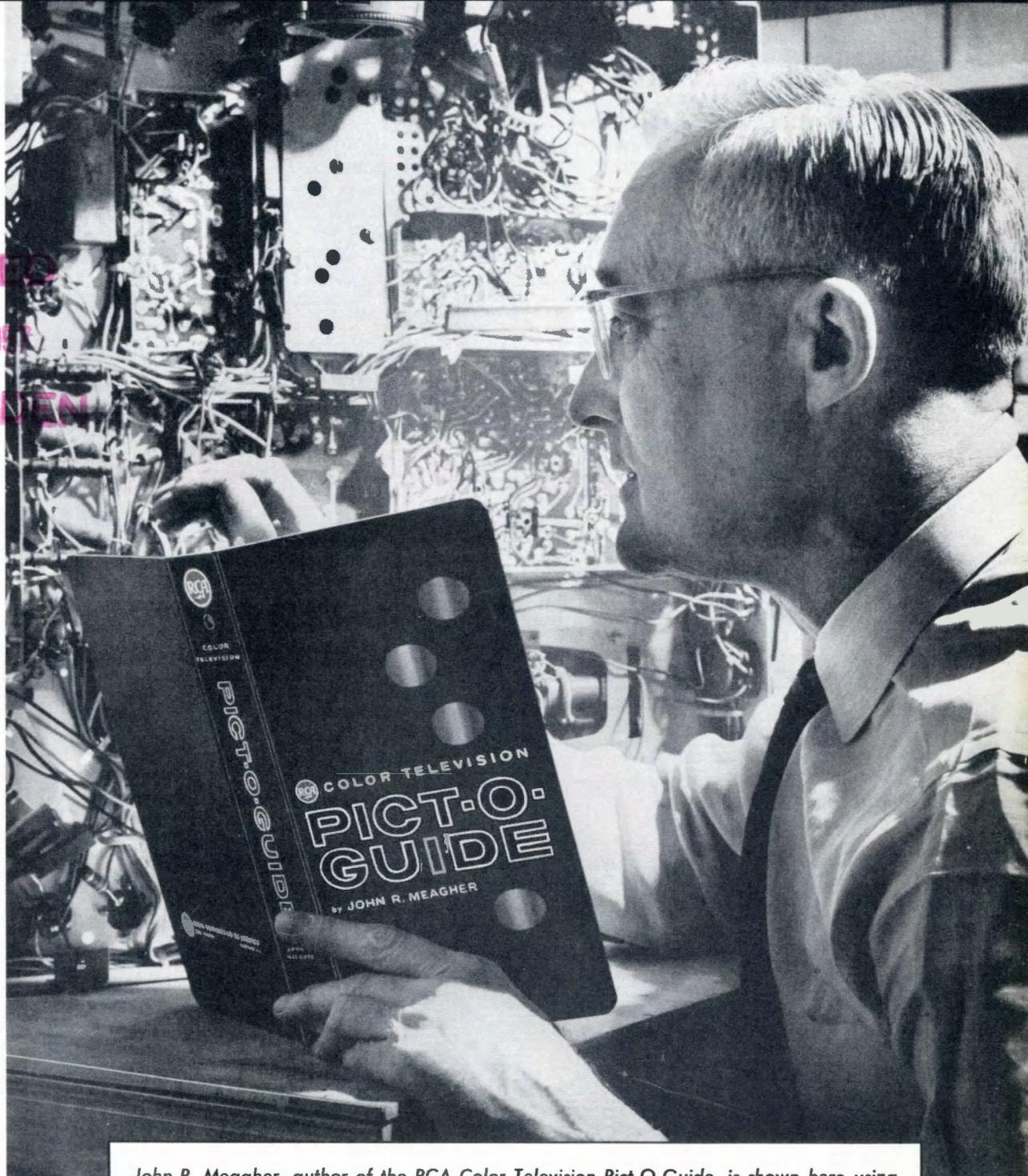




RADIO AND TELEVISION

Service News

A PUBLICATION OF THE RCA ELECTRON TUBE DIVISION



AUGUST

1957

Vol. 22, No. 3

John R. Meagher, author of the RCA Color Television Pict-O-Guide, is shown here using information in his new volume to check the circuitry of an RCA Victor color TV receiver. You can obtain your copy of this Guide free of charge with your purchases of RCA receiving tubes. Read the article on page 2. Then see your local RCA tube distributor.

Electronics Servicing is Big Business

by R. B. Sampson

Manager, Market Research
RCA Electron Tube Division

In this discussion of electronics as a business, it is my intent to select those areas of your business which I think will be of greatest interest to you.

You must agree that I cannot cover in this article all the areas of a service operation. After all, electronics servicing is big business and, as such, it is exposed to all the trials and complications of any other business, whether it be manufacturing, wholesaling, or retailing in their varying forms.

From my experience, I can assure you (and you know this better than I do) that there are a multitude of problems on both the distributor and service-dealer levels of distribution. For the distributor, his difficulties can be summed up as a shortage of capital with which to support the constantly expanding electronics replacement industry. For the service-dealer, in my opinion, his problem, in brief, is to rise to the opportunities that electronics as an industry has created.

