contained in three glass epoxy printed circuit boards or modules, with the power supply module located across the top of the camera. Raytheon.

TAPE RECORDER 705

Features bias selector for standard or low noise tapes

Introduced are two stereo "Audio Center" recorders and a tape deck. Three models are available:



Model 6360, with separate acoustic suspended, pedestal-mounted cube speakers; Model 6250, with self-contained acoustic suspension speakers; and the Model 6150, a three-headed deck version. Reportedly the new cubical speakers' reproduce full-range frequencies with exceptionally low distortion and have a built-in thermo overload protection circuit. A five-year warranty is offered on the speaker system. The amplifiers for all units have outputs of 62w dynamic (IHF) power at 1 percent harmonic distortion with 8Ω loads. A complete stereo system can be built around the recorders with the addition of a turntable and FM radio tuner. All of the models feature a record bias selector which makes it possible to obtain optimum performance with either standard or low noise tapes. Other features include open front threading; a patented self-aligning pressure roller which assures perfect tape alignment; an exclusive "see-through" head cover which permits easy tape editing; a two-motor drive system, and dynamic braking. List prices are: Model 6360, under $439.95; Model 6250, under $359.95; Model 6150 (without base) under $259.95; and Model A-1-50 cube speakers with pedestal, $79.95 a pair. 3M.

STEREO MODULAR SYSTEM 706

240w of peak music power

A custom stereo modular system, Model CS20W, is among five stereo high fidelity phonographs introduced.

The system has a contemporary walnut cabinet of hardwood solids and veneers with tinted glass panels. The stereo reportedly has 240w of peak music power. It features linear slide controls for cut/boost for bass and treble, stereo balance and acoustic level. Twelve pushbutton functions are included in a control panel with weighted flywheel tuning provided for FM stereo and FM/AM radio. The phonograph has a Dual 1015F automatic turntable with ceramic cartridge. Suggested list price for the CS20W, exclusive of speakers, is $339.95. List price for the 10in. speakers is $179. a pair, and $249. a pair for the 12in. Sylvania.

ANTENNA TRANSFORMER-BALUN 707

Eliminates need for additional antenna

Introduced is the Model TRS-57 Transformer-Balun to adapt the SWL-7 and RD-5 short wave listening antennas (and any short wave listening doublet) to receive standard broadcast bands below 4MHz. On these bands, the transformer-balun automatically transforms the doublet into the long wire anten-

continued on page 64

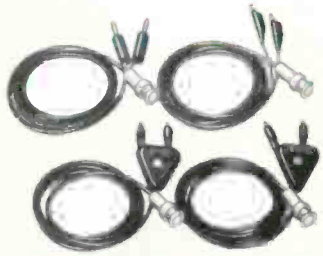
This NEW Sweep-Marker Generator Does Every Color Alignment Job That Needs Doing—and Saves You Up To $260

Heathkit® IG-57A — Kit $135*—Assembled $199*

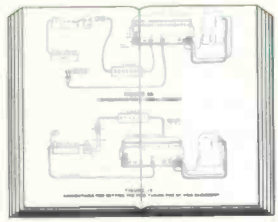
Now With Video Sweep Modulation & Second Bias Supply

Compare the Features — Compare the Cost

- **New Video Sweep Modulation** ..... allows you to inject chroma sweep directly into the IF amplifiers or through the antenna terminals . . . permits more accurate matching between color bandpass amplifiers and IF and observation of overall response.
- **Exclusive Heathkit Attenuator** ..... lets you quickly and accurately determine 6 dB points without guessing. Gives up to 70 dB total attenuation in 1, 3, 6, 10 and 20 dB steps.
- **15 Crystal-Controlled Markers** ..... provide all the most used marker frequencies . . . 3 for color bandpass, 1 for TV sound IF, 8 at the IF frequencies from 39.75-47.25 MHz including special markers for B&W bandpass. Markers also included for picture & sound carriers on channels 4 & 10. The 15th crystal marker is at 10.7 MHz for FM IF. A coil-tuned 100 kHz marker is also provided. A front-panel Input accepts an external marker generator.
- **New Built-In Bias Supplies** ..... two individually adjustable bias supplies can be switched for either positive or negative output . . . up to 15 V at 10 mA.
- **400 Hz Modulated Or CW Output** ..... of any individual marker for fast, simple trap alignment and FM tuner adjustment.
- **Proven Saturable Reactor Circuitry** ..... produces stable, linear sweep signals that cover the five most used frequency ranges.
- **Complete Scope Matching Controls** ..... switchable Retrace Blanking enables accurate Phase Control adjustment. Just switch on Retrace Blanking for convenient zero output base line. Trace Reverse function permits display of markers in proper sequence.
- **Quick-Disconnect BNC Connectors** ..... for quick, easy set-up changes.
- **Complete With All Probes, Test Leads & Terminated Cables** ..... includes terminated RF cable with built-in DC blocking capacitor . . . Demodulator Probe for envelope detection in color circuits . . . shielded Scope Vertical lead . . . shielded Clip Lead cable . . . Scope Horizontal lead . . . two Bias Leads.
- **How-To-Use** ..... the famous Heathkit manual includes a comprehensive, well-illustrated Applications Section that shows you how to align TV IF, Traps and Color Bandpass . . . how to do IF & RF Video Sweep Alignment, VHF Tuner checking, FM Tuner Tracking & IF alignment.



All Cables, Leads, & Probes are included. Nothing extra to buy.



26 pages of Instructions and Illustrations — show you exactly how to use your IG-57A for greater efficiency, greater profit.

Compare The New Heathkit IG-57A With All Others . . . you get more useable features, better performance, more versatility per dollar with the IG-57A. Order your IG-57A now . . . and keep up to $260 in your pocket.

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List Price $17.95 ● **Order No. T-101**

RCA Color TV Service Manual

A brand-new full size manual, covering 23 RCA Color chassis. Includes complete schematic diagrams for 12 chassis, from the CTC-12 to the CTC40 all-transistor model. Here in one compact, handy manual is everything you need to quickly and competently repair any RCA color set—from the CTC12 to the 1969 all-transistor CTC40. Encompasses both general and specific troubleshooting data applicable to all RCA chassis. The text delves into each section (Video, chroma, vertical, horizontal, etc.), and points out specific problems as well as general servicing procedures. Troubleshooting tips on each chassis, including circuit changes and factory modifications, are covered. While this material is related directly to RCA sets, much of it is applicable to other sets patterned after RCA designs. 176 pps., 8½ x 11, plus 36-page schematic foldout section. Over 175 illus.

List Price $7.95 ● **Order No. 496**

TV Troubleshooter's Handbook —New 2nd Edition

A completely updated, quick-reference source for scores of tried-and-tested solutions to "tough-dog" TV troubles. This detailed compilation of practical help is the answer to the need for a well-organized file of proven troubles and cures, field factory changes, new and unusual circuits and descriptions of how they work, etc. This brand-new edition represents the only known up-to-date digest of specific TV troubles and cures, for both color and monochrome sets, up to and including 1969 models. Every major brand is included, from Admiral to Zenith, as are such "off" brands as Gamble Skogmo, Packard Bell, and Montgomery Ward. All troubles are categorized by make and model. Included in the color TV section are hints for troubleshooting chroma circuits, making adjustments, etc. 288 pps., over 150 illus.

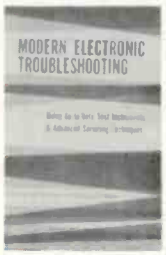
List Price $7.95 ● **Order No. 521**

How to Use Signal Generators . . . in Radio, Color TV, Hi-Fi Servicing

GIANT "2-Volumes-in-One" coverage — ALL the know-how required to use any type of signal generator in your troubleshooting work. Covers the use of RF, audio, sweep, marker, stereo FM, keyed rainbow, NTSC, and video generators of all types, and is devoted strictly to signal generators used in service shops; written specifically to provide guidance in the use of such equipment for troubleshooting and aligning all types of home-entertainment receivers. A variety of test procedures, using specified generators as the basic tool, are clearly detailed in step-by-step form. Shows how the various instruments work, and how to test and calibrate your own instruments. 240 pps., 182 illus., 16 chapters.

List Price $8.95 ● **Order No. 274**

Modern Electronic Troubleshooting



A down-to-earth handbook that deals with today's electronic servicing problems on a practical level, using modern test instruments and advanced troubleshooting procedures to cope with the special problems created by printed boards and solid-state circuitry. It is hard to conceive of a book that encompasses monochrome and color TV, multiband radio receivers, hi-fi equipment, tape recorders, two-way communications equipment, and test instruments for servicing all this equipment. Yet this book does! By getting right to the subject of how to service the equipment without the usual wordy theoretical discussions of how the circuits work. An all-inclusive servicing guidebook service technicians have been asking for. 256 pps., over 100 illus., 5 big sections, 24 chapters.

List Price $7.95 ● **Order No. 474**

Pinpoint Transistor Troubles in 12 Minutes

A giant of a book—495 pages . . . a virtual library of practical data of value to everyone who works with transistor circuits. Here is a unique servicing text you can put to immediate use, whether your interests are oriented toward home-entertainment or industrial type equipment. Organized so that needed information can be located quickly and easily. A quick-reference table tells you exactly where to find appropriate trouble-shooting charts and service procedures for practically every type of transistorized device. In all, nearly 100 different types of equipment are categorized under general headings such as amplifiers, radio receivers, radio transmitters, power supplies, test instruments, and special equipment. 495 pps., 243 illus. 78 tables, 10 sections. 5½" x 8½".

List Price $7.95 ● **Order No. 430**

Handbook of Semiconductor Circuits

Contains 124 examples of standard transistor circuits, complete with operational data for amplifiers, oscillators, logic and switching circuits, power supplies, and various nonlinear circuits. The broad range of circuits included were selected on the basis of application and practicality. A design philosophy section is included with each group of circuits, thereby providing a basis for understanding circuits other than those selected as examples. This is not a handbook of "preferred" circuits, but rather a collection of practical circuits which have wide application and exemplifying good engineering design. Each circuit description includes data concerning any unique design or operational data, along with schematic diagrams. Hundreds of illustrations and diagrams. 448 pps., 6" x 9". Hardbound.

