

How to Use
DIAGRAMS
in Radio Servicing.

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Instructor, National Defense Classes
Author of Many Radio Books and Articles

How to Use DIAGRAMS *in Radio Servicing.*



1. What is a radio diagram?
2. 1000 facts in every diagram.
3. What a diagram does not tell you.
4. How to use diagrams in service work.
5. How to find the probable trouble using diagrams.
6. How to make sure of your suspicion.
7. Making the actual repair.
8. How any serviceman can make more money.
9. How to obtain and file diagrams.

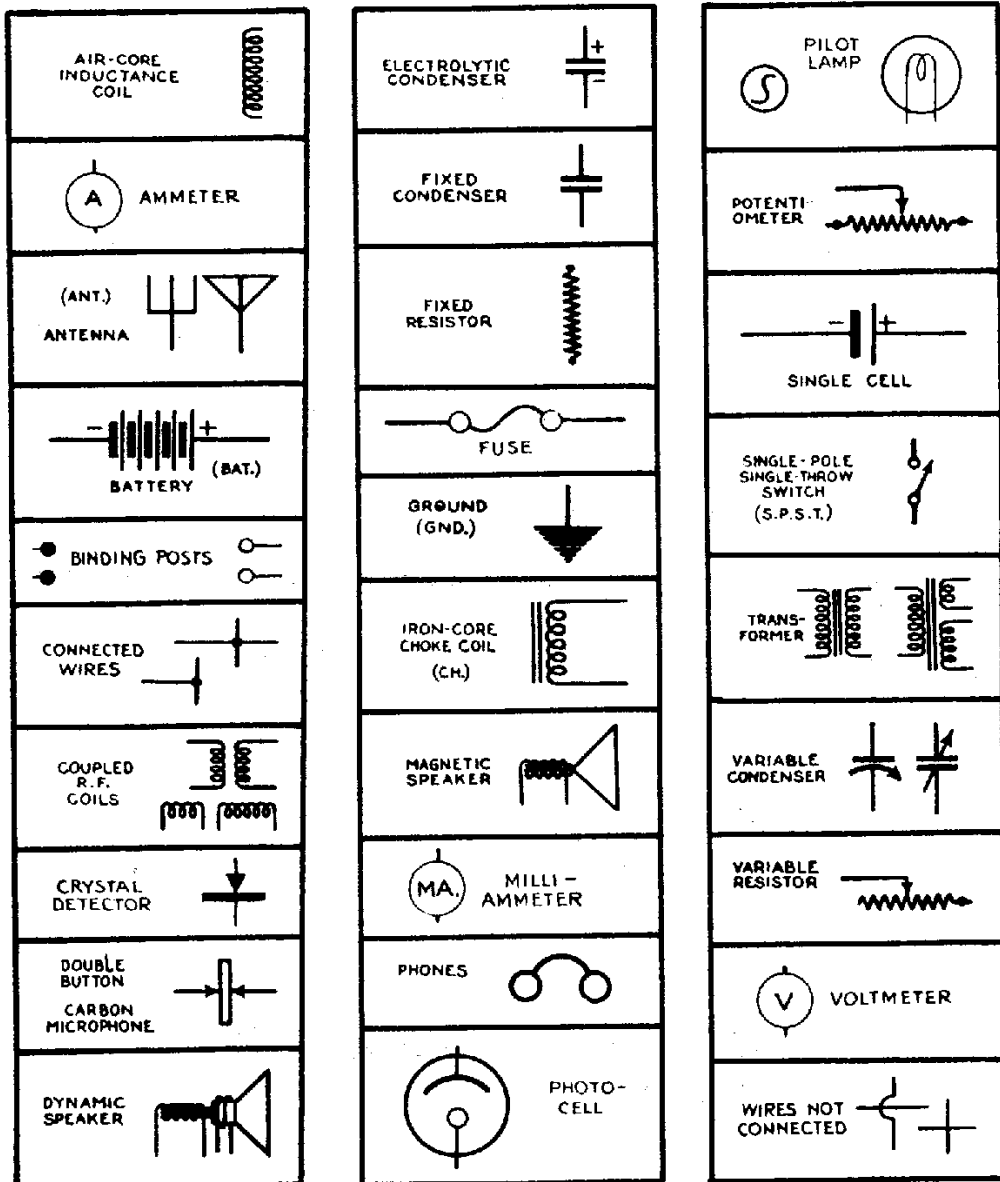
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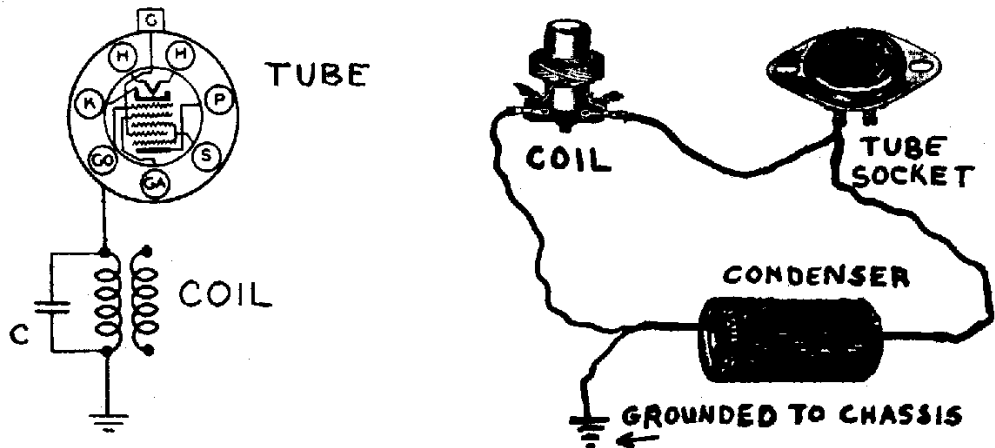
Only a few radio servicemen know how to get every bit of information from a schematic diagram. This booklet is prepared to help you learn how to use effectively radio diagrams for quicker and better repairs. Give this material a fair chance and, even if you are an old timer, you will agree with us that you learned plenty from this booklet about the use of diagrams and servicing methods. Let us begin with a simple question:

1. What is a radio diagram?

Short-hand symbolic notations are used in all branches of science. Radio diagrams show different parts used and the circuit connections in a simplified symbolic form. To save time, permit easier tracing of the connections, and allow quick comparison, radio diagrams are used. For the readers who are beginners and to serve as a reference for others, symbols of common radio parts are listed below.



In complete diagrams straight lines are used to indicate the connections between parts, but these lines do not indicate the actual wires. The parts may be wired in any fashion as long as exactly the same component parts are connected with the lines and are also wired to permit the passage of current.

