The Art of Desoldering
Understanding Today's Capacitors
Semi-Tips
NOW you can measure resistors accurately in CIRCUIT! in solid state devices

WITH THE NEW HI-LO FIELD EFFECT MULTIMETERS
USES ONLY .08 VOLTS TO POWER OHMMETER TO PREVENT TRANSISTORS FROM CONDUCTING AND UPSETTING READINGS

Look at these extra features to see why the Hi-Lo meter belongs on your want list:

- Unbelievable specifications of 15 megohm input impedance on DC and 12 megohms on AC
- Laboratory accuracy of 1.5 percent on DC and 3 percent on AC
- 9 DC voltage ranges from as low as .1 volts full scale to 1000 volts
- 3 hi-voltage ranges of 3 KV, 10 KV and 30 KV
- 9 DC zero center ranges from .05 volts to 500 volts... a must for delicate transistor bias measurements
- 7 resistance ranges from 1000 ohms full scale to 1000 megohms

Here is why you should have both Hi and Lo battery voltages for correct in-circuit resistance measurements in solid state circuits:

Higher voltage of 1.5 volts causes semiconductors to conduct to read proper front-to-back ratio or conductivity of transistors. Meter would not be complete without hi-ohms reading.

Low voltage of .08 volts prevents transistors from conducting and misreading circuit. Resistor will now read 10K as it should. Also prevents any damage to transistor.

FE20 HI-LO
with hi-voltage probe and large six-inch meter $129.50

FE21 HI-LO
with 4½-inch meter $99.50

Sencore INC. 3200 Sencore Drive • Sioux Falls, South Dakota 57107

for more details circle 123 on Reader Service Card
Color TV Chassis

Complete Manufacturers' Circuit Diagrams

5 new sets

Notes:
1. All resistors are 1/2 watt, ±10%, unless otherwise noted.
2. All capacitors are 5%, unless otherwise noted.
3. Caution! Use isolation transformers when working on chassis.
4. DC voltages measured with "X-ray" placed between points indicated & chassis GND, with normal signal input.
5. Indicators show capacitors between the stator and ground.
6. Line voltage input set at 120VAC.

Electronic Technician/Dealer

Copyright 1971 by ELECTRONIC TECHNICIAN/DEALER * 1 EAST FIRST STREET. DULUTH, MINNESOTA 55802
PROVIDES YOU WITH A COMPLETE SERVICE FOR ALL YOUR TELEVISION TUNER REQUIREMENTS AT ONE PRICE.

TUNER REPAIR

VHF Or UHF Any Type $9.75.
UHF/VHF Combo $15.00.

In this price all parts are included. Tubes, transistors, diodes, and nuvistors are charged at cost.

Fast efficient service at our four conveniently located service centers.

1 year guarantee backed up by the largest tuner manufacturer in the U.S.—SARKES TARZIAN, INC.

All tuners are cleaned inside and out, repaired, realigned and air tested.

TUNER REPLACEMENT

Replacement Tuner $9.75.

This price buys you a complete new tuner built specifically by SARKES TARZIAN INC. for this purpose.

The price is the same for every type of universal replacement tuner.

Specify heater type

Parallel 6.3V
Series 450 mA
Series 600 mA

All shafts have the same length of 12”.

Characteristics are:

Memory Fine Tuning
UHF Plug In
Universal Mounting
Hi-Gain Lo-Noise

If you prefer we'll customize this tuner for you. The price will be $18.25. Send in original tuner for comparison purposes to our office in INDIANAPOLIS, INDIANA.

TUNER SERVICE CORPORATION
FACTORY-SUPERVISED TUNER SERVICE

MIDWEST . . . . . . . . . . . 817 N. PENNSYLVANIA ST., Indianapolis, Indiana . . . . . TEL: 317-632-3493
(EHome Office)

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

... for more details circle 127 on Reader Service Card

JUNE 1971, ELECTRONIC TECHNICIAN/DEALER | 19
It takes time to replace a color picture tube...

GE ULTRACOLOR® works to cut back the need of replacing the replacement

sustained brightness and color purity are assured through use of advanced getter material. Gases generated by the tube's operation are removed, providing longer life and sustained color purity.

reliability and quality assurance are built in. Only the highest quality replacement components are used... and they're still expected to prove themselves. First during the manufacturing process, through continuing in-line inspections, and extensive life testing of the finished product, afterwards.

GE ULTRACOLOR™ picture tubes provide the service and dependability that guarantee customer satisfaction. *(Made by professionals, for professionals.)*

TUBE PRODUCTS DEPARTMENT - GENERAL ELECTRIC COMPANY
OWENSBORO, KENTUCKY 42301

GENERAL ELECTRIC
This month's cover, courtesy of Enterprise Development Corp., depicts removal of an IC from a Motorola Quasar circuit board with an ENDECO desoldering tool, Model 300. More details are provided in the article beginning on page 43.

TEKLAB REPORT
More information concerning what we encountered when examining Motorola's Quasar II—with Insta-Matic color tuning.

THE ART OF DESOLDERING
Helpful hints to assist you in removing circuit-board components by Ronald L. Kopernak.

NEW KINDS OF GROUND PROBLEMS
Whether positive, negative or somewhere in between, Norman Crowhurst's article will help you find that ground for effective solid-state servicing.

UNDERSTANDING TODAY'S CAPACITORS
The first in a new series on capacitors by Richard Marsh provides useful hints concerning electrolytic-capacitor replacement.

SEMI-TIPS
Introducing this series with a description of solid-state power rectifiers, Jack Jaques deals with basic semiconductor principles that must be understood for effective servicing.

GUEST AUTHOR: TV DEALERS CAN MINE THE HIGH-PROFIT ACCESSORY MARKET
Stephen Hennigan, vice-president of sales and marketing at GC Electronics, offers some helpful hints on how you can increase your revenue while the customer is waiting for your services.

TEST INSTRUMENT REPORT
Reviewing specifications for the RCA Type WR-508A Chro-Bar Generator.

COLORFAX: Tips for easier color-TV set repair.

TECHNICAL DIGEST: Hints and shortcuts for more effective servicing.

NEW PRODUCTS: Instruments and components to make your job easier.

DEALER SHOWCASE: These items may increase your sales revenue.

BOOK REVIEWS: Our appraisal of recent publications.

TECHNICAL LITERATURE: Informative material that you may need.

ADVERTISERS' INDEX: Manufacturers concerned about you.

READER SERVICE: A source of additional information.


POSTMASTER: Send form 3579 to ELECTRONIC TECHNICIAN/DEALER, P.O. Box 6016, Duluth, Minnesota 55802.
Many well prepared speeches were presented at the recent National Appliance and Radio-TV Dealers Association (NARDA) Convention in Chicago, concerning the projection of a better image to the customer, handling credit, community responsibility, salesmanship, and maintaining a proper working relationship between manufacturers, distributors and dealers. Valuable coverage was also given to service contracts and how they can increase your working capital.

Although each of these topics was well presented and provided information of merit to our industry, information gleaned from "off the cuff" comments also proved invaluable.

During the convention, it became apparent that many businesses in our field tend to remain in the family, their control eventually passing from father to son (or if not the business, then at least the skills). Many convention speakers—including C. W. Conn, Jr., president of NARDA—were introduced as being "the son of a dealer." And during one of the luncheons, I had the privilege of sitting next to a young gentleman who was also the son of a dealer. As we ate, he asked if I could supply some information concerning a problem that may be of vital significance to you. (Although he probably was not from your shop, I believe that too many of our readers will suspect that he was.)

Although Sam (not his real name) is a college graduate, his main aptitude was in business administration and the little college electronics that he took came hard. Sam did not claim to be an electronic technician, but relied on those hired to work in the shop.

The shop's head electronic technician is a very close friend of his father. They have worked together for a good many years. However, during the last few years the son has begun to fear that the technician has been taking advantage of his father's friendship. Sam has been observing that this man is quick to fix the easy jobs—like those requiring only a new tube—while he doesn't seem to do much of anything when the hard jobs come around. Those jobs just seem to sit—or at least until a young, part-time technician (who is employed during the day for an electronics manufacturer) can come in and "give them a going over."

As the conversation continued, it became apparent that this head technician is not really the "leech" that Sam seemed to think he was. This man is instead suffering from technical obsolescence. His skills are no longer matched to the job. As a faithful employee, during the past several years this man has on only a "handful of occasions" taken time off work to attend one-day training seminars.

This technician is in trouble. Although the father will probably be willing to keep him indefinitely on the payroll, I suspect that unless these conditions change, he will be fired once the son gains control of the company.

The situation described has reached a critical stage, just as it may have in your shop. But at least Sam now knows that no one is trying to take advantage of him and that this is a situation that can probably be rectified in a constructive manner.

It is extremely important that all electronic technicians—and if they don't work for themselves, the shop management as well—realize that a constant upgrading of technical competency is required (no matter how brilliant the technician) in order to keep up with the astonishingly rapid pace at which our technology is progressing. This must be the responsibility of both the shop—concerned with maintaining an adequate staff—and the technicians—concerned with maintaining their jobs. Despite busy schedules, time must be taken for this task—we simply can't afford to do otherwise.

There are many ways to maintain one's level of technical competency: ☐ If you are not familiar with a new semiconductor, purchase a few samples from your distributor and experiment with them. Breadboard them into working circuits similar to those encountered in the circuits serviced. Since these components are generally rather inexpensive, little is lost by burning a few out. ☐ Take time to read closely the technical material presented in your professional publications, such as ELECTRONIC TECHNICIAN/DEALER. Current electronic textbooks can also be of value. ☐ Attend seminars and training sessions offered by instrument and consumer product manufacturers. Study their literature. ☐ Attend refresher courses at local technical institutes or universities. ☐ Take an advanced correspondence school course.

Any combination of these activities will help keep you from becoming technically obsolete. There should be no need to fear the son of a dealer.
Now, your choice- 1 or 2 year warranty on all RCA color picture tubes

A big business builder for you with the industry's most complete line.

1. RCA offers an extended warranty, for a second year, on all Hi-Lite and Colorama color replacement tubes.

2. The second year is optional. You can still offer the customer RCA's one year warranty. Or for a modest extra charge there's a whole additional year of protection. It's your choice!

3. This extra protection will help you sell many customers on replacing the tube instead of the set.

4. It will keep them coming back to you for service on their TV sets and other equipment.

5. You can sell with extra confidence. There's added protection on the quality name picture tube line designed to enhance your professional reputation.

That's why the RCA extended warranty is your most powerful new sales tool for 1971! Get full details from your local RCA Distributor.

RCA | Electronic Components | Harrison, N.J. 07029
If your tuner spray doesn’t say “Non-Flammable” should you be using it?

The words “Non-Flammable” on the outside of your tuner spray, tell you a lot about the ingredients on the inside. Most obvious is that they will not support combustion and so are safe. Your customer’s property is protected . . . and so are you.

But the words “Non-Flammable” also have a hidden meaning. They tell you about the kind of ingredients inside the can.

For example, for cleaning and degreasing tuner contacts, Freon® has the best solvent, washing and degreasing action of any product, and is one of the finest propellants known for aerosols. Freon is also Non-Flammable.

For lubricating action Silicone is non-evaporating, inert, lasts almost indefinitely, will not gunk up contacts, and is one of the most efficient known. Silicone lubricant, too, is Non-Flammable.

That’s why Chemtronics uses these ingredients in its tuner sprays. They’re the very best. They’re also Non-Flammable, and Chemtronics says so right on the label. Non-Flammable. Think about it. Look for it.

*Trade name E. I. Dupont.