The service industry, as a whole, has come a long way in meeting the responsibilities that have been placed on it by the rapid surge of electronics at both the consumer and industrial level. However, I believe sincerely that more progress has been made in that respect during the last two years than during all the other years combined. I refer particularly to the emergence and recognition by service-dealers themselves that they are an important part of an industry—and a mighty big one, indeed. Service trade associations have been formed, united effort has taken place to cope with industry problems, and the dealer is recognizing that servicing is a business and not just a means of employment with a weekly pay check that is equal to or slightly better than that which could be earned working for someone else.

You will note that the word "electronics" is used in the headline of this article—rather than "television." In my opinion, electronics servicing is a better description of the work you are

doing and can do in the electronics maintenance industry.

Television is only one segment of a greatly expanding electronics industry. This expansion is taking place not only in TV, which will always be a major part of your business, but also in many other areas. For example, the number of radio sets in use today, including auto radios, is estimated at 142 million units. In addition, the steady flow of new "hi-fi" sets, phonographs, tape recorders, etc. results in further increases in the total number of instruments in use at the consumer level.

Looking ahead a few years, we see not only a steady flow of additional TV sets, radios, etc., but also a new giant-to-be: closed-circuit television. Who is to say where this device will lead us in the next five to 10 years? We visualize closed-circuit TV not only in widespread industrial applications, but also in the home. I could discuss this medium at length, but suffice it to say that many new markets and new products will offer you a greatly expanded

A Must for TV Service Work

The new RCA Victor TV Service Parts and Tuner Parts Guide is now available from your RCA Service Parts distributor. Keyed as the SP2001B, this revised version of the SP2001A lists parts for RCA TV receivers manufactured from 1946 through 1956.

COLOR TV PICT-O-GUIDE IS OFFERED

It's a fact! The amount of television installation and repair business which you do now and will be called upon to do in the future hinges to a major extent on how much technical know-how and practical experience you take with you on your servicing calls. Since this is especially true when it comes to color-TV service work, you owe it to yourself to obtain a copy of the new RCA Color Television Pict-O-Guide—now being offered to you free of charge with your purchases of RCA receiving tubes from your local RCA tube distributor.

Just published by the RCA Electron Tube Division, the Color TV Pict-O-Guide is an overnight sensation. Already it is being acclaimed as the most useful, practical aid to color-TV servicing work in the industry. Small wonder! It's precisely what service technicians need and want to help them over the color-TV servicing hurdles: a volume of illustrated, step-by-step instructions on the installation, adjustment, and servicing of color sets.

The Color TV Pict-O-Guide was developed and written by John R. Meagher, RCA's nationally recognized

authority on television servicing. Mr. Meagher, as you most probably know, built quite a reputation for himself by preparing the original Pict-O-Guide for black-and-white TV. Now, his latest book earns for him another well-deserved laurel.

Containing only practical information with a minimum of theory, the Color Pict-O-Guide features a multitude of full-color photographs taken from an operating color-TV receiver. These color prints are supplemented with monochrome illustrations and circuit diagrams that further clarify the easy-to-read text. A sturdy multiple-ring binder holds the pages flat for easy reference during service work.

The scores of photographs throughout the new book speed color-TV service work by showing the actual, visual indication of troubles in the color circuits, effects of purity and convergence adjustments, and color saturation and hue controls. By referring to the pictures, you can observe the effects of interference and the use of color-bar generator patterns and "green-stripe" color test signals. The illustrated step-by-step instructions make it possible

RADIO AND TELEVISION

RCA

Service News

A PUBLICATION OF THE RCA ELECTRON TUBE DIVISION

RCA RADIO & TELEVISION SERVICE NEWS is published in the interest of dealers and service technicians. It is written to assist them in providing better service, and to foster the growth of their business by supplying them with information on the latest trouble-shooting and sales promotion techniques, sales and service aids, together with invaluable data on RCA tubes, transistors, batteries, parts, and test equipment.

RCA RADIO & TELEVISION SERVICE NEWS is a bi-monthly publication of the RCA Electron Tube Division, Harrison, New Jersey.

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Radio Corporation of America

Harvey Slovik
Editor
Robert Leedy
Technical Editor

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Vol. 12, No. 1

maintenance market on which to plan your electronics servicing operations. And I have not as yet mentioned color television.

Color-TV set sales have not come up to expectations thus far; but color receivers are bound to emerge as *the* TV sets of tomorrow. When they do, a vast new market is open to you as an electronics service-dealer.

In passing, I should also like to mention the probable emergence within the next five to 10 years of such new products as electronic air conditioners and refrigerators. The electronic range is already on the market. That these products will require servicing is a foregone conclusion.

It will not be easy for electronics service-dealers to penetrate the industrial maintenance market; but for those firms which will do so, a further market opportunity will arise. I am not referring now to electronic parts and equipment manufacturers. I am referring to those industries and commercial firms which will use electronic devices in their manufacturing and maintenance processes (for example, newspapers, paper mills, lumber operations, railroads, municipalities, and schools). Again, entry into these areas will not be easy; but they are all a part of the

electronics world which we can visualize in the foreseeable future.