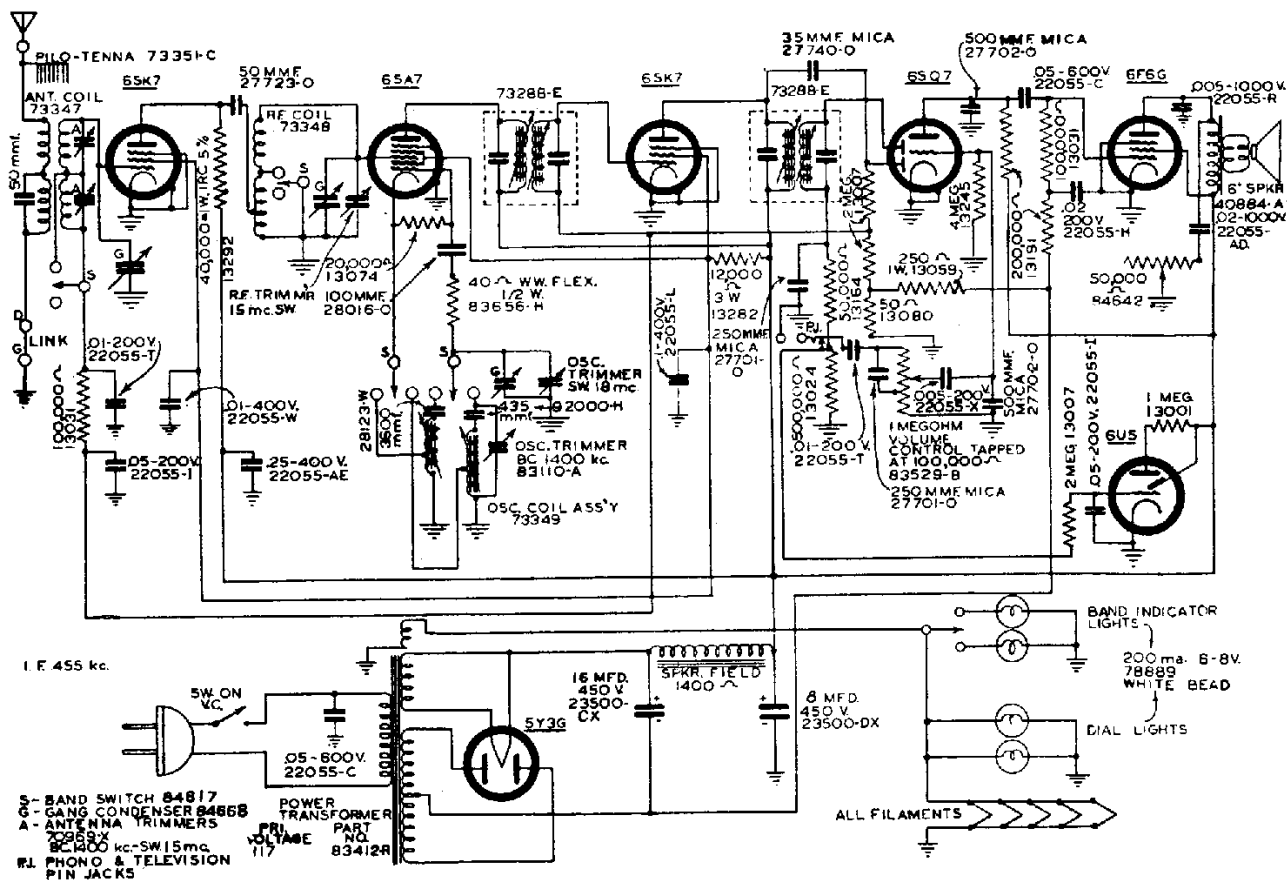
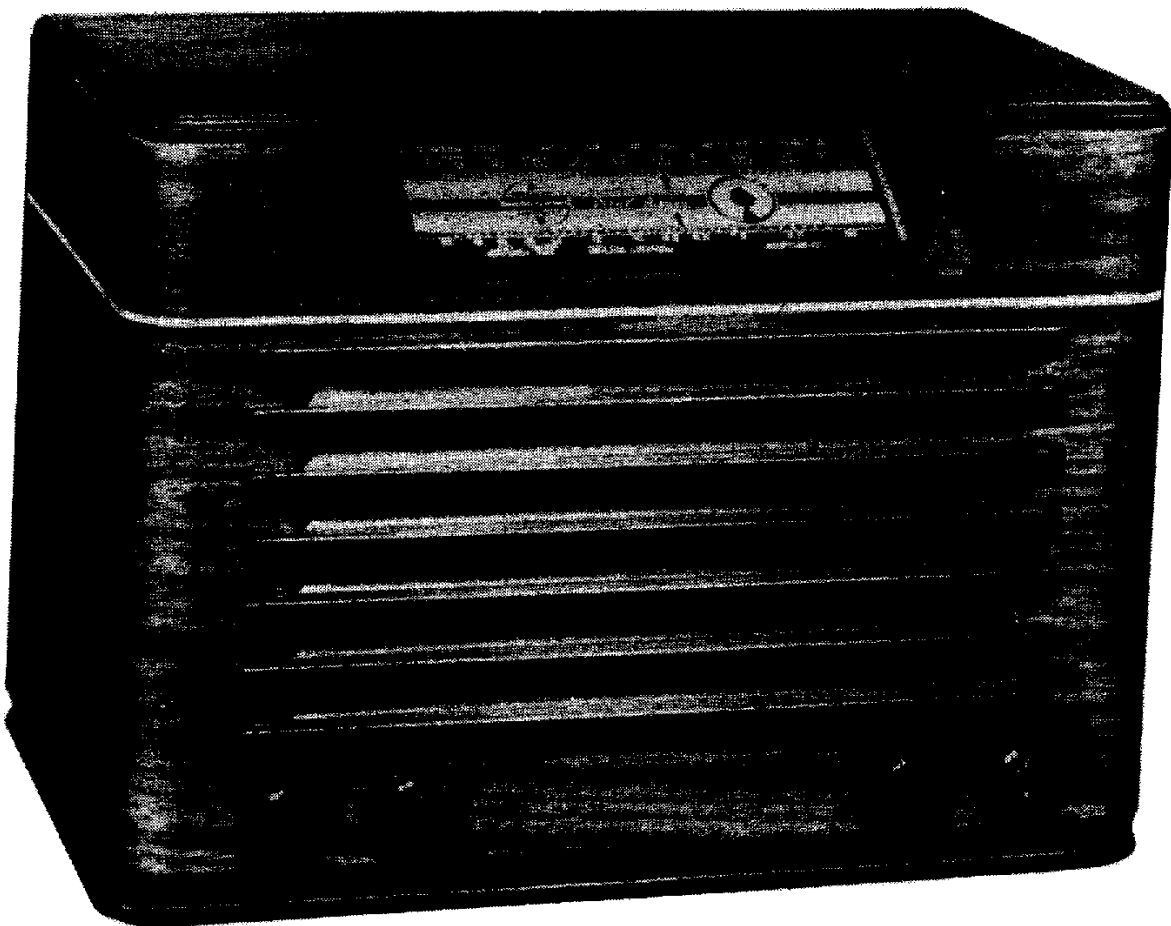


This example illustrates that the actual wires and the diagrammatical lines will permit the same passage of current and are, therefore, considered the same connections. But the lines are not exact representation of the wires for circuit tracing purposes.

