

OPERATING INSTRUCTIONS
FOR
TYPE 603-A
STANDARD-SIGNAL
GENERATOR
FORM 304-D



GENERAL RADIO COMPANY

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OPERATING INSTRUCTIONS FOR TYPE 603-A STANDARD-SIGNAL GENERATOR

PART 1 DESCRIPTION

USES -- The Type 603-A Standard-Signal Generator is a general-purpose instrument, designed to have the widest possible application in the measurement of receiver characteristics and transmitter field strengths. By means of easily accessible plug-in coils, the range extends from 100 kc to 25 megacycles, making the instrument particularly adaptable to the testing requirements of modern receivers operating in the high-frequency as well as in the broadcast spectra.

The standard-signal generator, with no additional equipment, is suitable for determining the sensitivity and selectivity of a radio receiver and, when modulated by an external audio-frequency oscillator, it may be used in measuring over-all fidelity.

When used in connection with a radio receiver, an output meter, and a antenna of known characteristics, the standard-signal generator may be used in making field-strength measurements.

PRINCIPLE OF OPERATION -- The Type 603-A Standard-Signal Generator consists, essentially, of a calibrated radio-frequency oscillator designed specifically for high stability and minimum frequency modulation. An additional oscillator, operating at 400 cycles is included to modulate the output of the radio-frequency oscillator.

Provision is made for determining the percentage modulation and for adjusting accurately the radio-frequency output voltage.

A complete wiring diagram of the instrument will be found on page 19.

ADVANTAGES -- A new attenuator design in the Type 603-A Standard-Signal Generator has made possible the extension of the carrier-frequency range and, at the same time, improved greatly the performance at broadcast frequencies. The attenuator is of the continuously variable type, indicating directly all output voltages from 0.5 microvolt to 1 volt.

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A type of shielding has been devised which permits changing coils by simply lifting the cabinet lid, without removing any screws or clamps. The shielding is so complete, however, that no appreciable field exists two inches from the instrument, even at the very high frequencies included in its operating range.

The frequency-control dial on this standard-signal generator is 8 inches in diameter and is graduated in 600 divisions, the scale being spread uniformly over 270° . An adjustable magnifying glass is provided so that the dial may be easily read to 0.2 division or better. The dial is also provided with four blank scales and an auxiliary indicator so that the user may calibrate the dial for any particular test frequencies desired.

The Type 603-A Standard-Signal Generator may be modulated up to 90% and is provided with a convenient and easy method for adjusting the percentage modulation. An internal source of 400 cycles modulation is provided. If desired, the frequency of the internal modulation oscillator may be changed.

All the batteries necessary for operation of the instrument are included in the cabinet.

Provision is also made for modulating the standard-signal generator at any audio frequency by means of an external oscillator.



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PART 2

INSTALLATION

TUBES AND BATTERIES REQUIRED -- The Type 603-A Standard-Signal Generator requires for its operation the following tubes and batteries:

- 1 30-type vacuum tube (RCA-230 or equivalent)
- 1 31-type vacuum tube (RCA-231 or equivalent)
- 2 1.5-volt dry cells (Burgess #6 or Eveready #7111)
- 4 45-volt block batteries (Burgess #5308 or Eveready #762)

INSTALLATION OF BATTERIES -- CAUTION: Before installing batteries and tubes, make sure that the ON-OFF switch is in the OFF position, and that the MOD. AMPL., CARRIER AMPLITUDE, and FILAMENT knobs are turned as far in a counterclockwise direction as they will go.

The batteries should be installed in the cabinet as follows:

1. The two dry cells should be placed in back of the metal strip in the left-hand section of the signal generator (audio oscillator section). They should be clamped in place by tightening the two nuts. The cells should be connected in series. The positive terminal of one should be connected to the red lead and the negative terminal of the other to the black lead.

2. The block batteries should be installed in the compartment provided in the right-hand (radio output) section of the signal generator. Remove the plug-in coil container by unscrewing the two thumbscrews. The forward bakelite strip on the B-battery compartment should then be taken off by removing two more thumbscrews.