You may well ask at this time: What about transistors, printed circuits, etc? (These products are earning a reputation for long life and dependability in operation.) If we are to judge from the past, such developments can only lead to more and better uses for electronic devices on a substantially broader basis. And, I have yet to see a device or piece of equipment which did not require maintenance and service to some degree.

So, I say to you: Let us look to our business as we know it today and plan for its development to meet the requirements of tomorrow.

RCA Introduces WR-99A

Television service technicians should take note of RCA's recently introduced WR-99A Crystal Calibrated Marker Generator. It will be available shortly from your local RCA test equipment distributor at a User price (optional) of \$242.50.

For details on the RCA WR-99A, check your RCA distributor . . . and be sure to read the feature article in the next issue of RADIO AND TELEVISION SERVICE NEWS.

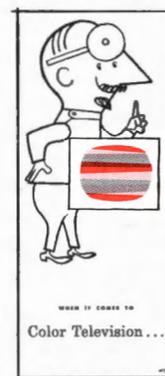
New RCA Battery Types

Three new battery types especially designed for use in portable radio receivers were recently added to the RCA line and are now available from your local RCA battery distributor.

Two of these types—identified as the VS315 and VS316—complement new portable radio sets recently announced by major American radio manufacturers. The third—designated as the VS318—is for use in imported portable radios.

The VS315 is a 7½-volt "A" battery, while the VS316 is a 90-volt "B" battery and the VS318 a 67½-volt "B" battery.

Simultaneous with the announcement of the VS315, VS316, and VS318, RCA also announced the VS317, a 6-volt battery type for industrial-lighting applications.



RCA's new Door Knob Hanger (top), Indoor Sign (center), Shelf Strip Book (bottom left), and TV "Greeting Card" Mailer (bottom right) will help you pyramid your sales and heighten your reputation in your community.

FREE WITH RCA TUBE PURCHASES

for you to learn the proper procedures without personal instruction.

Included in the pages of the Color Pict-O-Guide are many wave-form photographs which illustrate signal-tracing methods for localizing troubles in the color circuits. Through the use of this new RCA volume, you should be able to adjust and troubleshoot color receivers as speedily and proficiently as you perform these functions on black-and-white receivers.

* * *

When you check your RCA tube distributor on the new RCA Color TV Pict-O-Guide, tell him also that you would like to receive the new RCA promotion aids shown at right and described below. These merchandisers are geared to pep up your sales, boost your profits.

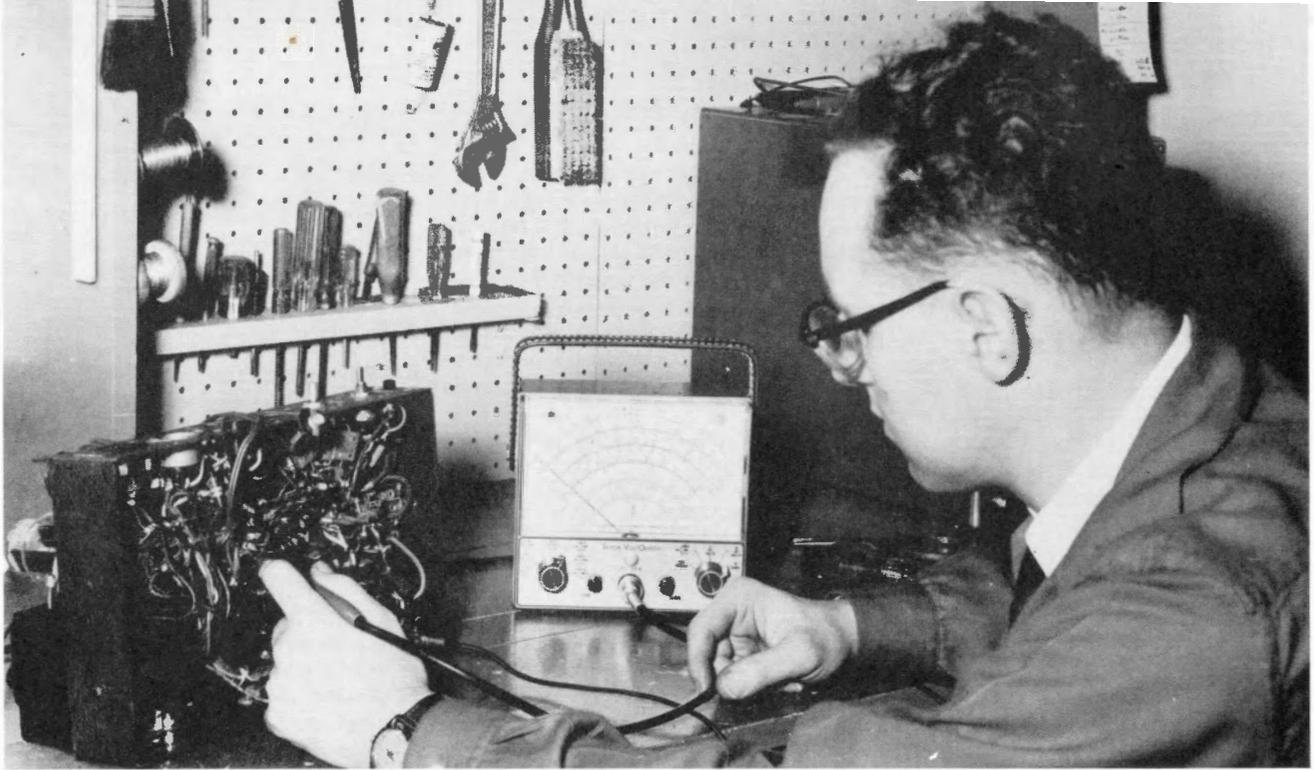
• Door Knob Hanger (Form 4F79) —A good reputation is vitally important in soliciting new business as well as in building repeat business. No better way to advertise your expert service than through recommendations made by satisfied customers. Use the new door knob hangers when making your service calls and let the neighborhood