CHEMTRONICS INC.
1260 Ralph Avenue, Brooklyn, New York 11236

Serving the Industry

Today I received my April issue of your fine magazine, which I have enjoyed and profited from for so many years. Your articles in the past dealing with Business Management have been helpful. This is probably the area that most of us that were technicians and became business men need the most guidance in. Let’s have more like those you ran a few years back.

In regards to the request about Depth & Fish Finding: Yes . . . we would like to see service information on them, especially in-shop servicing, testing and calibration. Many are used here in “Sunny Florida.”

As chairman of the National Consumer Affairs Committee of the National Electronics Association (NEA), I would like to say that much has been done in behalf of the professional electronics technicians and the electronics service dealers by this NEA committee. For example: We have sent proposals to Mrs. Virginia Knauer about meaningless amplifier ratings. A recommendation to the FTC for a simple, plain warranty and guarantee has been made. And a complete list concerning the regulations of cable TV systems was made to the FCC for their consideration.

NEA has worked hard and diligently with the manufacturers of sets and parts, distributors, publishers, broadcast and factory representatives on behalf of the consumer and professional electronics technicians and service dealers—without much fan-fare or publicity.

Your magazine should plan to attend the NEA National Convention in Portland, Oregon, in July and meet the “Cream of the Crop” in technicians and dealers who want to serve the consumer and manufacturers with maximum efficiency and satisfaction.

CHARLES R. COUCH, JR., CET
Couch's Inc.

Thank you for the invitation to attend the July NEA convention in Portland. I hope to be able to see you and a great number of our other readers at that convention, Ed.
They're “market-engineered” to dominate color reception lead-in sales. Metro-Color™ for congested viewing areas. Maxi-Color™ for the suburban viewing market. Real sales grabbers. Created to bring home a better color picture . . . more profit for you. Colorful eye-stopping packages. Long warranties. Flexible, small size for easy installation. Competitive pricing. And a “Hot Line” display, too! That’s the program. Grab it while it’s hot. See your Belden DISTRIBUTOR today.

Belden Corporation, P. O. Box 5070-A, Chicago, Illinois 60680.

Metro-Color and Maxi-Color also available in bulk.

... new ideas for moving electrical energy

... for more details circle 102 on Reader Service Card
WinFabulous Free Gifts
selling up to JERROLD antennas & systems

Spectrum '71 is designed to focus your attention on the broad spectrum of JERROLD high profit "better reception" products. When you sell up to the best in antennas and Master Antenna TV systems, you earn more profit . . . plus fabulous free gifts.

Ask your distributor for details on Spectrum '71 or write Jerrold Electronics Corporation, Distributor Sales Division, 401 Walnut Street, Philadelphia, Pa. 19105.

READERS' AID
Space contributed to help serve the personal needs of you, our readers.

Needs Transformer
I have a Pyramid capacitor-resistor analyzer, Model CRA-1, in which the power transformer has burned out. Since this company is out of business, can anyone tell me where I can get a transformer?

LANDON'S ELECTRIC SHOP
Wayne, W. Va. 25570

Needs Service Aids
I am starting to accumulate "Walkie-Talkies" with various brand names. I would appreciate help in securing parts and service aids.

THOMAS E. DIXON
Harvard Appliance Repair
Box 454
Harvard, Neb. 68944

Needs Schematic
I have two VHF Hartman business radio telephones for 152.3MHz. If anyone has any information on where I can obtain schematics or service information, I will be glad to pay for making copies.

ART HORSTMIEER
Two Way Radio Sales
4387 No. West Avenue
Fresno, Calif. 93705

I have a Westrex TV Model 8-PIA that needs repairs and I need a schematic for it. Also I need a schematic and any other information available on a Dumont, Type 208-B oscilloscope. If anyone can supply me with the information for these instruments, I will pay for any expense incurred.

JIM BLAINE
978 Belgrave
Reno, Nev. 89502

I need a schematic and service information on the Bell 360 tape recorder. I will gladly pay for making the copy I need.

RUSSELL E. BLADING
1706 Walnut St.
Prospect Heights, Ill. 60070

I am in need of a schematic for a Philco color bar/dot generator, Model 7100.

J. W. BUNN
Kenoza Lake, N.Y. 12750
continued on page 31
GTE Sylvania has the lines that lay it on the line.

Only GTE Sylvania gives you a choice of three different price lines in color picture tubes.
And GTE Sylvania tells you and your customer exactly what you are getting in each line.
That makes Sylvania tubes easier to sell.
You can tell your customers the advantages of the top-line color bright 85° XR.
You can show them where the savings come from in the economy color screen 85 line. And you can tell them exactly what they're getting for their money in the middle-line color bright 85° RE.
The way we see it, if we lay it on the line with you, you can lay it on the line with your customers.
Instead of just handing them a line.

GTE SYLVANIA

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NEWS OF THE INDUSTRY

Annual Convention Plans Announced By National Electronic Associations

The National Electronic Associations, Inc., plans to hold its seventh annual convention at the Sheraton Motor Inn in Portland, Oregon, on July 12 through July 18.

During the early part of the week those attending the convention will be learning the business practices of others in the industry in a informal manner while at the same time taking part in family fun, deep sea fishing, bowling, golf tournament, Indian Bar-B-Que and sight seeing trips.

On July 15 and 16 a business management school will be held. Dr. Amo DeBernardis will open the session with "The Introduction to Business Management." John Sperry will cover "Shop Layout"; Roger Meyer, "The Law and the Service Company"; John Sperry, "Practical Financial Management"; and Jerry Canter, "The Why's and Wherefore's of Service Contracts." The Thursday luncheon will be held at the Portland Community College and there will be a trip through its Electronics Department.

For those interested in improving their local or state associations, workshop seminars will be held covering the following topics: "Membership Recruitment," "College of Convention Knowledge," "Association News Letter Editors," "Financing State and Local Associations," "Better Board Meeting Planning," and "Educational Meeting Planning."

The business meetings will be held on July 17 and 18.

Those wishing either to register or obtain more information may write: National Electronic Associations, Inc., 1309 West Market St., Indianapolis, Ind. 46222.

TV-Radio-Phonograph Sales Up in First Month of 1971

Distributor sales to dealers in all major consumer electronics areas were ahead in sales in January, 1971, over sales in the same month a year ago, the Electronic Industries Assn.'s Marketing Services Dept. reports.

Distributor sales of color-TV sets to dealers were up 7.5% during January, 1971, over January, 1970. B/W-TV sales in January, totaling 357,636 sets were 6.0% ahead of the 337,429 sets sold the same month last year. Total TV sales to dealers were up 6.8%; 767,007 in January, 1971, to 718,270 in January, 1970. Total radio sales to dealers were 1,354,967 units in January, 1971; up 4.8% over the 1,293,051 units sold in January, 1970. Total phonograph sales to dealers were up 23.9% in January, 1971, over the first month last year.

British Company Sells Two Out of Three Record Changers in Japan

At a time when some American and European manufacturers of home electronics are feeling the effects of the tremendous resurgence of Japanese exports, a British company is said to be selling two out of every three record changers used in Japan. That company is BSR.

"The Japanese hi-fi industry has become a dominant factor in competitively priced quality stereo components," said John Hollands, vice-president and general manager of BSR (USA) Ltd., sole U.S. distributor for British-based BSR.

no other heat gun... offers all these attachments!

Attachments to speed your job... attachments that tailor Master heat gun airflow precisely to your needs... attachments that fit any existing Master flameless heat gun. No other line offers so many choices... including the exclusive patented cone for 1/4" concentrated heat, optional adjustable base, convenient carrying case, and the most complete line of U.L. listed guns available.

Send for free 12 page catalog.

MASTER HEAT GUNS
Racine, WI 53403

for more details circle 119 on Reader Service Card
If your problem is in-circuit testing of transistorized and integrated circuits... Solve it with Triplett's 601

It has 7 low-power resistance ranges that apply only 75 mV to the device under test... does not activate or damage solid-state component... full-scale DC measurements down to 100 mV and 10 µA and AC as low as 10 mV and 10 µA, it's obvious the Model 601 was designed for in-circuit testing.

Add such features as 10 megohm input impedance on AC and 11 megohm input resistance on DC, voltage readings to 2% DC and 3% AC (current: 3% DC and 4% AC), separate range-selection and function-selection switches, and a simplified dial on which all 53 ranges are read on only 4 scales, and it's equally obvious that here's a V-O-M that has what you need to do the job better, faster and more easily.

See the capable Model 601 — priced at $166 — at your local Triplett distributor. For more information, or for a free demonstration, call him or your Triplett sales representative right away.

Triplett Corporation, Bluffton, Ohio 45817.

1. Low power ohms — 7 ranges with 75 mV power source.
2. High sensitivity — 10 mV AC full scale at 10 megohm input impedance; 100 mV DC at 11 megohm input resistance.
3. Simplified scale — only 4 arcs for all 53 ranges.
“We’ve set up our own cross reference system in the Yellow Pages.”

“I have three businesses; selling Appliances, repairing Appliances and Electrical Contracting. The way I’ve listed myself under various headings, I get customers interested in any one of my three businesses,” explains Mr. Worth Warne, owner of Warne Appliance and Electric Service, Seattle, Washington. “I’ve been advertising in the Yellow Pages since about 1938. I personally go to the Yellow Pages when I need something, and I feel other people must do the same thing. It’s quick, it’s easy, items are listed alphabetically, and I can almost always find what I want. The Yellow Pages is one of the best attention getters in town, and it keeps old and new business coming through the doors.”

Let the Yellow Pages do your talking. People will listen.

An effective way to build business.
I am in need of a schematic for a Swimming Pool Monitor-Alarm, Model 400-A, made by Sonus Corp. Assistance from anyone would be greatly appreciated.

J. T. Combs
2602 Larwood Drive
Charleston, W. Va. 25302

I need a schematic for a Sonarettc depth finder which was made by the General Electronic Control Inc.

Ernest Huettmann
Box 5
Wisner, Nebr. 68791

Needs Manuals and Schematics

I need the manuals and schematics for the following instruments: Baird Associates, Transistor Test Set, Model GP; Solar EXAM-ETER; and General Radio Co., Twin-T Impedance Measuring Circuit.

William Misiek
405 Royalton Road
Silver Spring, Md. 20901

I am in need of a schematic and parts manual for a Lowery Organ, Model 07, installed in a Story and Clark Piano. I would purchase a photo copy or purchase the schematic.

Russell H. Mayes
R.D. #1
Hornell, N.Y. 14843

Needs Manual

I need a service manual with a schematic or just a schematic for a Precise Development Corp. scope, Model 300, Serial No. 3135.

Lee V. McKinis, Jr.
P.O. Box 1225
Bloomington, Ind. 47401

For Sale

I have for sale the following: John F. Riders Television Manuals, Perpetual Trouble Shooters Manuals, and Sam's Photo-Fact Folders.

J. E. Herman
Rt. L, Box 929
Sequim, Wa. 98382

I have for sale a CRT Picture Tube Rebuilding Machine which has been used one year.

Fred R. Fountain
211 Forrest Avenue
Valdosta, Ga. 31601

Performing like the big ones
Costs only $75*

- Provides color bar, dot, cross hatch, and blank raster patterns
- All solid state circuitry including ICs
- Pattern signals, RF output frequency and color subcarrier all crystal-controlled
- Battery operated, AC adapter available
- Lightweight — less than 20 oz., only 61/2" wide x 4" deep x 3" high

For all the technical specs get in touch with your RCA Distributor. RCA | Electronic Components | Harrison, N.J. 07029.