If all radio sets were made on large bases, all parts carefully laid out and clearly marked with their exact values, all wires were clearly visible, and we could see above and below the chassis at the same time, no schematic diagram would be required. Of course, this is not the case and what a job it really is to trace out even a small portion of a circuit. But a complete radio circuit diagram gives you this picture of the radio set and we will see the multitude of helpful hints and service pointers which can be found in any diagram.

2. 1000 facts in every diagram.

Probably you cannot see how a single diagram can give 1,000 facts about the circuit, but it does. Let us consider the diagram of a seven tube Pilot set on the next page.



Here is the general information
about the complete radio set:

This is a seven tube radio using a tuning eye tube and designed for A.C. operation. The set covers two bands and has a novel arrangement of pilot lights for band indication. Assuming single dial control, band switch, tone control, and volume control there should be four knobs employed. A dynamic speaker is used and it is indicated as a 6" unit. The set is a superhet using one stage of I.F. Of interest is the resistance-capacity coupled R.F. coil giving superior tone quality, Also note that the I.F. transformers marked 73288-E are of the permeability tuned type. These general facts are only a few of the many which can be found by examining this circuit.

Here is the basic information
about the audio output stage:

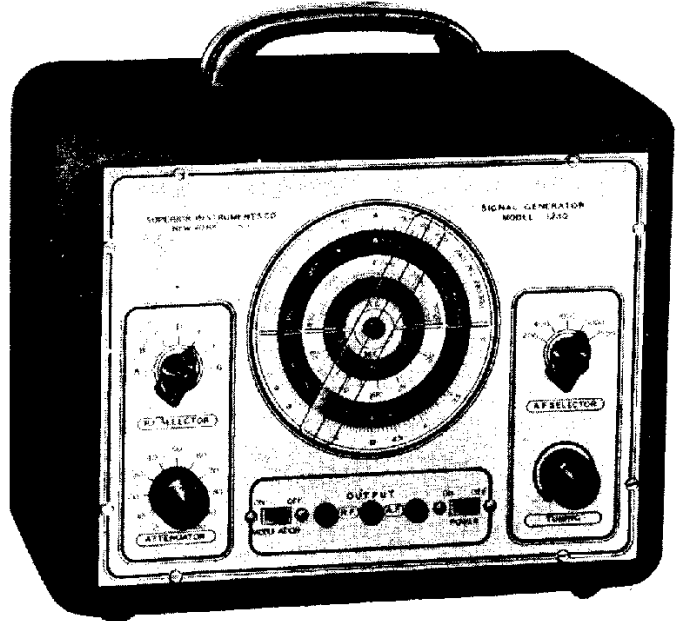
The power output stage employs a 6F6-G pentode and is resistance coupled to the previous triode section. The tube is coupled to the voice coil of a dynamic speaker by means of an output transformer. From a tube manual it is easy to learn that the power output is about three watts. A tone control is incorporated in this circuit.

Here is the specific data
about the same stage:

If we analyze this same stage with greater detail, we can obtain specific information on the value of each condenser and resistor used. Many of these parts are also listed with exact manufacturer's numbers. Circuit details also can be found. For example a .05 mfd. condenser is used as a tone compensator and the tone control consists of a series condenser and variable resistor and is also placed in the plate circuit. Of interest is the biasing method used for this 6F6-G tube. The cathode is kept at a ground potential and the .02 mfd. condenser serves as a grid return decoupling by-pass. The total drop in the negative leg of the power supply (in the 250 and 50 ohm series resistors) is used for this purpose. The voltage at the tap of these two resistors is used as the minimum bias for the tubes with A.V.C. This will give you an idea what we mean by specific data and, of course, there is plenty more.

The New Model 1230 SIGNAL-GENERATOR

WITH FIVE STEPS OF SINE WAVE AUDIO



The actual Size of this Instrument is 14" x 6" x 11"
Works on 90-130 Volts A.C. or D.C. (Any Frequency)

When Superior Instruments Company decided to bring out a new Signal Generator, it was resolved to introduce mass production so that the very finest type instrument could be produced at extremely low cost. Therefore all figuring was done on the basis of producing 10,000 Signal Generators, and the price was fixed accordingly, hence at only \$12.85 it is now possible to obtain an instrument that, in performance and excellence, measures up to other instruments selling for double, even triple, the price.

It is easy to see that by usual standards of comparison of price and performance, the Model 1230 Signal Generator is incomparably beyond competition: It covers 100 K.C. to 90 M.C. in seven steps, selected by front-panel switch; it has 1% accuracy on I.F. and broadcast bands, 2% accuracy on other bands; it has selection of modulated and unmodulated output, and when modulated, not the usual restriction to a single frequency, but a choice of any one of five audio frequencies, all of them sine-wave; moreover, each of these audio frequencies is independently selectable as audio alone, besides the freedom of modulating them on all the carrier frequencies generated.

Also, the usual advantages that are expected in a very high-grade signal generator are naturally present in this one: an attenuator that really attenuates to utmost satisfaction; a vernier dial with smooth and rugged drive; an etched metal front panel with direct-reading calibration; and a shield cabinet of attractive appearance. The cabinet is unique with its rounded edges and grey crinkle baked finish, with bumpers and carrying handle. By every criterion this Signal Generator is the one to buy! The performance is everything that one could ask, the price is so low that it is impossible to get such extensive performance even at considerably higher price; and the care taken in calibration, manufacture and testing is such that even the makers of high-priced laboratory instruments can offer no more. Remember that behind this instrument is Superior's five years of intensive experience in the manufacture of Signal Generators, during which time they have made and sold more Signal Generators than any other manufacturer.

SPECIFICATIONS

RADIO FREQUENCIES from 100 K.C. to 90 Megacycles in 7 bands by front panel switch manipulation. All direct reading and accurate to within 1% on I.F. and Broadcast bands, 2% on higher frequencies. The R.F. is obtainable separately or modulated by any one of the five Audio Frequencies.

AUDIO FREQUENCIES: 5 steps of SINE-WAVE audio 200, 400, 1000, 5000 and 7500 cycles WITH OUTPUT OF OVER 1 VOLT. Any one of the above frequencies obtainable separately for servicing P.A., hard-of-hearing aids, etc.

ATTENUATION: Late design, full-range attenuator used for controlling either the pure R.F. or modulated R.F.

CIRCUIT: The Model 1230 employs an improved electron coupled oscillator circuit for the R.F. affording positive protection against frequency drift and a Hartley oscillator circuit for the A.F. section.

DIAL MANIPULATION: Large 5½" dial etched directly on front panel, using a new mechanically perfected drive for perfect vernier control.

APPEARANCE: The front panel is etched by a recently perfected process which results in a life-long attractive finish and the instrument comes housed in a streamlined shielded cabinet.

