PRECISION ELECTRONIC INSTRUMENTS

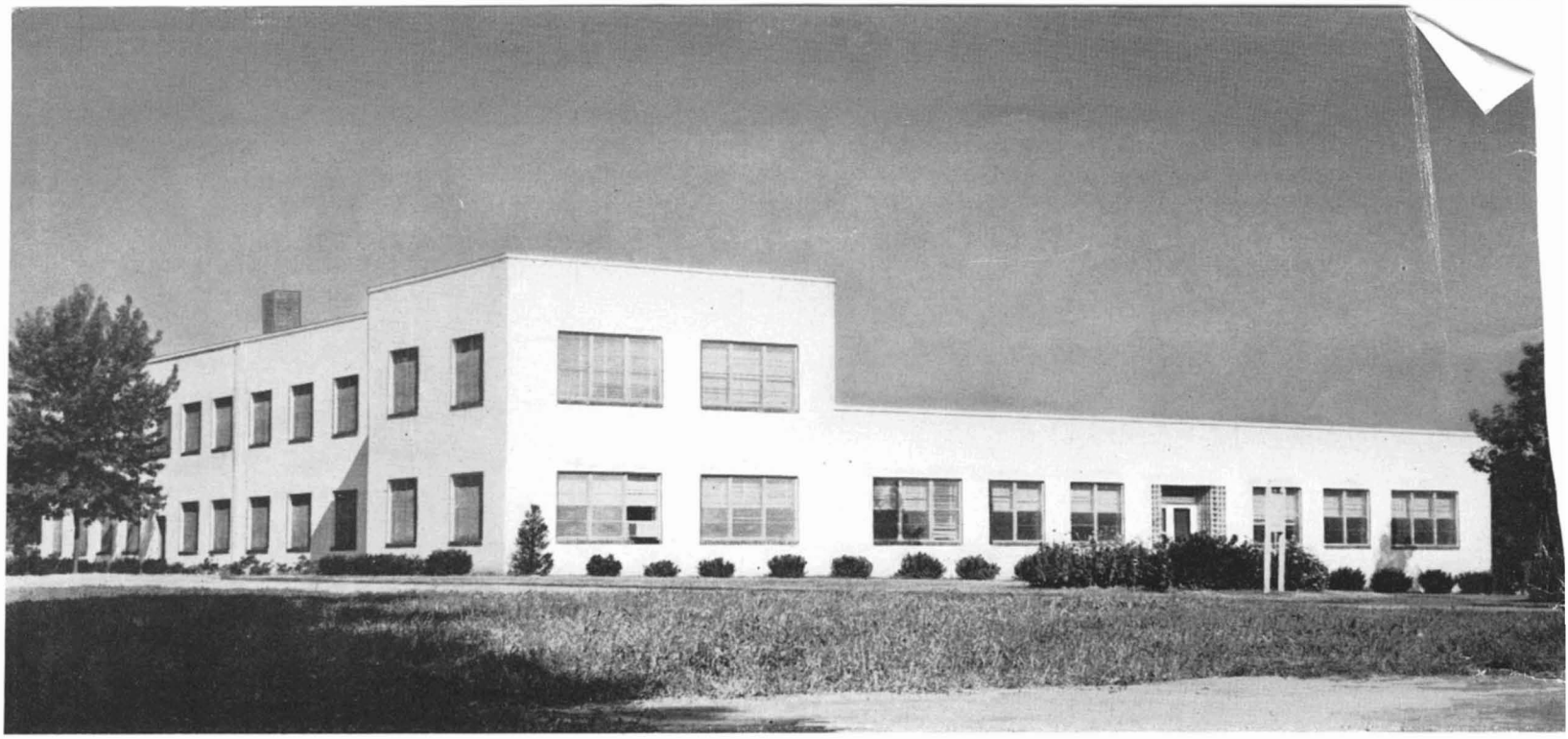
BOONTON RADIO CORPORATION
BOONTON, NEW JERSEY, U.S.A.

CATALOG "J-1"

BOONTON RADIO Corporation

BOONTON, NEW JERSEY, U.S.A.

BOONTON 8-3200



To Our Customers

BOONTON RADIO CORPORATION was established for the purpose of designing and manufacturing precision test equipment for application to a wide range of electronic problems. As our organization has grown, we have constantly endeavored to build a group of people and provide plant facilities capable of fulfilling this general aim. We have undertaken to design general purpose test equipment rather than equipment for highly specialized applications, and to this end, during the past 18 years, we have furnished the electronic engineer with a portion of the tools necessary to carry on his research, development and production programs. Our staff welcomes the opportunity of discussing with you any of your test equipment problems which may fall within the scope of our interests. We have a group of field representatives who have specialized in test equipment; a highly specialized group of electronic engineers familiar with the design and manufacturing problems associated with test equipment; a Sales Engineering staff, located at our plant, which is familiar with a wide variety of applications of our

test equipment and interested in the requirements for new types of equipment. We offer to you the experience and knowledge of any and all of these groups in connection with your particular problems.

It is our policy to engineer very carefully all of our products and to use only the highest grade components, materials and workmanship in building them. We realize that an objective of this type will, in general, yield high priced test equipment, but we intend, by careful selection of the characteristics of our equipment and proper engineering, to supply you with equipment for which you will have a fair degree of utilization for the dollar invested. It is our intention to design and build equipment with general purpose applications within various electronic fields, in order that the costs of designing such equipment may be spread over a relatively large number of units. This policy distributes to each individual customer only a relatively small portion of this part of our expenses.

We have endeavored, in all cases, to supply you with a mechanically and electrically reliable tool for your industry, and if any of our efforts in this direction have failed, we would be pleased to hear from you as to the nature of your problem and also receive from you any constructive criticisms which you may have in this direction.

We are pleased to present to you for the first time in this catalog our revised Q-Meters for both the lower frequencies (Type 260-A) and the higher frequencies (Type 190-A). These new Q-Meters are completely re-engineered versions of the long established Q-Meter which has served the electronic industry so well.

G. A. DOWNSBROUGH
President and General Manager

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GENERAL INFORMATION

Ordering: Orders should specify the type number of the equipment, together with other identifying details, such as the powerline voltage and frequency from which equipment is to be operated.

Prices and Shipments: Prices are subject to change without notice. Price quotations and estimated shipping schedules are based on acceptance within 30 days.

Terms: Domestic Commercial Orders: 1% 10 days, net 30 days, f.o.b. Boonton, New Jersey. No additional charges are made for domestic packing. Unless credit has been established shipments will be made C.O.D. Export Orders: Net cash in advance of shipment in U.S.A. funds or payment in the form of irrevocable sight letter of credit on the part of a prime New York bank.

Discounts: Our sales are made directly to customers. No trade, educational or quantity discounts are allowed.

Taxes: Federal, State, or local taxes (except Income Taxes), if any, upon the services, supplies and products or the production, manufacture, sale, or transportation thereof will be for account of BUYER, and if paid or required to be paid by SELLER, the amount thereof will be added to and become a part of the price payable by BUYER.

Specifications: We reserve the right to change specifications at any time without notice and without incurring any obligation to incorporate new features in instruments previously sold.

Modifications: Prices for operation on special powerline voltages and frequencies or other special modifications will be given on request.

Repairs: Instruments should be returned to us prepaid with papers indicating the nature of difficulties experienced. Instruments under warranty will be shipped prepaid to the customer by Boonton Radio Corporation.

New or repaired instruments damaged in transit should not be returned to the manufacturer without first obtaining specific handling instructions.

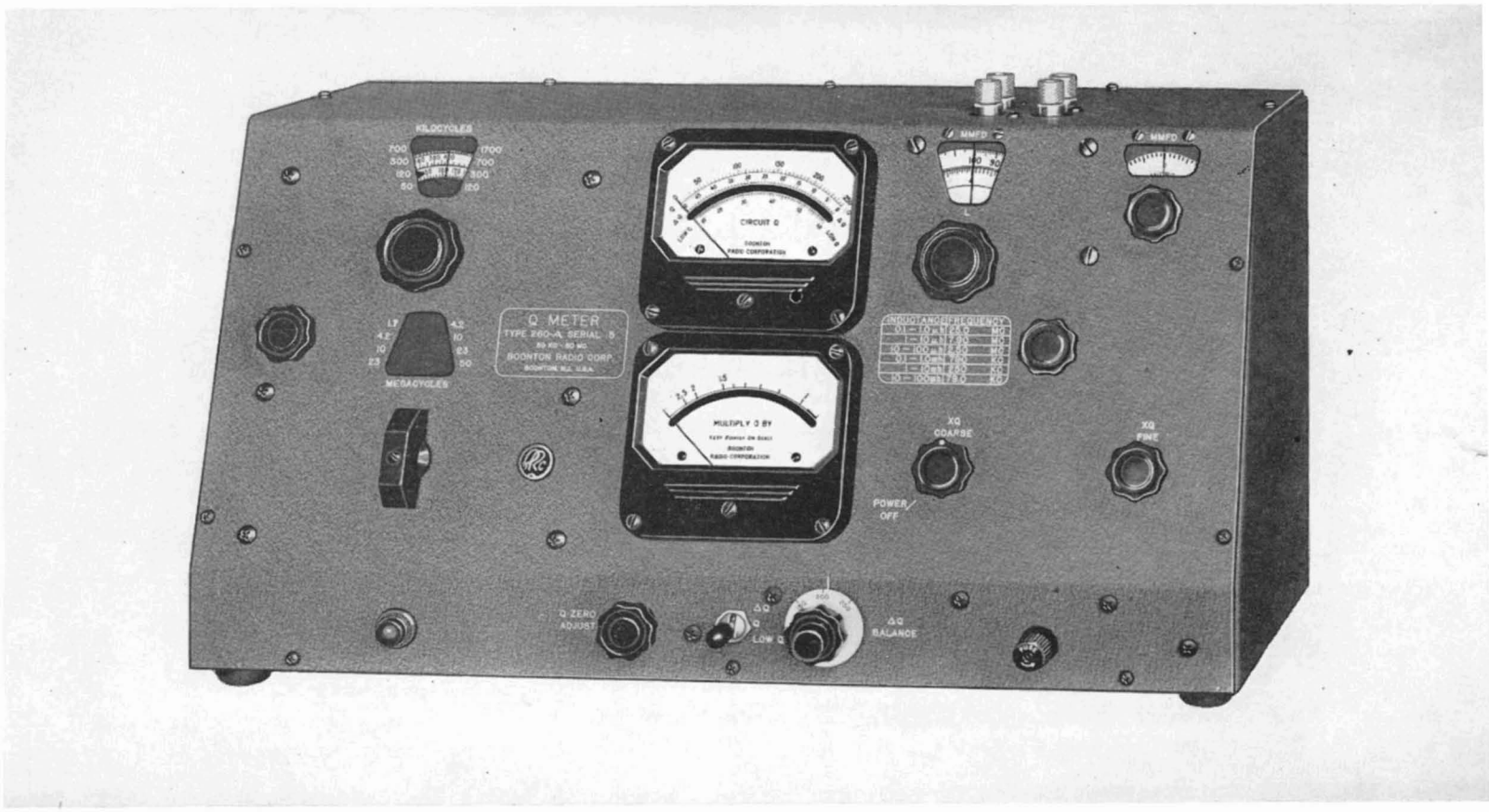
Replacement Parts or Spares: The type number and serial number of the instrument in which these are to be used should be supplied.