know you just completed a repair job.

• Indoor Sign (Form 4F77) —This colorful "shingle" will identify your shop as headquarters for color-TV repairs. With an easel for standing and a hook for hanging, the modern 9-inch by 12-inch Indoor Sign is tailor-made for display in your store or store window.

• Shelf Strip Book (Form 3F133A) —Label your shelves with the handy self-adhering strips contained in this booklet. You will find inventory taking much easier, you will locate tube types faster, and your shelves will have that "professional" look. Most of the strips have bold type numbers and space for your minimum inventory figures. For your convenience, some blanks are also included in the Shelf Strip Book.

• TV "Greeting Card" Mailer (Form 4F78) —Inject the idea into your customers' minds that "when it comes to color television," you are the expert to call. This clever greeting card promotes your technical proficiency . . . carries your name and address . . . helps increase your black-and-white TV repair business, too. The card comes complete with mailing envelope.



Get More from Your VoltOhmyst

by Rhys Samuel*

Commercial Engineering
RCA Components Division

Fully deserving its reputation for versatility, the RCA VoltOhmyst® is one of the most flexible test instruments devised. The inherent advantages of high input resistance on dc-voltage measurements, its good frequency response on ac-voltage measurements, and its ability to measure resistances over very wide ranges make the VoltOhmyst useful in countless applications. (As you most probably know, "VoltOhmyst" is a registered trademark of the Radio Corporation of America and refers to the vacuum-tube voltmeter sold by RCA.)

In certain applications, questions may arise as to the proper method of making a measurement. For example, it is often possible to check performance of a circuit by measurements at two or more points. In some of these cases, the technician may not be sure which measurement is the correct or best one to make. The decision will depend upon the characteristics of the circuit under test and upon the technician's understanding of the capabilities and limitations of his test instrument. With the knowledge of a few

*Author of "The V.T.V.M.—How It Works, How to Use It," published by the Gernsback Library, Inc., New York, N. Y.

important facts regarding the vtvm type of instrument, a decision as to the correct method of making a measurement and the correct interpretation of the resultant meter reading should not present a problem. With this knowledge, the technician can utilize his instrument to the fullest extent of its capabilities.

Measurement Accuracy

General

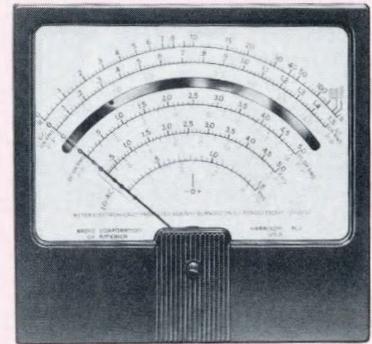
The accuracy of any measurement depends upon a number of factors in addition to the inherent accuracy of the instrument. It is important to remember that a properly operating measurement instrument will generally provide an accurate reading of the voltage or resistance component being measured. Very often, however, connection of the instrument into the test circuit will upset normal circuit operation. For example, circuit loading by the voltmeter can lower the normal operating voltage in the circuit, thereby causing the voltmeter to indicate a lower voltage than is normally present when the instrument is not connected into the circuit. In this case, the voltmeter is still providing an accurate reading of the circuit voltage, although the voltage is not that which exists when the voltmeter is disconnected. A number of similar pitfalls which can

beset various types of measurements are discussed below.

DC-Voltage Measurements

The degree of accuracy with which a VoltOhmyst or other type of vtvm can indicate a voltage reading is expressed as a percentage of full-scale reading. For the RCA VoltOhmysts, this accuracy is $\pm 3\%$ for dc-voltage measurements.

Measurement error within the instrument is introduced primarily by two factors: (1) error in the meter movement, and (2) variance in the values of the precision resistors used in



Scale face-plate of the RCA WV-87B Master VoltOhmyst. Note special low-voltage scales for ac measurements. Mirror backing is provided to eliminate meter-pointer parallax.

the divider networks. These errors may be cumulative. For example, if the meter movement causes a reading which is low by 2% and the resistor network introduces an additional error of -1%, the instrument will indicate a value which is 3% lower than the actual value of the test voltage. It is also possible for the tolerance of the meter movement and the error in resistance value to be in opposite directions so that the total measurement error is reduced to 1%. This error can be either high or low.