Two of the batteries should be placed upright in the compartment with the binding posts forward. They should then be slid back under the back bakelite strip and the other two batteries put in front of them with the binding posts toward the back.

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The four batteries should be wired in series and connections made to the colored wires as follows:

B-	yellow
+67.5	green
+180	blue*

The insulating strip, which holds the batteries securely in place, and the coil box should then be replaced and fastened with the thumbscrews provided.

INSTALLATION OF TUBES -- The 30-type vacuum tube should be inserted in the socket in the center (radio oscillator) section of the standard-signal generator. The 31-type vacuum tube should be inserted in the socket in the left-hand (audio oscillator) section of the instrument.

To insert the 30-type tube as well as to insert the radio-frequency coil in the center section of the instrument, the aluminum shield must be removed. After installing the tube and the coil, the shield should be replaced.

*To decrease the drain of the battery, connection to +180 volts should be made only when 90% modulation is required. 135 volts will be sufficient for 30% modulation.



PART 3
OPERATION

RADIO-FREQUENCY OUTPUT -- The radio-frequency output of the Type 603-A Standard-Signal Generator is obtained from the shielded jack on the front panel of the instrument. The setting of the MICROVOLTS and MULTIPLIER controls indicates the open-circuit radio-frequency voltage on the output of the generator.

CONNECTION TO RECEIVER UNDER TEST -- The Type 603-A Standard-Signal Generator is supplied with a concentric shielded cable for making connections to the receiver under test. The lead with the red tracer is the "high" side, while the brown lead is ground.

This cable is intended primarily for use at broadcast and lower frequencies. Details regarding the use of the generator at higher frequencies will be found in Part 5, page 12.

OPERATION WITHOUT MODULATION -- To operate the Type 603-A Standard-Signal Generator without modulation, proceed as follows:

The proper coil for the desired frequency should be inserted in the jacks in the center (radio oscillator) section of the generator and the large dial adjusted in accordance with the calibration supplied.

1. After making sure that the MOD. AMPL., CARRIER AMPLITUDE, and FILAMENT controls are turned as far in a counter-clockwise direction as they will go, snap the ON-OFF switch to the ON position and adjust the FILAMENT control until the filament voltmeter reads 2 volts. The plate voltage on the oscillator tube may be determined by pressing the button on the FIL AND PLATE voltmeter.

The plate voltage for coils 603-P3 to 603-P8 should be between 60 and 70 volts in order that the carrier output may be set to its proper value. The plate voltage for coils 603-P1 and 603-P2 should be between 80 and 90 volts.

2. Set the EXT.-INT. switch to the intermediate position and adjust the carrier amplitude by clockwise turning of the CARRIER AMPLITUDE knob so that the right-hand meter reads 25 (first red line). The radio-frequency output voltage of the signal generator may then be read directly from the settings of the MICROVOLTS dial and the MULTIPLIER switch. The actual output in microvolts is obtained by multiplying the readings of these two controls.

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The carrier amplitude should be reset whenever the frequency is changed appreciably.

CAUTION At the highest setting of the multiplier (that is, for output voltages from 0.1 to 1 volt) the output should not be connected to an impedance less than 10,000 ohms. A lower impedance will drop the output voltage appreciably and an impedance of less than 1000 ohms may cause the thermocouple to burn out.

HIGH-FREQUENCY COIL -- It usually will be impossible to obtain full output from the signal generator when using coil 603-P1. One-half of full output will be obtained when the meter is set to 7 instead of 25. In this connection, it should be remembered that possible errors in the absolute calibration of the attenuator are greatest at these very high frequencies and that the signal generator will generally be used with coil 603-P1 only for comparison purposes. A reduction in the voltage output will accordingly be of no practical disadvantage.