Warranty: We warrant each new instrument manufactured and sold by us to be free from defects in material, workmanship and design. Under this warranty, our obligation is limited to the original purchaser and to the extent of repairing or replacing any instrument or any part proved to be defective by our inspection within one year after the original sale.

All instruments returned under this warranty should be sent to us with charges prepaid. After repairs have been completed we will return the instrument with all charges prepaid. This warranty shall not apply to tubes or any instrument which shall have been repaired or altered outside of our plant so as, in our judgment, to affect its stability or reliability, or which has been subject to misuse, negligence or accident.

Patents: Many of our instruments are manufactured and sold under United States Letter Patents owned by the Boonton Radio Corporation; General Radio Company; American Telephone and Telegraph Company; Western Electric Company, Incorporated; and Radio Corporation of America.

Q METER TYPE 260-A



Frequency Range 50 KC to 50 MC

DESCRIPTION

The symbol Q is commonly used to designate the ratio of reactance to effective resistance of a coil ($Q=2\pi fL/R$) or a condenser ($Q=1/2\pi fCR$). This factor is of fundamental significance in circuit design since it is a "figure of merit" of the reactive elements. By introducing a calibrated r.f. voltage from the self-contained oscillator into the series resonant Q circuit and measuring the voltage across one of circuit reactances, the ratio of the latter to the applied voltage is the Q of the circuit. The measurement requires a single operation, and the circuit Q is read directly on the meter.

FEATURES

The Type 260-A Q Meter provides a scale for reading low values of Q, as well as a "ΔQ" scale, two parallax-free meters, recessed dials, and other desirable features. The beam pentode r.f. oscillator results in good waveform and allows smooth oscillator output variation through screen grid control. The use of a newly developed low inductance, low resistance injection resistor, a rugged thermocouple running at a comparatively low temperature, and a controlled oscillator output between ranges, minimizes the possibility of thermocouple damage. The "LoQ" and "ΔQ" scales greatly facilitate the use of the instrument in measuring the effect on Q resulting from changes in test circuit parameters, as well as allowing closer readings of Q at the lower values.

USES

The instruction book which accompanies each Q Meter describes in detail the many applications of this instrument. A few of the more common uses are as follows:

RF Coils: The Q as well as the effective inductance can be read directly. Coils may be rapidly matched and Q simultaneously observed.

AF Coils: The Q and inductance of the larger inductors employed in supersonic and AF circuits down to 1 KC may be measured. Provision has been made for coupling an external oscillator (1 KC to 50 KC) into the internal Q Meter transmission line.

Variable and Small Fixed Condensers: The Q or power factor is determined from a simple computation in terms of the change in circuit Q effected by the addition of the test condenser in parallel with the Q Meter condenser. The change in setting of the variable Q Meter condenser is a direct measure of the capacitance of the condenser under test.

Insulating Material — Dielectrics: A specimen condenser is made by securing conducting surfaces on opposite sides of a plate of the material to be measured. The same technique used in measuring fixed condensers is employed.

Antennas: The effective series resistance, capacitance, inductance, and fundamental frequencies of small antennas may be determined over a wide frequency range.

SPECIFICATIONS

Oscillator Frequency Range: Continuously variable from 50 kilocycles to 50 megacycles in eight self-contained ranges.

Oscillator Frequency Accuracy: Approximately $\pm 1\%$.

Range of Q Measurement: Q Measurements can be made from 10 to 625. Range of ΔQ scale is from 0 to 60.

Accuracy of Q Measurement: Circuit Q of 250 read directly on the indicating meter is accurate to $\pm 5\%$ to 30 mc increasing to $\pm 10\%$ at 50 mc.

Capacitance Calibration of Q Condenser: 30 to 450 mmf (direct reading) calibrated in 1.0 mmf increments from 30 to 100 mmf: 5.0 mmf increments from 100 to 450 mmf.

Accuracy: Approximately 1% or 1.0 mmf, whichever is greater. Range of Vernier capacitance dial is —3.0 to +3.0 mmf (direct reading) calibrated in 0.1 mmf increments. Accuracy ± 0.1 mmf.

Power Supply: 90-130 volts — 60 cps only (internally regulated); power consumption is 65 watts.

Weight: 40 lbs.

Model 260-AP available for either 115 or 230 volts, 50-60 cps. State voltage required in your order. External regulating transformer recommended; power consumption is 45 watts.

Weight: 33 lbs.

Dimensions: Width 20", depth 8½", height 12½".

Tubes: The instrument is supplied complete with the following tubes:

1 Type BRC 105-A
1 Type 5763
1 Type 6X4
1 Type 0B2
1 Type 0A2
1 Mazda 47

Accessories: See page 32 for Type 103-A Inductors, page 35 for Type 162-A Constant Voltage Transformer, and page 34 for Type 141-B Coupling Unit. Prices of above accessories on attached price list.

Q METER TYPE 190-A

Frequency Range 20 to 260 MC

DESCRIPTION

The Q Meter Type 190-A is designed for operation in the VHF frequency range. It consists of an accurate, continuously tuned oscillator, which develops an adjustable voltage across a very small coupling impedance connected in series with a tuned circuit. The series tuned circuit includes the coupling impedance, a precision variable condenser of low loss and low inductance, and binding posts for attachment of an external inductance. Arrangements are also included to permit the connection of impedance elements in parallel with the variable condenser. The voltage across the coupling impedance and the voltage across the variable condenser are measured by vacuum tube voltmeters with high input impedance and low input capacitance. Voltages are indicated on a single front panel meter. The ratio of these two voltages is equal to Q of the tuned circuit, and the instrument is calibrated to read directly in Q values. Since the Q of the internal elements of the tuned circuit is very high, the indicated ratio is essentially equal to the Q of the externally connected impedances. A differential circuit is included in one of the vacuum tube voltmeters to permit subtraction of the voltage resulting from a Q measurement under one condition of external connection from a second condition. This allows the difference in Q between the two conditions to be read directly. The power requirements of the instrument are furnished from an internally regulated supply.

FEATURES

The Q Meter Type 190-A uses a single, highly accurate, parallax corrected front panel meter which combines all functions. A special variable capacitor designed and manufactured by Boonton Radio is used to resonate the tuned Q circuit. This capacitor has very low minimum capacitance, low inductance, and is linear down to 10 $\mu\mu$fd. A single knob varies the capacitance, and two dials geared together indicate the capacitance in increments down to 0.1 $\mu\mu$fd. Approximately eleven turns of the tuning knob cover the capacitance range. The frequency is adjusted by a single knob and is continuously variable in four self-contained ranges. A low Q scale is included which extends the range of Q measurements down to a value of 5. A meter scale and balancing system is included which permits a direct meter indication of the difference of Q between two externally conected circuits. Careful design has resulted in a low minimum capacitance in the Q measuring circuit, which permits measurement of coils designed to operate in low capacitance circuits. Internal residual impedance in the Q measuring circuit has been kept to a minimum so that correct measurement of higher values of Q can be made. The instrument has an internally regulated power supply which assures stability of readings in the presence of normal power source-variation.

USES

The Instruction Book shipped with each instrument describes in detail many applications of the Q Meter. A few of the more common uses are as follows:

IF and RF Coils: The Q can be read directly and the inductance easily determined. High frequency high Q coils, and low Q coils used in broad band circuits, can be measured directly. The instrument may be used to compare the Q and inductance of production coils to a standard or to measure the effect of adding iron core slugs, condensers or resistors to a resonant circuit.

Variable and Small Fixed Condensers: The Q or power factor is determined from a simple computation in terms of the difference in Q resulting from the addition of the test condenser in parallel with the Q Meter tuning capacitance. The change in setting of the variable Q Meter condenser to re-establish resonance is a direct measure of the capacitance of the condenser under test.

Insulating Material — Dielectrics: A specimen condenser is made by securing conducting surfaces on opposite sides of the plate to be measured. The technique used in measuring fixed condensers is then employed.

Antennas: The effective series resistance, capacitance, inductance and fundamental frequencies of small antennas may be determined over a wide frequency range.

SPECIFICATIONS

Frequency Range: 20 to 260 mc. Continuously variable in four self-contained ranges.

Frequency Accuracy: $\pm 1\%$.