CURRENT SOURCE: The Model 1230 operates on 90 to 130 Volts A.C. or D.C. any frequency.

The Model 1230 comes complete with tubes, shielded cables, moulded carrying handle and instructions. Size 14" x 6" x 11". Shipping weight 15 pounds.

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And here is the specific information about one part -- the plate coupling resistor of 6SQ7 tube, part 13191:

This resistor has a resistance value of 200,000 ohms, as marked. It is used to load the triode section of the tube mentioned and carries the plate current for this tube. Without consulting tube characteristic information, you can guess that the current is in the order of a few milliamperes. Applying the wattage formula: Watts equals current in amperes multiplied by itself multiplied by the resistance, we can find the power handling requirements of this resistor. (Actual problem: about $.002 \times .002 \times 200,000$ equals 0.8 watts; probably one watt resistor used.) An important fact to notice is the possibility of this resistor to burn out if the plate R.F. by-pass 500 mmfd. condenser shorts.

Now consider the several stages used as well as the power supply, multiply this by the many different parts used in each stage, multiply this by facts known to you in general but made specific with the aid of a circuit diagram, and you have the total information needed to service the set quickly and efficiently.

3. What a diagram does not tell you.

But a diagram does not tell you many things. Sometimes the non-indicated data can be found in the actual radio, or figured out by reasoning or formulae, or obtained from a parts list. Let us see how this additional information may be obtained.

In the previous chapter, we assumed that there were four control knobs from the data given in the circuit. This, of course, can be checked by examining the chassis itself. Using a formula for wattage, we have also calculated the wattage of a resistor.

Now looking back at the circuit we have been using in our discussion, we notice several switches marked "S" located in different sections of the circuit. The foot-note in the lower left hand corner of the diagram, tells us that this is the band switch and these many separate switches must be controlled by a single knob. This fact, you will notice, is not obvious from the circuit, but can be understood by an experienced radio man with the aid of a diagram.

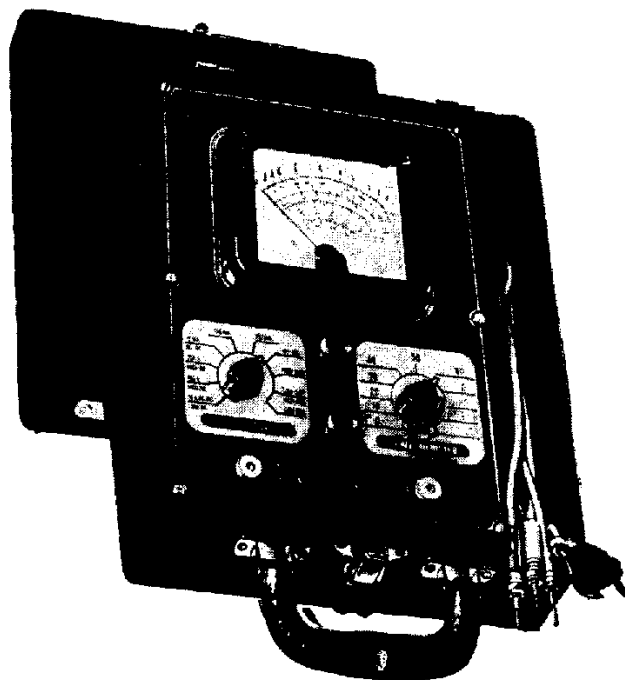
Information on number of turns in a coil, the type of base used for pilot lights, and other such facts are not often included, but they are not needed for servicing.

THE NEW MODEL 1250 MULTITESTER

with Sloping Panel for Precise Rapid Servicing

MEASURES

A.C. Volts
D.C. Volts
A.C. Currents
D.C. Currents
High Resistance
Low Resistance
High Capacity
Low Capacity
Inductance
Decibels
Watts



FEATURES

Positive silvered contact switches.
6H6 linear rectifier.
4½" d'Arsonval type meter, 2% accuracy.
Precision multipliers and shunts.
Simple manipulation process with original switching arrangement, and clear designations of functions on the front panel plate.
Accuracy 2% on D.C. voltages. Resistances and Currents, 5% on all other measurements.
Attractive etched aluminum panel.
Housed in sturdy, attractive black case, with sloping panel for rapid precise measurements.

The Actual Size of this Instrument is 9½" x 11" x 6½"
Sensitivity—1000 ohms per volt.
Works on 90-130 Volts 60 Cycles A.C.

SPECIFICATIONS

Complete A.C. and D.C. Voltage and Current Ranges
D.C. Voltage:—0-15, 0-150, 0-750 volts
A.C. Voltage:—0-15, 0-150, 0-750 volts
D.C. Current:—0.1, 0-15, 0-150, 0-750 ma.
A.C. Current:—0-15, 0-150, 0-750 ma.
2 Resistance Ranges
0-500 ohms, 500-5 megohms

High and Low Capacity Scales
.0005 to 1 mfd. and .05 to .50 mfd.
3 Decibel Ranges
—10 to +19,
—10 to +38, 10 to +53.
Inductance: 1 to 700 Henrys
Watts: Based on 6 mw. at 0 D.B. in 500 ohms .006000
M.W. to 600 Watts.

Here is an opportunity to acquire a Multi-Service, Precision Engineered Instrument, for less than you would have to pay for an ordinary Volt-Ohm Milliammeter. Besides making the usual volt, resistance and current measurements (both A.C. and D.C.) this unit accurately measures the CAPACITIES of mica, paper and electrolytic condensers, INDUCTANCE of coils, chokes, and transformers, DECIBEL gain or loss, of power amplifiers and public address systems, WATTS output of amplifiers, receivers, etc.

Model 1250 comes complete with test leads, Tabular charts and instructions. Shipping weight 9 lbs.

PORTABLE COVER \$1.00 ADDITIONAL

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4. How to use diagrams in service work.

Facts about radio diagrams are interesting, but you are primarily interested in knowing how to apply this knowledge to actual servicing problems. Let us show you how a circuit diagram

- (1) Saves time in servicing,
- (2) Points directly to the fault, and
- (3) Eliminates the need for complex and expensive test equipment for many jobs.

We will study several service jobs and consider the procedure used with and without a suitable diagram for each case.

For example let us assume you are called to repair a large, rather complex radio. You suspect that the service work was first attempted by the self-styled mechanical expert of the household, and this probably resulted in several connections being changed to some wrong positions. While the more able of us in the servicing game can trace a circuit with ease, only a few are able to find a wrong connection in the 20,000 different models manufactured to date. To find actual changes made in wiring a circuit diagram is absolutely essential.

But even if the wiring has not been changed, how does one locate a shorted by-pass condenser in the grid circuit of a power output tube which receives its bias from a tap in the field coil. We will require twenty to thirty minutes to trace things to a point where we can realize that the field coil is used as a choke and is connected in semi-fixed bias arrangement.