INTERNAL MODULATION -- The Type 603-A Standard-Signal Generator is provided with an audio oscillator to modulate the radio-frequency output at 400 cycles. When it is desired to use this internal modulation system, proceed as follows:

1. Turn the MOD. AMPL. knob as far in a counterclockwise direction as it will go, set the EXT.-INT. switch to the INT. position, and adjust the CARRIER AMPLITUDE knob so that the right-hand meter reads 25 (first red line).
2. Turn the PERCENTAGE MODULATION dial so that it indicates the desired modulation percentage.
3. Depress the button on the FIL. AND PLATE voltmeter and read the oscillator plate voltage.
4. Adjust the MOD. AMPL. knob so that the left-hand meter indicates the oscillator plate voltage. The instrument is now operating at the desired percentage of modulation and the output attenuator may be adjusted as previously described.
5. For high percentages (70% and 90%) of modulation, the PERCENTAGE MODULATION dial gives only an approximate setting. To adjust the generator to 70% or 90% modulation, set the PERCENTAGE MODULATION dial to the approximate position and adjust the MOD. AMPL. control so that the right-hand meter indicates on the red scale the desired percentage of modulation.

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EXTERNAL MODULATION -- For determining the audio-frequency characteristics of a receiver, it is necessary to modulate the signal generator from an external source of audio-frequency power. For this purpose, an oscillator with an output of approximately 30 milliwatts at 12 volts will modulate the generator satisfactorily at 30% at frequencies up to 8000 cycles. Slightly more power will be required for modulation at higher frequencies and proportionally higher power for higher percentages of modulation.

Procedure when using external modulation is the same as when using internal modulation, except that the EXT.-INT. switch should be set to the EXT. position. With the MOD. AMPL. control turned to the left, adjust the CARRIER AMPLITUDE control so that the right-hand meter reads 25. The modulating oscillator should be connected to the EXT. MOD. terminals and the percentage modulation adjusted as described for internal modulation.

If one of the output terminals at the modulation oscillator is grounded, it should be connected to the lower terminal on the signal generator. If neither is grounded, the oscillator should be grounded to the GND terminal on the left-hand end of the standard-signal generator.



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PART 4

OPERATING CHARACTERISTICS

RADIO-FREQUENCY RANGE -- The Type 603-A Standard-Signal Generator is regularly supplied with two plug-in coils (603-P5 and 603-P6) to cover a range including the broadcast band (actually 420 to 1900 kc). Other coils may be obtained for various ranges between 100 kc and 15 megacycles, and an additional coil can be supplied for frequencies of 15 to 25 megacycles. Due to the design of the Type 603-A Standard-Signal Generator, measurements at these extremely high frequencies will be less accurate, but, for some purposes, the additional extension of the frequency range may still be useful.

The ranges of the coils that can be supplied are:

Frequency	Type
100-210 kc	603-P8
210-420 "	603-P7
420-850 "	603-P6
850-1900 "	603-P5
1.9 - 4.4 megacycles	603-P4
4.4 - 10 "	603-P3
10 - 15 "	603-P2
15 - 25 "	603-P1
550 - 1500 kc	603-P11*

RADIO-FREQUENCY CALIBRATION -- Under normal operating conditions and with average tubes the frequency calibration of the Type 603-A Standard-Signal Generator can be relied upon to 0.5%.

OUTPUT-VOLTAGE RANGE -- The output voltage is continuously variable within the limits of 0.5 microvolt and 1 volt.

ACCURACY OF CARRIER OUTPUT VOLTAGE -- The accuracy of the carrier output voltage depends upon the accuracy of calibration of the

*Frequency modulation on coil 603-P11 will be slightly in excess of the values given for the regular coils.

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thermocouple and the accuracy of manufacture of the attenuator. There are also unavoidable capacitances and inductances in the various units which cause errors increasing with frequency.

The accuracy of the output voltage of the standard-signal generator at various frequencies is as follows:

In the broadcast band and at lower frequencies	3%
At 10 megacycles	10%
At 15 "	12%

REACTION OF ATTENUATOR -- The reaction of the attenuator on the carrier frequency is less than 150 cycles at broadcast and lower frequencies but slightly more at higher frequencies.