Range of Q Measurements: The Q indicating voltmeter scale reads from 50 to 400. The Lo-Q scale reads from 10 to 100. The above readings are multiplied by the reading of the XQ scale which reads from 0.5 to 3.0 to obtain the correct indication of Q. Total range: 5 to 1200.

The ΔQ scale reads from 0 to 100 and must be multiplied by the XQ scale for correct Q.

Accuracy of Q Measurements: Circuit Q of 400 read directly on the meter can be determined to an accuracy of $\pm 7\%$ to 100 mc and to $\pm 15\%$ to 260 mc.

Internal Resonating Capacitance Range: 7.5 $\mu\mu$fd to 100 $\mu\mu$fd (direct reading) calibrated in 0.1 $\mu\mu$fd increments.

Accuracy of Internal Resonating Capacitor:

± 0.2 $\mu\mu$fd to 20 $\mu\mu$fd
± 0.3 $\mu\mu$fd to 50 $\mu\mu$fd
± 0.5 $\mu\mu$fd to 100 $\mu\mu$fd

Power Supply: 90-130 volts, 60 cps only, (internally regulated). Power consumption 55 watts. **Note:** Q Meter Type 190-AP available for either 115 or 230 volt, 50-60 cps operation. State voltage required in your order. External regulating transformer Type 162-A recommended.

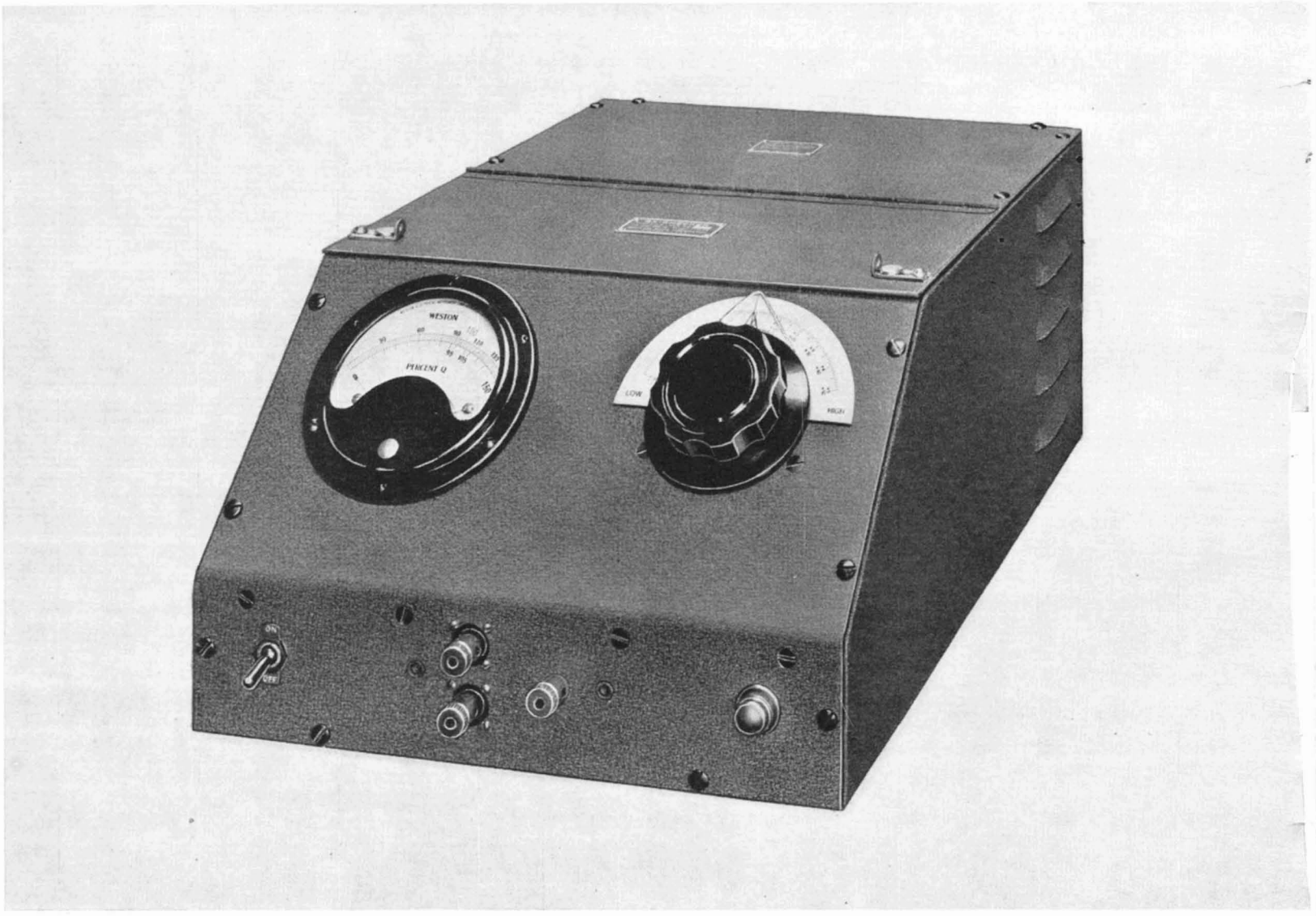
Tubes:

2 Type 5718
2 Type 9005
1 Type 12AT7
1 Type OB2

Dimensions: Height 10½", length 13⅛", depth 9½".
Weight: 25 pounds.

Accessories: Type 590-A Inductors listed elsewhere in this catalog are useful as reference coils in making various measurements.

QX CHECKER TYPE 110-A



Frequency Range 100 KC-25 MC

BUILT FOR THE PRODUCTION LINE

This instrument makes possible the rapid and accurate comparison of inductors or capacitors with known standards, simultaneously indicating the relative loss or Q of the component under test. The speed with which comparisons can be made results from the fact that when the component is resonated in a tuned circuit the two factors — reactance deviation from nominal and relative Q — are separately indicated, one on a meter scale and the other on a capacitor dial, so that the departure of either from established tolerances is immediately shown.

The adoption of the QX-Checker as a production testing instrument offers laboratory accuracy under factory conditions. Where parts are purchased from outside sources it gives both the supplier and purchaser a unified testing means, the importance of which cannot be too strongly emphasized.

The QX-Checker is a sturdy, simple, foolproof instrument for use in actual production work and in the hands of usual factory personnel. Since comparisons are made with established standards, predetermined and uniform characteristics are insured.

COIL TESTING

Coils are compared by resonating them in the low-loss tuned circuit of the QX-Checker to a frequency which is generally in or near the operating range of the coil. The inductance and Q comparison is thus made under conditions closely approximating those of actual operation. Resonance is indicated by a large-scale, high torque meter which indicates directly, at maximum deflection, the relative Q of the tested coil in percentage relation to the standard coil.

The dial of the vernier condenser employed in resonating the coil may be marked to indicate, on a well-expanded scale, the difference in inductance between the standard and test coils. Reasonably accurate readings may be made of inductances differing from the standard by about 0.1 per cent. The scale is provided with a special writing surface on which any predetermined limits may be marked in pencil. Such marks can be erased and new limits marked on the scale repeatedly. Scales may be readily replaced.

The inductance compared is effective inductance. This is equivalent to a comparison of true inductance assuming that the distributed capacitances are equal.

CONDENSER TESTING

Condensers are checked by comparing a test condenser to a standard condenser. For condenser tests, there is required an accessory coil which plugs into the panel jacks. This accessory coil unit, housed in a round metal case, also provides the necessary terminals for connecting the condenser to be tested. The unit may be permanently mounted if desired. See description of type 112-A22 Condenser Test Unit below.

The QX-Checker is resonated with the standard condenser connected, and with the vernier set at zero. Test condensers are one by one substituted for the standard and resonated with the vernier which indicates directly the difference in capacitance, expressed in micro-microfarads, between test condenser and standard. Relative loss of the condensers is indicated by the meter reading at resonance.

SPECIFICATIONS

Oscillator Frequency Range: 100 kilocycles to 25 megacycles in six ranges, using plug-in coils or inductors as follows:

TYPE NO.	FREQUENCY RANGE
111-A 1	10 — 25 megacycles
111-A 4	4 — 10 megacycles
111-A12	1.5 — 4 megacycles
*111-A22	500 — 1500 kilocycles
*111-A27	300 — 900 kilocycles
111-A36	100 — 300 kilocycles

Accuracy of Frequency Calibration: Standard calibration curves supplied for each inductor or coil, accurate to approximately ±3%.

Range of Coil Checks: Coils having inductance ranging between 1 microhenry and 10 millihenries may be checked or matched.

Accuracy of Coil Checks: For coils having inductance of 10 microhenries to 10 millihenries and Q of 100 or greater, the inductance may be checked against the standard to within ±0.1% to ±0.2%. The accuracy of checking coils of less than 10 microhenries decreases with inductance.

Range of Condenser Checks: The capacitance values of condensers ranging between 1 or 2 mmf and 1000 mmf may be checked against the standard by the direct substitution method with an accuracy of a few tenths of one mmf if the Q of the condensers is high.

Indicating System: Large diameter Q indicating meter, with well expanded 3¼ inch scale. The double-range 5 inch vernier condenser scale contains direct-reading calibration in micro-microfarads. The two ranges are plus or minus 5 and plus or minus 50 micro-microfarads. An eradicable writing surface for limit lines is provided.

Voltmeter: The Q voltmeter is self-contained. Specially designed for high accuracy over long period of time. Calibrations practically independent of normal line voltage fluctuations. Selected tubes may be interchanged without re-calibration.

Power Supply: 100-125 volt, 50-60 cycle. Also 200-250 volt, 50-60 cycles. Power consumption approximately 50 watts.