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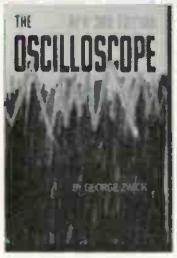
The Oscilloscope



An all-new revised third edition of the classic work on understanding and using oscilloscopes. Completely expanded and updated to include triggered sweeps, dual-trace scopes, electronic switches for multi-waveform displays, DC-to-DC supplies, DC-to-AC inverters, and DC-to-DC converters, this brand-new book is right up-to-date. Revised to include the latest information in keeping with technology. It is a virtual handbook on the subject, explaining scope operation from the simplest to the most intricate uses. Beginning where the scope manual stops, the author covers basic waveforms (DC, sine, sawtooth, trapezoid, and pulse) clearly detailing their generic characteristics and how they are interpreted in oscillography. 256 pps., over 179 illus., 8 chapters.

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Semiconductors From A to Z

Here it is—everything you need to know about semiconductors — from basic diodes and transistors to FETs, MOS FETs, tunnel diodes, integrated circuits, varicaps, photoFETs, light-sensitive and light-emissive devices, incandescent and luminescent optic-electronic circuits, unijunction transistors, field-effect diodes, SCR and zener diodes, etc. Explains how these various devices work and how they are used, with descriptions of all the common and unique circuits used in modern semiconductor technology. Attention is given to integrated circuit applications — variable-current and constant-current sources, unbalanced differential amplifiers, IC applications in FM and TV receivers, TV sound circuits, discriminator circuits, and cascade amplifier networks. 272 pps., over 300 illus., 26 Chapters.

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Electronics Reference Data Book	List Price $7.95; Club Price $4.95
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Radio Operator's Q & A Manual	List Price $8.95; Club Price $7.50
Motorola Color TV Service Manual	List Price $7.95; Club Price $4.95
Installing & Servicing Home Audio Systems	List Price $7.95; Club Price $4.95
Tape Recording For Fun & Profit	List Price $7.95; Club Price $4.95
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Audio Systems Handbook	List Price $7.95; Club Price $4.95
Electronic Test & Measurement Handbook	List Price $7.95; Club Price $4.95
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ET/D DEALER SHOWCASE

continued from page 58

na necessary for broadcast band reception; it eliminates the need for an additional antenna to receive

local stations and distant cities. On regular short wave bands, the transformer acts as a balun to provide balanced receiver input. Mosley.

ZOOM LENS 708

Camera operator adjusts zoom and focus from rear of camera

A zoom lens which can be controlled from the rear of a viewfinder camera is introduced. Designat-

ed Model RC-ZL1, the unit is designed for ETV, CATV training and other studio applications. It enables the camera operator to adjust both zoom and focus from the rear of the viewfinder camera while he watches the monitor. The zoom lens has a focal length adjustable from 22.5mm to 90mm, 15 hand coated lens elements and F stop apertures from 1.5 to 22 with click stop settings. The rear control is made of anodized aluminum. Since all moving parts utilize teflon bearings for smooth, easy movement, no lubrication or maintenance is required. The lens can easily be attached to any viewfinder CCTV camera with two mounting screws. It carries a full year and 100 percent unconditional guarantee. Price $495. GBC.

WHAT DO YOU DO FOR AN ENCORE...?

after you have sold your customers the best home TV towers.

That's one of the big advantages when you stock and sell Spaulding AX Series Home TV Towers. You're offering a tower in which they'll not only see the quality, which is apparent, but they'll also see the trouble-free performance they are looking for.

The Spaulding AX Home TV Tower is designed for quick economical installation . . . and is all-steel, galvanized and all riveted construction with no welds to rust.

The AX 48′ Home TV Tower package only requires 2 sq. ft. of floor space . . . the AX series packages are available in heights up to 64′. Package includes base stubs, hardware, mast and mast kit.

The Spaulding AX Series Tower is a self-supporting tower and is extremely rigid under most erection situations. The higher the tower goes, the greater the strength at the base. The wind resistance at the top decreases with height. The "tapering" effect adds to the attractiveness of the tower.

Get specifications on this complete tower package, and profit in two ways—bigger sales and greater goodwill from your customers.

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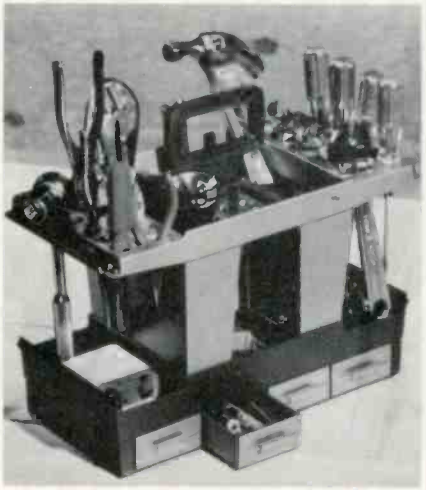
TOOLS 709

Everything stored in upright position

Introduced is the Tool-Mate which solves the problems of storing and carrying both hand tools and small parts.

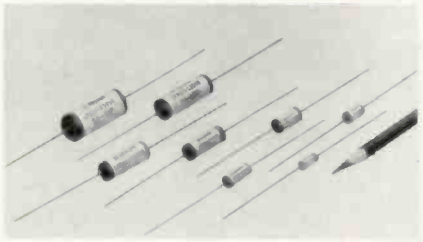


It contains 39 different tool holding slots; two jumbo storage wells for storing large items, hammers, flashlights, etc.; four dust-free drawers for storing small parts, nails, screws, nuts, bolts, etc. Everything is stored in an upright, easy-to-use, easy-to-find position plus it has a large sturdy carrying handle. The unit measures 11 1/2in. high by 14in. long by 7in. wide and color is beige and brown. The price is $5.35. Whicon.

CAPACITORS 710

Low capacitance change over temperature range

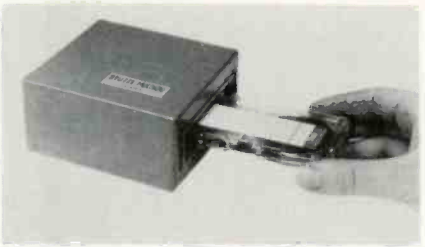
Deltafilm LP88 Metallized Polycarbonate-Film Capacitors in 50 and 200wvdc ratings for design engineers is introduced. The capacitors are designed to provide the advantages of metallized polycarbonate-film within smaller case sizes than molded or metal-encased tubulars of comparable ratings. Highly stable, these capacitors exhibit less than four percent capacitance change over their entire operating temperature range. A feature of the capacitor is "Fuz-ion Sealed" construction. A heat-shrinkable plastic case is fused to epoxy to insure maximum seal efficiency. The case is nonconductive, fungus-proof, corrosion-proof, and humidity resistant. The minimal effects of temperature and the low-power-factor of polycarbonate film make the capacitors well suited for ac and RF applications as well as for dc usage. Operating and storage temperature range is −55C to +125C without voltage derating. The capacitors are available in 50 and 200vdc ratings, with capacitance values ranging from .01μf to 50μf. Sprague.



TAPE ERASER 711

No electric current is required

Introduced is the Voice-Master MX-500 Erase-O-Matic which erases all previous recordings on Memocord, Philips type C30 and C60, Norelco 85, Mini Memo and other magnetic tape cassettes. The unit is service-free and guaranteed indefinitely. Requiring no electric current, it may be used anywhere and is ideally suited to clearing recordings for security reasons or prior to re-use. The unit measures 3-3/4 x 4 x 2in. Audio Applications.



MOBILE ANTENNA 712

Beam direction can be changed as desired

Directional gain at 27MHz and electronic beam control in a mobile citizens two-way radio antenna system are two radical developments featured in a new class of mobile antenna systems introduced. The new systems, designated "Mobile Scanner," comprise a matched pair of 50Ω, base-loaded mobile antennas inter-connected through a dash-mounted control box similar in function to the A/S Scanner Base Station. Employing a three-posi-

Now the Chromacolor revolution comes to replacement tubes too!

Now you can install Zenith's patented Chromacolor picture tube that outcolors, outbrightens, outcontrasts and outdetails every other 23″ diag. color picture tube.

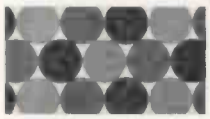
With a full 2-year warranty!

After years of pioneering research and development, Zenith has perfected a color TV picture tube different than any other on the market. So revolutionary that it outcolors, outbrightens, outcontrasts and outdetails every other 23″ diag. color tube. And it's a Zenith exclusive—covered by U.S. Patent No. 3,146,368.

Before Chromacolor, every giant-screen color picture was made up of tiny dots on a gray background.

But Zenith made the dots smaller, surrounded them with jet black and, for the first time, *fully* illuminated every dot. Result: the brightest, sharpest picture tube in giant-screen color TV.

The Zenith Chromacolor tube will readily replace the 23″ diag. tube in almost any TV, whatever brand. And, unlike most replacement tubes, it's warranted for *two* full years.



Magnified drawing of ordinary color TV screen before Chromacolor

Magnified drawing of Zenith Chromacolor TV screen

Simulated TV picture

Order the Zenith Chromacolor picture tube from your Zenith distributor for your next installation. And put your customer in a better light.

At Zenith, the quality goes in before the name goes on.®

TWO-YEAR WARRANTY

Zenith Radio Corporation warrants the replacement CHROMACOLOR picture tube to be free from defects in material arising from normal usage for two years from date of original consumer purchase. Warranty covers replacement or repair of picture tube, through any authorized Zenith dealer; transportation, labor and service charges are the obligation of the owner.

ZENITH®

CHROMACOLOR™

ONLY ZENITH HAS IT

tion switch, the radiated or received signal is fed through the dividing circuitry to produce a highly directional pattern higher forward, rearward or simultaneously to the sides of the vehicles. In the "forward" positions, directional gain is reportedly 2.0dB while attenuation of unwanted signals and interference is 17dB front-to-side. "Rear" gain is slightly greater—2.5dB. "Sideward" gain is 1.0dB each direction if whips are center-mounted; 2.0dB may be achieved in one direction with offset mounting, such as right cowl and right rear fender. Mounting separation of the two antennas is an optimum of 9ft with a tolerance of 6in. in this spacing acceptable for gain performance. Ideally, the antenna should be centered laterally on the vehicle; diagonal or offset mounting will produce a corresponding directional offset of the pattern although identical gain will be achieved. The antenna is available with a choice of mounts; swivel-type, for cowl or curved surface (Model M-230) or deck/roof mount for flat surface (Model M-231). Antenna Specialists.