OUTPUT IMPEDANCE -- The internal output impedance of the Type 603-A Standard-Signal Generator is as follows:

<u>Multiplier Setting</u>	<u>Output Impedance</u>
1-10-100-1000	10 ohms
10M	37.5 "
100M	200 " (average)

The output impedance does not vary with the setting of the MICRO-VOLTS dial except at the 100M position.

MEASUREMENT OF PERCENTAGE MODULATION -- The Type 603-A Standard-Signal Generator is provided with two different means for determining the percentage modulation.

One method is based on the static characteristic of the oscillator and determines the percentage modulation from the ratio of the d-c and a-c voltages applied to the oscillator tube. This method is quite satisfactory for low percentage modulation but has the disadvantage that the static characteristic of the oscillator varies somewhat with frequency, with condenser setting, and with the tube.

The second method is based on the fact that the r-m-s value of the output increases when the percentage modulation is increased and the carrier amplitude is held constant. The r-m-s value of the modulated wave is

$$i = i_0 \sqrt{1 + 1/2 \left(\frac{m}{100} \right)^2}$$

when i_0 is the r-m-s value of the carrier amplitude and m is the

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modulation expressed in per cent. For 100% modulation, for instance, $i = 1.23 i_0$. As long as positive and negative peaks in the modulated wave are essentially symmetrical, the method will give accurate results without regard to the static characteristic of the oscillator. The disadvantage of this method is that it is suitable only for use at high modulation percentages, since the change in $r\text{-m-s}$ value is too small below 50% modulation to be easily detected.

In the Type 603-A Standard-Signal Generator, the first method described above is used for determining modulation percentages up to 50%, and the second method is used at modulation percentages of 70% and 90%.

If it is desired to use a frequency differing from 400 cycles for the internal modulating oscillator of the signal generator, the audio-frequency oscillating circuit can be changed. The whole audio oscillator assembly (Type 603-Q) can be removed from the signal generator by removing the four screws holding the metal case in the rear left-hand corner of the left-hand compartment. The General Radio Company will quote prices upon request for plug-in oscillators for operation at different frequencies.

ACCURACY OF PERCENTAGE MODULATION -- The accuracy of the percentage modulation is $\pm 10\%$ for modulating frequencies less than 1.5% of the carrier frequency.

ACCURACY OF MODULATION FREQUENCY -- The modulation frequency is accurate to within 5%.

AUDIO-FREQUENCY HARMONICS -- Harmonics in the audio-frequency envelope of the modulated signal are due to harmonics generated by the audio-frequency oscillator and to distortion occurring in the modulating system. When using the 400-cycle internal modulation oscillator, the second harmonic in the audio-frequency envelope is less than 5% for modulation percentages up to 50% and less than 10% at 90% modulation.

EXTERNAL MODULATION SYSTEM -- The output impedance of the EXT. MOD. terminals is approximately 5000 ohms and about 60 milliwatts is necessary to modulate the instrument to 30% throughout the entire audio-frequency range. For frequencies up to 8000 cycles, 30 milliwatts will be sufficient.

FREQUENCY MODULATION -- The frequency modulation with 30% amplitude modulation does not exceed 200 cycles for radio frequencies up to 2 megacycles, and is less than 50 cycles at the standard

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test frequencies for broadcast receivers (600 kc, 800 kc, 1000 kc, 1200 kc, and 1400 kc). Frequency modulation at higher radio frequencies and for higher percentages of modulation is proportionately greater.

AGING OF BATTERIES -- Care should be taken to keep the FILAMENT control set so that the FILAMENT voltmeter always reads 2 volts when the generator is in operation.

The audio-frequency oscillator tube contained in the signal generator draws plate current only when the EXT.-INT. switch is on the INT. position. Accordingly, in order to eliminate changes in radio-frequency oscillator voltage due to varying load, the EXT.-INT. switch should be set to the INT. position and the MOD. AMPL. control turned off, when the CARRIER AMPLITUDE is being set for use with internal modulation. Similarly, the EXT.-INT. switch should never be set on the INT. position when the CARRIER AMPLITUDE is being adjusted for external or no modulation.