* Optional User Price
NEW AND NOTEWORTHY

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

SOLDER VACUUM 700
Cleans itself automatically when reloaded with replaceable tip

A self-contained vacuum tool is designed for desoldering of components on printed-circuit boards or terminal strips. This tool reportedly features a captive plunger-rod which, after loading, remains in the same position when the tool is fired, preventing eye injury. In operation the solder is first melted, then the suction tip of the tool is placed in contact with the molten puddle and the trigger button is pressed. Because of a very high onset of vacuum, all the solder is said to be sucked up. Specifications indicate that the tool is operated with one hand and cleans itself automatically when reloaded. Price $10. Conseil.

TELEPHONE ANSWERING SYSTEM 701
Automatically answers unattended telephone

An automatic telephone answering system, the Ansafone, Model 540, is designed to use tape cassettes to automatically answer an unattended telephone, play a prerecorded message to the caller and record callers' messages. Specifications indicate that four announcement cassettes are available with varying length of cycle times: 45, 60, 90 and 120 sec. These cassettes may easily be transcribed using a standard cassette transcriber. Price $275. Dictaphone.

FOR MORE NEW PRODUCTS SEE PAGE 60

DIGITAL MULTIMETER 702
Low cost with 21 switch selectable ranges

A solid-state three-digit multimeter is designed with 21 switch selectable ranges—eight ac voltage and current ranges, eight dc voltage and current ranges, and five resistance ranges. Specifications indicate the unit measures 10mV and 10μA steps on the lowest voltage and current ranges. Other features reportedly include linear readings, accuracy of 1% with a 10% over-range on all scales and a non-blinking panel display. The unit measures 5¼ in. H by 6½ in. W by 2½ in. D and weighs 2½ lb. Price $195.50. Esterline Angus.
Replacing a 23EG CRT used to be a tearful experience, what with the trouble in finding one, paying through the nose for it...and then going through all the grief of installing it. Many tears have been shed in the name of the 23EG!

Well, Channel Master is taking care of the problem with our new 25EGP22. For Motorola chassis models 908 and 914 we've got a high quality, rare earth phosphor replacement picture tube in our 2 year warranty Color-Lux line.

They all come with preassembled hardware and harnesses for easy front end mounting...and they go for under 90 bucks.

Now, with all the color sets out there just crying for a new 23EG, here's your chance to dry a lot of tears...and land a lot of service business with the Channel Master 25EG series!
An Extraordinary Offer

to introduce you to the benefits of Membership in
ELECTRONICS BOOK CLUB
for a limited time only you can obtain
ANY 3... yours for only 99¢ each

May we send you your choice of any three books on the facing page, part of an unusual offer of a Trial Membership in Electronics Book Club?

Here are quality hardbound volumes, each especially designed to help you increase your know-how, expand your knowledge, and enjoyment of electronics.

These handsome, hardbound books are indicative of the many other fine offerings made to Members... important books to read and keep... volumes with your specialized interests in mind.

Whatever your interest in electronics—radio and TV servicing, audio and hi-fi, industrial electronics, communications, engineering—you will find that Electronics Book Club will help you.

With the Club providing you with top-quality books, you may broaden your knowledge and skills to build your income and increase your understanding of electronics, too.

How You Profit From Club Membership

This special offer is just a sample of the help and generous savings the Club offers you. For here is a Club devoted exclusively to seeking out only those titles of direct interest to you. Membership in the Club offers you several advantages.

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TEKLAB REPORT

By pushing a button, a solid-state switch goes into action, controlling the color demodulators for better flesh tones; and the automatic color circuit monitors the chroma signal keeping it at a predetermined level.

Motorola's Insta-Matic Color TV Tuning

by Joseph Zauhar

As we view our color TV receivers, we sometimes find variations in the channels or stations, and they often need color adjustments for a natural looking color picture.

The TV stations monitor the programs and give considerable attention to correcting color variations, but we still find some differences of color quality from local to network and between tape, film and camera programs. We also find changes of color in transmission paths and antenna systems which vary with the location of the TV set.

A great deal of work already has been done, but until we come up with a standard constant signal, we need a method to compensate for signal differences. TV manufacturers have come up with new circuits to satisfactorily correct for signal variations and simplifying the customer color controls.

continued on next page

Fig. 1—The front control panel showing the customer controls and the Insta-Matic switch.
Insta-Matic color tuning is Motorola's latest circuit to achieve a more uniform color picture. To satisfy our curiosity concerning this circuitry, we obtained a Quasar II, Model WP563GWA, employing the TS-929 chassis with Insta-Matic color tuning. The new circuit proved to be different from the automatic color circuits reviewed in the past.

By pushing a button on the front panel, the preset circuitry is activated. The circuit shifts the picture background toward red, increasing the color demodulator phase angle and controlling color intensity.

We found this circuit capable of producing an acceptable color picture automatically on all channels without manual adjustments of the front panel controls (HUE, INTENSITY, CONTRAST and BRIGHTNESS).

A green light, located on the front panel of the TV set (Fig. 1), glows when the Insta-Matic color tuning feature is activated. Should the owner desire a manual setting, he can push the Insta-Matic color tuning button to the OFF position and manually adjust the picture as desired.

The new circuitry is located on the Insta-Matic color preset panel "PA," as shown in Fig. 2. This circuit has been mounted "piggy back" (and connected by a plug and eight wires) on the top of the "SA" color panel in TV sets that feature the automatic circuit.

In other Motorola TV sets the two panels are integrated, the combined panel being designated "CA." This second version of the circuitry (Fig. 3) eliminates the need for the "piggy back" section, because an additional IC condenses the circuitry, providing sufficient space for all of the circuits. These panels are coded CA-50 and up.

The CA panel is essentially an SA panel, so it may be used in a set without Insta-Matic tuning. However, the Insta-Matic circuits on the panel will be inoperative and cannot improve the performance of the set over an SA panel. The reverse is not true—an SA panel cannot be substituted for a CA panel. Although the Insta-Matic set would operate normally on manual, you would not have color on Insta-Matic. It is recommended that only
CA panels be carried in your panel caddy and used as a CA or SA substitute.

On this particular chassis, the preset controls are located on top of the chassis frame (Fig. 4). Holes in back cover permit adjustments without dismantling the TV receiver. The contrast and hue controls are duplicates of the front panel controls. However, the manual brightness control has a 1K value while the preset brightness control has a 5K resistance, and the manual intensity control has a 5K resistance while the preset intensity control has a 750Ω resistance—this latter control also being associated with an automatic intensity circuit.

The complete schematic for the Motorola TS-929 chassis can be found in this month’s TEKFAX schematic No. 1363.

Hue and Tint (Background Circuit)

The solid-state switch shown in Fig. 5 operates as an “AND GATE.” If both switches are closed, one end of the 33pf capacitor and one end of the 22K resistance are grounded, and two separate actions take place:

The demodulation system is altered to favor flesh tones, by placing the 33pf capacitor in parallel with the phase-shifting capacitor in the color oscillator input to the blue demodulator. Any flesh tone error in the station or program material is reduced to a minimum and the color programs now have acceptable flesh tones.

By placing the 22K resistor in parallel with the red video transistor’s emitter resistor, it increases transistor conduction. This lowers the red video transistor’s collector voltage and the CRT red gun cathode voltage, resulting in a warmer background color.

The solid-state switch employs two transistors, Q3 and Q4, as shown in Fig. 6. When the Insta-Matic circuit is switched to manual operation, Q3 is biased off with its base grounded and the switch is open.

When the circuit is in automatic operation (switched left), the bias from the 20v supply turns Q3 on, causing the transistor to go into saturation and effectively shorting the collector to the emitter.

If color sync is present at the same time, color killer transistor Q11 conducts and a positive voltage appears at the upper end of the resistor R67. Transistor Q4 is then biased into saturation and the collector of Q3 is grounded through both transistors. Phase shifting capacitor C4 is then in parallel with capacitor C41, and resistor R4 is in parallel with resistor R90. The phase angle of the blue demodulator...
has now shifted and the CRT red gun voltage is increased as desired.

If there is no color sync present, or if the Insta-Matic switch is off, the solid-state "AND" gate cannot operate without conduction and the flesh tone (or hue) and dc background are unchanged.

**Automatic Intensity Circuit**

Two independent automatic gain controls for the color IF signal are shown in the block diagram (Fig. 7). The first, the ever-present ACC signal, is applied to the first stage and acts to maintain a constant signal level with color sync changes.

A second gain-control circuit is activated in the second color IF stage, when placed in Insta-Matic operation. A second IF total chroma output signal is applied to a two-stage amplifier and rectified to a negative-going dc voltage. This voltage is applied as the second color IF transistor bias control and maintains a constant chroma level. With gain control for changes of either color sync or chroma level, the intensity stays constant for all input signals.

The bias control circuit for the second color IF stage is shown in Fig. 8. The chroma output sample is applied to a conventional two-stage amplifier and the output is then rectified in a double-diode circuit to provide a negative dc voltage, which represents the chroma level.

At point A, negative dc voltage is applied through a zener diode to the color IF amplifier base-bias circuit. Although the upper end of the zener is positive, and the transistor base is forward biased by the color killer circuit, any increases in the output level of the color IF will increase the negative voltage at point A, which in turn will cause a corresponding change at point B. This lowers the transistor's forward bias and maintains a constant output level.

The basic zener diode circuit shown in Fig. 9 consists of a resistor, a zener diode and a variable series voltage supply. Regardless of the changing voltage, the 12v biases the diode in its zener mode and its voltage remains a constant 6v.

Assume the variable voltage is 0v and point A is at ground potential while point B is +6v above ground. As the variable voltage is made negative, point A becomes negative and point B less positive. The change at B is the same as that at A—except that B is 6v more positive due to the constant 6v across the zener.

The Insta-Matic switch connects the base of the second color IF stage to the operator's intensity control during the manual operation and the automatic circuit becomes inactive.

During Insta-Matic operation, the color IF amplifier bias is switched to the automatic circuit as shown in Fig. 10. The bias is then supplied from the color killer through resistor R8. However, this bias also depends on, and is varied by, the negative voltage of the doubler output capacitor (C5). The emitter and base of Q5 are now connected as a zener diode. Transistor Q1 and Q2 are the two amplifiers, and the intensity is now determined by a control at the emitter of Q2. This determines the amplifier gain, the voltage of C5 and the bias of the color IF. Capacitor C1 (0.001) couples the second color IF output to the input of the first control amplifier.

Next month we will cover field readjustment, troubleshooting the Insta-Matic circuits and what happens to the various circuit voltages when placed in automatic tuning.
The Art of Desoldering

by Ronald L. Kopernak

Today's skilled electronic technician can quickly remove even the most delicate components from printed-circuit boards without damaging either the parts or the boards.

Probably every electronic technician has labored to remove a soldered component by heating and pulling or by cutting, then cleaning with a metal pick or wire brush. The results have been largely disastrous. Excessive heat damages printed-circuit boards and components during this awkward and time-wasting process.

Some recent breakthroughs include "bar" and "braid" desoldering. (A bar is simply a specially designed soldering tip that can melt solder on several connections simultaneously.) This frees the solder bond as long as the heat is present, and thus enables the component to be lifted out. The bar method has proven its worth in certain industrial situations, but is generally too expensive and likely to cause heat damage or contamination to be a practical method for most technicians.

In most cases, braid desoldering is much better. Tinned copper shield braid wire is dipped in flux and pressed against a connection. When heat is applied, melted solder is drawn to the braid by capillary action. This technique is especially good for the amateur or hobbyist, who encounters few desoldering problems. But the technician may find serious complications again resulting from heat damage, time lost or having to use both hands. (Occasionally the braid will adhere to the printed circuit, damaging the board.)

The introduction of vacuum has finally made desoldering a reliable technique. One of the first applications of vacuum was the use of a rubber bulb with a short teflon tube to suck melted solder from a connection. This relatively inefficient method led to the development of the vacuum desoldering iron. This one-hand tool is readily available on the market and is capable of quickly and safely removing solder from heretofore difficult, if not impossible problem situations (Fig. 1).