STEREO FM RECEIVER 713

Frequency response from 20 to 30,000Hz

Announced is the KR-70 FM receiver which combines a sensitive FM tuner and a 75w amplifier with terminals to accommodate record player, tape recorder, auxiliary, two pairs of stereo speakers and center channel output. The tuner section features two integrated circuit FM IF stages and two FET four-gang tuning condensers, an FM sensitivity (IHF) of claimed 1.9μv; harmonic distortion of less than 0.8 percent; a capture ratio of 2.5db; and FM selectivity of 45db (alternate channel). A new luminous dial, tuning meter and FM stereo indicator are also included. Keyboard controls regulate LOUDNESS, NOISE FILTER, TAPE MONITOR and MODE; and front panel jacks provide convenient access for stereo headphones and dubbing/tape record. The silicon power transistor amplifier incorporates a power transistor protection circuit to safeguard against transistor blowouts. The unit has a claimed frequency response from 20 to 30,000Hz and a power bandwidth of 20 to 30,000Hz. The unit is priced at $199.95. Kenwood.

TOOL KIT 714

Tools mount on two removable pallets

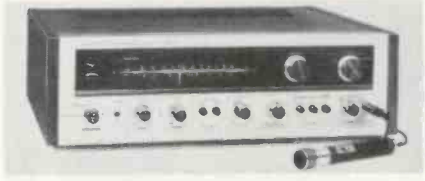
A 100-piece multi-purpose tool kit is announced. Designated JTK-17, the attaché-case kit includes virtually every standard tool required in the field for maintenance of complex electronic and data processing equipment. Most of the tools are mounted on two removable pallets. These pallets hold the tools securely in an organized manner and at the same time present them to the view of the user. The case features hardwood construction with

llama-grain covering and solid brass hardware. Three roomy compartments are provided in the bottom for large tools, a test meter and spare parts. A space for service manuals and documents is provided in the cover. The complement of 100 tools includes 7 regular-slot screwdrivers, 4 Phillips-type screwdrivers, a jewelers screwdriver set, a hex screwdriver set, a spline screwdriver set and two special-purpose screwdrivers. Seven pairs of pliers are furnished including cutters, chainnose pliers, instrument pliers, power-track pliers and retaining-ring pliers. Also included in the kit are electronic alignment tools, burnishers, a crimping tool/bolt cutter, feeler gauge, hammer, center punch, flashlight, scribe, electrician's knife, dental mirror, nut-driver set, instrument oiler, pin-punch set, stainless rule, scissors, soldering iron, solder aid, solder brush, tweezers, spring tools, and wire stripper. Wrenches include 4in. and 8in. adjustable types, an ignition-wrench set, a 1/4in. drive socket set with ratchet handle and a metrictype hex-key set. A Simpson VOM tester is available as an optional accessory. Kit price $169.00. Jensen.

AM/FM MULTIPLEX STEREO RECEIVER 715

Monolithic IC in multiplex section

Introduced is the Model SX-1500TD receiver with advanced circuitry. An FET front end ensures sensitive FM reception with four IC's in the IF and a monolithic IC in the multiplex sec-



tion for improved separation. Silicon transistors ensure low-noise music power of 180w. Microphone mixing is also a feature of the unit which is supplied with a unidirectional dynamic microphone and an on-off switch. A microphone jack on the front panel and an input level adjustment knob provides mixing. Three speaker outputs on the rear panel and a five-position speaker selector on the front panel give a variety of speaker combinations, A, B, C,; A plus B; or, A plus C. The pre-amplifier and the main amplifiers can be used separately by means of a switch on the rear panel. A center channel output on the rear panel provides the composite left and right signals for a three-dimensional system when another amplifier is connected to the center channel output. Price $399.95. Pioneer.

ET/D DEALER SHOWCASE

STEREO PRE-AMP 716

Distortion reportedly less than .01 percent

Introduced is the Model SP-1A preamp. The stereo control panel measures 15-5/8in. wide by 5in. high and

the overall depth is 14-1/2in. The panel mounting cutout is 4-1/2in. high by 15-1/4in. wide with depth behind the panel at 14in. Weighing 30lb., the unit has a harmonic distortion of reportedly less than .01 percent at 5v RMS output 1kHz on either auxiliary of mag input, gain max., high impedance. The noise and hum are aux: 90dB below 2v input and mag: 60dB below 10mv input. Maximum output level is at least 30v RMS 1kHz into high impedance. Maximum input levels without overload is aux: 50v RMS@1kHz and mag: 750mv RMS @ 1kHz. It is priced at $750. Peploe.

AMPLIFIER 717

Six individual microphone and/or program inputs

Introduced is the LT-1005, a professional quality amplifier rated at 100w (RMS). The amplifier incorporates

multiple inputs and a number of other features not available on competitive models. The output of the unit is achieved with reportedly less than 1 percent distortion (50Hz to 15kHz). Distortion of less than 2 percent (40Hz to 18kHz) can be achieved at levels up to 80w(RMS). Six individual microphone and/or program inputs are available and all are transformer balanced and have low impedance. Inputs one, two and three are directly coupled from their respective preamplifiers to the tone amplifier. Input four has a selector switch for conversion to RIAA phono input. Input five is switchable from microphone to an auxiliary 10K unbalanced input. Input six features selection of either of two high level lines. Tone controls are a full 15dB for bass and treble at 50Hz and 15kHz respectively. Microphone inputs may be changed to a 10dB controlled rolloff at 30Hz during installation. All inputs and the master gain can be remotely controlled through LDR circuits with remote volume controls. The unit has an automatic protective circuit which protects the output stages. McMartin.

CASSETTE PLAYER 718

Front loading is simple and fool-proof

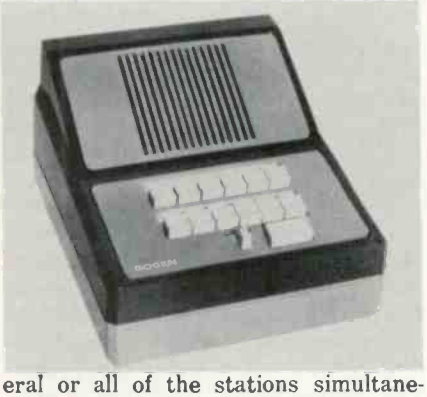
Introduced is the Model 20 stereo automobile cassette player. Weighing only 7 lb, the player permits up to two hours of listening. Primary feature is its Insta-Load facility, with a

push-in front loading operation that reportedly is simple and fool-proof. Another exclusive feature of the player is its 18w (IHF) music power output. Other features include automatic cassette ejection, which ejects a cassette when the end of the tape has been reached, and then shuts off power to the unit; a program search capability with fast-forward and rewind to permit instant location of a selection; complete compatibility with any prerecorded cassette, mono or stereo; and stereo balance, tone and volume controls. The cassette player is compatible with any type of automobile, operating on both negative and positive ground and on any 12v electrical system. It comes complete with car mounting bracket and hardware. Specifications: frequency response -50Hz to 10,000Hz @ 1 7/8 ips; signal-to-noise-ratio -45dB; wow and flutter -0.28%@ 1 7/8ips; head configuration -1 quarter track playback; outputs -2 extension speakers (one for each channel), plug type, pigtail; impedance, 3.2Ω; dimensions -2 7/8H x 7 3/16W x 8 1/4in. D. The price is under $119.50. Super Scope.

INTERCOM 719

Six separate conversations at the same time

Introduced is the IE series solid-state intercoms which may be employed in either an all-master system, a single master-multiple remote configuration or a master system which operates one or two non-private remotes. The IE-13 masters have 12 and 6 station-selector buttons, respectively, all of the non-interlock type which enable the master station to call sev-



eral or all of the stations simultaneously. This is a convenient means for a conference call. In the all-master system as many as six separate conversations may be held at the same time. By adding the company's TBR-1 relay accessory to an IE system, paging through any PA system is possible with hands-free response from loudspeaker or horn. The RIE-1 remote may function either non-privately or privately i.e., when the privacy switch is on, the remote cannot be monitored. IE systems are operated from a 120vac power source, 50/60Hz, but can easily be adapted for a 12v dc battery supply. Bogen.

PROMOTION DISPLAY 720

Scale model trucks offered

True to scale models of cargo-trailer trucks that are seen every day on the highways are being offered

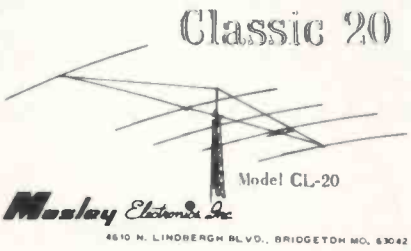
to distributors for resale to their customers. The toy replicas, normally priced at $3.98 are being offered by distributors at a special $2.49 price. Packaged in a display carton holding 24 pieces, each truck is in a clear plastic front box allowing the potential buyer to readily see the handsome toy. The play safe

toy is designed from drawings of an actual vehicle to a scale of 3/16in. equals one foot. It has 40 separate parts of the same materials used in its real life counterpart. Authentic detail, bright true to life colors and rugged construction add up to a quality toy. Finco.

AMATEUR ANTENNA 721

20 meter single-band beam

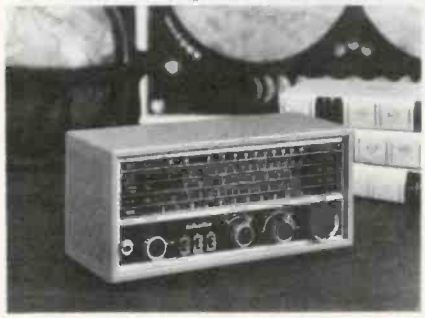
Announced is the CLASSIC 20, a 20 meter single-band beam antenna featuring the classic feed system. The improved electrical balance, "balanced capacitive matching," reportedly combines with optimum spacing to provide maximum gain and increased bandwidth. High-impact insulators, clamping blocks, aluminum tubing and stainless steel hardware are some of the construction features. Specifications and performance data: Electrical—Band: 20 meters. Power Rated: 1kw AM/CW; 2kw PEP SSB input to the final. Forward Gain: 9.8db compared to reference dipole; 11.9db over isotropic source. Front-to-back Ratio: 20db. SWR: 1.5/1 or better. Mechanical—Number of Elements: 5. Maximum Element Length: 38ft. 1 1/2in. Boom Length: 46ft. Assembled Weight: approx. 139 lb. Mosley.