PART 5

RECEIVER TESTING

EXTERNAL CONNECTIONS FOR OPERATION AT BROADCAST FREQUENCIES -- The radio-frequency output from the Type 603-A Standard-Signal Generator is obtained from the shielded jack in the lower right-hand corner of the panel. A 6-foot cable is supplied with the instrument, for making the necessary connections between the signal generator and the receiver under test. This cable is suitable for use at broadcast and lower frequencies.

A red tracer has been woven into the covering of the "high" conductor. The ground conductor has a plain brown covering.

Under all circumstances, the radio receiver under test should be carefully grounded. It is not necessary to ground the signal generator.



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DUMMY ANTENNA AT BROADCAST FREQUENCIES -- The input circuit applied to a receiver under normal operating conditions may be considered as a radio-frequency voltage in series with the antenna impedance. The operation of the receiver will accordingly depend to a large extent upon the characteristics of the antenna system to which it is connected. It is therefore necessary to take this factor into consideration when testing a radio receiver, and it is generally advisable to connect the signal generator to the receiver through some form of dummy antenna which simulates the actual conditions under which the receiver is normally used. The dummy antenna should be connected at the receiver rather than the signal generator terminals.

The I.R.E. has recommended standard tests for broadcast receivers, which have been generally accepted. The standard dummy antenna has the following characteristics:

Series capacitance	200 μ f
Series inductance	20 μ h
Series resistance	25 ohms

As explained in Part 4, the output impedance of the Type 603-A Standard-Signal Generator for the attenuator settings commonly used is 10 ohms. The dummy antenna used with the signal generator should accordingly have a series resistance of only 15 ohms. For this purpose, the General Radio Type 418-B Dummy Antenna is recommended, and one is supplied.

EXTERNAL CONNECTIONS FOR FREQUENCIES ABOVE THE BROADCAST BAND -- Not only will the operation of the radio receiver depend considerably upon the impedance that is connected to its input terminals, but also the voltage supplied by the signal generator will depend to a large extent upon the impedance connected to its output terminals.

The signal generator is so constructed and calibrated that the reading of the MICROVOLTS and MULTIPLIER dials indicates the open-circuit radio-frequency voltage existing across the output terminals. Although the output cable supplied with the signal generator will introduce no serious errors at broadcast and lower frequencies, its natural impedance changes considerably as the frequency is increased above the broadcast band. It is not advisable, therefore, to use this cable when making measurements at higher frequencies, particularly where accuracy is required.

For making tests at high radio frequencies, it is recommended that the receiver be placed at a distance of one or two



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feet from the signal generator. It is important also that all connections between the two instruments be carefully shielded. A short cable, the characteristics of which are known, should be used between the signal generator and receiver when accurate sensitivity measurements are to be made. The characteristic impedance of this cable should be the same as the input impedance of the receiver under test.

To facilitate the proper use of the Type 603-A Standard-Signal Generator at high radio frequencies, an extra plug is supplied that will fit the output jack on the generator panel and will make it possible to build up special connectors to a high-frequency receiver without dismantling the 6-foot broadcast-frequency cable supplied.

In connection with the above discussion, it is well to note that the broadcast-frequency cable is suitable for making comparative measurements at a single high frequency for generator output voltages up to 10,000 microvolts. This is because comparative values of sensitivity can be taken without knowledge of the absolute values of the transmission characteristics of the cable as long as these characteristics remain unchanged.

DUMMY ANTENNA AT HIGH RADIO FREQUENCIES -- No standard dummy antenna has been agreed upon for frequencies above the broadcast band. It has been suggested, however, that a non-inductive resistance of 400 ohms would be quite suitable for the purpose. As at broadcast frequencies, the actual impedance of the attenuator should be included in the impedance of the dummy antenna. For this purpose the G.R. Type 418-C Dummy Antenna is recommended and one is included with the instrument.