Tubes: The instrument is supplied complete with the following tubes:

1 Type BRC 101-C
1 Type 89
1 Type 874
1 Type 80
1 Mazda 47

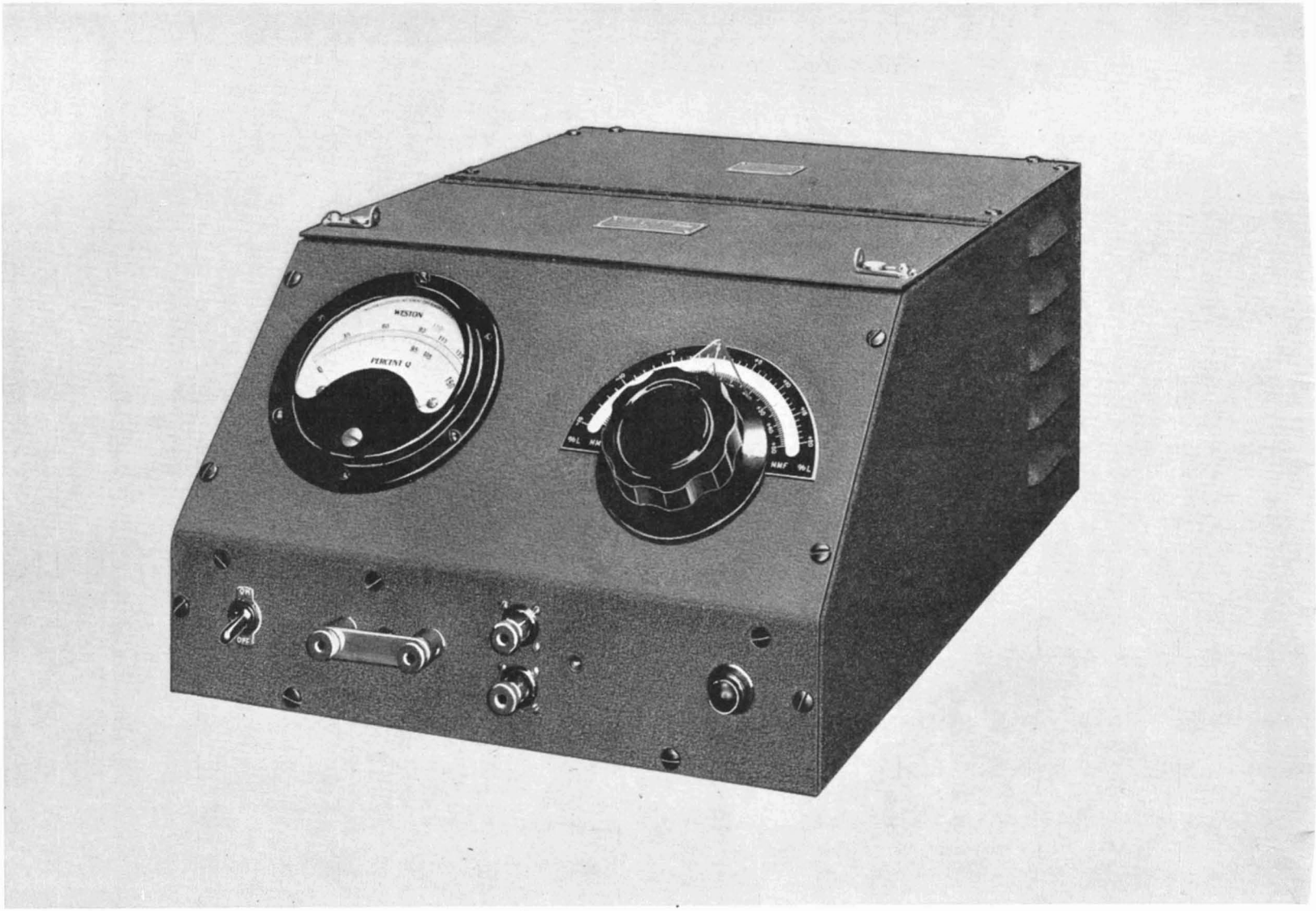
Dimensions: Width 12¼", depth 18", height 8".

Weight: 26 lbs.

Accessories: Type 112-A-22 Condenser Unit for testing small condensers up to about 1000 mmf in capacitance. A completely shielded high Q coil which plugs into the terminals of the QX-Checker and may be screwed on permanently if desired. Two binding posts are provided for connecting condensers to be tested. The inductance is 250 microhenries, which provides for operation over the frequency range of approximately 300 to 1300 kc.

* This instrument is normally supplied with one type 111-A22 and one type 111-A27 oscillator plug-in inductor. Any two of these type 111-A oscillator inductors, however, will be supplied on request.

QX CHECKER TYPE 110-B



Frequency Range 1.5-25 MC

DESCRIPTION

The 110-B QX Checker is quite similar to the 110-A QX Checker in principle and application except that certain design features have been introduced to permit the accurate comparison of small inductance values.

A convenient and time-saving feature of this instrument is the percent inductance dial scale which, when the inductor under test is resonated by means of the front panel dial, indicates directly the percent departure of the inductor from the established nominal value. Simultaneously the relative Q of the inductor as compared to the nominal Q of the standard is shown on the large open faced meter.

The 110-B QX Checker is well adapted for the relative measurement of inductors ranging from a few tenths of a microhenry to about 35 microhenries, the region where the 110-A QX Checker tends to become less accurate due to internal inductance. Capacitance values can also be compared with established standards over a wide range, a feature which greatly adds to the versatility of the instrument.

Manufacturers of high frequency receivers and components will welcome the simplicity and speed of operation of this instrument which permits laboratory accuracy to be maintained under factory conditions.

COIL TESTING

Coils are compared by resonating them in the low loss tuned circuit of the QX Checker to a frequency which is generally in or near the operating range of the coil. The inductance and Q comparison is thus made under conditions closely approximating those of actual operation. Resonance is indicated by a large-scale, high torque meter which indicates directly, at maximum deflection, the relative Q of the tested coil in percentage relation to the standard coil.

The dial of the vernier condenser employed in resonating the coil is calibrated directly in percent deviation from the standard. Reasonably accurate readings may be made of inductances differing from the standard by about 0.1 percent. The scale is provided with a special writing surface on which any predetermined limits may be marked in pencil. Such marks can be erased and new limits marked on the scale repeatedly.

The inductance compared is effective inductance. This is equivalent to a comparison of true inductance, assuming that the distributed capacitances are equal.

CONDENSER TESTING

Condensers are checked by comparing a test condenser to a standard condenser. For condenser tests, an external coil connected across the panel terminals is required. The QX Checker is then resonated with the standard condenser connected and with the vernier set at zero. Test condensers are one by one substituted for the standard and resonated with the vernier which indicates directly the difference in capacitance, expressed in micromicrofarads, between test condenser and standard. Relative loss of the condensers is indicated by the meter reading at resonance.

SPECIFICATIONS

Oscillator Frequency Range: 1.5 to 25 megacycles in three ranges using plug-in coils as follows:

INDUCTOR TYPE	FREQUENCY RANGE
111-B1	10-25 mc.
111-B4*	4-10 mc.
111-B12*	1.5-4 mc.

Accuracy of Frequency Calibration: Standard calibration curves are supplied for each inductor or coil, accurate to approximately ±3%.

Range of Coil Checks: Coils having inductance ranging between 0.1 microhenry and 35 microhenries may be checked or matched.

Accuracy of Coil Checks: For coils having an inductance of 5 microhenries to 35 microhenries, the present inductance scale on the instrument is accurate to within ±0.5%. For smaller values down to 0.1 microhenry the accuracy of the calibrated scale decreases with inductance but coils can be checked against limit standards with an accuracy of approximately ±0.5%.

Range of Condenser Checks: The capacitance values of condensers ranging between 50 and 1000 mmfd. may be checked against a standard by the direct substitution method; condenser checks are generally more accurate at low frequencies.

* This instrument is normally supplied with one Type 111-B4 and 111-B12 oscillator plug-in inductor; however, any two of these 111-B oscillator inductors will be supplied on request.

Indicating System: A large diameter Q indicating meter, with well expanded 3¼" scale. The 6" vernier condenser scale is calibrated to read directly the inductance of the component under test in terms of percent departure from a known standard, over the range of from —15% to +20%. In addition, a capacitance scale is provided reading changes of —50 mmf. to +50 mmf. from a nominal circuit capacitance of 300 mmf.

Voltmeter: The Q-voltmeter is self-contained. Specially designed for high accuracy over long periods of time. Calibrations practically independent of normal line voltage fluctuations. Selected tubes may be interchanged without recalibrations.

Power Supply: 100-125 volts, 50-60 cycles. Also 200-250 volts, 50-60 cycles. Power consumption approximately 50 watts.