RADIO 722

Four band operation on either ac or dc

A low-priced, all transistorized table model broadcast and shortwave radio receiver Model S-120A that provides the user with the means for literally "tuning in the entire world" is introduced. The shortwave reception has been boosted up to 200 percent over conventional sets including both CW (code) and SSB (single-sideband) due to special advanced circuitry. It can be operated on 117vac, 50/60Hz power and as an exclusive feature, the unit is equipped with an external power jack making it possible to operate from a battery source. The receiver is attractively housed in a communications equipment type steel cabinet with full front panel controls and a large, easy-to-read, multicolor coded, lighted dial scale marked with countried broadcasting on short wave. It is fully transistorized and includes a number of features. Frequency coverage is .54-31MHz in four bands: standard AM broadcast (550-1600kHz); Shortwave Band I (weather marine and amateur—2.0-5.0MHz); Shortwave Band II (afternoon and evening shortwave reception—4.8-11.5MHz); Shortwave Band III (all day shortwave monitoring—11.0-30.0MHz). The front panel controls consist of: main tuning control; electrical band spread control; volume power on-off; band selector; BFO on-off; standby on-off; receiver/standby. The receiver is styled in a light grey color with black, white and silver trim to fit or match any decor and measures 12in. wide by 5 1/2in. high by 5in. deep. Weight is 8 lb. Hallicrafter.



STEREO TAPE DECKS 723

Synchronous drive meter assures precise speed regulation

Introduced are three high fidelity, reel-to-reel tape decks in the luxury class. The new solid-state electronic units are designated the Mark Series. Features for all three models include a hysteresis (high torque) synchronous drive motor; solid-state electronics with integrated circuit preamps; three heads—wide-gap record head, narrow-gap 2 micron playback head and erase head for optimum fidelity and frequency response; tape and source monitoring; flip-up head cover with head positions marked for easy editing, which provides easy access to tape heads; built-in head cleaner. Other features include automatic sound-on-sound recording, variable echo control for reverb effects and cue control for instantaneous "stop" and "start" operation. Supply and take up tension arms provide instantaneous startup of the transport mechanism and eliminate tape burble. All Mark Series recorders have three operating speeds—7 1/2, 3 3/4 and 1 7/8ips—and are equipped with inputs for microphone and auxiliary and outputs for line and headphones. The tape decks may be operated in either a vertical or horizontal position and have a reel capacity of 7in. Additional features include record-indicator light for each channel, built-in tape cleaner, automatic tape lifters, automatic stop, stereo headphone jack for personal listening and monitoring, flutter filter and dynamic muting. The Mark II (shown in photo) has a frequency response range of 20 to 23,000Hz at 7 1/2ips and a suggested retail price of less than $230. Concord.

MAGNIFYING SYSTEM 724

Full 360deg sweep over an 8sqft area

Introduced is the Stereorama Work/Viewer, a widely used magnifying system which has two new versions, each with specially engineered lighting installed as an integral part of the instrument. The instrument has a plano-convex lens that can be turned for individual viewing through the flat side or for relaxed, distance or group viewing through the convex side. The panoramic suspension arm provides a full unobstructed 360deg sweep over an 8sqft area. The viewer has a special fluorescent lighting built into it. This cool-light, glare-free illumination provides excellent supporting light, the sort of shadowless illumination required for many work operations. The other viewer has two flood lights built into it for work operations that require intensive illumination. Either flood light can be used alone or both can be used at once, and both can be adjusted to any desired angle. Ednalite Corp.

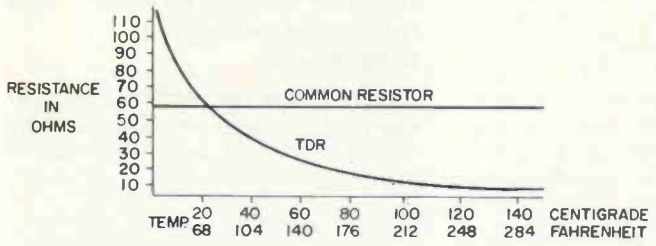
COLORFAX

The material used in this section is selected from information supplied through the cooperation of the respective manufacturers or their agencies.

GENERAL ELECTRIC

Testing the TDR

The TDR is a non-linear resistor whose resistance is a function of temperature. The heat that influences the TDR can be externally applied or developed by the current passing through the device. Characteristics of a typical negative coefficient TDR are compared with an ordinary resistor in the graph shown.



TDR's were used initially in filament systems for controlling warm-up or limiting surges. They were commonly referred to in the past as "glow bars." Currently they are being used extensively in automatic degaussing circuits and deflection yoke circuits. In degaussing circuits they provide a fading effect which results in a gradually decreasing magnetic field that eliminates undesired magnetism. In deflection circuits they correct for the increased resistance of the windings as they heat up.

TDR's can usually be checked with an ohmmeter. To test a TDR, connect an ohmmeter to the device and apply a source of heat (such as a soldering iron or heat lamp). The resistance of the TDR will change as the temperature changes. For low ohmic values, the heating effects of the meter current will have to be allowed for.

Some of the TDR's currently being used include:

EP14X10	100Ω@25°C	(C chassis)
EU14X147	3.8Ω@25°C	(C chassis)
EP14X206	1.052M@25°C	(G chassis) (H chassis)
EP14X5	120Ω@25°C	(G chassis)
ES14X213	3000Ω@25°C	(TC/T--1 chassis)

25° C is assumed to be normal room temperature and all resistance figures are ±25 per cent.

RCA VICTOR

Color TV Receivers—Sound Trap Adjustments

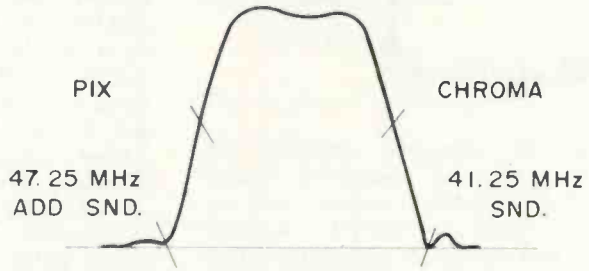
Color television receivers use tuned trap circuits to minimize or eliminate undesired signals. In most chassis, these resonant traps serve to attenuate three frequency components.

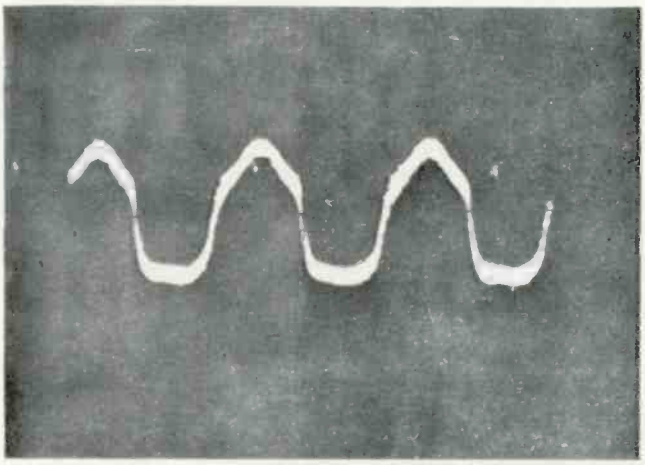
The 41.25MHz sound trap reduces the amplitude of the co-channel sound carrier to a point low enough to prevent beats between it and the video carrier.

Another trap (adjacent channel sound) is tuned to 47.25 MHz. As its name implies, this trap restricts the bandpass of the IF system so that the adjacent low-channel sound carrier will not cause interference.

A third trap, resonant at 4.5MHz, is located at the input of the video amplifier system in a color receiver. This trap serves to prevent the 4.5MHz sound signal from beating against the 3.58MHz chroma signal. If the two frequencies are permitted to combine, a 920kHz beat pattern is visible on the screen of the receiver.

All of the above traps should be checked and/or set during the receiver alignment procedure. Shown in the illustration are the positions of the 41.25MHz and 47.25MHz trap frequencies on a typical IF response curve. Both trap frequencies are at the bottom (minimum gain point) on the curve. The alignment instructions specify that the traps are to be adjusted for minimum marker response. This may (or may not) be easy, depending upon the technician's methods and skill. At best, good judgement is required for accurate settings.

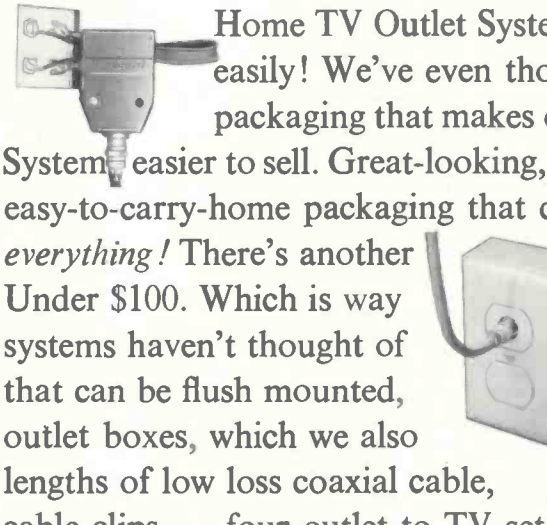


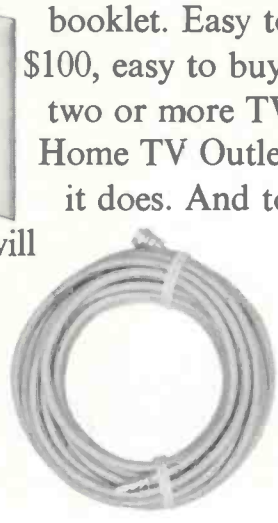


It is common practice in many service shops to radiate the marker signals into the chassis. This system, aside from making trap adjustment difficult, can also cause other problems, such as overloading and distortion of the sweep curve. As previously indicated, the trap frequencies are at the minimum gain points in the IF system. Therefore, it is often difficult or impossible to see the markers without using excessively high levels of marker signal, and risking possible distortion of the sweep curve because of signal overload. It is also evident that it is difficult to judge the exact points of minimum 41.25 and 47.25 response with low

WINEGARD ANNOUNCES THE EASIEST TO INSTALL HOME TV OUTLET SYSTEM EVER! AND THE EASIEST TO SELL!