MEASUREMENT OF OUTPUT OF RADIO RECEIVER -- In general, the output of a radio receiver is measured by substituting a resistive load for the loud-speaker and measuring the power dissipated in this load. The resistance of the load should be equal to the impedance of the loud-speaker used with the receiver or to the tube manufacturer's specified value of load impedance for maximum undistorted power output for the particular combination of tubes used in the output stage.

The General Radio Company manufactures several types of output meters suitable for this purpose. The power in milliwatts across a load impedance R is given by the formula

$$P = \frac{1000 E^2}{R} \text{ milliwatts}$$

where E is the r-m-s voltage developed across the resistance.

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For work of this type the new General Radio Type 583-A Output Power Meter is particularly recommended because it is direct reading in milliwatts and is adjustable in its internal input impedance for 40 values between 2.5 ohms and 20,000 ohms. The instrument is described in the General Radio Company's current catalog of laboratory apparatus (Price: \$95.00).

If there is any d-c component in the output voltage of the receiver, a relatively low-impedance condenser should be inserted in series with the output meter.

STANDARD OUTPUT POWER -- In general, 50 milliwatts is considered as the standard power output of a radio receiver designed for use with a loud-speaker.

SENSITIVITY TEST -- Sensitivity is measured by impressing a radio-frequency voltage with standard modulation (30%) and varying the attenuator settings until standard output (50 milliwatts) is obtained. For this test, all tuning and volume adjustments on the radio receiver should be set for maximum sensitivity. The maximum sensitivity of the receiver is then given directly by the reading of the signal generator attenuator in microvolts.

SELECTIVITY TEST -- The selectivity of a radio receiver is determined by adjusting the radio receiver for maximum output at the test frequency and measuring the radio-frequency voltage necessary to give normal test output at a number of carrier frequencies adjacent to the test frequency. This is usually accomplished by varying the signal generator carrier frequency from the standard test frequency and plotting a graph showing kilocycles deviation as abscissae and the ratio of r-f voltage off resonance to r-f voltage at resonance as ordinates. This should be continued until it is necessary to increase the radio-frequency voltage to at least 1000 times its value at resonance. With sensitive receivers, a ratio of at least 10,000 is desirable. Curves should be plotted for variations in carrier frequency, both above and below the resonance frequency.

On the Type 603-A Standard-Signal Generator no separate control is provided for making selectivity tests. The open scale on the main frequency-control dial, together with the magnifying glass, makes possible adequate selectivity measurements without additional controls.

FIDELITY TEST -- The over-all audio-frequency fidelity of a radio receiver is usually determined by tuning the receiver to the test frequency and modulating the signal generator at a fixed

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percentage (usually 30%) from an external audio-frequency oscillator. For each test frequency, a curve may be plotted showing modulation frequency as abscissae and audio-frequency response as ordinates.

ADJUSTMENT OF RECEIVER UNDER TEST -- The controls of the receiver under test should be adjusted in accordance with the instructions furnished by the manufacturer. In some types of receivers, the operation depends in a very critical manner upon the adjustment of certain controls. The following sections have been added to suggest methods by which the characteristics of such receivers can be more fully determined.

REGENERATIVE RECEIVERS -- Due to the extreme changes in the characteristics of a regenerative receiver for various settings of the regeneration control, it is usually desirable to measure the characteristics of such a receiver, both when adjusted for minimum regeneration and when adjusted for maximum regeneration without actual oscillation. In some cases, characteristics at intermediate settings of the regeneration control will also be valuable.

STABILIZING RADIO RECEIVERS -- If a radio receiver is provided with adjustable stabilizing controls intended to be used for controlling sensitivity, precautions similar to those outlined under REGENERATIVE RECEIVERS should be taken.