Tracking error in a meter movement is another source of deviation from the true meter reading. Tracking error is the amount of deviation from the true meter reading at various points below the full-scale point. When voltage readings are taken at scale points below full scale, tracking error may cause the reading to be inaccurate. Tracking error is usually most noticeable in the lower quarter of the voltage scales. It is generally not advisable to make readings near the zero point of the scale because vacuum-tube and meter-movement nonlinearity and meter-bearing friction often make these readings less accurate than readings nearer full scale.

Very few manufacturers of commercial vacuum-tube voltmeters publish the amount of tracking error characteristic of their instruments. In the RCA VoltOhmysts, however, tracking error is restricted to no more than $\pm 1\%$. During dc-voltage measurements, it is



RCA's WG-264 and WG-301A Crystal-Diode Probes.

generally good practice with any voltmeter, including the VoltOhmyst, to use the range or scale which gives a reading nearest the full-scale point.

Ohms Measurements

Nearly all ohmmeters, including the VoltOhmysts, are designed to provide most accurate resistance readings at the center-scale points. This factor should be remembered by the service technician when measurements are taken. Calibration checks are made at mid-scale points because of the difficulty which would be present in attempting to check accuracy at the full-scale point, which is infinite resistance,

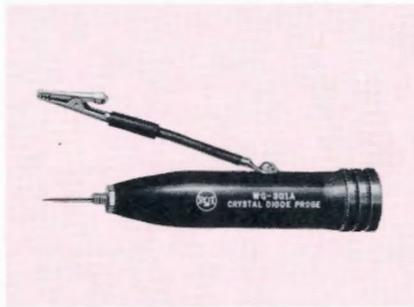
or at the zero-resistance point, which is a short circuit.

Although most manufacturers specify accuracy percentages for the ac- and dc-voltage functions of their instruments, they do not specify an accuracy figure for resistance measurements. While this practice may be questionable, it should be remembered that resistance measurements of high accuracy are not required in general service work. The tolerance of most resistors used in conventional TV and radio receivers is in the order of $\pm 10\%$ and $\pm 20\%$. If the receiver can tolerate deviations of these magnitudes, it is not necessary to measure the values to a close tolerance. Resistance values which must lie within very narrow limits should be measured with calibrated resistance bridges designed especially for such applications.

With the RCA VoltOhmysts and other types of ohmmeters, therefore, the highest resistance which can be measured with maximum assurance of accuracy is the resistance shown at center scale on the highest resistance range. In the VoltOhmysts, this center point is the 10-megohm mark. In non-electronic meters, this maximum center-scale value is usually less than one megohm.

AC-Voltage Measurements

The same considerations discussed under "DC-Voltage Measurements" above apply to the use of ac-voltage



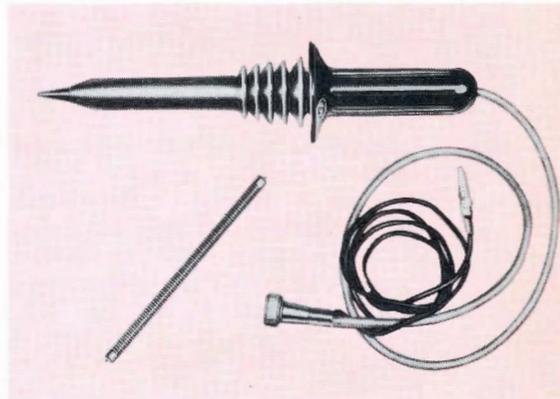
ranges and scales except for the use of a special scale marked "Low AC." AC voltages applied to the VoltOhmysts are converted to dc voltages by a vacuum-tube rectifier before application to the measurement circuit of the instrument. At very low signal levels, usually below 0.5 volt, the rectifier diode is nonlinear so that it is necessary to use a special, nonlinear voltage scale on the lowest ac-voltage range. For this reason, low-voltage ac measurements should always be made on the special "Low AC" scale.

Important additional factors affecting accuracy of ac-voltage measurements are the type of waveshape and

impedance in the test circuit. These problems are discussed under "Application."

Application

Use of Auxiliary Probes • Two types of auxiliary probes are available for use with the VoltOhmyst. The RCA WG-289 High-Voltage Probe and the WG-206 Multiplier Resistor make possible the direct measurement of dc voltages up to 50,000 volts with complete safety to the operator. When the WG-289 probe is used, the total dc-input resistance of the VoltOhmyst is increased to 1100 megohms. This extremely high input resistance permits



RCA's WG-289 High-Voltage Probe and WG-206 Multiplier Resistor.

use of the VoltOhmyst in circuits which are extremely sensitive to loading, such as high-voltage low-current power supplies and other voltage sources characterized by poor regulation. In addition to routine service applications in television, the WG-289 is valuable in the servicing of radio transmitters, X-ray equipment, and other electronic devices which operate at high dc voltages.

The WG-264 and WG-301A Crystal-Diode Probes are slip-on type high-frequency probes which extend the frequency range of the VoltOhmyst up to 250 Mc. They are rectifying probes which provide dc output voltage, so that readings can be made on the dc-voltage scales of the instrument. These probes are useful in signal tracing and in trouble-shooting high-frequency circuits, such as TV tuners and if amplifiers. Rectifying probes are extremely useful devices in many applications and can greatly increase the flexibility of a vacuum-tube voltmeter.