With a diagram the symptom of this fault will be a guide which cannot fail. The continued "hum" will suggest poor filtering of the power supply at some point and, seeing that a special biasing circuit is employed, you would immediately suspect the condenser mentioned. You must agree with us that hours can be saved almost every day by using diagrams.

5. How to find the probable trouble using diagrams.

A radio diagram divides the set into definite sections and, thereby, permits you to find quickly the single section at fault. In actual placement, a filter condenser may be located near the antenna coil, but even a beginner can see from a diagram that these parts belong to totally distinct sections. If the one faulty section is discovered, you need not search among all the parts for the fault, but can confine the work to a limited number of parts in this single section.

THE NEW CHANNEL

Follows the SIGNAL from Antenna

The well-established and authentic dynamic method of locating the very circuit in which there causes the trouble, is now for the first time available at a price any radio serviceman can afford, and designed and calibrated. The years of experience Superior has had in making fine test equipment a instrument that does what the usual test equipment can not do, that raises servicing to a new high plane owner as one of the advanced operators in his field.

Fundamentally, what the Superior Channel-Analyzer does is to permit the serviceman to follow the SIGNAL from antenna to speaker through each and every stage of any set ever made, and inferentially, of any set that ever will be made, using the SIGNAL as the basis of measurements. Thus if there is trouble in one particular channel or stage of a receiver, the serviceman can isolate the faulty stage and then proceed to ascertain the very part or component that causes the trouble.

Many of the troubles in modern receivers are due to the Automatic-Volume-Control and Automatic-Frequency-Control circuits and ordinary instruments do not permit measurements directly upon these circuits, so the Superior Channel-Analyzer includes a direct-current Vacuum-Tube Voltmeter that DOES make these measurements directly and with a negligible loading of the measured circuits. Other problems cease to be problems too, when the quick-solution method of the Channel-Analyzer is applied. For instance, suppose a local oscillator in a superheterodyne drifts. The Channel-Analyzer has a switch operated, tuned input circuit with amplifier, whereby not only the presence of drift may be discovered, but also the amount and direction of drift.

Distortion is another difficulty that often nettles a serviceman. The Channel-Analyzer has a jack for the insertion of earphones so that you can listen to the signal directly from any stage and, therefore, discover the stage in which the distortion takes place. Next, the VTVM is used to discover the very component in that circuit that is causing the trouble. How often have you cherished the hope that someday you would own an instrument that enables you to measure the actual signal voltage across the load of any stage in the set, and thus by comparison determine the gain per stage. The Channel-Analyzer enables those dynamic voltage measurements and does a whole assortment of other work besides, yet at a price much less than that usually asked for a dynamic voltmeter alone.

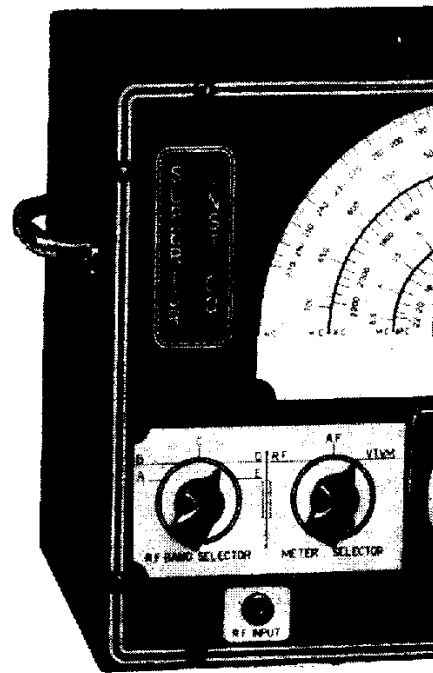
D.C. Voltages have important bearings on receiver performances. All these voltages can be measured on the Channel-Analyzer with the receiver in reproducing operation. In fact, that one important consideration, MEASUREMENTS WITHOUT MOLESTATION OF THE RECEIVER, gets rid of the drawback of most conventional equipment which greatly reduces the very voltage it attempts to measure, or kills the signal completely.

Tubes that are used in the receiver under test are also given a thorough check by the Channel-Analyzer and as such a specialized tube tester, this new and remarkable instrument is proof against any possibility of obsolescence.

Noise, another serious problem to servicemen, can be located with the aid of the Channel-Analyzer and can be done with incredible speed. Here are the basic components of the Channel-Analyzer:

1. B Supply rectifier and filter circuit.
2. One-stage, high-gain flat amplifier and linear diode detector.
3. Tuned-circuit, high-gain amplifier and linear diode detector, 100 KC. to 18 MC.
4. D.C. Vacuum-Tube Voltmeter, for measuring the rectified R.F., I.F. or A.F., and for independent use on external circuits, all by front panel switching.

By adroit engineering and skillful application of a wide knowledge of servicing requirements based on Superior's years of experience, the four components listed above are made to do so many things and do them so well and fast that a large benefit is bestowed on servicemen, their tasks lightened, their work speeded and their experience greatly extended, all at record-breaking low price.



The Actual Size of this Instrument
Works on 90-125

The Channel A

1. Follow signal from antenna to speaker ever made.
2. Instantly track down exact cause of
3. Measure both Automatic-Volume-control voltages and circuits without built-in highly sensitive Vacuum-T
4. Check exact gain of every individ
5. Track down and locate cause of d
6. Check exact operating voltage of
7. Locate leaky condensers and all
8. Measure exact frequencies, among oscillators in superhets.
9. Track down exact cause of noise.

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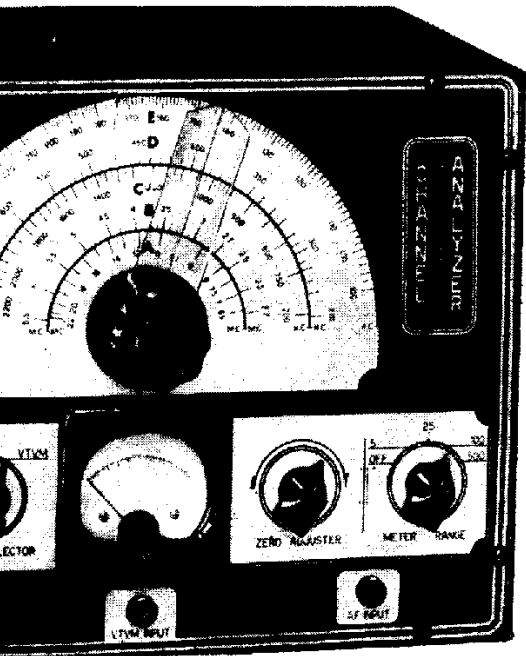
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CHANNEL-ANALYZER

Antenna to Speaker of any Set!

When there is trouble, and the very component that is at fault, and in an instrument that has been expertly designed, the Channel-Analyzer, the instrument of speed and accuracy and marks the



Size of this Instrument is 13" x 10" x 6"
on 90-125 Volts. 60 Cycles A.C.