SUPERHETERODYNE RECEIVERS -- If a superheterodyne radio receiver has a separate control for its oscillator frequency, all tests should generally be made with the oscillator adjusted to the higher frequency above the signal unless the instructions accompanying the receiver specify other conditions. Selectivity tests should also include response with the oscillator set at the lower frequencies. In making selectivity tests, the radio-frequency oscillator should be varied over twice the intermediate frequency in order to detect unwanted signals in the output. It is also desirable to check for extraneous signals at frequencies corresponding to harmonics of the intermediate frequency.

NOTE: For further information on I.R.E. standard tests, see pages 121-143 of the Year Book for 1931, obtainable from the Institute of Radio Engineers, 33 West 39th Street, New York, N.Y.



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PART 6

MAINTENANCE AND SERVICING

REPLACEMENT OF TUBES AND BATTERIES -- When replacing tubes or batteries, care should be taken to turn the MOD. AMPL., CARRIER AMPLITUDE, and FILAMENT controls as far in a counterclockwise direction as they will go.

REPLACEMENT OF THERMOCOUPLE -- A special thermocouple (Type 603-R, code word EXACT) is provided in the Type 603-A Standard-Signal Generator for measuring the input to the attenuator. Under normal operation, no trouble should be experienced with this thermocouple, but it may be burned out by application of too high a voltage. Replacement thermocouples can be supplied by the General Radio Company. They are carried in stock and shipments can be made promptly.

A replacement couple may be installed in the signal generator as follows: Remove the screws around the edge of the signal generator panel and lift the generator carefully out of the cabinet. On the bottom of the sub-panel of the radio-frequency oscillator (center) unit, the thermocouple will be found. It is of the plug-in type and may be readily replaced.



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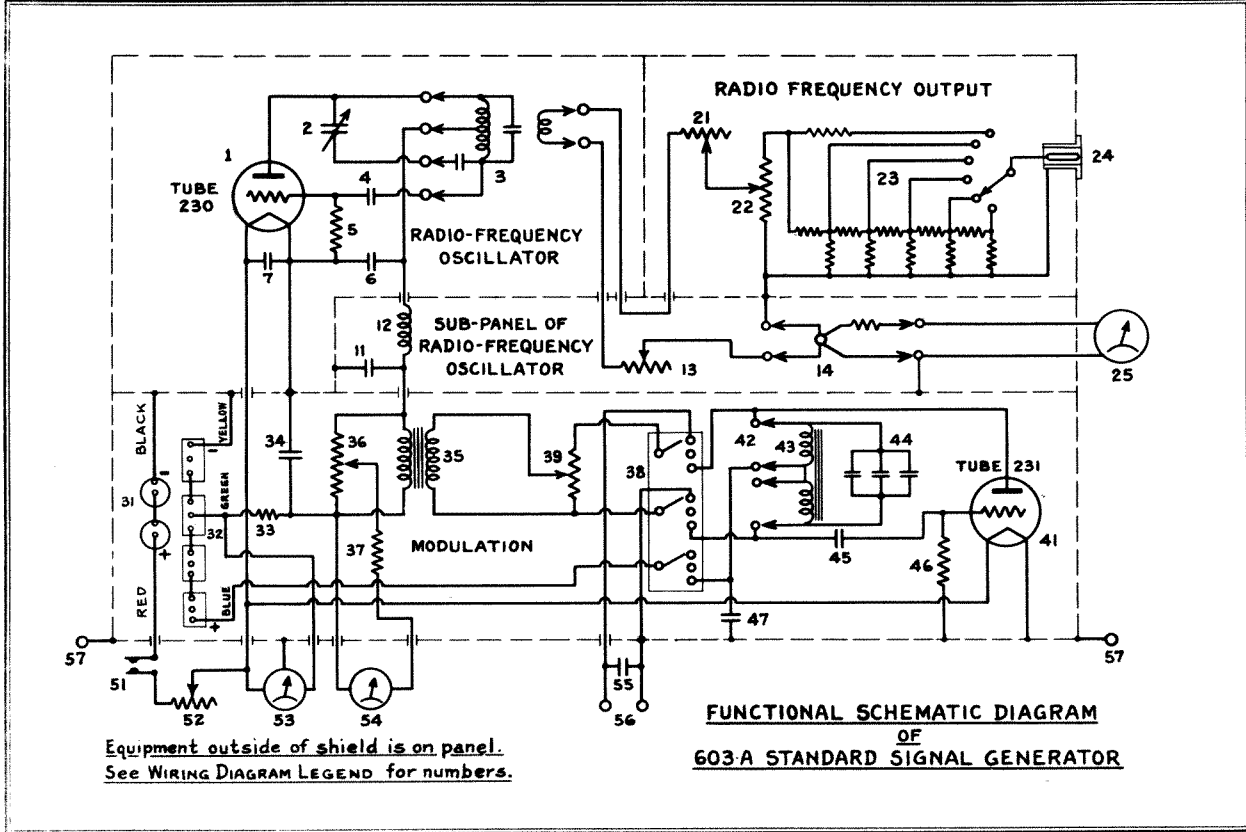
WIRING DIAGRAM LEGEND
FOR
TYPE 603-A STANDARD-SIGNAL GENERATOR