It's the easy to install part that helps make our Home TV Outlet System easy to sell. If you have your own installation men, it's easy for them to install. And it's almost as easy to install for do-it-yourselfers. You see, when we say we thought of everything, we mean everything—including a fully illustrated installation booklet that shows, step-by-step, how to install a Winegard Home TV Outlet System—easily! We've even thought of packaging that makes our System easier to sell. Great-looking, colorful, easy-to-carry-home packaging that contains *everything!* There's another reason why our System is easy to sell. The price. Under $100. Which is way under any other system around. And the other systems haven't thought of everything. Like four TV/FM ivory wall outlets that can be flush mounted, or surface mounted with the four low profile ivory outlet boxes, which we also happen to supply . . . two 35-foot and two 25-foot lengths of low loss coaxial cable, *with connectors already attached* . . . 12 adhesive cable clips . . . four outlet to TV set cords *with* VHF-UHF band separators . . . our finest quality 82-channel, solid state booster-coupler with both 75 and 300 ohm inputs . . . and the illustrated installation booklet. Easy to install. And, at less than $100, easy to buy. No wonder everybody with two or more TV sets will want a Winegard Home TV Outlet System when they find out what it does. And to make sure they find out, our System, the HSO-782, will be nationally advertised. Any more questions? Call your Winegard distributor, or write for Fact-Finder #289.





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ANTENNA SYSTEMS

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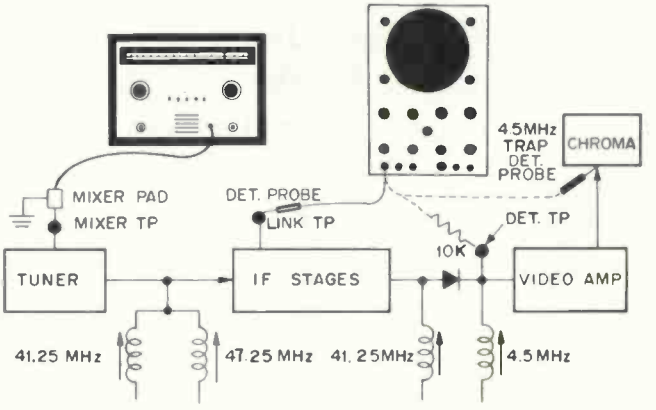
. . . for more details circle 143 on Reader Service Card

level marker signals when making sound trap adjustments.

The situation can be greatly improved by using the post detection marker insertion system in which the marker signals are not passed through the chassis and thus not affected by IF gain. This is easily accomplished by using an external marker adder. Some recently manufactured alignment equipment includes built-in provisions for post detection marker insertion. Although this system represents an improvement over radiating markers into the chassis, trap adjustment still depends upon correctly interpreting the minimum response points on the curve—often difficult for maximum accuracy.

Modulated CW Method

There is a simple and positive method for setting traps that overcomes the limitations of the radiated marker system, does not require a marker adder, or rely entirely upon the judgement of the technician. This system uses the calibrated marker generator to supply a modulated signal (at the trap frequency) to the input of the television receiver. The normal detector probe (or video detector in the receiver) with an oscilloscope for visible indication, acts as a null detector. Trap setting then becomes simply a matter of adjusting the trap while observing the scope pattern for minimum response. This is easy because the "high Q" nature of these traps makes the null quite sudden and sharp as seen with the modulated signal. With the trap nulled, it has been adjusted to the exact frequency required.



This trap adjustment procedure is accomplished by disconnecting the mixer grid pad from the sweep generator

and connecting it to the output of the marker generator. The technician should next adjust the attenuator switches on the front panel of the marker generator to obtain a low amplitude signal on the lowest input voltage range of the oscilloscope. A suitable level is indicated when the modulated sine wave is undistorted—both top and bottom are symmetrical. (Some experimentation should be attempted on a chassis known to be aligned properly before this procedure is adopted.) When the signal (41.25MHz or 47.25 MHz with 600Hz modulation) is applied, a sine-wave pattern will appear on the scope. The trap can then be adjusted for minimum scope response.

The reader should realize that the accuracy of trap adjustment depends on supplying accurate, calibrated, test frequencies. Therefore, it is advisable to review the marker generator frequency calibration instructions supplied with the instrument before using this procedure.

4.5MHz Trap

The remaining trap (4.5MHz) is located at the input of the video amplifier. This trap is adjusted somewhat differently, in that we are now dealing with video frequency signals. Also, the procedure will vary somewhat from chassis-to-chassis.

To adjust the 4.5MHz trap, service data will specify connecting the oscilloscope to a particular point in the chroma circuit—usually bandpass amplifier. Once correct input and output conditions are established as per instruction in the service data, the 4.5MHz trap is adjusted for a minimum 600Hz response on the oscilloscope.

Although the foregoing procedures involve changing connections of test equipment, and may on the surface seem somewhat cumbersome, the technician will find (after a little practice) that traps are quickly and easily adjusted with no element of guesswork involved.

ET/D NEWS OF THE INDUSTRY

GE Introduces New Horizontal Output Tube for Color TV

A breakthrough—in the design of horizontal output tubes for color TV receivers is the 6LW6 by General Electric's Tube Dept. Rated at 40w plate dissipation, the 6LW6 will permit using picture tubes with increased deflection angles, making possible smaller—approximately 15 percent thinner—color TV cabinetry. Slated to go into production in early 1970, GE's 6LW6 will provide a horizontal deflection tube with enough reserve to reliably scan the new 110 deg color tubes. The 6LW6 is GE's first receiving tube made in a T-14 bulb.

Enthusiastic Response Greets New Show Plans

114 companies have already enrolled as exhibitors in the 1970 NEW Show/Conference, the national gathering of electronic distributors that will take place at the Hilton Hotel in Chicago, May 11, 12 and 13, 1970.

Participating companies have to date purchased 155 booths. Twelve firms which require no product displays but wish an opportunity to confer with their distributors, have elected to participate in conference suites.

The special "Show within the Show," Industribution Center, will cater to manufacturers and distributors whose interests are primarily industrial. Industribution Center, on the fifth floor of the Hilton Hotel, has already enrolled 14 companies. This "Show within the Show" will allow industrial-oriented manufacturers to see their distributors and prospective distributors in an environment which screens out distractions and interruptions from those primarily interested in the consumer electronics aftermarket or in the audio field.

Kenneth C. Prince, Executive Vice President of the sponsoring Electronic Industry Show Corporation, said that the companies include eight which have never before exhibited in an EISC event. He also indicated that more than half the companies which participated in the 1969 Show in Las Vegas have confirmed their plans to repeat next May in Chicago.

Complete exhibitor information about the 1970 NEW Show Conference is available from the Show office, 100 South Wacker Drive, Chicago, Illinois 60606.

Varactor Diode Developed

A new series of low-cost varactor diodes with high Q, linear response and a spread of five to one at 3 to 30 volts has been developed by the Kollstan facility of Standard Kollsman Industries for use in solid-state television tuners, instrumentation, remote frequency controls and microwave circuits.

The unique junction in the Kollstan varactors provides linear capacitance versus voltage characteristics, eliminating the need for matching diodes where several are used, or where repeatability from circuit to circuit is required. Elimination of matching simplifies equipment design, reduces production costs and eases service and maintenance.

The Kollstan diodes are completely passivated devices encased in specially formulated plastic housings. They provide superior mechanical shock resistance through solid junction-to-lead construction, and low series inductance and simple mounting through the use of gold plated axial leads.

Specification sheets on the new variable capacitance diodes are available from Kollstan Semiconductors, Standard Kollsman Industries, 111 New York Avenue, Westbury, N. Y. 11590.

USA Standard Requirements for Electronic Analog Voltmeters

The electric power industry, the electronics industry, testing laboratories, and radio and television servicemen are among the groups who will benefit from use of the first complete set of requirements for electronic analog voltmeters, Draft USA Standard C39.7, released by the Standards Institute for a one-year period of trial use and criticism.

Covered in the standard are quantitative requirements for conformance with a given accuracy rating; both ac and dc voltmeter specifications which manufacturers should furnish to users; and testing and calibration procedures. An appendix describes how to determine total error on the calibration tests given.

The standard also classifies electronic voltmeters according to operating principles, accuracy ratings, responses, inputs and power supplies.

Single copies of Draft USA Standard Requirements for Electronic Analog Voltmeters, C39.7, are available from the Standards Institute at $2.75.

The draft was developed by a subcommittee of Committee C39, operating under the procedures of the Standards Institute, which is the national clearinghouse and coordinating agency for voluntary standardization in the United States. USASI is changing its name to American National Standards Institute, Inc. The change became effective on October 6, 1969, when the institute moved to new headquarters at 1430 Broadway, New York, N. Y. 10018. When the name change went into effect the Institute also changed the designation of the standards it approves from "USA Standard" to "American National Standard."

The Standards Institute approves a standard when it receives evidence that all national groups concerned with the application of the standard have been given an opportunity to cooperate in its development and these interests have reached substantial agreement on its provisions. The Institute also represents United States interests in international standardization work carried out by such non-treaty organizations as the International Organization for Standardization and the International Electrotechnical Commission.

Instrumentation Fair Goes West in 1970

Instrumentation Fair, often described as an IEEE Show or WESCON, devoted exclusively to electronic instrumentation and related products and services, has gone to the West Coast in 1970. Enthusiastic manufacturer, rep and attendee reception to the show, which ran very successfully in Washington, D.C., in 1968 and 1969 has pointed up the need for a similar show in California.

Instrumentation Fair West will run February 18 and 19, 1970 at the International Hotel in Los Angeles and February 25 and 26, 1970 at the San Mateo Fairgrounds (just south of San Francisco). It is expected to draw over 3000 attendees and over 100 exhibitors to each location.

Product categories to be featured in Instrumentation Fair West are: measurement - computation - data acquisition - calibration - control - communication - data transmission - maintenance services for all of the above categories.

Exhibits and exhibitor workshops will be directed toward key prospects who specify, purchase and use: small computers - peripheral equipment - laboratory test equipment - microwave devices - lasers - calibration and standards -

data systems - sophisticated systems components - production test equipment.

Many exhibitors will conduct one hour application workshops in which their new products or new product applications will be presented in one hour sessions to select groups of up to 50 people.