Channel Analyzer Will—

Antenna to speaker through all stages of any receiver

Diagnose cause of intermittent operation.

Adjust Volume-Control and Automatic-Frequency-Control without appreciably loading the circuit, using Vacuum-Tube Voltmeter.

Test individual stage in receiver.

Reduce distortion in R.F., I.F., and A.F. amplifiers.

Locate stage of each tube.

Find and all high-resistance shorts, also show open circuits.

Measure amount of drift and comparative output of stages.

Eliminate noise.

SPECIFICATIONS:

Linear vacuum-tube voltmeter of unusual sensitivity, for measuring any D.C. voltages, even those across diode load resistors in A.F.C., A.V.C. and other circuits. Voltage ranges, by front-panel switch selection, are 0-5-25-100-500 volts, at practically constant input resistance of 11,000,000 ohms. Hence 5-volt range is at 2,000,000 ohms per volt. The electromagnetic meter used in the VTVM is a 3" square 0-1 milliammeter.

Unusually sensitive frequency meter, with input amplifier. This valuable component measures the quantity of R.F. - I.F. voltage supplied to it, including voltage from oscillators, or any other external circuit under test, also the frequency of the supply source. The enormous dial (8" diameter) gives clear, well-spaced frequency readings. Scale length is more than 40". The ranges are 100 KC.-265 KC.; 265-700 KC.; 700-2000 KC.; 2 MC.-6 MC.; 6 MC.-18 MC., by front-panel switch selection.

Quadruple rectifier system. One rectifier is for the line voltage. The others are for R.F., I.F., A.F. and VTVM and are linear.

Simplified switching operation, eliminating the multifarious gadgets and controls found on some instruments. Frequency range, voltage range, function selector and VTVM zero adjuster are the four controls. A jack for 'phones performs an automatic switching operation, by cutting out the VTVM when the 'phones are in use. Three separate, shielded input leads, each one specially engineered for its particular purpose, so that proper impedance and resistance levels are established and filtering, for VTVM frequency meter (R.F. - I.F.) and independent A.F. input.

Enclosure of metal-chassis in a completely shielded black, baked wrinkle finish cabinet, with carrying handle, special pains taken for proper grounding of input leads to correct chassis point.

Thorough reliability of engineering and extreme care in workmanship, testing and packing, to insure receipt in good condition and long, useful life of a truly sensitive and versatile instrument.

An unusual variety of measurements, practically encompassing all the requirements for proper servicing of a receiver, transmitter or amplifier by the approved dynamic and functional method. Measurements include those made directly upon the signal from the antenna to the loudspeaker, through all the stages of any receiver, past, present or future; for locating and curing causes of intermittent reception, dead set, weak volume, distortion, wavering reception, misalignment, in fact, practically any and all the ills to which a set is heir, including D.C. improper voltages across resistance circuits, be they of high or low resistance. It is not possible for any one person to correlate all the many actual particular functions, purposes, uses and measurements which this all-extensive creation covers.

A price so low that at last anybody and everybody in the service business can afford to have his own instrument for servicing by the dynamic-functional method of channel analysis.

Superior Channel-Analyzer comes housed in shielded cabinet and features an attractive etched aluminum panel. Supplied complete with tubes, three specially engineered shielded input cables, each identified as to its purpose. Also full operating instructions. Size 13" x 10" x 6". Shipping weight 19 pounds.

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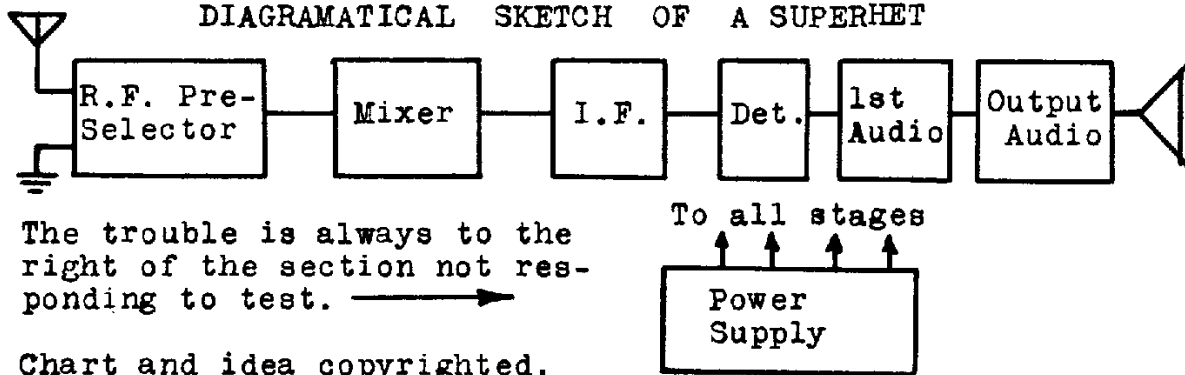
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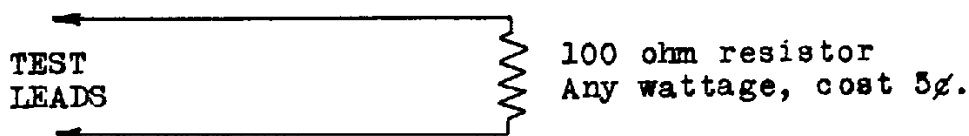
DIAGRAMMATICAL SKETCH OF A SUPERHET



And here is the simple way to find the section at fault. Every section or stage of a receiver can be upset electrically, so that, if this one section being tested and all following stages leading to the speaker are functioning, this change in the circuit under test will alter the output volume or tone, or cause a hiss or click.

For example, in making this test in the 1st audio stage, a certain response may be expected (see table) if this stage, the following audio stage, the loud speaker, and power supply are working properly.

While test instruments may be used, these informative tests may be made with two pieces of wire and a 5¢ resistor. This simple test unit is explained below.



It is best to begin upsetting the circuit in the power supply. For this, as well as for almost all other tests, hold one lead of the test unit shown above to the chassis -- usually B minus. Touch the other prod to a B plus point, such as the positive side of a filter condenser, or the screen grid of an output pentode. If there is a noticeable spark at the point of contact assume the voltage is OK. Of course, a voltmeter can be used with greater accuracy. Please notice that the B+, and B- connections can be found immediately with a diagram.

Next test the speaker. Determine from the diagram if the speaker is of the electro-dynamic type and, if so, bring an iron blade of a screw driver near the field. There should be magnetic attraction -- none will be present if set is off or field not operating.

To test voice coil operation, one prod should be held to the chassis as mentioned before, and with the other prod touch the plate prong of the output tube. There will be a spark at the contact and a loud single click in the speaker. Any previously existing "hum" in the speaker will be reduced. These facts indicate that the speaker probably is operating correctly. See chart for other tests.