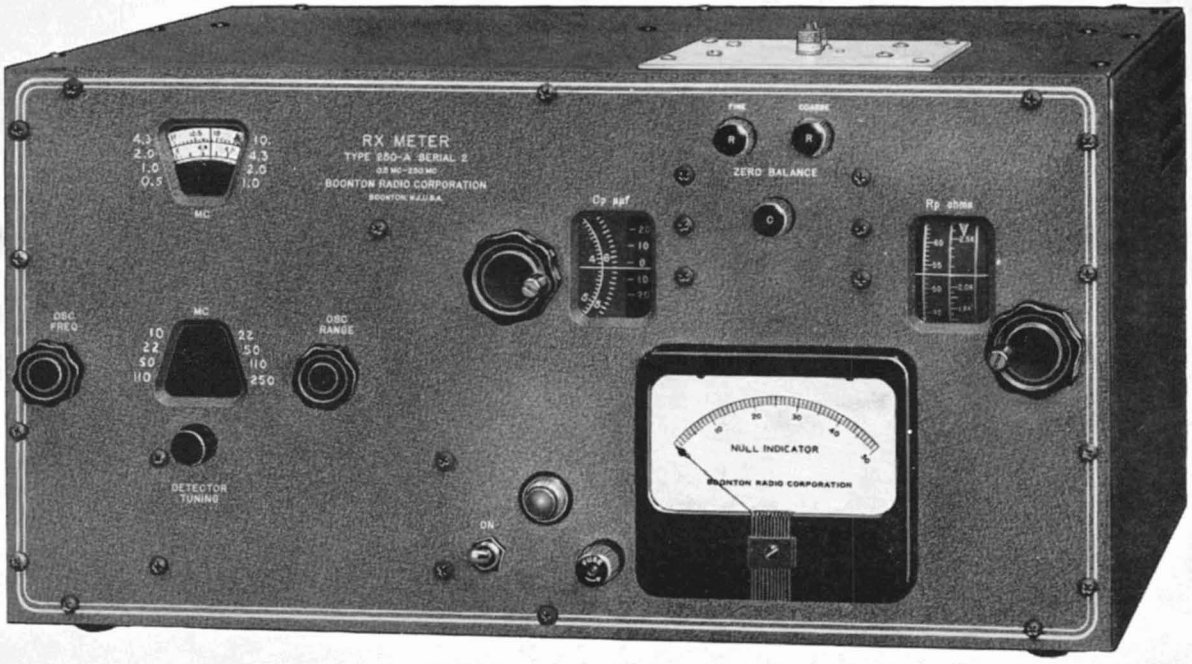
Tubes: The instrument is supplied complete with the following tubes:

1 Type BRC 101-C
1 Type 89
1 Type 874
1 Type 80
1 Mazda 47

Dimensions: Width 12¼", depth 18", height 8".

Weight: 26 lbs.

RX METER TYPE 250-A



Frequency Range 0.5 to 250 MC

DESCRIPTION

The RX Meter Type 250-A is a completely self-contained instrument for use in measuring the equivalent parallel resistance and capacitance or inductance of two terminal networks. The instrument's design includes an accurate, continuously tuned oscillator, high frequency bridge, amplifier-detector, and null indicating meter.

The oscillator, which is carefully designed to minimize temperature effects, is mounted inside a rigid casting in order to obtain a high degree of accuracy, stability, and low leakage. A long life subminiature triode is used, and the unit is carefully shielded to avoid any leakage of signal to the amplifier-detector by any path other than through the bridge. The high frequency bridge is also mounted inside a casting, and is specially designed to minimize the effects of coupling between arms. All calibrated variable elements of the bridge are special low inductance high quality variable capacitors driven by anti-backlash gears. Connections to the unknown impedance are arranged for almost zero lead length. Convenient, easily adjusted bridge balance controls are available.

The amplifier-detector null indicator has high, automatically controlled, gain and a very low noise level. The power supply is internally regulated to minimize the effect of line voltage variation.

FEATURES

The RX Meter is self-contained and requires no external units for its operation. This feature permits an integrated design and eliminates difficulties arising from leakage, hand effects, or improper matching which can occur when several different units must be interconnected in the laboratory. The instrument is always ready for use, and the assembly of several laboratory units, some of which may be in use, is avoided.

The range of measurement of equivalent parallel resistance, capacitance or inductance over the frequency range (0.5 to 250 mc) is as follows: 15 to 100,000 ohms for parallel resistance (0 to 15 ohms by indirect methods); 0.1 to 120 mmfd. for capacitance; and 0.001 microhenries to 100 millihenries for inductance. Resistance values are indicated directly, and no corrections are necessary over the entire frequency range. Small corrections at the higher frequencies, as indicated in the instruction book, are necessary in order to obtain the highest accuracy in the measurement of capacitance and inductance.

The capacitance dial is calibrated in 0.1 mmf increments, and the resistance dial has good readability over a 28 inch scale length. The automatic gain control on the null indicator avoids meter damage and permits indication at all times of the correct direction for adjusting to balance. The low noise, high gain characteristics of the amplifier-detector result in high sensitivity near the balance point.

USES

The RX Meter Type 250-A has particular application to the measurement of the impedance of unbalanced, two terminal components or networks which require moderate values of capacitance to resonate the reactance present. Measurements can be made on two terminal or three terminal balanced networks by use of one-half wavelength of high quality coaxial cable as a matching element. Networks which require values of capacitance beyond the range of the Cp dial to resonate the reactance can be measured in most cases by use of a high quality auxiliary parallel capacitor or inductor.

All measurements made by the RX Meter are indicated in equivalent parallel values. The equivalent series values can be readily obtained by use of simple formulas included in the Instruction Book.

The RX Meter can be used to determine the parameters of the impedance of resistors over its frequency range, the characteristics of antennas and the characteristic impedance, velocity of propagation and attenuation of transmission lines. It can also be used to determine the characteristics of broad band IF transformers, filters, transistors, attenuators, thermistors, crystal diodes, and vacuum tubes. The oscillator is sufficiently accurate and stable to permit measurements and comparison at closely specified frequencies. The instrument's sensitivity makes it possible to determine the effects of very small changes in circuit configuration and location, such as small changes in lead length and position in relation to a ground plane.

SPECIFICATIONS

Frequency Range: 0.5 to 250 mc continuously variable in eight self-contained ranges.

Frequency Accuracy: ±1%.

Resistance Range (Rp): 15 to 100,000 ohms. Values from 0 to 15 ohms can be determined by indirect means.

Accuracy of Resistance Measurements:

$\pm\left(2 + \frac{Fmc}{200} + \frac{Rp}{5000} + \frac{Q}{20}\right)$ % ±0.2 ohms where Fmc = frequency in megacycles; Rp = Equivalent parallel resistance as indicated by the RX Meter dial. $Q = \frac{Rp}{Xp}$ as determined from RX Meter indications.

Capacitance Range (Cp): 0 to 20 mmfd. By use of auxiliary resonating coils this range may be extended to 0 to 120 mmfd.

Accuracy of Capacitance Measurements:
$\pm(0.5 + 0.0002\ F^2mc)\%$ ±0.15 mmf where Fmc = Frequency in megacycles.

Inductance Range (L): Values of L which will resonate with capacities from 0 to 100 mmf over the frequency range may be determined. By the use of auxiliary series resistors, values of L may be measured over the following ranges:

	L	
Frequency	*Minimum*	*Maximum*
0.5 mc	0.01 μh	100 mh
250 mc	0.001 μh	0.4 μh

Voltage Applied Across Unknown Impedance:

DC voltage = 0: External DC to 50 ma may be used.
RF voltage = Approximately 0.1 to 0.5 volts.

Power Requirements: 105 — 125 volts 50 — 60 cps 60 watts. (Power supply of instrument internally regulated)

Tubes: The instrument is supplied complete with the following tubes:

2 Type 5718	1 Type OD3
1 Type 6AB4	1 Type 5Y3
2 Type 6AG5	1 Type 6H-6 Ballast Tube

Dimensions: Height 10"; length 20"; depth 12".

Weight: 40 pounds.

G METER TYPE 192-A

Frequencies 1 or 30 MC

DESCRIPTION

The use of electrical insulating materials at high frequencies is limited by the capacitance and the power loss which these materials add to the circuit. These factors can be investigated by a knowledge of the dielectric constant and the power factor of the insulating material. Both of these quantities can be derived from measurements of the conductance (G) and the capacitance (C) of the insulating material. A material with a low value of G and C at the frequency in question will, in general, make a satisfactory insulating material for use.

The C of a sample of insulating material may be measured by noting the capacitance necessary to resonate a parallel tuned circuit; first, without the insulating sample being used as the dielectric between two electrodes across the circuit; and, secondly, with the insulating material being used between two electrodes across the tuned circuit. The G of the insulating material may be conveniently measured by establishing a known voltage across a resonant tuned circuit with the insulating material between two electrodes paralleling the circuit. The insulating material may then be removed and a calibrated resistive loss placed across the tuned

circuit and a value of resistance established which reproduces the voltage originally used across the tuned circuit. The G Meter Type 192-A has been arranged to use these two principles to measure the C and the G of insulating materials.

The G Meter 192-A employs a crystal controlled oscillator to supply a constant amplitude voltage to a high quality reference tuned circuit. A calibrated precision loss circuit and a differential VTVM are internally connected across the resonant circuit. By use of external connections, test samples are connected across this same resonant circuit and a reference voltage established. By substituting internally connected values of calibrated loss and capacitance for the test sample, to secure the same reference voltage, the conductance and capacitance of the sample may be determined. The differential VTVM provides very great sensitivity to changes from the reference voltage, allowing very accurate settings of the conductance and capacitance dials.

The G Meter is a self-contained instrument and requires no external generator or detector for its operation. The internal reference resonant circuit is of high quality, and its characteristics drift very little with time. The scales indicating the conductance are hand calibrated, and the drives for both the capacitance and conductance dials are carefully constructed to avoid backlash and other possible mechanical inaccuracies. Three different meter sensitivity positions and four different balance controls are provided for use with the null indicating differential VTVM in order to provide high accuracy of the reference voltage used across the resonant circuit, both in the condition with the sample in place, and without the sample in place. This very careful design minimizes errors due to improper establishment of the reference voltage in the two cases.

FEATURES

The G Meter Type 192-A contains a crystal controlled oscillator which insures stability and accuracy of frequency; an automatic output control on the oscillator insures stability of amplitude from measurement to measurement. Very high quality reference resistors and a high quality reference potentiometer are used in the circuit which indicates the conductance, G. The scale on the potentiometer is hand calibrated, and seven ranges of conductance are included in order to obtain a greater reading accuracy. The variable capacitor used in the stable reference resonant circuit contains two dials: one reads in tens of micro-micro farads; and another reads in 0.1 mmf. A small fine tuning adjustment is included for varying the capacitance continuously by very small amounts. The crystal controlled oscillator is housed in a cast shield to insure good shielding and the extreme mechanical rigidity necessary to obtain constancy of frequency.