- Nos. RADIO-FREQUENCY OSCILLATOR
- 1 R.F. Oscillator Tube Type 230
 - 2 Main Tuning Condenser 500 μ f.
 - 3 R.F. Coil and Plug-in arrangement
 - 4 Grid Coupling Condenser 0.0001 μ f.
 - 5 Grid Leak 50,000 ohms
 - 6 By-pass Condenser 0.005 μ f.
 - 7 By-pass Condenser 0.5 μ f.
- SUB-PANEL OF R. F. OSCILLATOR
- 11 By-pass Condenser 0.005 μ f.
 - 12 Radio-Frequency Choke 8 mh.
 - 13 R. F. Carrier Control 240 ohms (Ayrton-Perry winding)
 - 14 Thermocouple & plug-in arrangement
 (Separate heater thermocouple Type 603-R; heater re-
 sistance 50 ohms)
- RADIO-FREQUENCY OUTPUT
- 21,22 Slide Wire combination (MICROVOLTS dial)
 - 21 Compensating Rheostat 150 ohms (Ayrton-Perry winding)
 - 22 Potentiometer 240 ohms (Ayrton-Perry winding)
 - 23 Step Attenuator (MULTIPLIER)
 - 24 Output Plug
 - 25 Output Meter 500 μ A D-C
- MODULATION
- 31 "A" Battery 3 volts
 - 32 "B" Battery 180 volts
 - 33 Filter Resistance 1000 ohms
 - 34 By-Pass Condenser 1 μ f.
 - 35 Modulation Transformer
 - 36 Mod. Percentage Potentiometer 20,000 ohms
 - 37 Series Resistance 4000 ohms
 - 38 Switch for internal and external modulation
 - 41 Audio Oscillator Tube 231-type
 - 42 Plug-in arrangement for Audio Osc. Circuit (Type 603-Q)
 - 43 Audio-Frequency Coil
 - 44 Audio-Frequency Cond. (0.3 μ f. for 400 Cycles
 Mos. 43 and 44 are assembled in a metal case, repre-
 sented a plug-in unit for 400-cycle modulation.
 Type 603-Q.)

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WIRING DIAGRAM LEGEND
FOR
TYPE 603-A STANDARD-SIGNAL GENERATOR
(Continued)

Nos.	MODULATION (Continued)
45	Grid Coupling Condenser 0.01 μ f.
46	Grid Leak 2 megohms
47	By-Pass Condenser 4 μ f.
FRONT PANEL	
51	On and Off Switch
52	Filament Rheostat 25 ohms
53	Filament & Plate-Voltage Meter 0-3 V; 0-150 V.
54	Modulation Meter 0-2 V A-C calibrated to be "Set equal to plate voltage"
55	By-Pass Condenser 0.01 μ f.
56	Terminals for External Modulation
57	Ground Terminals



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