Since successful desoldering requires a basic understanding of soldering, let us quickly review basic soldering techniques.

The Art of Soldering

Good soldering requires cleanliness. Tips should be well tinned (most are pre-tinned by manufacturers) and kept free of contamination by wiping with a moistened sponge.

Connections must also be cleaned prior to soldering. This, of course, is the purpose of the flux present in rosin-core solders. When these solders are heated, flux flows ahead of the solder, cleaning the metal so that the solder can effectively alloy with the connection. Modern fluxes are only active in the presence of heat, but prolonged exposure to heat may cause burning. Therefore, solder is never applied to an iron tip and allowed to flow from the tip to the connection. Such a procedure risks the probability that the flux will burn up before it can travel to the connection to perform its cleaning function. Failures of flux, caused by the improper use of heat (usually not enough), are the biggest source of "cold solder" problems.

Solder and heat should be applied simultaneously to the same portion of the connection (Fig. 2). Flux will then immediately begin cleaning both the tip and connection, allowing solder to flow freely and thereby creating a very efficient heat transfer from the iron to the connection. (Good heat transfer is crucial—dirty or oxidized surfaces will not allow maximum transfer.)

It is very important to remove the iron or heat source at the proper time. Too little heat (usually resulting from a dirty tip or poor heat transfer) may result in the flux failing to clean properly. Too much heat, or prolonged heat, can burn the flux and cause contamination. Both result in poor solder joints.

Generally, the iron should be removed as soon as the solder flows around the connection. The key is in watching. When the active flowing reaches the entire connection, the flux will retrace the solder, giving it a very bright mirror-like appearance. At this instant the iron should be removed.

We exclusively recommend the use of rosin core solders having a 60 percent tin to 40 percent lead or 63/37 composition. This composition (eutectic) eliminates the plastic.
stage—allowing the solder to immediately change from a solid to a liquid. Eutectic solder thus eliminates the possibility of cold joints forming during a plastic stage. Most authorities recommend heating soldering-iron tips to between 510° and 750°F when using eutectic solders.

Damage caused to heat-sensitive components and printed-circuit boards has long been the primary problem encountered in desoldering. Like soldering, artful desoldering requires careful attention to the previously mentioned factors—including a clean tip, good heat transfer and timely removal of the iron.

**How to Desolder**

Once again, the secret is in careful observation. Your eyes will tell you when and where to act.

Let's illustrate the basic desoldering technique with reference to a simple soldered connection. (We are using an ENDECO Model 300 Desoldering/Resoldering unit—Fig. 3. This unit features one-hand operation, the required desoldering temperature—about 700°F—and tips of various sizes which are plated for good wetting.)

After the iron has been heated and tinned, the bulb is depressed by either index finger or thumb. The tip is then placed over the lead to be desoldered (the objective is to obtain maximum surface contact between the hollow tip and the solder—Fig. 4). As soon as the solder liquefies or flows, the bulb is released—creating a vacuum which actually picks up the melted solder. The iron must be removed while the vacuum is still in effect.

Some situations may require a longer vacuum duration. That duration can be easily regulated by simply controlling the release of the bulb with one’s finger or thumb. A slower release, of course, provides a longer vacuum duration.

Timely iron removal is crucial. If the tip remains on the connection after the vacuum has ceased, gravity (the primary factor) and capillary action will tend to cause some solder to remain when the iron is removed—this solder naturally being found where you want it least.

**Cold Solder Problems**

As had been previously indicated, “cold” solder joints are the results of either too much or too little heat, including problems caused by poor heat transfers. Generally, when desoldering cold solder joints, at least one of three situations are encountered:

- Poor heat transfer has never allowed the flux to clean the connection so that solder could effectively alloy.
- Good heat transfer has been extended to the point that the flux has been burned and has formed an oxide or carbon contamination.
- Occasionally a connection will be so dirty that the flux is unable to flow properly.

In desoldering cold solder fillets, one should first attempt the standard desoldering technique just described—being careful to get the best heat transfer possible and promptly removing the iron. If this fails to remove all the solder, then fresh rosin-core solder should be applied to the connection. The addition of new flux will permit the solder to flow again and thus facilitate vacuum removal.

**Choosing the Best Tip**

Whenever a vacuum is required, some attention is usually given to the problem of forming a vacuum seal. The better this seal, the better the desoldering.

The most important factors here are tip plating and tip orifice size (assuming adequate temperature). Tips should be plated with a metal that wets with solder (nickel, silver and iron are all very efficient). Of course, strategic tip placement is also important and closely related to tip orifice size. Generally, the inside diameter of the tip should be just large enough to permit placing it over a lead (we consider a 0.063-in. inside-diameter tip standard—Fig. 5).

However, in the case of very large leads or terminals, a smaller tip is preferred for more efficient use of the vacuum. This method usually requires two or three removals from various sides of the connection in what we call a “mopping action” (Fig. 6). Careful regulation of the vacuum (with finger or thumb) will continued on page 51.
New Kinds of Ground Problems

by Norman Crowhurst

Those familiar with traditional tube amplifiers encounter something entirely different when checking semiconductor amplifier grounds.

It seems like quite a long time ago since some of us have serviced traditional tube circuits, but many of these audio amplifiers are still around and encountered more frequently by some technicians than the rest of us. For these amplifiers, ground was always predictable—the negative side of the high-voltage supply. In a good tube amplifier the chassis ground would generally be connected at the signal input while the negative output of the power supply was connected to the opposite end of the ground bus—by the output stage (Fig. 1).

But semiconductors have changed all of this simplicity so that ground arrangements are far less predictable. In fact, in some circuits what you would call ground may be difficult to identify since it would depend on whether you happen to be thinking of dc ground or signal ground.

Then in some transistorized amplifiers, audio output circuits further complicate matters by containing a ground which is connected to neither the positive or negative power-supply output. The usual way of achieving this is with a balanced power supply, with separate rectifiers and filter capacitors (Fig. 2). Usually this is all balanced up neatly so that both halves of the power supply are equal in voltage and the output stage works quite symmetrically. However, failure in this equality between “halves” can cause trouble. If the two halves are supposed to contain equal voltages but do not, this is probably the result of something happening to the load on one side, due to a fault that has caused the imbalance.

This could result from either of two conditions—an excessive load across the “half” that is low in voltage, or some of the load having “fallen off” the portion of the circuit containing the higher voltage. If the load has fallen off, some of the components have probably “blown,” opening the circuit and resulting in signal failure or severe signal loss with very high distortion.

If the imbalance is due to an excessive load across the other half of the circuit, this may also be due to a circuit fault, but it may not immediately result in circuit failure. One half of the output stage (the half containing the low voltage) may have too high a static or quiescent current due to a change in component values, a failure of a quiescent stabilizing current (such as that flowing through a diode) or some failure of a similar nature (Fig. 2).

So far we have not considered the ground connection in transistor circuits as such. The fact that the ground is positive, negative or somewhere in between—from a voltage measuring point of view—and that voltages may deviate to indicate a fault in the power section is one thing. What can happen to ground connections themselves is something else again.

“Front ends”—preamplifier sections, tuners, IF sections, etc., usually operate with single-polarity power supplies—the other side being grounded. But there are different ways of operating transistors using power supplies with alternative polarities, unlike the simple, familiar, universal way that could be relied upon in tube circuits.

There are two transistor polarities (NPN and PNP transistors) and two polarities from a power supply. And the two pairs can be used in several combinations, yielding four possible combinations of ground connections (Fig. 3).

In most instances failure results because the dc supply to part of the circuit is broken and thus that part of the circuit ceases to operate. So you get your voltmeter to check things out.

Maybe, for example, you find a transistor that shows the same voltage at its collector as at the supply point from which it draws current (or should be doing so) through a resistor, indicating that there is no voltage drop in the collector resistor, and causing you to deduce that there is no collector current (Fig. 4). Perhaps you also find a similar volt-
age on the transistor’s base and are inclined to deduce that the transistor is “shot.”

But as a double check, because you hesitate to unsolder a transistor without being sure that it is bad, you switch off the amplifier and check the transistor in place. Then upon checking it with an ohmmeter or an in-circuit transistor checker you find that the transistor is okay. Perhaps, when making voltage checks, you failed to note that the emitter also had the same voltage reading as the collector and base.

Fig. 2—Typical output stage in a transistor amplifier using a split supply voltage. If the two voltages are not equal, this may indicate that a fault has developed in the circuit.

Fig. 3—Four basic grounding configurations in “front end” transistor amplifiers. The circuits shown represent resistance-coupled audio stages.
That was the mistake, because it was not grounded—not any more! The ground bus was blown. That is the kind of thing that can be "a Tough Dog," until you become aware of the possibility. When anything strange happens, like this, it is a good idea to check the ground bus.

Clip one side of your voltmeter to the power supply lead that is connected to the ground bus and probe points along the bus (which you can follow visually on an etched circuit board, Fig. 5) to make certain that the same voltage (0v) reaches all of them. As a double check, an ohmmeter can be used between the same connections while the power supply is off.

If you suddenly get a voltage that should not be there, or cease to get continuity, the ground bus has blown. You can find out where by using the same techniques in checking.

This is fine, once you have determined which side is ground, how the transistors are wired and their polarity (NPN or PNP transistors). What can sometimes complicate matters a little more is a composite circuit in which opposite sides of the power supply are used as "ground" for different sections of the circuit being tested.

Why would a designer do this? It is a good trick to provide separate grounds for the individual sections, thus easing decoupling problems. More than this, the engineer can get a bonus in the switching (function selection) circuits. For example, if the phonograph preamplifier uses a positive ground while the tuner uses a negative ground, switching can merely transfer a common point (an interconnected, but voltage switchable "ground") from one side of the voltage supply to the other, thus deactivating one unit and activating the other, with only one simple changeover set of contacts (Fig. 6).

But with this kind of circuit, even more things can happen to your multiplicity of ground busses. Either one of them can "blow," and the voltages can go even crazier when you change the position of the function switch. The trick, once again, is to know what is supposed to happen and then deduct why it does not; and why the crazy, different things you observe happen.

When you have tracked down the break in the circuit, whether of the simpler or more complicated variety, it is a very good idea to spend a little more time trying to find out why it blew, preferably before you repair or replace the defective connection or circuit board. Failure to do this can prove expensive since the same thing may then happen again.

The cause may be a faulty shield connection, or a ground that goes to an unprotected or inadequately protected point in the circuit. In the older tube circuits, such a fault would usually have been easy to "smell out"—literally—since a short in the high-voltage supply caused some burning, which left a characteristic odor and the visual charring of some component. But in the lower-voltage transistor circuits, a temporary or unwanted ground may not even result in visual charring, much less smell!

This calls for careful continuity testing with an ohmmeter, along with some deduction based on where the ground bus blew, which will tell something about where the excess current continued on page 66
Understanding Today’s Capacitors

by Richard Marsh

There are as many types of capacitors in use today as there are varieties of food on the shelf in the grocery store. Each one of these types was designed for a particular purpose and to perform under certain demanding conditions.

Today’s electronic technicians are faced with a parts availability problem that is unprecedented in the industry. Many of these problems are aggravated by the task of servicing electronic products manufactured off shore—the replacement parts either differing from those produced domestically or unavailable from foreign sources.

A better understanding of the components used in electronic equipment makes it possible for technicians to substitute standard, readily available parts for those that would normally be difficult to procure. Although some modern electronic consumer products require precise and carefully selected replacement parts, this is not true in many applications—particularly in the field of capacitor replacement.

Two Families of Capacitors

There are two distinct families of capacitors. They can be divided easily and identified as either electrolytic or electrostatic. It is most important that the technician realize the basic difference in both the construction and application of these two types of capacitors.