USES

The G Meter may be used to make the following measurements:

1. Conductance values of very low loss insulating materials.
2. The Q of small high quality capacitors.
3. Capacitance of insulating materials and capacitors.
4. The RF resistance of large value resistors.
5. The dynamic impedance of resonant circuits.

These measurements may be made to the degree of refinement required in standard testing methods, such as the American Standard Testing Methods specification D-150-52T. The frequencies at which the instrument operates have been selected according to the standards set forth in the ASTM specification mentioned above.

SPECIFICATIONS

Frequency of Operation:* Either 1 mc or 30 mc crystal controlled.

Conductance Range (G): 0 to 35 micromhos. Continuously variable and direct reading in seven ranges.

Capacitance Range: 0 to 100 mmf. Direct reading (Simple indirect method allows measurements to 1000 mmf.)

Sensitivity: Approximately 10% deflection of Panel Meter results from conductance (G) change of 0.004 micromhos at 1 mc and 0.04 micromhos at 30 mc.

Voltage on Test Sample: 20 to 35 volts RMS.

Power Source:** 105-125 volts 60 cps 85 watts. Power Supply internally regulated.

Dimensions: 18" high x 15" wide x 15" deep.

Weight: 59 pounds.

Accessories: The Type 512-A Adapter is available for use in attaching the General Radio Sample Holder Type 1690-A to the G Meter Type 192-A. The Adapter includes all parts necessary to permit use of the sample holder as electrodes for supporting samples under test.

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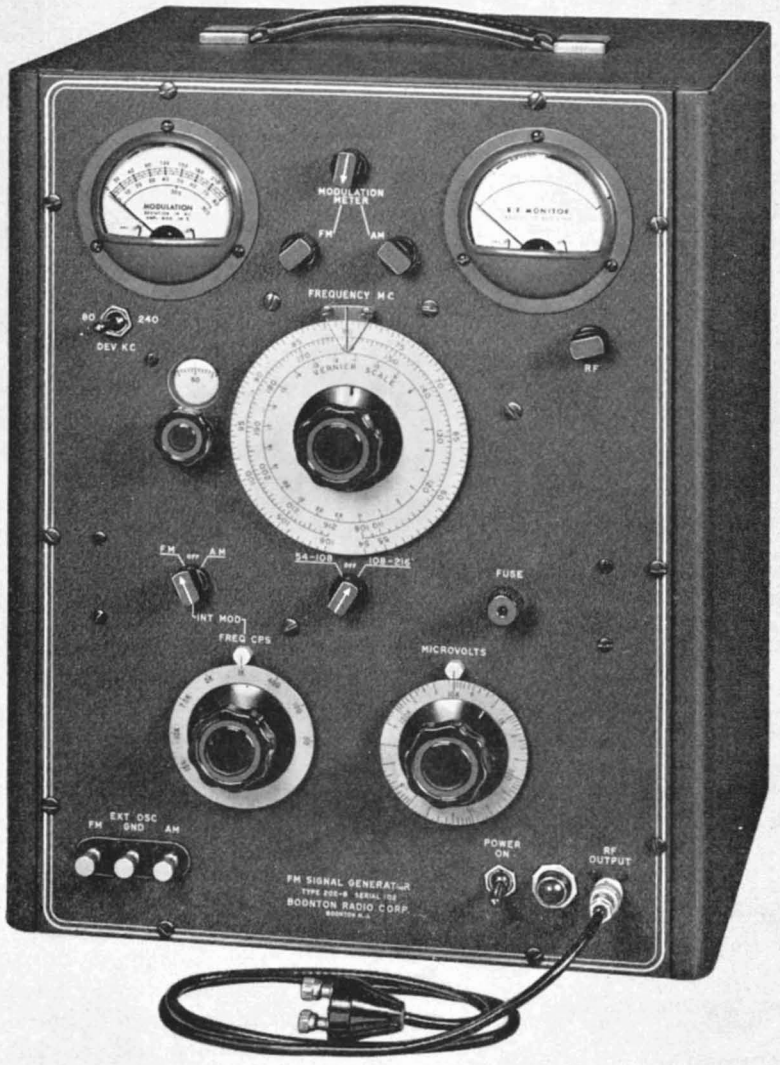
* Instrument shipped with plug-in crystal oscillator Type 592-A1 or Type 592-A30 installed for 1 or 30 mc operation. Additional plug-in oscillator available at extra price.

** Instruments available for other voltages and frequencies. Write for information.

SIGNAL GENERATOR TYPE 202-B: FM-AM



Frequency Range 54-216 MC

DESCRIPTION

The Type 202-B FM-AM Signal Generator has been developed to meet the needs of engineers engaged in the design of FM and television receivers for operation within the frequency range of from 54 megacycles to 216 megacycles.

This instrument has been proportioned for maximum conservation of laboratory bench space, with frequency dial, modulation and output meters positioned at eyelevel for maximum readability.

An internal audio frequency oscillator provides eight modulation frequencies ranging from 50 cycles to 15 kilocycles, any one of which may be conveniently selected by a rotary type switch for either amplitude or frequency modulation.

An external audio oscillator may be used in place of the internal modulating oscillator or used in conjunction with the internal oscillator to provide AM and FM simultaneously.

Three deviation ranges: 0-24 kc, 0-80 kc, and 0-240 kc are available for frequency modulation, and amplitude modulation settings may be made at 30% and 50%.

A calibrated piston type of RF attenuator is used, the range of which is 0.1 microvolts to 0.2 volts. Direct settings in microvolts are made by means of the front panel attenuator dial after the output level has been standardized by adjusting the pointer of the output meter to a single calibration line on the meter scale.

The output cable connects at the front panel by means of a BNC type connector, permitting quick detachment and interchangeability with other output cables.

The unit is finished in grey wrinkle enamel with engraved panel and is supplied complete with tubes and standard output cable.

SPECIFICATIONS

RF Range: Frequencies from 54 mc to 216 mc are covered in two ranges: 54-108 mc; and 108-216 mc. By use of the 207-A univerter, the range is extended to 0.1 to 216 mc (see page 22).

Main Frequency Dial: The two RF ranges are calibrated directly in megacycles to an accuracy of within ±0.5%. The dial is also divided in 24 equal divisions for use with the vernier frequency dial.

Vernier Frequency Dial: The vernier frequency dial is divided in 100 divisions and is geared to the main dial through a gear train having a 24:1 ratio. The approximate frequency change per vernier division is 26 kc on the low range and 52 kc on the high range.

Frequency Modulation (Deviation): The FM deviation is continuously variable from zero to 240 kc. The modulation meter is calibrated in three FM ranges (1) zero to 24 kc, (2) zero to 80 kc, and (3) zero to 240 kc deviation.

Amplitude Modulation: The modulation meter is calibrated at 30% and 50% amplitude modulation. AM is continuously variable from zero to 50%.

Modulation Controls: Separate potentiometers are provided for continuous control of FM and AM levels.

Modulating Oscillator: The internal AF oscillator may be switched to provide either frequency or amplitude modulation: it may also be switched off. External binding posts permit the use of an external AF oscillator for either FM or AM. Both internal and external AF oscillators may be used simultaneously, thus providing either FM or AM at two modulation frequencies simultaneously or simultaneous FM and AM.

The internal AF oscillator provides eight fixed frequencies which may be selected by a rotary type switch — 50, 100, 400 cycles and 1, 5, 7.5, 10, and 15 kilocycles, accurate to within 5%. The output voltage of the internal AF oscillator is available at the external binding posts for synchronizing or other purposes.

RF Output Voltage: The RF output voltage is continuously variable over a range from 0.1 microvolts to 0.2 volts at the terminals of the output cable. The impedance at the RF output jack, looking into the instrument, is 53 ohms resistive. The output cable has a 53 ohm resistance termination at the terminal end hence the output impedance of the unit with cable attached is 26.5 ohms.

Distortion: FM distortion at 75 kc deviation is less than 2% when modulated with the internal AF oscillator or an external AF oscillator having 0.5% distortion or less.

At 50% amplitude modulation the distortion is about 5% using the internal AF oscillator and decreases as the modulation percentage is reduced. An external AF oscillator may be employed for amplitude modulation if desired.

Spurious RF Output: All spurious RF output voltages are at least 30 db below the desired fundamental. The RF leakage is very low.

Fidelity Characteristics: The deviation sensitivity of the FM modulation system as a function of frequency is constant from dc to over 10 kc. At 15 kc the deviation as indicated on the modulation meter is 0.5 db higher than the true value. The amplitude modulation system is also flat from dc to 10 kc, and departs from nominal by 1.0 db at 15 kilocycles.

Power Supply: The power supply is self-contained in the instrument for use on 50-60 cycles, 105-125 volts. Internal regulation is provided so that the frequency does not change by more than 0.05% for line voltage variations from 105-125 volts. The power consumption is 65 watts.