Ultimate aim of Instrumentation Fair West is to kick-off an Instrumentation Week in California where manufacturers, regional sales offices, independent reps and customers can get together.

A no host cocktail party for manufacturers, salesmen, reps and customers will be held on the final evening of each show.

NAB Objects to Proposed FCC Rule Permitting Coded Information on TV

The National Assn. of Broadcasters has asked the Federal Communications Commission not to adopt a rule which would permit the transmission of coded identifying information on video tape and film.

The commission has been petitioned to allow such transmission by the International Digisonics Corp. (IDC), which stressed the need for a monitoring service that could provide verification of the number of times a TV program or commercial has been broadcast.

In a filing, NAB objected that such a rule is not in the public interest, that it would have a deterring effect on future refinement and development of television receivers, and that consideration of any coded monitoring system should be considered along with other test devices now under study and review.

Although IDC said the information would be limited to a small portion of the picture tube which is not visible to the viewer, NAB said that in numerous instances, especially on many old receivers, the picture barely occupies the visible picture tube area and the coded transmissions would be visible.

Also, NAB said, efforts are underway to develop a picture tube which would substantially utilize the entire transmitted picture. The adoption of a technique which is dependent upon the use of the masked corner areas could deter future development of picture tubes.

In addition, such a monitoring system "has inherent operational shortcomings which could seriously affect the accuracy of the desired information."

Therefore, NAB feels that individual station operating techniques and procedures could have an adverse effect upon the accuracy of the proposed system which could result in controversy as to the reliability of the coded transmissions.

Technical Clinics For A-V Servicemen

A series of tape recorder technical clinics for educational audiovisual servicemen has been initiated by 3M/Wollensak.

The first clinics were conducted recently in San Francisco and Los Angeles with the joint sponsorship of Photo and Sound Co., San Francisco.

"The clinics are designed to acquaint school A-V equipment servicemen with maintenance and repair procedures on the new line of Wollensak audiovisual recorders. Instruction was given in the servicing of earlier models, many of which are still in use after 10 or more years of service," said W. F. Jensen, marketing manager for Wollensak educational products.

The clinics are conducted by representatives of the Wollensak technical service group.

ET/D NEW PRODUCTS

For additional information on products described in this section, circle the numbers on Reader Service Card. Requests will be handled promptly.

FIELD STRENGTH METER 725

Shielding attained by use of feed-thrus

Introduced is the Model FM-2 field strength meter, the ideal instrument for installation and maintenance on

all systems. New features include a silicone treated fiber glass P/C board. Circuit design employs the latest in silicon semiconductor and transistor technology to assure stability and reliability. Complete shielding is attained by employing feed-thru capacitors. Improved tuning, easy to read log scale, switchable dial lamps, new battery clips and battery saver are featured. Furnished with padded saddle leather carrying case and priced at $329. Video Instruments.

MULTITESTER 726

Special scales permit semiconductor testing

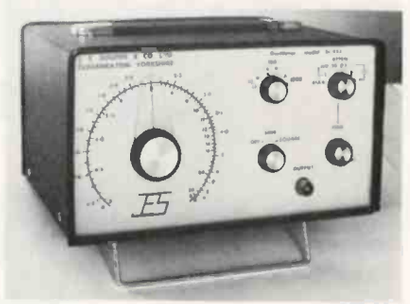
Introduced are the TR series multitesters performing all of the conventional functions of standard VOM's

and feature simplified semiconductor checking capabilities. Simplified, easy to read scales indicate current and voltage applied to a transistor during test. The maximum current applied to a transistor for a given resistance range is printed above the function switch, providing a reference that permits test of the semiconductor within the working limits of the unit being checked. Combined with the special scales this provides a quick easy indication of the condition of the transistor. The Model 501ZTRD Multitester also has 22 ranges, a single function and selector switch, polarity reversing switch and is equipped with a high voltage probe. All instruments are backed by a two-year warranty. Sanwa.

AUDIO FREQUENCY OSCILLATOR 727

Frequency coverage of 13Hz to 30kHz in six ranges

An AF oscillator with an output that simulates a typical high-quality phono cartridge with a sensitivity

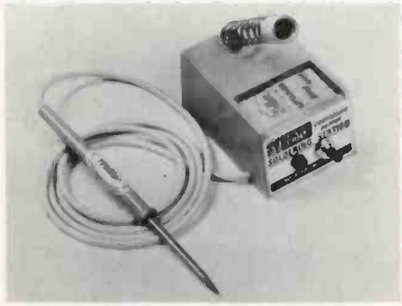


of 2mv/cm/sec is introduced. The output, with a maximum of 10mv at 1kHz, conforms to the fine groove recording characteristic of the RIAA (Recording Industries of America Assn.). This reportedly enables the equalization response of a phono input to be checked quickly and easily without using auxiliary equipment or making long calculations. In the range 30Hz to 18kHz, the characteristic is maintained at ±0.5dB. The Model SI453 AF oscillator was developed for the routine testing or development of audio frequency apparatus, in particular amplifiers and associated equipment of a Hi Fi type. It has a frequency coverage of 13Hz to 30kHz in six ranges. Total harmonic distortion is reportedly less than 0.05 percent at 1kHz. A square wave facility is provided for the checking transient response and amplifier stability in reactive loads with a rise time of less than 0.5μs. Maximum output is 2v rms and output stability is ±5 percent. The oscillator is battery-operated with all internal ferrous components plated with cadmium and passivated. Dimensions are 10 by 5 by 7in. and the weight is 11lb. Sugden.

SOLDERING STATION 728

Automatically controlled output and temperatures

Introduced is a series of miniature low voltage controlled output soldering stations. The W-MCP series tools



have a solid state closed loop control system coupled with a curie point temperature sensing system to automatically control output and temperatures. The units are available with fixed control point temperatures of 500°F and 750°F. A 6 1/2in. long super lightweight pencil iron weighing only 1.35oz and featuring a highly flexible, burnproof silicone rubber cord comprises the working end of the station. The iron is normally supplied with a 1/8in. chisel tip, however, interchangeable 1/32, 3/64, and 5/64in. tips are also available. The power unit is isolated and electrostatically shielded. A specially designed non-sinking iron holder is provided. Incorporated in the case are an on/off switch, indicator light and a tip cleaning sponge installed in a convenient well. Weller.

UHF AMPLIFIERS 729

Can accommodate up to 200 TV sets

Introduced is the Model M-174 and M-175 Solid State UHF Amplifiers, designated to overcome UHF frequen-

cy amplification problems found in large all channel/on channel MATV systems and serve a MATV system

that can accommodate up to 200 TV sets. The single channel UHF amplifier offers a 30±3dB gain with a 1v output on a single UHF channel and broadband UHF amplifier offers a 30±3dB gain with a 1v composite output on all UHF channels. Both amplifiers have a 75Ω single output. The design and relatively low cost of both amplifiers make them ideal for handling UHF frequencies in all channel/on channel MATV systems. Finney Company.

SOLID STATE WIDE BAND OSCILLOSCOPES 730

DC bandwidth to 7MHz

Introduced is the Model LBO-32B 3in. scope with a bandwidth of dc to 7MHz making it ideal for every phase

of color TV servicing. Special input circuitry stabilizes the dc level so that power line fluctuations are said to have no effect on the position of the CRT display. The instrument has an

input sensitivity of 10mv/cm. The horizontal and vertical amplifiers are easily balanced so the instrument adopts itself to use as a vectorscope. The line sweep position makes an effective frequency comparator using the lissajous technique. The calibration voltage is set at 0.03v P-P at line frequency. The sweep circuit has a frequency range of 1Hz to 200kHz in 6 steps and automatically locks to the horizontal video pattern of the TV signal. Power required is 105-125v 50/60Hz @ 55va and measures 9in. H x 6-3/4in. W x 10-1/2in. D, weighing 17.6lb. Price $189.50. Leader.

PICTURE TUBE TESTER 731

Simulates conditions in the TV set

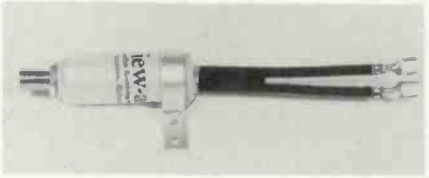
Announced is a Model 880 picture tube color tracking analyzer and picture tube rejuvenator. The unit tests all color tubes in accordance with CRT manufacturer's recommended procedures. Each gun of a color tube is adjusted to cutoff before the beam current reading is taken, simulating conditions in the TV set. Universal sockets and adapters eliminate numerous cables. The unit checks for shorts, interelement leakage and also pro-

vides a life test for checking useful cathode emission. Unit comes complete with data book. Price is $79.95. Mercury.

MATCHING TRANSFORMER 732

Employs heavy aluminum shell

Two matching transformers for use in areas with strong local signals are offered. The Model VMT-25 is a



broadband, trifilar wound, matching transformer featuring longitudinal

balance of at least 20dB. DC/AC isolation is provided by the inclusion of three capacitors into the circuitry. The Model VMT-26, illustrated, has identical electrical characteristics but is provided with a strap to facilitate RF grounding to the set and has a longitudinal balance of at least 25dB. Exceptionally rugged mechanical characteristics are accomplished through the use of a heavy aluminum shell and heavy duty twin lead. A plastic sleeving over the aluminum shell prevents shock hazards. View-All.

SPRAY CHEMICALS 733

Selection of most needed spray chemicals

A complete selection of "most needed" electronic spray chemicals, packaged in a rainbow assortment of color-cod-

ed cans, is introduced. The colorful array of cans features cleaners, coolers, lubricants, insulators and protectors—all sprays, designed to meet the demands of service technicians in TV, radio, record player, tape recorder repair, plus additional applications in computer, office machine, industrial and broadcast servicing. Six of the nine cans feature a snap-on extension spray nozzle, included for precise application of the chemical to explicit circuit areas. A dealer/distributor warranty against defects in material and workmanship under normal usage backs all of the spray chemicals for a period of six months from date of purchase. RCA.

CB TRANSCEIVER 734

Compact size and light weight

A Citizens Band mobile 2-way radio unit designated as the Citifone 19 with full 23 channel selection is announced. Over 25 separate features are detailed in a descriptive piece and includes reference to the size—less than 7in. deep, 2in. high and 5-5/16in. wide. The

transceiver can be installed on practically any vehicle from smallest compacts to largest over-the-cab tractors. Built-in transistorized dependability and 23 channel feature makes the unit ideal for fleet usage. The price is $159.95. Multi-Elmac.