There are a number of considerations to keep in mind, however, when these probes are utilized. Each probe is equipped with a short ground lead which should always be grounded as close as possible to the high-frequency test point. Although the probes have a

(Continued on next page)

GET MORE FROM YOUR VOLTOHMYST

(Continued from preceding page)

maximum input signal rating of 20 rms volts (28 peak volts), they cannot be used for signal tracing in very-low-level stages because the signal voltage is in the order of a few millivolts. Service-type vtms, including VoltOhmysts, are not designed to measure such small voltages. In other applications involving large amounts of rf power, it should also be remembered that these probes have input-voltage limitations. They can be very useful in checking low-level exciter units and oscillators, for example, but they are not intended for measurement of the strong rf signals encountered in transmitter amplifier stages. Within their ratings, however, they can be used for measurements and comparative voltage checks in many applications which are unsuited to the use of conventional vacuum-type voltmeters or oscilloscopes.

When any auxiliary probe is used with a vacuum-tube voltmeter, allowance should be made for the possible introduction of additional measurement error. The resistor used in the high-voltage probe, for example, has a tolerance of $\pm 2\%$ which, when added to the $\pm 3\%$ possible error of the VoltOhmyst, will provide a reading which is within $\pm 5\%$ of full-scale accuracy. This tolerance, however, is more than acceptable for general service work.

DC-Voltage Measurements • Measurement of dc voltages presents few problems to the technician, although there are a number of precautions to be observed when dc measurements are made in circuits containing ac voltages. For example, although the dc probe contains an isolating resistor which acts to reduce the ac circuit loading of the VoltOhmyst, it is always best to make a dc-voltage measurement at

some point in the circuit which is at ac-ground potential. Because such points are relatively insensitive to ac loading, connection of the VoltOhmyst will not affect circuit operation. In the plate circuits of rf and if amplifiers, for example, the cold end of the tuned circuit is bypassed to ground with a capacitor. The dc voltage at this point is the same as that at the plate of the tube.

The dc voltage measurement function is also useful in checking performance of oscillator stages in various types of equipment. The amount of negative dc grid voltage developed by an oscillator is a good indication of whether the stage is functioning properly. Some oscillator circuits, however, such as the vertical oscillator in a television receiver, are extremely sensitive to loading, and the connection of a vacuum-tube voltmeter may cause a reduction in the measured bias. If the normal developed bias is high enough, it is possible to use a high-voltage probe in the measurement to decrease the amount of circuit loading. There are very few applications in which low circuit loading is considered a disadvantage. Battery testing is one exception, however, because batteries should always be tested under load. It is characteristic of all batteries that the load voltage decreases with battery age and use. A used or out-dated battery develops an increased internal resistance which acts to lower the output voltage when load current is drawn.

Because of this characteristic, the battery voltage should always be measured under load in the equipment in which it is used. In the case of portable radios, the voltage should be measured with batteries connected to the receiver and the power switch turned on. If batteries are not installed in the re-

ceiver, a suitable external resistance should be temporarily connected across the output terminals. The value of this load resistance can be calculated by Ohm's law. The resistor should draw an amount of current equal to that drawn from the battery under normal load. The resistor should have a wattage rating sufficient to handle the current drawn during the test. The VoltOhmyst should be set to read dc volts, and a suitable range scale should be selected.

A frequent cause of error in dc measurements is failure to set the sliding switch in the multi-purpose probe to "DC" prior to measurement. In the "DC" position of the switch, the 1-megohm isolating resistor is connected in series with the probe and becomes part of the 11-megohm input resistance of the VoltOhmyst. When this resistor is switched out on dc-voltage measurements, an additional error in the order of 10% is possible.

Ohms Measurements • In-circuit resistance measurements are often complicated by the presence of other resistors and capacitors across the component being measured. In such cases, it is always best to disconnect one end of the component under test before making the measurement. If the resistance can be measured on two or three scales, the scale which provides a reading nearest the mid-scale point should be used, as described under "Measurement Accuracy."

Power should always be removed from the circuit under test before resistance measurements are made. Failure to observe this precaution may result in damage to the precision resistors used in the ohms-divider network in the instrument. Although this precaution may seem obvious, it is frequently overlooked by experienced technicians.

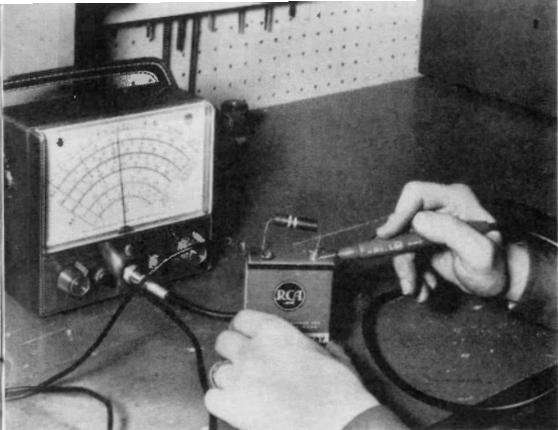
When leakage resistance of large capacitors is being measured, several seconds or minutes may be required for the meter pointer to stabilize its reading. This effect is caused by the charging of the capacitor by the battery in the VoltOhmyst. The current drawn from the battery by the external capacitor must flow through the resistance in the ohms-divider network in the VoltOhmyst. The charging time may sometimes be reduced by turning the Range switch to the RX1 position and then switching to higher ranges as the capacitor becomes charged.