LOCALIZING TEST CHART, IN RECOMMENDED ORDER				
First prod <u>momentary contact only</u>	Second prod	Visual observation at contact	Aural response	Where to look for faults.
B+ point before filter at rectifier tube	Chassis B-	Arc made, wire will weld.	Clicks, hiss.	Rectifier tube, 1st filter, pwr. transformer
B+ point after filter	Chassis B-	Large spark	Dual click	Choke, or field, 2nd filter cond. short in set
Plate prong output tube	Chassis B-	Spark	Click less hum	Output transformer
Control grid output tube	Hold in hand	None	Hiss	Wrong bias on output tube
Triode, or pentode detector tube cont. grid	Antenna post	None	Click, strong hiss	Bad condenser or resistor in circuit of detector tube
Control grid of any R.F. or I.F. tube	Hold in hand, remove grid cap	None	Strong oscillations, hum, change in tone	Parts of the associated circuit.

You can see that a diagram will help you find the places for these suggested tests. A diagram is like a "floor-plan" of the radio hook-up and permits immediate location of all parts and circuit connections for quick tests by any method.

By using instruments, the different parts of the circuit can be actually measured (resistors with an ohmmeter, condensers with a condenser tester) and compared to the values indicated in the diagram. At times, the voltages at important points are marked in the diagram. In such cases, using a voltmeter, you may measure voltages between these individual points and chassis. Incorrect reading suggests that the trouble lies in the associated circuit.

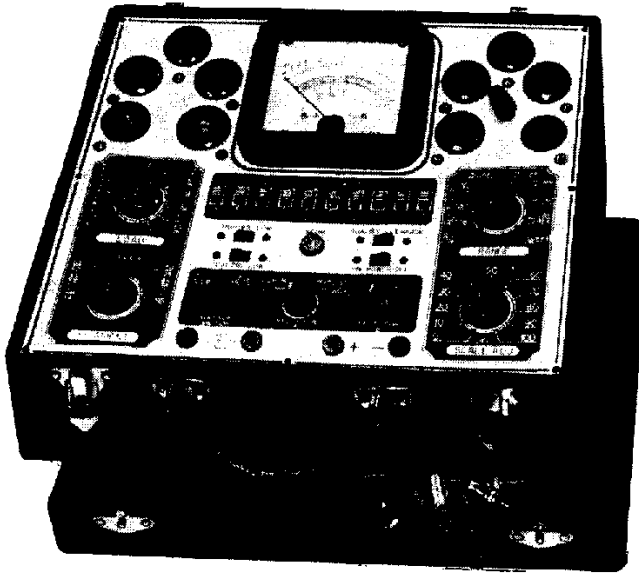
THE NEW MODEL 1280 SET TESTER

Combines the Models 1240 and 1250

HERE'S SUPERIOR'S ANSWER TO THE DEMANDS OF RADIO SERVICEMEN. A COMPLETE, ALL PURPOSE TESTING LABORATORY. THE MODEL 1280, COMBINES THE MODELS 1250 MULTITESTER AND 1240 TUBE TESTER.

Even those servicemen who through past purchases know they can always get SUPER-VALUES from Superior will be amazed and delighted when they read the specifications of this all-purpose instrument and then note the unbelievably low price. The Model 1280 features a $\frac{1}{2}$ " d'Arsonval type meter for easy reading of the various scales, and in line with our new policy of stressing appearance as well as serviceability in our new 1200 line of test equipment, our Model 1280 utilizes an aluminum etched panel, designed for beauty as well as ruggedness.

The primary function of an instrument is, of course, to make measurements accurately and when designing test equipment this is our first thought. However, we also appreciate the important part the appearance of an instrument plays in the impression a serviceman makes on his customers, especially on home calls. We have, therefore, paid special attention to the outward design of all of our new instruments. For instance the panel of this Model 1280 is made of aluminum and etched by a radically new process, which results in a beautiful, confidence-inspiring appearance.



The Actual Size of this Instrument is 7" x 11" x 13"

Sensitivity—1000 ohms per volt.
Works on 90-125 Volts, 60 Cycle A.C.

A complete testing laboratory all in one unit. Tests all tubes, reads A.C. volts, D.C. volts, A.C. current, D.C. current, High Resistance, Low Resistance, High Capacity, Low Capacity, Decibels, Inductance, and Watts.

- ★ INSTANTANEOUS SNAP SWITCHES REDUCE ACTUAL TESTING TIME TO ABSOLUTE MINIMUM.
- ★ SPARE SOCKET, AND FILAMENT VOLTAGES UP TO 117 VOLTS MAKE THE MODEL 1280 PROOF AGAINST OBSOLESCENCE.
- ★ LATEST DESIGN $\frac{1}{2}$ " D'ARSONVAL TYPE METER.
- ★ COMES HOUSED IN ATTRACTIVE, LEATHERETTE COVERED CARRYING CASE.
- ★ SLOPING PANEL FOR RAPID, PRECISE SERVICING.
- ★ WORKS ON 90 - 125 VOLTS 60 CYCLES A.C.

SPECIFICATIONS

- ★ Tests all tubes, 1.4 to 117 volts, including 4, 5, 6, 7, 7L, octals, loctals, Bantam Jr., Peanut, single ended, floating filament. Mercury Vapor Rectifiers, the new S series, in fact every tube designed to date.
- ★ Spare socket included on front panel for any future tubes.
- ★ Tests by the well-established emission method for tube quality, directly read on the GOOD ? BAD scale of the meter.
- ★ Jewel protected neon.
- ★ Tests shorts and leakages up to 2 megohms in all tubes.
- ★ Tests leakages and shorts in all elements AGAINST all elements in all tubes.
- ★ Tests BOTH plates in rectifiers.
- ★ Tests individual sections such as diodes, triodes, pentodes, etc., in multi-purpose tubes.
- ★ Latest type voltage regulator.
- ★ Features an attractive etched aluminum panel.

Complete A.C. and D.C. Voltage and Current Ranges
 D.C. Voltage: 0-15, 0-150, 0-750 Volts.
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 -10 to +38, -10 to +53.
 Inductance: 1 to 700 Henries
 Watts: Based on 6 MW. at 0 D.B. in 500 ohms .006000 M.W. to 600 watts.

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Model 1280 comes complete with test leads, tabular charts, instructions, and tabular data for every known type of receiving tube and many transmitting tubes. Shipping weight 18 lbs.

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You can see that with diagrams the fault in a radio can be found faster. And since any service job is primarily a task of finding what is wrong — only a few minutes being needed for the actual repair or part replacement — you will earn the same service charge for less time spent on the job.

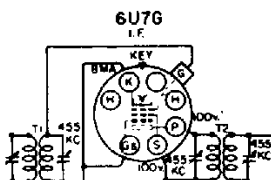
6. How to make sure of your suspicion.

The simple localizing test will suggest, or perhaps your own favorite point-to-point test with a voltmeter or ohmmeter will point to the section of the radio receiver at fault. Now to find the actual source of trouble.

The recommended procedure can be best described with a few examples. If the trouble seems to lie in the section between the I.F. tube and the detector, your localizing test will give expected response at the detector but not at the I.F. tube.