SCOPE DOLLY 735

Steel construction supports 500lb

Introduced is the Model 962-S Mobile Scope Dolly which will accommodate any popular-type scope up to 17in.w x 22in.long. Its steel construction is capable of supporting a 500lb. load and features a rubber mat-covered storage shelf, felt-lined drawer (12-3/4 x 14 x 3in.) mounted with nylon rollers (for manuals, probes, etc.), a three prong (U-type) power outlet and one-three-prong power

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input. The unit swivels on four-5in. diameter, double ball-bearing, solid rubber wheels. It also has a convenient 36in. height and 20deg viewing angle. The dolly is finished in gray baked-enamel and weighs 75 lb. Metal Dynamics.

FET TESTER 736

Can be added as a companion to transistor tester

Announced is the Model FT155 tester for checking field effect transistors. The company stated that a field effect transistor cannot be checked on a tester that has been designed to check transistors only; the field effect transistor is measured like a cold vacuum tube and requires charts that measure the gain in transconductance and leakage in different terms than a regular transistor. Use is not limited to the service trade but is expected to fill the need of the many industrial technicians and engineers who can now test transistors but cannot check the field effect transistor. The mechanical design is identical to the company's earlier model TR139 that checked transistors only and the tester can be added as a companion unit at a savings over a combination tester. Price is $94.50. Sencore.

SOLDER 737

Excellent adhesion to glass and other substrates

A two-component silver-filled epoxy alloy that contains no solvents, volatiles, copper, carbon or plated fillers is introduced. Dynaloy 335 is claimed lower in cost than other two-part silver-filled conductive epoxies, yet has volume resistivity lower than .01Ωcm. The new product cures at room temperature but will operate continuously at temperatures up to 210°F, with no electrical drift or migration. The alloy reportedly has excellent adhesion to ceramic, glass and other substrates. It is used for connecting heat-sensitive components to printed circuit boards, bonding wave guides, shielding and replacing solder where temperature or convenience in application is required.

It is available in 2 oz. evaluation kits for $9.50 while prices run from $28 per pound to $40 per pound in larger quantities. Dynaloy, Inc.

CCTV CAMERA TRIPOD 738

Adjustable height from 27 to 69in.

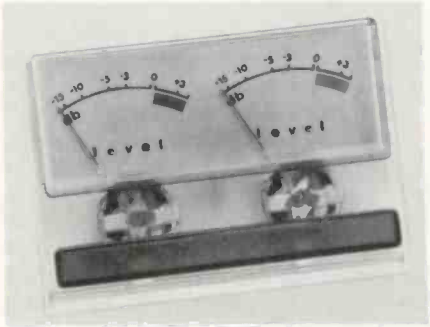
Announced is a new heavy duty tripod for CCTV cameras and viewfinders. The model T-2 tripod features a pan/tilt head, camera turntable, elevator and indoor/outdoor leg tips. Made of aircraft aluminum, the new

tripod is light, yet able to handle loads greater than 20lb. The unit is adjustable to any height from 27 to 69in. by means of telescoping legs and an elevator column. A convenient crank can be used to set the geared elevator column to the height desired. The pan and tilt head provides 360deg pan and ±90deg tilt. The camera turntable can be rotated over a 360deg range and locked into place by the flip of a lever. The three section legs are tipped by spikes which dig into the ground for outdoor applications. For indoor use, the spikes are retracted, leaving non-slip rubber tips to contact the floor without damage or marking. All shiny aluminum parts are anodized to prevent corrosion. Coated aluminum parts are anodized and then finished with two coats of baked enamel. List price $59.50. GBC.

OUTPUT METERS 739

Dual db meters for stereo

Introduced is a line of dual db meters for monitoring stereo recorders or speaker output levels. The unit

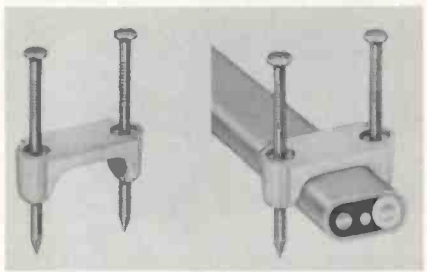


can also be used to indicate any simultaneously occurring functions which can be reduced to electrical characteristics. Cyclotronics.

PLASTIC STAPLE 740

Provides insulation and high dielectric strength

A combination staple and strap is introduced. It is made in 1/2 and 3/4in. sizes to fit new or old type No. 10, 12 and 14 Romex, or UF, BX and other



cables. The staple consists of an injection molded plastic strap with two zinc plated nails. It is claimed that the strap provides insulation with

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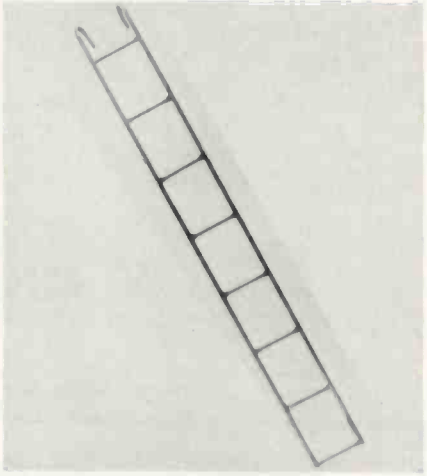
high dielectric strength and is not affected by heat or cold, will not rust, rot or deteriorate. The nails can be driven together without bending or splitting wood, while the smooth saddle eliminates indenting and protects cable insulation. Holub.

LADDER 741

Antenna installer's aid is lightweight

Introduced is a ladder designed for antenna service and installation. The ladder will hook into another lad-

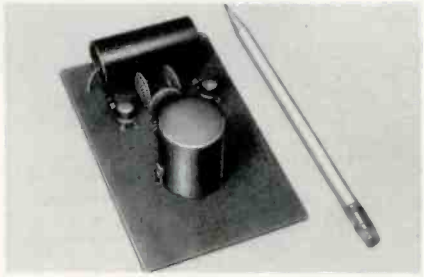


der for extended use. It weighs 21 lb. and can be carried on the top of service vehicles. The ladder is made of strong, lightweight tubular steel with all-welded construction. The hooks are bent for strength and rigidity with U-shaped standoffs allowing steps to be taken with ease. Price $15. Winfield.

POWER OSCILLATOR 742

Two-transistor push-pull supersonic oscillator

Announced is the Model OS-100 a two-transistor push-pull supersonic oscillator (2kHz to 150kHz, with design



center 60kHz to 80kHz), with sine wave output of relatively high power levels at reportedly less than 1 percent harmonic distortion. Changing condenser Cf from the output circuit determines the oscillator frequency: normally supplied value is 0.02μf for 85kHz. Three taps in the output transformer supply a variety of output voltage. The oscillator operates from any well-filtered dc source from 18 to 22vdc, drawing approximately 18ma. Typical uses for the oscillator include supersonic signaling, biasing of tape recorder heads, supplying power to tape erasing circuits and similar applications. It is also supplied with terminals so that the oscillator can be amplitude modulated. The oscillator size is: 5L, 3W, 2in. H and weighs 4 oz. Price is $21.95. Round Hill.

DIGITAL VOLTMETER 743

Solid-state light-emitting numeric readout

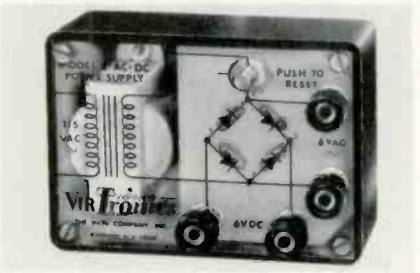
Introduced is the Model 200A integrating dc digital voltmeter, reportedly the first commercial test instrument to be equipped with a true solid-state light-emitting numeric readout. The voltmeter features five-digit readout including 20 percent overranging up to 1KV, automatic polarity selection and remotely programmable range selection. The unit includes

programmability, oven-stabilized reference, BCD output and solid-state numeric indicators. Price is $895. Monsanto.

BATTERY ELIMINATOR 744

Designed for students experimenting in electricity

Introduced is the VirTronic Model 6ac-dc power supply. This compact low voltage power supply, housed in a high-impact plastic case, features visible components and circuit, full protection against dead shorts and overloads, safety, low initial and oper-



ating expense. It may be operated singly or in groups for classroom use. VirTis.

ET/D CATALOGS & BULLETINS

Tape Players 400

A 16-page catalog describing the complete line of tape players is available. Included are portable cassette tape recorders, radio-corders, complete home entertainment systems and reel-to-reel stereo tape decks including the Mark Series tape decks, as well as receivers, speakers and an eight-track cartridge player. The four-color illustrated catalog covers applications and features. Concord.

Neon Lamps 401

A 12-page technical brochure which describes application ideas for neon glow lamps as circuit components and voltage regulators is available.

The brochure, entitled, "Application Ideas", lists some 22 circuit applications for neon lamps in vidicons, photomultipliers, power supplies, remote controls, memories, timers, proportional controls, moving signs, suppressors, photochoppers, binary decoding, frequency dividers, flash tube triggering and energy transfer applications.

Most of the neon lamps discussed are new and were chosen for the specific application because of their unique characteristics. In each case the applications discussed represent actual field-tested uses. Signalite.

Home Study Program 402

A book, "How to Prepare Today for Tomorrow's Jobs in Electronics," is available. Home study programs in electronics make it possible for you to get the advanced education you need without going back to school. You study at your own pace, on your own schedule, with the assurance that what you learn can be applied to the job almost immediately. These programs are prepared with the assistance of scientists and engineers who are acknowledged experts in their fields. CREI.

Schematics and Service Information 403

Schematic diagrams and service information on specific radio and TV sets are available at a nominal charge. Supreme Publications is offering to mail service material on almost any television, radio, stereo or changer. It is able to supply such information from its own service manuals, files going back to the 1930's, from manuals of other publishers (some no longer in business) and from factory-released material. The usual charge is $1 for radio material and $1.50 for TV material covering a specific set. Supreme Publications, 1760 Balsam Road, Highland Park, Ill.

Music Systems 404

A six-page pamphlet describes the easiest ways to improve the quality of your home music system and to improve the sound characteristics of your home music listening room. The pamphlet, "Sound Conditioning for Music," is reprinted from the HOUSE & GARDEN magazine. The pamphlet explains how to use drapery, carpeting, upholstered furniture and other household items to enhance the sound from a component high fidelity system, piano or organ. It includes pointers for eliminating "dead" spots, or doing away with excess reverberation without an acoustical engineer. Institute of High Fidelity.