Tubes:
1 — 6AU6
1 — 6V6GTG
1 — 6C4
3 — 6AK5*
1 — 5Y3GTG
1 — 6H-6
1 — OD3/VR-150

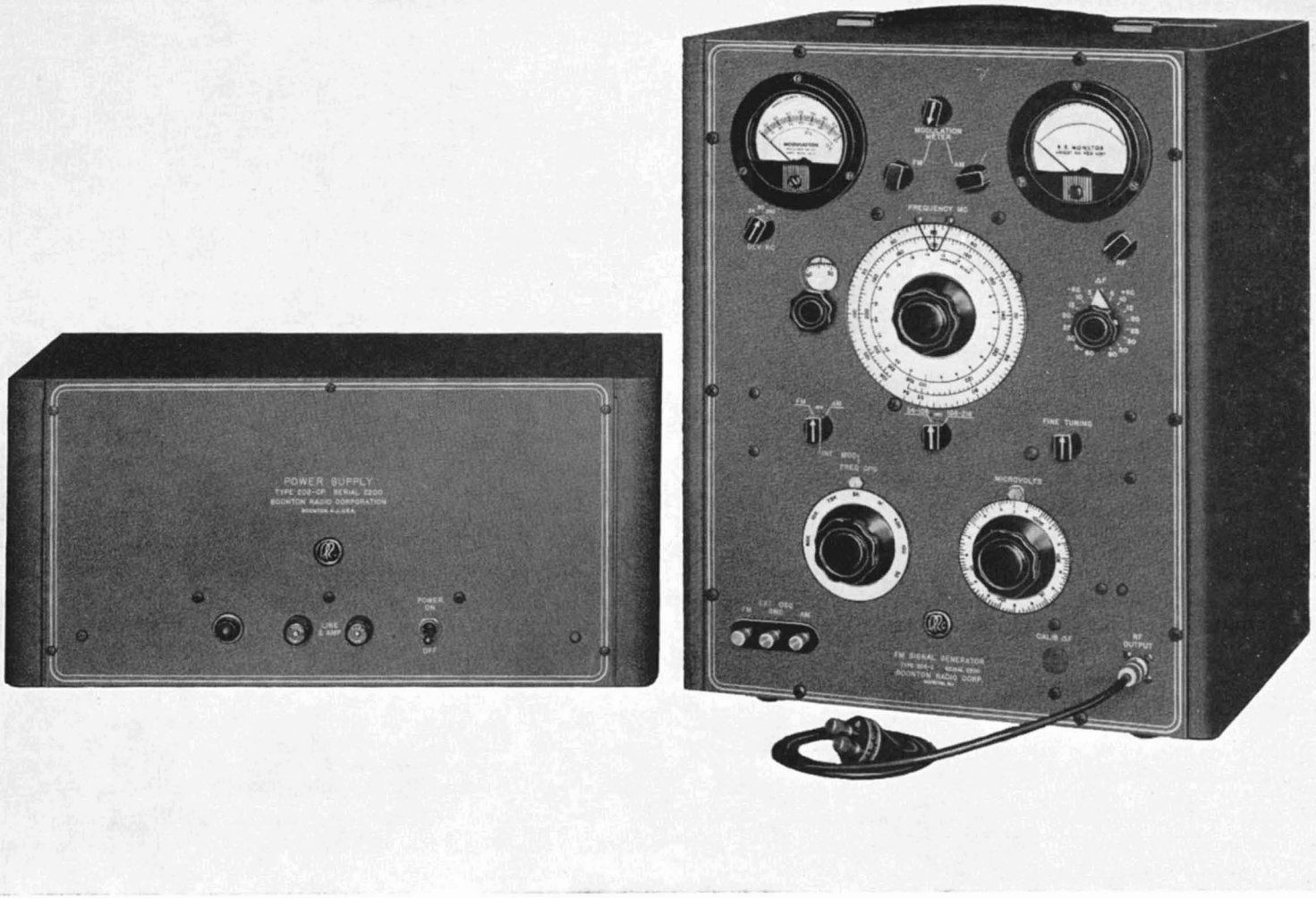
**Specially selected.*

Accessories: 207-A Frequency Converter (frequency range 0.1 mc to 55 mc).

Dimensions: Height 17"; Width 13½"; Depth 11½"

Weight: 35 lbs.

SIGNAL GENERATOR TYPE 202-C: FM-AM



Frequency Range 54-216 MC

DESCRIPTION

The Type 202-C FM-AM Signal Generator is particularly well adapted for testing and evaluating mobile radio receiving equipment and other systems employing narrow band frequency modulation within the range from 54-216 mc.

This instrument is very similar in design and appearance to the Type 202-BFM-AM Signal Generator except that an electronic tuning feature has been added which permits continuous, fine adjustment of the carrier frequency either side of center to a maximum of 10 kc. in the 54-108 mc. range and 20 kc. in the 108-216 mc. range. An incremental frequency switch has also been provided which enables the operator to change the carrier frequency by accurately determined increments, thus enabling selectivity measurements to be accomplished with rapidity and ease.

Seven audio frequencies ranging from 50 cycles to 10 kilocycles are available from the internal audio oscillator for either amplitude or frequency modulation. In addition, a 60 kilocycle modulation frequency may be selected which permits the accuracy of the incremental frequency calibration to be checked from time to time.

In order to reduce the noise level of the carrier to an absolute minimum the power supply and all associated circuits have been incorporated in a completely separate unit thus eliminating stray magnetic fields, vibration, etc. The unit is attractively finished in grey wrinkle enamel and is supplied complete with external power supply, tubes, and output cable.

SPECIFICATIONS

RF Range: Overall frequency coverage 54 to 216 megacycles in two ranges: 54-108 megacycles and 108-216 megacycles, accurate to within ±0.5% after a warm-up period of one hour. The main frequency dial is also calibrated in 24 equal divisions for use with the vernier frequency dial.

Fine Tuning Range: The fine tuning control permits continuous tuning over a range of approximately ±20 kc. in the 108 to 216 mc. range, and ±10 kc. in the 54-108 mc. range. No calibration is provided.

Incremental Frequency Range: The ΔF switch permits tuning in frequency increments of ±5, ±10, ±15, ±20, ±25, ±30, ±50, ±60 kc. in the 108 to 216 mc. range — half of these values in the 54 to 108 mc. range. The relative accuracy of the increments is ±1%. Overall accuracy is dependent on the accuracy of the 60 kc. frequency, and is within ±3% when the 60 kc. accuracy is ±2% or better.

RF Output Voltage: The maximum open circuit output voltage from the BNC type RF output jack at the front panel is about 0.4 volt. With the standard output cable (type 501-A) attached, the maximum calibrated output voltage at the cable terminals is 0.2 volt. When the RF monitor meter is set to the red calibration line and the standard output cable attached, the RF output attenuator is direct reading on microvolts and continuously adjustable from 0.1 microvolt to 0.2 volt. The approximate accuracy is ±10%.

RF Output Impedance: The RF output impedance of the signal generator as seen looking in at the BNC type front panel connector is 53 ohms resistive. With the standard output cable attached, the RF output impedance as seen looking in at the output cable terminals is 26.5 ohms resistive.

Frequency Modulation: Three frequency deviation ranges, 0-24 kc., 0-80 kc., and 0-240 kc. are provided, each continuously adjustable. Calibrated frequency increments are 1 kc. on the 24 kc. range, 5 kc. on the 80 kc. range, and 10 kc. on the 240 kc. range.

Amplitude Modulation: Amplitude modulation is available over the range from 0-50% with meter calibration points provided at 30% and 50% modulation.

Distortion:

1. FM: The overall FM distortion at 75 kc. is less than 2% and at 240 kc. less than 10%.

These distortion percentages apply when the front panel fine tuning control is set midway in rotation and the ΔF control at zero electronic deviation, or when the sum of the fixed deviation and modulation deviations do not exceed the stated deviation.

2. AM: Overall distortion is less than 3% at 30% modulation, and 6.5% at 50% modulation.

Spurious RF Output: All spurious RF output voltages are at least 30 db. below the desired fundamental.

Signal-to-Noise Ratio: The signal-to-noise ratio referred to the level established by 10 kc. deviation is better than 60 db. in a quiet location. Where considerable noise and vibration are present, the ratio may drop to 55 db.

Fidelity Characteristics: The deviation sensitivity of the FM modulation system is down approx. 3 db. at 12 cycles (due to the inclusion of a blocking capacitor), then rises and becomes constant to well above the audible range.

The amplitude modulation system is flat within ±1% db. from approx. 30 cps. to well above the audible range.

Internal A-F Oscillator: The internal A-F oscillator may be switched to provide either frequency or amplitude modulation; it may also be switched off.

The internal A-F oscillator provides eight fixed frequencies which may be selected by a rotary switch, — 50, 100 and 400 cycles, and 1, 5, 7.5, 10 and 60 kc. Frequency accuracy is within 5% on all but 60 kc., where accuracy is ±2%. The output of the internal oscillator is available (at the external binding posts) for synchronizing or other applications if desired. Approximately 5 V on the FM posts and 50 V on the AM posts are available.

Simultaneous FM and AM: The 202-C FM Signal Generator, in combination with an external low distortion audio oscillator, may be used for this purpose provided that the audio oscillator is capable of developing approximately 5 volts across a 1500 ohm load, the FM requirement for 240 kc. deviation.

In use the external audio oscillator is connected to the FM external binding posts, the modulation selector switch set to AM, and the levels of each type of modulation independently set on the modulation meter, by operation of the modulation meter switch, FM deviation control, and amplitude modulation control.

Power Supply — 202-CP1: A separate external power supply furnishes all the dc potentials required for the operation of the 202-C Signal Generator. Output voltages are 250, 150 and 6.9 volts dc, with ripple contents averaging 15 millivolts, less than 1 millivolt, and 25 millivolt, respectively.

Power Requirements: (input to separate power supply). 80 watts at 115 volts, 50 to 60 cycles input. For best stability a regulating transformer should supply input power.