If the tubes have not been tested initially, first test the tube used in the I.F. stage. This I.F. tube is part of the section at fault. Next the circuit of this suspected section should be examined and a diagram is essential for this purpose.

Our test-unit, described before, or a voltmeter may be used to determine if the expected voltages are at the plate of the I.F. tube, screen grid, and the B connection of the I.F. transformer (usually the red lead). If the home-made test-unit is used, connect one lead to the chassis, and touch the other to the points mentioned watching for a small spark which will indicate voltage present. A voltmeter is used the same way, but will indicate exact voltage.



In a AC-DC type of radio about 100 volts may be expected at the points mentioned, in AC sets with transformers about 200 to 250 volts. An I.F. stage from a AC-DC set is illustrated.

Lack of voltage at a point where it is required and expected indicates that either it cannot get to this point because of a part being open or wire broken, or because an associated by-pass condenser is shorted and passes the voltage to the chassis. This means we will look for broken wire in wiring or coil, or shorted wire, or try disconnecting condensers one at a time.

This is but a single test procedure applicable to a section; however, it does suggest a simplified servicing method made possible with a circuit diagram of the radio under repair.

THE NEW MODEL 1240 TUBE TESTER

FEATURING—

Filament voltages up to 117 volts!!!

New Type Snap Switches for Fingertip Control!!

Sockets for all tubes. **No adapters!!**

Spare Socket for future tubes!!

Etched Aluminum Sloping Panel!!

In designing the Model 1240 Tube Tester special attention was paid to speed of service, also reduction of obsolescence to minimum.

The New type of snap switch used in the Model 1240 makes it possible to thoroughly test any tube for quality, leakage, etc. in a jiffy, and filament voltage sources up to 117 volts plus a spare socket on the front panel give positive protection against obsolescence. Another strong point is the concentration of controls, so that they are as few as practical with necessary extensiveness and reliability of service.



A really modern tube tester conforming to all standards of good engineering practice. Utilizes a 3" D'Arsonval type meter with calibrated scale. Furnished in a sturdy black case with sloping panel for easy operation. Removable cover and carrying handle for either portable or counter use. For serviceman, dealer, experimenter, constructor, schools and laboratories. Absolutely thorough, accurate and quick-testing, — yet priced unbelievably lower than any other equivalently efficient tester.

The Actual Size of this Instrument is 6" x 7½" x 10¼"
Works on 90-125 Volts, 60 Cycles A.C.

SPECIFICATIONS

- ★ Tests all tubes, 1.4 to 117 volts, including 4, 5, 6, 7, 7L, octals, loctals, Bantam Jr., Peanut, single ended, floating filament, Mercury Vapor Rectifiers, the new S series, in fact every tube designed to date.
- ★ Spare socket included on front panel for any future tubes.
- ★ Tests by the well-established emission method for tube quality, directly read on the GOOD ? BAD scale of the meter.
- ★ Jewel protected neon.
- ★ Tests shorts and leakages up to 2 megohms in all tubes.
- ★ Tests leakages and shorts in all elements AGAINST all elements in all tubes.
- ★ Tests BOTH plates in rectifiers.
- ★ Tests individual sections such as diodes, triodes, pentodes, etc., in multi-purpose tubes.
- ★ Latest type voltage regulator.
- ★ Features an attractive etched aluminum panel.
- ★ Works on 90 to 125 volts 60 cycles A.C.

EXTRA SERVICE—The Model 1240 can also be used to detect leakages up to 2 megohms in condensers, insulation, etc.

Model 1240 comes complete with Instructions and tabular data for every known type of receiving tube. Shipping weight 12 pounds. Size 6" x 7½" x 10¼". Our Net Price

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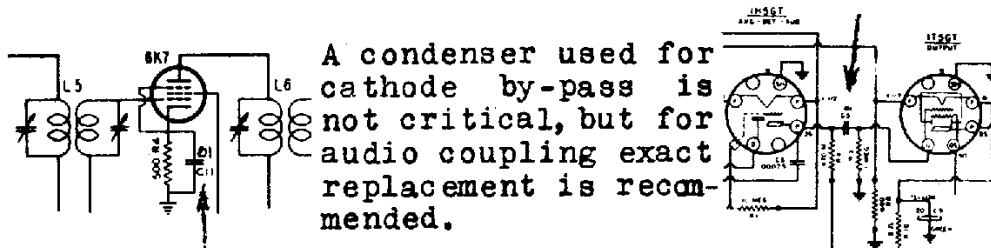
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7. Making the actual repair.

When you finally locate the actual source of trouble -- a shorted condenser, two wires touching, or an open winding in a transformer -- you are ready to do the mechanical work of actual repair. And here again a wiring diagram is an indispensable aid.

The diagram also serves as a catalog of parts employed and will permit you to obtain the proper replacement. But more than just this -- the diagram will tell you how far off in value a replacement condenser or resistor may be without noticeable ill effects.

For example, a .01 mfd., 400 volt condenser needs to be replaced. It is used to by-pass the biasing resistor of a R.F. amplifier tube. This data about the use of this condenser obtained from a diagram will tell you that the capacity really is not critical. A somewhat smaller capacity will serve and, of course, .05, .1, or even .5 mfd. will do. The diagram also will let you know that the voltage in this cathode circuit is small and a 200 volt condenser may be used. Besides you also know that higher voltage condensers are always permissible in any circuit.



If this same size condenser was used in a resistance coupled stage, the value of the condenser would be much more critical. In this application, as is evident from the diagram, any other size condenser will sacrifice audio response. A larger unit will permit greater "hum" amplification; while a smaller capacity will reduce the response of the "highs."

8. How any serviceman can make more money.

A radio circuit diagram of the set you are servicing will:

1. Eliminate the need for complex equipment,
2. Help you localize the trouble,
3. Help you to find the actual fault,
4. Permit you to select a replacement part.

This really means that you can,

1. Save time on every job,
2. Do the job better,
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9. How to obtain and file diagrams.

An active radio serviceman is interested in commercial diagrams of sets he repairs or in circuits of recently developed radios for the purpose of keeping up with the times. Several technical magazines publish a limited number of circuits of lately released sets. These should be filed by you in a suitable binder which will form a manual.

Sets in use are covered by diagrams in published service manuals. Some of these attempt to include every circuit released and are bulky and expensive books. The manuals compiled by the author are not planned to be complete, but are of reasonable size and price and are designed to include the diagrams you will need "most-often." Almost every diagram you need will be found here, and the few unusual ones needed from time to time may be purchased at only 25¢ each from Supreme Publications. See the advertisement on the next page.



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Very few radio manufacturers have diagrams for distribution to servicemen. If the diagram you want is available, a week or more will be required by the manufacturer to answer your letter. We do not recommend trying to obtain diagrams from a set manufacturer.

The diagrams should be kept in a suitable note book or filing case. A complete index with cross references should be made for a quick location of the diagram you need or as a check to see if a certain diagram is available.

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