Speaker Systems 405

A 10-page brochure featuring advanced speaker systems with "electronic suspension" is offered.

Printed in two colors, the illustrated "Sound of Excellence" brochure describes the entire LWE speaker system line including "instant kits". The economical kits, providing the user savings to 30 percent, consist of sound components mounted on a baffle board completely wired in an unfurnished wooden enclosure ready for operation. The user simply adds the wood finish and grille cloth design of his own desire. LWE.

Relays 406

An 8-page catalog describing the complete line of solid-state variable delay relays—featuring external knob adjustment for a delay range of 0.1 to 10s., 0.6 to 60s., or 1.8 to 180s.—is available. The time delay relays consist of a solid-state timing network and an electromechanical relay energized by the timing network. The units find application where delays must be introduced as a safety factor for protection of equipment such as motors, where certain machine sequences must be maintained and in automated equipment systems. Included in the graphs, line drawings, electrical characteristics, plug wiring diagrams and mechanical specifications on four popular solid-state time delay relay families. These consist of (1) variable delay with internal relay, (2) variable delay module requiring external relay, (3) fixed delay with internal relay and (4) fixed delay module requiring external relay. All can be supplied to operate from the following voltages: 24vac, 115vac, 24vdc, 48vdc or 110vdc. Ohmite.

The Professional Way to Service TV Tuners

by Tony Ferris

Tuners Inc. does not deal with the public. We are strictly "technicians' technicians", solving the really tough servicing problems that it doesn't pay the average man in the field to tackle. We handle all kinds of TV work but, as our name implies, we specialize in tuners. This article will tell you how to cure tuner troubles rapidly — and profitably.

Types of Tuner Troubles

The following symptoms may be caused by a defective tuner: (1) snowy picture; (2) streaking or flashing in picture; (3) loss of sound and picture; (4) loss of certain channels; (5) picture pulling or distortion; (6) partial blanking of raster.

If you suspect tuner trouble, try the following approach:

1. Clean and Degrease Contacts with Tun-O-Wash

In servicing tuners, it's important to start with clean contacts. Poor contacts cause at least 70% of all tuner troubles. In fact, we get many tuners in for repair that need nothing more than a thorough cleaning.

Chemtronics TUN-O-WASH is excellent for this purpose. It's almost like an ultrasonic bath in a can. Use this high pressure degreasing spray on all tuner contacts. Be sure to remove the tubes and spray the sockets thoroughly, to remove corrosion.

A thorough cleaning will often eliminate intermittents and restore tuner alignment.

2. Lubricate and Protect Contacts with Tun-O-Foam

After the tuner has been flushed out with TUN-O-WASH, let it dry thoroughly. Then, respray all contacts (including tube sockets) with TUN-O-FOAM. Once the TUN-O-FOAM has been applied, rotate the channel selector through all channels several times. Also, work the tubes in and out of their sockets several times. This will spread the lubricant to all critical surfaces.

You will find that a thorough cleaning and lubrication will clear up about 70% of the tuner troubles you encounter (aside from tubes, which should always be checked by substitution before any servicing is attempted).

What's more, the TUN-O-FOAM protects contacts from future corrosion, provides excellent lubricity for smooth operation, and continues to clean and lubricate contacts each time the channel is changed.

Most important, neither TUN-O-WASH nor TUN-O-FOAM attack plastics or cause detuning. This is vital, since a spray that detunes a color set almost always results in a profit-consuming callback.

Isolate the Trouble to the Tuner

If a thorough cleaning and lubrication (which takes only a moment) fails to restore proper operation, you will have to start troubleshooting. But before you start tearing into the circuit, make sure it's the tuner that's at fault.

IF and AGC defects often look an awful lot like tuner troubles.

If the picture is snowy, for example, too much AGC voltage may be the problem. To check this out, simply short the AGC test point to ground. This makes AGC voltage zero, permitting the RF amplifier to operate at full gain.

Next, check out the IF stages. Start with a good TV set connected to a good antenna. Connect the IF cable from the tuner of the known good receiver to the IF input of the set you are troubleshooting, if you get a good picture with the substitute tuner, you know you have tuner trouble. Otherwise, it's a chassis problem.

The 10 Minute Tuner Check

Once you have cleaned and lubricated the tuner and made sure that it is really the trouble source, give it a 10 minute check. Discipline yourself not to spend too much time tracking down tuner trouble. If you can't spot the trouble in 10 minutes, it may take you hours. Therefore you're a lot better off to send the tuner to a professional rebuilder. But the 10 minute check will reveal many tuner troubles.

If your preliminary checks revealed a shorted or gassy tube, chances are that excessive current has damaged a resistor. Burned resistors, of course, are fairly easy to spot.

After a brief visual inspection, make voltage checks at the test points provided. B+ voltage should be accurate ±20%. Then, use a test socket to make voltage and resistance checks at tube pins. If you read a low plate or screen voltage, this generally indicates that a series resistor has changed value or a capacitor has shorted.

Check to see if the oscillator is working by measuring the mixer grid test point voltage. A dead oscillator is often caused by the plate load resistor.

Be sure to check the balun. Defective baluns often cause snow or loss of certain channels. Your ohmeter will generally spot balun troubles.

One final word of advice: Treat all tuners carefully. Don't poke around in coils or you'll cause misalignment. Replace defective parts carefully with exact replacements. If you do have to send the tuner in, mark all leads clearly, keep the brackets in a safe place, wrap the tubes well and pack them carefully with the tuner.

Follow these simple rules and you'll make money on tuner repairs, whether you spot the trouble yourself or send the tuner to a specialist.

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Sylvania Electric Products	33
T&T Sales Company	80
Tech Spray	24
Tuner Service Corp.	19
TV Tech Aid	81
Weller Electric Corporation	75
Winegard Company	73
Workman Electronic Products, Inc.	84
Xcelite, Inc.	85
Zenith Radio Corp.	67

A COMPLETE LINE OF QUALITY UHF-VHF-FM ANTENNAS

KAY-TOWNES

OVER 1,000 MODELS — AREA CUSTOM DESIGNED AND PRIVATE LABELED

THE CT FAMILY
UHF-VHF

BEST
BECAUSE IT'S

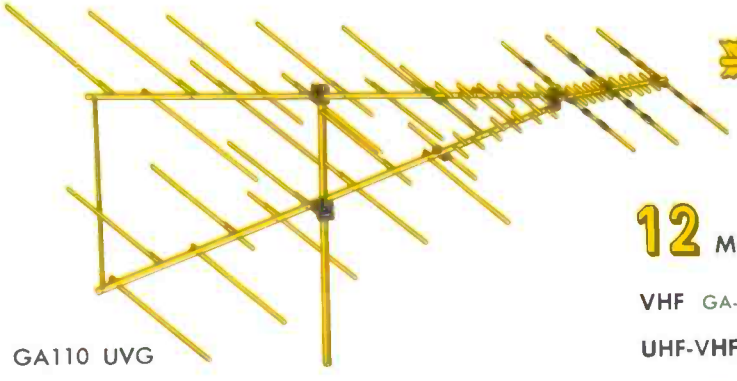
"COLOR-TUNED"

FOR PERFECT COLOR RECEPTION
RAIN OR SHINE!

FIELD TESTED AND PROVEN MODELS
5 FOR EVERY RECEPTION NEED
CT-42G, 34G, 30G, 24G, 18G
WITH FREE BAND SPLITTER

CT-42G

GET A BETTER PICTURE FROM ANY SET — COLOR OR BLACK AND WHITE — WITH A KAY-TOWNES ANTENNA



GA110 UVG

GOLDEN ARROW

ENGINEERED FOR THE ULTIMATE IN
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12 MODELS FOR EVERY VHF AND UHF-VHF NEED

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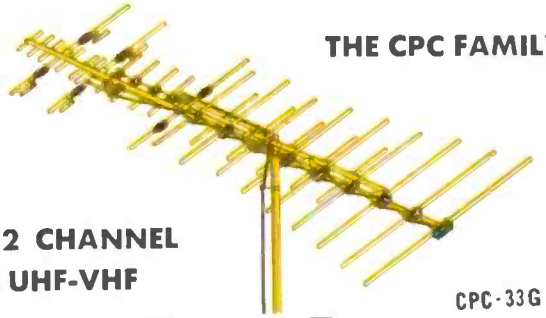


THE CPC FAMILY

82 CHANNEL
UHF-VHF

CPC-33G

colorphase

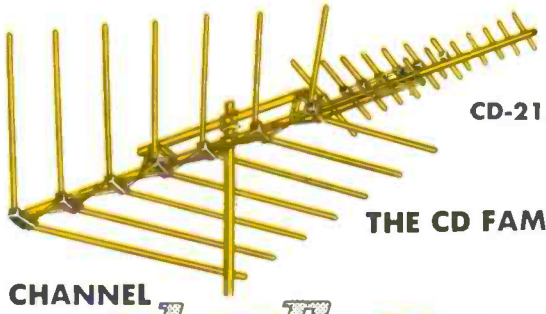
COMBINATION ANTENNA

All channels with single downlead

5 MODELS FOR EVERY RECEPTION NEED

CPC-33G, 27G, 24G, 18G, 12G

FREE BAND SPLITTER



CD-21G

THE CD FAMILY

82 CHANNEL

colorDyNE

UHF-VHF-FM COMBINATION

WITH FREE BAND SPLITTER

4 MODELS FOR EVERY RECEPTION NEED

CD-21G, 19G, 13G, 11G

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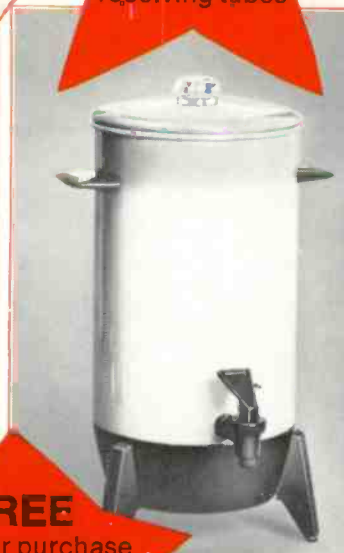

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RCA

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