I often compare the two types of capacitors to the two basic types of batteries. There are storage batteries and dry batteries—not that capacitors function in this manner, but the means of classifying are similar.

The author is marketing manager of Cornell Dubilier Electronics.

Electrolytic Capacitors

A very thin film of aluminum oxide is formed on the surface of an aluminum anode, where it functions as a dielectric in most electrolytic capacitors. This dielectric is much thinner than any man-made dielectric. By etching or roughing the surface of the anode, the contact area (or dielectric surface) can be multiplied many times. The thickness of the dielectric depends on the voltage at which it was formed. (Contrary to many beliefs, the dielectric will not change if operated at a lower voltage.) An aluminum cathode is employed to make contact with the electrolyte and can either be the container of the capacitor or more often another aluminum foil somewhat like the anode.

The modern electrolytic capacitor is manufactured by employing two thin strips of aluminum, separated by absorbent papers saturated with electrolyte. The anode is pre-etched and preformed. This laminated strip is rolled into the form of a tube and placed in a container. Preformed aluminum tabs are attached to the aluminum strips and brought out to either wire leads or solder lugs.

Two popular types of electrolytic capacitors are the tubular axial lead or tubular single-end printed-circuit types, and the very familiar twist prong “can” employing one or more sections sharing a common cathode. It is important that the container of the capacitor be sealed from the air to prevent evaporation or leakage of the electrolyte. The best method employs an aluminum can and hermetic sealing. Other methods—such as cardboard sleeves with wax-filled ends, plastic, and dipping processes—have been somewhat successful, but are not as reliable as the aluminum can.

The maximum practical voltage limit for electrolytics is 450v. However, by special processes and careful selection of materials, capacitors rated at 475v, 500v and as high as 525v have been manufactured. The maximum operating temperature must be reduced from 85°C (185°F) to 65°C (149°F) for these higher voltages. (It is helpful to know that a capacitor rated above 450v at 150°F can be operated at 185°F when used at 450v or less.)

Standard electrolytic capacitors are polarized, due to the fact that the formation of the oxide dielectric film is not reversible. In the event that an electrolytic capacitor is incorrectly installed and exposed to a reversed polarity, a new cathode will attempt to form. The capacitor will then experience an immediate and often disastrous temperature rise—causing the safety vents to blow, permanently damaging the component, and often other adjacent circuitry.

The shelf life of modern aluminum-cased electrolytic capacitors is extremely long, as compared to electrolytics manufactured many years ago. And the stabilities of the electrolyte and purity of the aluminum used prevent them from deforming to lower voltage ratings when either idle or operating at voltages.
lower than those specified for the capacitor.

**Capacitor Tolerances**

Some of the most misunderstood facts about electrolytic capacitors concern their tolerances. Due to the electro-chemical processes used in manufacturing electrolytic capacitors—coupled with the variation in yield of the etch—it is almost impossible to build an electrolytic capacitor close to its intended capacitance. Fortunately, the circuits designed to use electrolytic capacitors will generally tolerate at least 50 percent excess capacitance and in many cases several hundred percent.

As an example: A circuit designed to use a 60µf capacitor could easily accept a 100µf to 120µf capacitor—usually even much greater values. It makes little difference to a filter circuit how great the capacitance is, as long as it is a sufficient amount. It is never recommended to substitute a capacitor having lower rated capacitance.

The rated voltage of an electrolytic capacitor, like that of most other capacitors, should never be exceeded. If the original capacitor was rated at 450v, then a capacitor rated at 475v or 500v will be acceptable, while capacitors rated at only 350v or 400v would not be satisfactory. When the applied voltage exceeds the capacitor rating, there is a dramatic increase in leakage current and the capacitor’s life will either be drastically shortened or immediately terminated.

A rule of thumb in replacing electrolytic capacitors is to use one with a capacitance rating at least as high as the old one and a voltage rating at least as high as before. Many electronic technicians spend needless time and suffer undue frustration—costing untold dollars and customer dissatisfaction—by seeking a so-called “exact” replacement electrolytic capacitor. The original electrolytic capacitor was not exactly what was said on the label in the first place.

I have personally checked thousands of electrolytic capacitors in original equipment and so-called “exact” replacement electrolytic capacitors, and have found them to measure up to 300 percent over their labeled capacitance.

In one instance I did some checking concerning a specific 160µf, 250v electrolytic capacitor used as an original part in a color-TV set produced by a reputable manufacturer. Its capacitance was actually measured on a capacity meter as being 450µf. Many others in this same group were found to measure between 250µf and 375µf, plus even some higher values. This in no way affected their performance or the performance of the TV set. And capacitors having these higher values will last longer and provide good or better service.

There are as many as 25,000 different twist-prong type electrolytic capacitors in use today, representing an almost unsurmountable replacement dilemma for the electronic technician. Since most of these are multi-section types, this even further complicates the problem. In most all cases the diameters are either 1 in. or 1 ½ in., while the lengths vary anywhere from 1½ in. to as much as 5½ in. A capacitor of greater physical length can always be substituted if room permits.

**EIA Specifications**

Some manufacturers of replacement electrolytic capacitors have adopted a “wide range” labeling system for their products. This employs the application of the EIA tolerance to a suggested range of use for the capacitor. (As an example, a capacitor that was designed and produced as a 100µf 350v component could be labeled 60 to 100µf, up to 350v.) If the capacitor was actually measured, it would in almost all cases be at least 100µf and could be as much as 200µf.

The manufacturers that use this system do so on the conservative side, and you are always getting a capacitor that is at least the maximum rating shown on the label. By employing this system, it is possible to replace many capacitors with only one. This drastically reduces inventories and makes available many more possible replacements that would normally be considered special.

Cross-references and indexes have been produced showing original part numbers and recommended replacements, as well as descriptions and recommended replacements. This makes the process of choosing a wide-range capacitor extremely simple.

Remember that a wide-range electrolytic capacitor is just as good or better than the original component. The label on the original electrolytic capacitor merely means that the circuit was designed to require at least that much capacity.

**Common Misconceptions**

At this point I would like to mention a few of the comments that I have received from some electronic technicians concerning the substitution of electrolytic capacitors:

One common belief is that the input filter circuit will experience an increase in voltage if a higher value capacity is used. However, the purpose of the filter capacitor is to smooth out the ripple. There is nothing you can do by increasing the capacity to cause it to go higher than the peak ac voltage.

In many instances, when a new capacitor is substituted for a weak or defective one, the voltage will increase to its specified value. The capacitor did raise the voltage, but only to the proper value.

Some think that the substitution of a higher capacity will increase the leakage. But a new capacitor, even of higher capacity, will have less leakage than an old one “on its last legs.” With the exception of some coupling circuits, this is not an important factor.

Others complain that the substitution of higher capacities in certain coupling circuits has caused them to operate improperly. This is possible in rare instances, where the inductance of the capacitor has increased because of the larger size and more layers of electrolyte. With new processes, employing hard aluminum foils, it is possible to reduce the size of the capacitor for the same value to such a fraction of the old one that this is no longer a factor.

The misunderstanding about electrolytic capacitors deforming at lower voltages or when on the shelf stems from the fact that until 10 or 15 years ago capacitors were manufactured with those characteristics. Continued on page 67.
Introducing a new series of articles written to promote a better understanding of the most common types of semiconductors in use today

Each article in this series will attempt to "clear the smoke" on some of the most common problems encountered with one specific type of semiconductor. And this introductory Semi-Tip deals specifically with power rectifiers—not including what is termed small-signal diodes, such as RF mixers, detectors, etc.

The phenomenon of rectification is based on the physics and chemistry related to the junction of dissimilar conductors, or in this case, semiconductors. The basic theory states that when two dissimilar conductors are joined together to form a junction, that conduction through this junction will be greater in one direction than in the other. The first junctions of this type to receive much actual attention consisted of copper and cuprous oxide, but due to high cost their use was limited almost totally to industrial applications. The next rectifier, one that really saw broad applications, was the so-called selenium rectifier. They were first constructed of selenium and later of selenium/iron and later of selenium/aluminum. These devices are called polycrystalline, because they are actually formed by millions of individual crystal junctions in parallel. Most of today's rectifier applications are conducted by single-crystal junctions made from germanium or silicon and known as monocrystalline devices.

Polycrystalline devices are characterized by moderate forward voltage drops per cell, fairly low reverse breakdown voltage and a forward-to-reverse current ratio of about 10,000-to-1 for germanium and almost a million-to-1 for silicon. Due to these high reverse voltage capabilities, it is not necessary to series-connect cells, so that the forward voltage drop is not a significant factor. From this information, it can be readily seen that the monocrystalline diodes offer far greater efficiency as well as significant size and temperature reductions.

Although germanium offers a slightly lower forward voltage drop than silicon, its use is limited by its temperature capabilities (about 100°C or 212°F) and its inherent sensitivity to transient voltage and current peaks. The ability of silicon to accept these adverse conditions, plus its temperature capabilities (up to 200°C or 392°F), makes it by far the most widely used and accepted semiconductive element.

Ignoring such matters as electron-hole theory, atomic structure, impurities, doping, etc., it is sufficient to say that a rectifier is made by taking a small ultra-pure silicon wafer and coating one side of it with a material that has a surplus of electrons and the other side with a material that has a deficiency of electrons. The wafer is then placed in a furnace and the heat causes these materials to be diffused into the silicon. Thus, by attaching a lead to each side of the wafer and encapsulating it in the proper housing, a rectifier is produced—one lead representing the cathode and the other lead the anode. The inherent characteristics of the rectifier are controlled by the types and amounts of materials, the physical size of the wafer, how the actual diffusing process is carried out, and the rectifier housing itself.

Heat is by far the worst enemy of any semiconductor device. Since there is an inherent resistance in all P-N junctions, ohmic heating is produced when a current passes through the junction, and the higher the current, the higher the temperature.

Rectifier systems go all the way from the fairly simple low-current, axial-lead devices, where the heat is dissipated into the surrounding air via the case and leads; to the medium-current, chassis-mounted device, where the heat is transferred into the surrounding chassis or heat sink; to the high-current devices where forced air, water or coolant is used to carry away the heat.

Some tips regarding heat dissipation are as follows:

**Axial-Lead Rectifiers**

- Keep the leads as short as possible (invariably the tie points are much larger and will dissipate much more heat), but always put a small kink in each lead to compensate for expansion and contraction.
- Locate the rectifier away from...
high-heat areas and in a manner that allows the maximum amount of free air to circulate around it.

- Test-run all circuits under worst-case conditions to ascertain whether or not there is adequate heat dissipation.

**Stud-Mount Rectifiers**

- *Always* use silicone grease between the rectifier and the mounting surface.
- Locate the rectifier and/or chassis and heat sink away from high-temperature areas in a manner that allows the maximum amount of free air to pass across the chassis or through the heat sink.
- Test-run all circuits under worst-case conditions to ascertain whether or not there is adequate heat dissipation.

**Force-Cooled Rectifiers**

- If air cooled, make certain that the flow of air is directed in the proper manner (some systems blow the air directly at the rectifier or heat sink while other systems pull the air across).
- Make certain that there is an adequate volume of air (checking blower-motor speed, size of blade and pitch of blade).
- Be certain that the air is exhausted into a free area and is not recirculated.
- If water or coolant cooled, make certain that the rate of flow is in accordance to the manufacturer's specifications.
- Check for any possibility of line restrictions.
- Some of these systems are thermostatically controlled. This should be checked.
- Test-run all circuits under worst-case conditions to ascertain whether or not there is adequate heat dissipation.