When in-circuit resistance is measured, all paper and electrolytic capacitors should be shorted to ground before probes are connected. These capacitors frequently retain a residual charge which can seriously upset the

TABLE I

Conversion chart for sine waves only

MULTIPLY			TO GET
RMS By	PEAK By	P-P By	
—	0.707	0.353	RMS
1.414	—	0.5	PEAK
2.38	2.0	—	PEAK-TO-PEAK



This photo points up the proper method for checking battery voltages with a vacuum-tube voltmeter. Note load resistor connected across battery terminals.

meter reading. If convenient, the large-value capacitors should be disconnected.

AC-Voltage Measurements • Ac-voltage measurements are an unnecessary source of confusion to many technicians. With a few facts in mind, the technician should be able to use the VoltOhmyst without hesitation or error in a wide variety of ac-voltage applications.

Reliable ac measurements can be assured if the following basic factors are kept in mind.

1) The VoltOhmyst is designed to measure the rms and peak-to-peak values of sine waves and certain types of symmetrical and nonsymmetrical complex waves.

2) The shape and repetition rate of the waveform being measured have a direct affect on the accuracy of the meter indication.

3) The VoltOhmyst is designed to measure ac signals over a specified frequency range and under specified circuit impedances.

The WV-77C Junior VoltOhmyst is designed to measure the rms values of sine waves only. Both the rms and peak-to-peak values of sine waves and complex waveshapes can be measured directly with the WV-87B Master VoltOhmyst and the WV-98A Senior VoltOhmyst. The relationships between the rms, peak, and peak-to-peak portions of a sine wave are shown in Figure 1. The chart in Table I provides conversion information for the computation of all other values when any one value is known. It should be noted that these factors apply to sine waves only. They cannot be applied to any other type of waveshape. If this point is ignored, trouble may result because each type of waveshape has its own mathematical relationships. The rms value of the pulse shown in Figure 2 may be only 10% or 20% of its peak value, depending upon the width of the pulse, the repetition rate, and the reference level. If an attempt is made to measure the

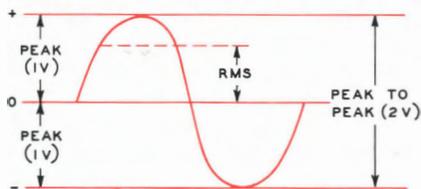


Figure 1. RMS, peak, and peak-to-peak relationships of a sine wave.

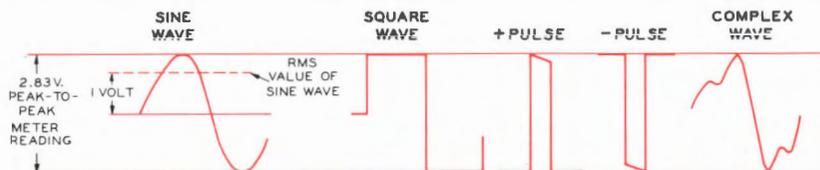


Figure 2. Types of waveshapes encountered in electronics servicing.

rms value of this pulse on an instrument designed to indicate only the rms value of a sine wave (such as the Junior VoltOhmyst), the reading will be erroneous.

When only sine-wave measurements are involved, it is possible to calibrate meter scales in both the rms and peak-to-peak values because it is necessary only to multiply an rms reading by 2.83 to obtain the equivalent peak-to-peak value. In such cases, a single half-wave diode rectifier can be used in the ac-signal section. The diode rectifies either the negative or positive half of the sine wave.

Instruments which are designed to measure the peak-to-peak values of complex waveshapes, such as the RCA WV-87B and WV-98A VoltOhmysts, rectify both the positive and negative peaks of the incoming signal. These peak-to-peak rectifiers, which utilize two diodes, require special filter circuitry having a long time constant. Even these peak-to-peak circuits have their limitations, however, and it is important to know what types of complex waveshapes they are designed to measure. The WV-87B and WV-98A VoltOhmysts can measure a number of types of complex waves, both symmetrical and nonsymmetrical, including those shown in Figure 3.

In applications involving repeated measurements of other types of waveshapes, the technician may have to determine the measurement capability of his vacuum-tube voltmeter. Once the amplitude of a complex waveshape has been checked on a suitable oscillo-

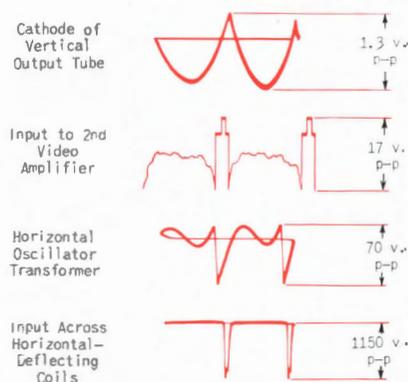


Figure 3. Representative TV waveforms which can be measured with the RCA WV-87B and WV-98A VoltOhmysts.

scope, the peak-to-peak reading of the vacuum-tube voltmeter can be checked against the oscilloscope measurement. This initial check is especially useful in applications involving repeated vacuum-tube voltmeter measurements, such as those encountered in electronics servicing and production-line testing.