Many rectifier failures are attributed directly to the device itself—when the real culprit is unknown, or unnoticed, transient spikes that have been introduced onto the line or generated by other components (relays, for example, are noted for this and should have a suppression rectifier across the coil). To guard against transient difficulties, make certain that the peak current-voltage (PIV) rating of the rectifier is high enough to tolerate these conditions, and/or include an adequate suppression network.

The PIV rating can easily be increased by connecting two or more rectifiers in series. The rectifiers do not have to be matched, or even close to the same PIV rating—since these ratings are additive (a 200V, 3A rectifier in series with a 400V, 1A rectifier will form a 600V, 1A device). It must be noted that the current capabilities are not altered and that the maximum forward current will be that of the lowest rated rectifier used. Also, the forward voltage drop is additive, but for just a few rectifiers this condition is relatively unimportant and easily ignored (figure about 1V per rectifier).

The current-handling capabilities of a rectifier are defined as its maximum forward current rating. Whenever a rectifier has failed, or when it operates much hotter than normal, the current flowing in the circuit should be checked against the manufacturer's specifications. This condition can usually be traced to some other circuit defect such as open, shorted or leaky components.

As a matter of expediency, rectifiers can be operated in parallel. In this case, the forward current ratings should be matched, but the lowest PIV of each rectifier must be equal to the minimum circuit requirements (a 200PIV, 1A rectifier in series with a 400PIV, 1A rectifier and a 600PIV, 1A rectifier, would form a rectifier rated at 200PIV, 3A). Since the forward voltage drop of a rectifier is a function of the internal resistance, parallel devices would reflect a lower voltage drop, based on Ohms Law.

Selenium rectifiers are similar to vacuum tubes in that they deteriorate and the resultant output voltage drops. Silicon rectifiers, however, are not affected in this manner and certainly offer the ideal replacement. But, due to the much higher efficiency of the silicon rectifiers, a voltage-dropping resistor should be installed in series with the rectifier output. In most cases a 2w, 5Ω to 10Ω resistor will be satisfactory. However, the resultant output voltage should be checked against the equipment manufacturer’s specifications in order to assure optimum performance.

It is sincerely hoped that the information presented in this article will prove beneficial to the many and varied endeavors to which they can be readily applied. It is also hoped that it will prove that the universality of the silicon rectifier is perhaps a little broader than many people have realized. Any comments, adverse, converse or otherwise, will be greatly appreciated.

**DESOLDERING...**

*continued from page 44*

also aid this mopping procedure. (Since a smaller tip orifice cannot admit solder as fast as a large opening, releasing the bulb slowly will increase the vacuum duration and allow us to remove most of the solder.)

**Bent or Wrapped Leads**

Leads are often wrapped around terminals or bent close to circuit boards. These connections should first be desoldered, like the large leads just described, (Fig. 7). The wrapped or bent wires can then be easily removed with the use of a small soldering aid or knife.
How often must a customer spend some time standing in your store—either to be waited on for a TV-set purchase or for a technician to pull his set off the shelf and bring it to the counter? If your answer is “30 percent of the time,” then you certainly have potential to build additional sales volume with a variety of self-sell items that every customer wants.

Self-sell display racks are not a new idea—what is new is the idea of aiming attractively blister-packaged electronic accessories at the lay consumer market. Items specifically selected for high consumer sales appeal, with descriptions and instructions clearly printed on the back of the packages, have been building self-service sales in shops across the country.

What TV customer is not interested in getting better reception? These display racks can show everything from new antennas to installation hardware—and even such relatively big-ticket non-TV items as wireless intercoms. Typically, such displays include a variety of other TV-related accessories: silent viewing control extensions with headphones, interference filters, multi-set couplers, wall-mounting plates for antenna lead-ins and connecting cables.

Other parts of the display should sell fast-moving accessories items for stereo and tape equipment—such as tape and record care materials and kits, empty tape reels, head-cleaning tape, degaussers, stereo headphones, extension speakers and aerosol sprays of various kinds for electronic equipment. Smaller items can be shown on pegs on a small countertop turntable near the cash register for “instant impulse” sales.

Very often a new TV-set customer or a service customer may be an excellent candidate for a new antenna. Such customers may possibly balk at the cost of having an antenna installed, and this is where it is possible to cash in on the do-it-yourself craze that is sweeping the country.

The old disclaimer, “A new antenna would cost too much right now,” no longer is valid if you take the customer’s side, showing him how he can save 50 to 60 percent of the cost by using his own labor. Point out how easy it is and how other customers (whom he may know) bought an antenna and installed it just a week (or a month) before. Suggest that a neighbor help, since four hands are always better than two.

The antenna display can include over-the-counter retail prices as well as installed prices. Point out the advantages of the new antenna designs over the “museum piece” he now has—the greater sensitivity and the all-channel features if the area is served by UHF. If your customer can handle a pair of pliers, there is no reason why he cannot tackle his own installation. Sell him the antenna he needs, the mast sections, guy wires and turnbuckles (if needed) and all the other mounting hardware. Tell him how to run two TV sets and his FM stereo from one antenna and how simple it is to install a multi-set coupler. In this manner, you can immediately ring up $50 or so in extra sales that might otherwise be lost entirely if you pushed only for the installation job.

The secret to selling this way is to have the needed items prominently displayed and ready for delivery. A customer should be shown that the antenna package includes printed instructions. Emphasize that if you were to install the antenna, you would use exactly the same materials he sees on display.

All that is needed is a little imagination and some willingness to convince the customers of their own abilities, especially those who have been turned off by the high price of labor. The TV service and installation business is just one of many that have made the do-it-yourself fad so popular. Others are home improvement stores, which today do an enormous business in parts and hardware for weekend plumbers, electricians and carpenters.
RCA's Type WR-508A Chro-Bar Generator

by Phillip Dahlen

Especially designed to provide stable patterns without flicker.

RCA has developed a color-bar generator that is designed to be powered by a single 4.5v long-life alkaline battery. A slide-out compartment is said to be located on the rear panel for convenient battery replacement; and an accessory ac-power adapter (type WG-425A) is reportedly available for operating the generator from a standard 120v, 60Hz power-line outlet.

According to the manufacturer, the new crystal-controlled solid-state circuitry, including IC components, is especially designed to provide stable, flicker-free patterns. Special pattern adjustments are reportedly provided on the rear panel; and if the circuit should require readjustments, these controls are said to be quickly and easily reset using only a properly operating TV receiver.

Specifications indicate that 10 color bars are provided simultaneously in the color-bar pattern—including R–Y, B–Y, G–Y, I and Q signals, spaced at 30° phase intervals. This pattern is said to be used for checking color phase and matrixing circuits, and adjusting the automatic frequency phase control (AFPC). Narrow brightness pulses are said to be added at the edges of each color bar to aid in checking the color “fit” or registration of the brightness and color signals.

In addition to the impressive manufacturer specifications that have been given, the following specifications are also of significance:

- RF Carrier: 61.25MHz picture carrier (Channel 3).
- Output Voltage: Approximately 10mv.
- Horizontal Sync: 15804Hz.
- Color Subcarrier: 3563.741kHz ±20Hz, keyed at 189kHz.
- Output Impedance: Approximately 300Ω.
- Test Patterns: Color bars (variable chroma level), Dots, Cross hatch, Blank raster.
- Dimensions: 3 in. H × 6½ in. W × 4 in. D.
- Weight: 19.5 oz.
The material used in this section is selected from information supplied through the cooperation of the respective manufacturers or their agencies.

**GENERAL ELECTRIC**

Color TV Chassis N-2—Troubleshooting Guide

The N-2 chassis can be followed in May 1971 TEKFAX schematic No. 1357.

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>POSSIBILITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>No raster</td>
<td>Defective tubes (Horizontal Output, Damper, High-Voltage Rectifier) 15v source out of order (open resistor R401 or shorted diode Y203). Transistor Q204 shorted base to emitter. NOTE: Anytime replacement of fuse F402 or F403 restores operation of the receiver, be suspicious of the horizontal output tube, 21LG6, it may be intermittently arcing.</td>
</tr>
<tr>
<td>Poor or intermittent focus</td>
<td>Resistors R241, R242, R243, or focus spark gap. The resistors can open or develop arc circuits to chassis ground through the focus module container walls. (Do not attempt to repair the focus module. Replace it!) Microscopic particles within the focus spark gap can produce corona, causing focus problems. Clean the gap with a soft rag or cotton-tipped applicator soaked in alcohol (with the receiver de-energized).</td>
</tr>
<tr>
<td>Continuous arcing of focus spark gap</td>
<td>Resistor R243—open</td>
</tr>
<tr>
<td>No sync</td>
<td>Capacitor C311—open</td>
</tr>
<tr>
<td>Negative picture with full contrast setting</td>
<td>Capacitor C159—shorted</td>
</tr>
<tr>
<td>No video</td>
<td>Delay line—open (usually broken leads at mounting terminals)</td>
</tr>
<tr>
<td>No vertical sweep</td>
<td>Capacitor C272—shorted</td>
</tr>
<tr>
<td>Intermittent or drifting horizontal oscillator</td>
<td>Capacitor C207—leaky or shorted</td>
</tr>
<tr>
<td>Driveline center of screen</td>
<td>Transistor Q204—excess leakage</td>
</tr>
<tr>
<td>Scallop pattern across top of raster</td>
<td>Capacitor C523—shorted (transistor Q502 functions as an amplifier)</td>
</tr>
<tr>
<td>Vertical jitter (sensitive to line voltage fluctuation)</td>
<td>Change resistor R251 to 68K and capacitor C251 to 0.015/400v</td>
</tr>
<tr>
<td>AGC trouble</td>
<td>Check for cracked copper pattern in left front corner of signal board. (Keying pulse circuit.)</td>
</tr>
<tr>
<td>Blooming (slight) (N2 Chassis)</td>
<td>Diode Y155 (dc restoration) and/or diode Y156 (CRT cathode current limiting diode) may cause B+ fuse to fail.</td>
</tr>
<tr>
<td>Blown fuse F402</td>
<td>Check B+ input to UHF tuner for solder bridges.</td>
</tr>
<tr>
<td>Gray scale tracking</td>
<td>Check CRT emission.</td>
</tr>
<tr>
<td>Very low brightness (N2 Chassis)</td>
<td>Resistor R410 open. 15v line being energized by tube V5C video amplifier cathode.</td>
</tr>
<tr>
<td>No raster, high cathode current on 40K06 (horizontal output)</td>
<td>Check “Q” of coil L409, also waveform at grid of horizontal oscillator V401B.</td>
</tr>
<tr>
<td>One bar similar to blanking bar on left</td>
<td>Try replacing L409 (horizontal oscillator coil). A low &quot;Q&quot; coil may not phase properly.</td>
</tr>
<tr>
<td>Several bars on screen of CRT</td>
<td>Check value of capacitor C434 (.01µf, 2kv) and capacitor C437 (.01µf, 2kv), there may be mismatch between C434 and C437.</td>
</tr>
<tr>
<td>No high voltage</td>
<td>Capacitor C421 shorted. This is a .0015µf polystyrene capacitor in the horizontal oscillator circuit. When working with polystyrene capacitors, it is very important to keep heat away from the outside plastic, or capacitor failure may occur. Replace C421.</td>
</tr>
<tr>
<td>Intermittent picture</td>
<td>Shorted cable from flyback transformer terminal number 10 to R412, a 33K, 2w resistor in the horizontal AFC circuit. Moving the cable causes the problem to disappear. The problem reappears after operating the set a few hours. Replace cable.</td>
</tr>
<tr>
<td>Insufficient width</td>
<td>Check if resistor R430 (10M, 1w) changed value.</td>
</tr>
<tr>
<td>Insufficient width</td>
<td>If slightly more width is required for a full screen, change capacitor C438, 47pf 5 kv to 82pf 5kv.</td>
</tr>
<tr>
<td>Poor drive or no high voltage</td>
<td>Changed value or open R422, a 47K resistor.</td>
</tr>
<tr>
<td>Foldover in center</td>
<td>Leaky capacitor C420, 390pf.</td>
</tr>
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**WESTINGHOUSE**

Color TV Chassis V2655, V2656—Horizontal and Output Circuit

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**MAGNAVOX**

Color TV Chassis T940/T951—Reducing “Nuisance” Opening of Fuse F3

As the current flows across the junctions of the fuse clips and metal ferrules on the ends of Fuse F3, a substantial amount of heat is developed because of the resistivity of the junction. This heat lowers the opening current value of the fuse and it may subsequently open for no apparent reason. The application of a small amount of silicone grease to the fuse ferrules will aid in the dissipation of the heat and reduce the “nuisance” opening of the fuse. Do not bend the fuse clips to attempt to establish firmer contact between clip and ferrule as this results in less clip resiliency and an increase in contact resistance.
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The best color TV deserves the best antenna. And you can recommend and install Zenith antennas with confidence. For every Zenith antenna is electronically engineered for optimum reception in any signal area.

For outstanding performance, Zenith-engineered antennas include:

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- Staggered square UHF directors on UHF/VHF Zenith antennas.
- Low-impedance, triple boom construction.
- Gold-color anodized coating (to help antennas look better and last longer, with greater corrosion resistance and electrical conductivity).

Your Zenith Distributor has the complete line of Zenith quality-engineered TV antennas and antenna accessories. His staff has the technical experience and knowledge of your area to recommend the best antenna for any installation.

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The quality goes in before the name goes on
NEW AND ONLY FROM EICO-THE INDUSTRY'S
LOWEST-PRICED PROFESSIONAL FET-TVM.

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New Model 239
$39.95 KIT
$59.95 Wired

Use the new 239 on your bench or in the field. Checks semiconductor and vacuum tube circuits. 11 Megohm DC input impedance. Reads AC rms and DC voltages in seven 10db steps from 1 to 1000 volts on large 4½” meter. Measures and reads peak-to-peak AC to 2800 volts. Check resistance from 0.2Ω to 1000 MΩ on seven ranges. Includes exclusive time-saving Uniprobe.

2 NEW DE-LUXE FET-TVM’s
Includes all purpose DC/AC ohms Uniprobe.

EICO 240 Solid-State FET-TVM. $59.95 kit, $79.95 wired. AC or battery operated. 7 ranges each + and − DC volts, peak-to-peak AC volts, ohms. 10 turn zero adjust pot. 4½” 200 µA meter. response to 2 MHz (to 250 MHz with optional r-f probe).

EICO 242 Solid-State FET-TVOM. $69.95 kit, $94.50 wired. As 240 plus 7 ranges each AC/DC milliammeter, 1 ma to 1A: very low voltage ohmmeter. 10 turn ohms and zero adjust pots. Large 6½”, 200 µA meter.

Write for ’71 catalog of 200 EICO Top Buys in test equipment, stereo, color organs, science project kits, environmental lighting.

EICO, 283 Malta St., Brooklyn, N.Y. 11207. (212) 949-1100.

COLORFAX

RCA SALES CORPORATION
Color TV Chassis Employing U Tuner (KRK170)—UHF Channel Indicator

In areas of multiple UHF channel reception (where the TV station channels used are relatively close together), some difficulty may be encountered identifying specific channels on instruments utilizing the six-detent U tuner (KRK170).

Optimum channel identification can be achieved by either of the following methods. Both require removal of the tuner mounting assembly.

First, if the error is slight and the instrument is non-remote:
- Tune the mechanism so that the lowest channel in the area is indicated on the drum.
- Loosen three ¼-in. U tuner mounting screws and slide the tuner (holes are slotted) until that channel is received, then tighten the screws.

If the error is greater, or the instrument is a remote type:
- Tune the KRK170 for reception of a known channel, preferably one between channels 45 and 55.
- While holding the indicator drum, spring the nylon retainer out until the teeth of the drum gear are disengaged from the teeth of the rack gear arm.
- Turn the U drum until the indicator shows the channel being received.
- Mesh the teeth of the drum gear and the rack gear, then return the nylon retainer to its original position.

ADIMARL
Color Chassis K10, K20—Replacement Transistor 57A159-12

Transistor 57A159-12 may be obtained with two different basing configurations. Orient the transistor as shown in the drawings to determine the elements. Notice that the leads are in a straight pattern on Type I and in a triangle pattern on Type II. An instruction sheet will be packed with future shipments of this transistor.
How to tell which is the largest compact van built in America. (No matter how you look at it.)

Load 11-foot stepladder behind driver's seat.

Load 12-foot rolled carpet behind engine cover.

Remove right front seat and load 14¼-foot canoe or 15-foot rolled carpet diagonally.

If you can't close the rear doors, you haven't loaded a Dodge Maxivan Strong Box. And you'd better get one.

Dodge Strong Boxes give you a lot more than just more room: Independent front suspension and longer 127-inch wheelbase mean better handling and ride. Shorter turning circle. Even with a 127-inch wheelbase, you have greater maneuverability. Wind-tunnel body and curved windows reduce wind-sway effect. Front wheels can be inexpensively aligned on passenger-car equipment. Biggest V8 engine offered. 360 cubic inches. Three-speed TorqueFlite automatic transmission with a choice of three engines available on all models. Integral power steering. Power brakes. Fresh Air air conditioning and exclusive Fresh Air heater provide even flow of clean air. Air is not recirculated. High-level air intake helps keep incoming air cleaner. Front passenger’s seat does not block side cargo door entrance. Both front seats are easily adjustable. Concealed side safety-step offers firm footing since it doesn't collect ice or snow. Wider front doors and door steps and less wheelhouse intrusion make for easier ins and outs. Full-foam padded bucket seats up front give softer ride and more comfort. For more details circle 107 on Reader Service Card

Two-stage door checks conveniently hold doors in two positions. Biggest gas tank. 26 gallons. Smaller engine cover is easy to remove for servicing. Also, easier for driver to reach back seats. Extra rust protection on undersides, doors, and panels. Large hood opening. Battery, dipstick, and radiator are easy to reach. Engine can be removed quickly and easily through the front. And the list continues at your Dodge Dealer's.

Dodge Maxivan takes the "packed" out of compact vans!

Optional at extra cost.

JUNE 1971, ELECTRONIC TECHNICIAN/DEALER | 57
TECHNICAL DIGEST

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

RCA SALES CORPORATION
Remote Amplifier CTC44/CTP19A—Service Tips

If the VHF to UHF driver transistor Q1108 in the CTP19A remote amplifier fails (shorts), the instrument will go to the UHF function only. Should this failure occur in early-production versions of this chassis, the following circuit changes will improve reliability. Later-production chassis have these changes incorporated. ~ Add a 100Ω, 1/2w resistor (Stock No. 502110) in series with the collector lead when replacing transistor Q1108. ~ Unsolder diode CR1120 cathode lead and add a 100Ω, 1/2w resistor (Stock No. 502110) in series.

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“SPACE-AGE” VHF/UHF/FM COLOR ANTENNAS
FOR ALL AREAS!

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Similar design to Space Tracking Antennas! Combines the “Corner Reflector Disc Director Array” for total UHF coverage, with “Multiple Tuned, Cut-to-Channel, VHF Elements” for unsurpassed Color and Black and White TV! Includes VHF/UHF Splitter for economical single down-lead installation. Licensed under U.S. Pat. No. 3,440,658 of Richard D. Bogner the designer of many Antennas used in the Space Program!

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50 Antin Place, Bronx, N.Y. 10462 • (212) 892-6700

... for more details circle 122 on Reader Service Card

MAGNAVOX
TV Chassis T946—Hum Bars When the VHF Tuner is Set to the UHF Position

Some receivers may have 60Hz hum bars on the screen when the VHF tuner is set to the UHF position. This symptom can be caused by 60Hz radiation from the UHF neon indicator lamp circuit. The problem can be corrected by moving the UHF indicator lamp ground lead from its present grounding point on the control unit and reconnecting it at a grounding point on the main chassis. A convenient grounding point is the grounded terminal pin (AC-2) located adjacent to the Vertical Hold Control (R73).
When people turn to you to make things right again...

use GE receiving tubes (made by professionals for professionals)

TUBE PRODUCTS DEPARTMENT • GENERAL ELECTRIC COMPANY
OWENSBORO, KENTUCKY 42301

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

**NEW PRODUCTS**

Tuner Lubricant and Cleaner 703

Continually polishes tuner contacts

An aerosol has been developed to foam away corrosion, dirt and oxidation. It is said to clean, lubricate and restore while continually polishing tuner contacts on all types of tuners. This highly concentrated cleaner and lubricant will reportedly not cause drift or detuning. Electronic Chemical Corp.

Transformer 704

Plugs into the cigarette lighter

A plug-in power transformer is designed to permit running portable electronic devices on automotive electrical systems. The unit is said to eliminate frequent battery replacement in transistor radios, portable tape recorders and other such devices when they are used in the car. The transformer plugs into the cigarette lighter socket and is said to provide the precise voltage required. Specifications indicate that Model 30-3131 has an output of 7.5v, and is designed to operate from a 12v negative-ground electrical system. Price $6.85. GC Electronics.

Oscilloscope 705

Low cost with solid-state circuitry

A general purpose scope, Model 557A, is designed for use in the field or on the bench. The vertical amplifier is reportedly ac/dc coupled with a sensitivity of 20mv/cm over a dc to 5MHz bandwidth. The sweep frequency is reportedly from 10Hz to 100KHz in 4 ranges and continuously variable.

It is also said to contain a 5-in. flat-faced CRT for extra sharp traces, solid-state circuitry and 3 calibration voltages. Physical dimensions are 8 in. W by 12 in. H by 17½ in L. Weight 22 lb. Price $249.00. Kikusui Electronics.

Tuner Degreaser 706

Cleans switches, relays and contacts of all types

An aerosol cleaner and degreaser, called Tuner Cleaner, has been developed primarily for restoring the contacts of tuners that have been fouled by build-ups of lubricants, dust, dirt and corrosion. The cleaner is said to be a very high powered spray which dissolves and flushes away all foreign material, leaving no residue. The cleaner is also recommended for switches, relays and contact devices. It is said to be excellent for removing soldering flux from printed circuit boards. The manufacturer indicates that unlike ordinary tuner degreasers, the cleaner spray does not frost contacts and components, since it uses a blend of Freon 12 and other propellants to produce a relatively warm spray. 24 oz can $3.25. Channel Master.

Tape Head Cleaner 707

For use on cassette, video, 8-track and reel-to-reel tape recorders

An aerosol cleaner specifically formulated for cassette, video, 8-track and reel-to-reel tape recorders is designed to remove dirt, film and oxide build-up from heads, tape guides, capstan rollers and all other critical parts. The manufacturer indicates that the cleaner will penetrate into the tightest spaces, help to preserve heads and tapes, minimize noise and improve high frequency response. It is said to be guaranteed to be non-abrasive, safe for all plastics, non-flammable, non-toxic and non-conductive. A 6-in. spray extender is said to be included with each standard 6-oz. spray can. Chemtronics, Inc.