All RCA VoltOhmysts are designed for ac measurements over the frequency range from approximately 30 cps to 3 Mc. These instruments are frequency compensated on all ac-voltage ranges except the 1500-volt range on the WV-87B and WV-98A and the 1200-volt range on the WV-77C. This wide range permits measurement in audio-frequency and low-frequency rf applications. The wide-range frequency response is made possible by the use of vacuum-tube diodes in the ac-signal sections.

Replacement Meters and Cases for RCA Test Equipment

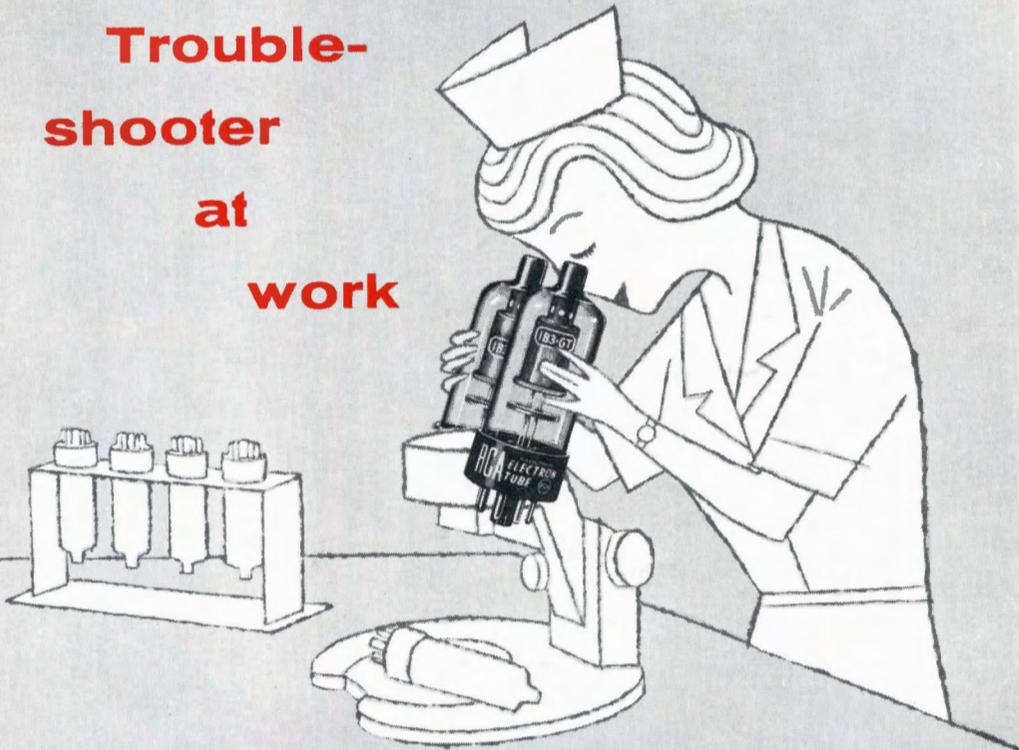
Your local RCA distributor can now provide you with replacement meters and meter cases for a wide variety of RCA test and measuring instruments, including VoltOhmysts®. Bear in mind that he is offering only complete meters and individual meter cases. Meter movements, glass windows, and other

meter parts are not available.

For a listing of the stock numbers of the meters and meter cases that go with specific RCA test equipment, write for the new Form ICE-116A bulletin. It is obtainable from Commercial Engineering, RCA Components Division, Bldg. 60, Camden, N. J.

QUIET

**Trouble-
shooter
at
work**



Here's how Microscopic Inspection by RCA helps reduce costly callbacks...

A bad tube, or a potential trouble-maker—can it get by this gal? Not likely. She's part of the specially trained RCA group of inspectors whose important job it is to find trouble and help prevent it from happening *to you*.

RCA Quality-Control Procedures include MICROSCOPIC INSPECTION OF POPULAR TV RECEIVING TYPES! These types are closely examined for possible poor welds, weld splatter, bad crimps, damaged stems, improper assembly, and many other factors that can affect top quality, long-term performance. Though the tubes may pass all electrical tests, such defects could slip by and mean the difference between a profitable service call and a costly callback.

You gain valuable assurances from this *extra* care: (1) that popular TV receiving types shipped to RCA Tube Distributors have had the *extra* benefit of the MICROSCOPIC INSPECTION PROGRAM and (2) that you can always service your customers with the confidence that RCA TV Receiving Types are top quality replacement tubes.

When you order—tell your distributor "RCA only" and watch your profits grow.



RECEIVING TUBES

RADIO CORPORATION OF AMERICA

Electron Tube Division, Harrison, N. J.



RCA
Electron Tube Division
Harrison, N. J.

**Compliments of Your
Local RCA Distributor**

Headquarters for:

RCA

Tubes
Batteries
Electronic Components
Test Equipment
Technical Publications

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