Circuit Analyzer 708

A self-contained, dynamic and static portable test device

A complete, self-contained portable field test device is designed to facilitate the servicing of all types of electronic equipment. The Model E-C Serviset is ultra-compact and can be carried in a coat pocket. The absence of mechanical switches and the use of only one test reportedly permits rapid selection of functions and eliminates moving bulky test equipment. Simply select function; plug test lead and phone if required into appropriate jack and make test. Indications are visual, audible or both. A special HV adapter is supplied for checking TV HV supplies (RF, pulse, or flyback type up to 20 kv) with slim insulated extension tip. The AF signal tracer test is said to permit checking audio, video, sync and sweep amplifiers. Also, provided are three ranges for continuity, leakage and short circuit tests on coils, capacitors, resistors, etc. A fabric pouch is said to be provided for carrying all accessories. Price $29.95. Lee Electronic Lab.

For information about the products described in this section, circle the numbers on the Reader Service Card.
Who said B & K couldn’t improve the only complete Television Analyst?

Now there is a new model…the 1077-B, with solid state sweep drive.

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Model 1077-B $399.95

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indispensable for RCA color TV adjustment

Adjusting the AccuMatic Color Level Control on RCA sets incorporating the CTC 46 Series Chassis takes a special tool.

And this is it! Xcelite's TW-140 spanner wrench. Recommended by RCA, this midget (3-5/8" long) wrench with plastic handle and pocket clip is a giant when you need it. Every TV tool kit should carry the TW-140.

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DEALER SHOWCASE

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

AUDIO CABLE AND ADAPTER DISPLAY

Contains 17 audio cables and 8 audio adapters

A display, Model No. ACA, is said to contain 17 different audio cables and eight different audio adapters. Re-}


CASSETTE STORAGE UNIT

Stores up to 96 cassettes

A modular, walnut unit, Model 1518, has been developed for storing cassettes. It features molded plastic compartment trays that can hold up to 96 cassettes. This turntable model revolves on a ball-bearing swivel base for easy selection of tapes. Price $19.95. RMS Electronics, Inc.

PHONO 45-RPM SPINDLE ADAPTOR

Replaces almost 50 round and flat adaptors

A universal adaptor for 45-RPM records is designed to eliminate inventory and identification problems. The "Omidaptor" reportedly fits more than 90 percent of all automatic record changers currently in use in the United States and Canada. It is said to be fully automatic and employs a gentle dropping motion. It is reportedly molded of high-impact styrene. Retail price $3.95. Aldshir.
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Ford Econoline

Easy, out-front servicing.
Simply raise the convenient outside hood and your routine service points are right at hand: radiator, oil level, battery, windshield washer reservoir, voltage regulator, wiper motor, brake master cylinder. Better ideas make servicing fast, easy.

Shorter outside, easier to park.
Overall length of Econoline Vans is significantly shorter than other makes. This means easier parking and better maneuverability in city delivery operations—time saved on every trip.

Wider at top for built-ins
Body sides are more vertical, wider apart at top than other vans. So built-in units fit better and leave more aisle. Modular units, designed to fit and work together allow you to custom design almost any interior you need. Job packages, such as insulated florist's van, are also available.

Engine clear forward
The engine is moved forward in Ford's clear-deck van—all the way out of the cargo area. Clear floor space behind driver's seat measures over 8½ ft. in Econoline Van... over 10 ft. in the Supervan.

Strong, smooth-riding Twin-I-Beam
The independent front suspension that has revolutionized truck riding qualities. Two forged steel I-beam axles give it strength... big coil springs give it a smoother ride.

Biggest payload of all
Husky construction and high capacity axles allow you to carry a heavier load than any other van. Maximum payload of 4320 lbs. is largest in industry.

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Driver's "walk-thru" to rear
Econoline's forward engine position clears the deck for the driver, too. He can easily step from his seat into the rear load area and exit through side or rear doors.

See your Ford Dealer and see all the better ideas in America's best-selling van—Ford Econoline.

... for more details circle 110 on Reader Service Card
BOOK REVIEWS

This month's Editor's Memo discusses the importance of keeping up-to-date with technological developments in order to maintain job security. Among the many suggested ways of doing this, I mentioned studying books and breadthboarding basic circuitry incorporated in the electronic products serviced. With this in mind, three books have been selected for review which contain fundamental circuit descriptions that can be applied to basic construction projects.


Once, while visiting with the owner of a successful one-man shop, I asked him if he was a ham. Turning red, he advised me that he was a professional.

Whether or not you choose to be licensed to broadcast on the amateur bands, the material presented by the American Radio Relay League can prove to be of value to all electronic technicians—however professional or sophisticated their electronic backgrounds. Each year the staff that assembles this book see that it is updated to include current electronic communications technology. Although this book does not cover TV circuitry and devotes some attention to transmitters, which are not serviced by some of our readers, a significant portion of this book does cover subjects that are of considerable importance to all electronic technicians.

Some of these topics include: Electric and magnetic fields, frequency and wavelength, series and parallel resistances, time constants, reactances, impedance-matching circuits, UHF resonant lines, vacuum-tube amplifiers, interelectrode capacities, transistor characteristics and practical circuit details, types of integrated-circuit amplifiers, detection and detectors, heterodyne and product detectors, solid-state mixers, improving oscillator stability, noise reduction, improving receiver selectivity, reducing broadcast station interference, active filters, solid-state receivers, power-line considerations, testing old coaxial cable, dipole antennas, directive arrays with parasitic elements, VHF and UHF receiving, plus many other topics too numerous to mention. If constructing some of the related circuitry will help improve your technical competence, then you can use the construction details provided—which include both parts lists and mechanical considerations. This handbook is a must for any electronic technician that wishes to increase the depth of his technical competence.

RCA LINEAR INTEGRATED CIRCUITS published by RCA Solid State Div., paperbound $2.50.

Integrated circuits are becoming increasingly common components in the electronic products that must be serviced. Unlike transistors, these semiconductors contain many subcomponents that permit them to perform several circuit functions simultaneously in a single electronic product. They typically represent the "last straw" for the technician that has already become overwhelmed by technological advances.

This book—if studied closely, as one must to gain value from any technical publications—can be an excellent aid in overcoming these hurdles. After providing a description of the physical composition of integrated circuits, the book progresses to "Basic Circuit Elements" where simplified schematics are used to compare each portion of the integrated circuit with its transistor equivalent. The book then goes on to describe differential-amplifier circuits, operational voltage amplifiers, operational transconductance amplifiers, multipurpose amplifiers, special-purpose amplifiers (such as automatic fine tuning circuits), plus transistor, diode and amplifier arrays. Tables, graphs and waveforms are frequently used to help explain circuit functions; and many schematics include component values that you choose to experiment with some of the circuits described.

This book deals more in mathematical theory than the others, but also includes information of considerable value to electronic technicians striving to keep abreast of our changing technology.

125 ONE-TRANSISTOR PROJECTS by Rufus P. Turner, published by Tab Books, hardbound $6.95, paperbound $3.95.

Even an entirely solid-state color-TV set (ignoring the CRT) can be considered a combination of many, many one-transistor circuits, which together perform the desired function. If you understand each of these one-transistor circuits and the basic principles...
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Just because we were #1 in 1970 color TV sales to consumers doesn’t mean we’ve forgotten you today. We created "PS", a warranty program which backs you up as well as every AccuColor" TV. PS means Profitable Servicing for two reasons: First, because AccuColor owners can select any service agency they want. And, second, because RCA pays your going rate for warranty service rendered. Sound good? For details, read on.

RCA's Symbol of Purchaser Satisfaction. AccuColor Parts and Labor Basic Warranty Provisions. For one full year from the date of purchase, RCA Corporation warrants to the first retail purchaser that it will pay all labor charges for repair of defects in 100% solid state AccuColor models (90 days on AccuColor models with "New Vista" chassis) and will make available replacements for any defective parts. (If the picture tube becomes defective within two years, it will be exchanged for a rebuilt picture tube.) On portable models RCA will make available replacements for defective parts and pay labor charges only on a "carry-in" basis; transportation to and from the service agency is the purchaser's responsibility. Installation and set-up, foreign use, antenna systems, and adjustment of customer controls are not included. To obtain warranty benefits, contact your RCA dealer or the service agency of your choice with your Warranty Registration Card.

For a copy of the PS booklet which covers all of our products, and the name of your field representative, write RCA Sales Corporation, Dept. 634, 600 N. Sherman Drive, Indianapolis, Indiana 46201.

... for more details circle 120 on Reader Service Card
Pressure Sensitive Decals

The 16-page catalog shows identification decal products for shops and trucks. The catalog includes stock designs, stock numerals and letters, special designs for cab doors, do-it-yourself kits in vinyl decals and bin and self markers. Prest-On.

Diamond Line Catalog

A new 16-page catalog lists transistors, photocells, rectifiers, triacs, diacs, capacitors, heat exchangers, controlled rectifiers and many more solid-state components. Many of these are indexed on the front cover for easy reference. An easy-to-use cross-reference of selected items is also included. IR.

New Product Catalog

A new general catalog, N. FR-71-72, lists over 14,000 products from all of the company's various operations. The 312-page catalog includes chemicals, servicing tools, printed circuit materials, servicing aids, automotive connectors and hardware, accessories, replacement parts, electronic hardware, replacement knobs and replacement antennas, as well as many other items. GC Electronics.

Test Instruments

A 1971 test-instruments catalog contains photographs, condensed specifications and prices for tube testers, transistors testers, scopes and signal generators. Both bench top and portable test-instrument models are shown. Hickok Electrical Instrument.

TV Line

A 20-page booklet describes low- and medium-priced products for closed-circuit TV applications. Both B/W and color cameras are covered, including a unique "convertible" camera which reportedly may be purchased for monochrome use and modified for color at any time. Live and film cameras and related film, tape terminal and switching equipment are illustrated and described. RCA.

Ground Problems...

continued from page 47

current could have come into the circuit. Try all false-ground possibilities, which could have resulted in applying the wrong supply voltage to the ground bus (which is usually fatal to the latter), that can be found on the "other side" of the break in the ground bus—the side no longer connected to the power supply circuit (Fig. 7).

Do not be easily satisfied with the notion that it was some erratic fault that may have "gone away" if you cannot find a definite cause. A ground bus does not blow with normal current, and excessive current must have come from somewhere. Keep looking and explore all possibilities of undue mechanical stress breaking through insulation, and things like that.

For more information on DEALER SHOWCASE
See page 69
READERS SERVICE
CAPACITORS... continued from page 49

Modern electrolytic capacitors are stable and will work at lower voltages without deforming and changing capacity.

A survey of electronic technicians revealed that less than 5 percent of those interviewed knew what the EIA tolerances were for electrolytic capacitors. Approximately 10 percent were close and the remaining 85 percent were far off. A popular answer was "± 10 percent." This belief stems from the tolerances shown on most electrostatic capacitors—such as paper-mylar, ceramic, mica, etc.

Good judgment, coupled with a sufficient knowledge of the capacitor, will result in time savings and better performance in servicing electronic products.

The next article in this series will deal with electrostatic capacitors.

BOOK REVIEWS... continued from page 64

principle of what a color-TV set does when converting an antenna signal into a colored picture, then you should be able to understand this set and be capable of maintaining it.

This book offers the technician a good start in understanding basic circuitry—not only in solid-state color-TV sets but almost any other solid-state electronic products. In addition to including a schematic and description of each circuit, the book provides a complete parts list. If merely studying the circuitry proves insufficient, then you can actually construct it, observe it function, and then observe what happens when changes are made in the circuitry.

A few of these circuits include: germanium common-emitter amplifier, silicon common-emitter amplifier, FET source follower, inductor-capacitor-tuned bandpass amplifier, RC-tuned bandstop amplifier, conventional 455kHz IF amplifier, wideband (video) amplifier, multi-frequency crystal oscillator, self-modulated RF oscillator, carrier-failure alarm RF signal comparator, tuned AF analyzer, dc voltage regulator, constant-current adapter, electronic filter, autodyne converter, plus many others.

We feel that this book can provide valuable assistance in learning circuit functions.

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