Tube Complement:

Audio Oscillator	6AU6, 6V6GT/G	(V1, V2)
Rectifier	5Y3GT/G	(V3)
Voltage Regulator	OD3/VR-150	(V4)
Reactance Modulator	6AK5*	(V5)
R-F Oscillator	6C4	(V6)
Doubler Stage	6AK5*	(V7)
Doubler and Output	6AK5*	(V8)

*Specially Selected

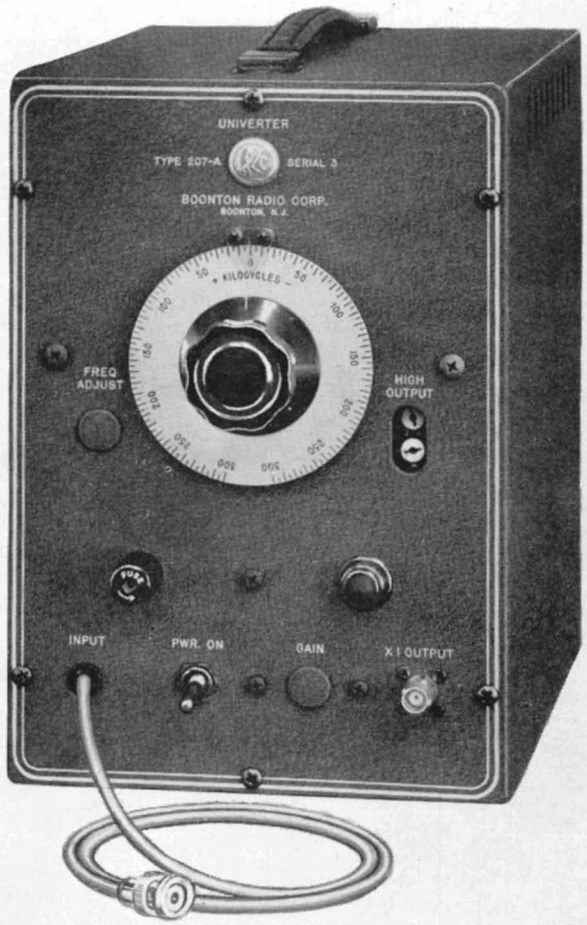
Dimensions:

1. 202-C Signal Generator: 17" H., 13½" W., 11½" D.
2. 202-CP1 Power Supply: 8¼" H., 16¼" W., 8" D.

Weight:

1. 202-C Signal Generator: 28 pounds.
2. 202-CP1 Power Supply: 23½ pounds.

UNIVERTER TYPE 207-A



Frequency Range 0.1 MC to 55 MC

DESCRIPTION

The Type 207-A Univerter, a frequency converter accessory with unity gain, is designed for use with the Type 202-B and the Type 202-C FM-AM Signal Generators to provide additional frequency coverage from 0.1 mc to 55 mc. Since the 202-B and the 202-C FM-AM Signal Generators cover a frequency range of 54 to 216 megacycles, the 207-A Univerter provides a convenient method of obtaining the additional coverage of commonly used intermediate and radio frequencies.

This instrument also enables the frequency and amplitude modulation features of the 202-B and the 202-C instruments, as well as the attenuator calibration feature of the instruments, to be utilized at these lower frequencies without causing any appreciable distortion. The Univerter consists essentially of a semi-fixed frequency 150 mc heterodyne oscillator, a wide band amplifier, and a self-contained regulated power supply. In operation, the internal heterodyne oscillator beats with the output signal of the 202-B or the 202-C FM-AM Signal Generator, and the difference frequency is passed through the wide band amplifier to the output system.

The Univerter requires that the frequency of the 202-B or the 202-C FM-AM Signal Generator be

used from 150 mc to 205 mc. The output frequency of the Univerter is easily determined by subtracting 150 mc from the frequency dial reading of the 202-B or the 202-C FM-AM Signal Generator. The heterodyne oscillator may be continuously varied over a narrow frequency range of ±300 kc by means of a front panel incremental frequency control calibrated at 5 kc intervals, thereby enabling selectivity measurements to be made.

Internal adjustments are provided for setting the overall gain of the instrument to unity, and for adjusting the center frequency of the local oscillator to zero beat with the 150 mc dial calibration of the 202-B or the 202-C FM-AM Signal Generator.

To use the Univerter with the 202-B or the 202-C FM-AM Signal Generator, it is necessary only to connect the input cable of the univerter to the RF output BNC panel connector of the 202-B or the 202-C FM-AM Signal Generator and transfer the output cable from the Signal Generator to the X1 output JACK of the Univerter. Since the output impedance of the Univerter at the BNC type X1 OUTPUT JACK is approximately 53 ohms, the output cable of the driving signal generator suffices for use with either instrument. The Univerter has in addition to the X1 OUTPUT JACK a 1.5 volts maximum output jack marked HIGH OUTPUT, which is useful in making relatively high level measurements.

The 207-A Univerter operates from a power source of 95 to 130 volts, 60 cycles per second only. If this power source is not available, the 207-AP, which operates from 115/230 volts, 50/60 cycles per second, should be ordered. Since the 207-AP has an unregulated power supply, it is recommended that a constant voltage transformer Type 162-A, mentioned elsewhere in this catalog, should be purchased as an external attachment. The use of the external transformer makes it possible to obtain the same performance characteristics from the 207-AP that are available in the 207-A.

The 207-A and the 207-AP Univerters match the 202-B and the 202-C Signal Generators in style and finish and are supplied complete with tubes and instruction books.

SPECIFICATIONS

(When used with FM-AM Signal Generator Type 202-B or Type 202-C)

Frequency Range: 0.1 mc to 55 mc (0.3 mc to 55 mc with 200 kc carrier deviation).

Frequency Response: Flat within ± 1 db over frequency range.

Frequency Increment Dial: This dial is calibrated from plus 300 kc through zero to minus 300 kc in increments of 5 kc.

Frequency Adjust: Front panel control allows calibration of local oscillator in 207-A with output frequency of 202-B or 202-C.

Output: X1 Jack reproduces calibrated output voltage of 202-B or 202-C FM-AM Signal Generator over continuous range of 0.1 to 100,000 microvolts under control of attenuator of Signal Generator.

High Output: Uncalibrated output approximately 1.5 volts under control of attenuator of 202-B or 202-C Signal Generators.

Internal Impedance: The output impedance at the X1 jack is approximately 53 ohms; the impedance looking into a terminated 53 ohm cable connected to the jack is 26.5 ohms.

The impedance at the HIGH OUTPUT jack is approximately 330 ohms.

Distortion: No appreciable FM distortion at any level. No appreciable AM distortion at carrier levels below 0.05 volt and modulation of 50%.

Spurious RF Output: At least 30 db down at input levels less than 0.05 volts.

Tube Complement:

1 6C4
1 6AB4
2 6AK5
1 6AH6

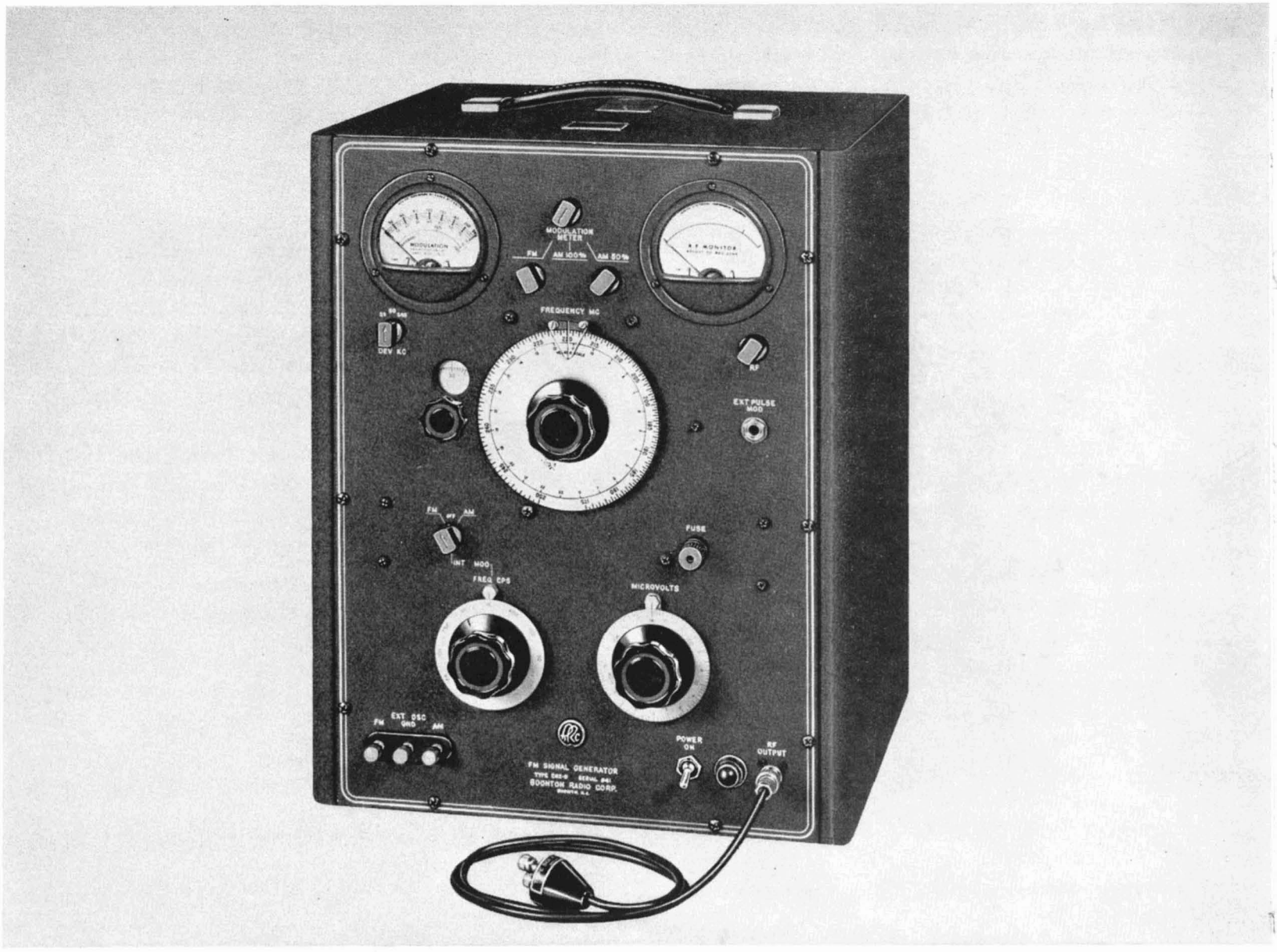
Power Supply: 90-130 volts 60 cycles 45 watts approximately.

Note: 207-AP available for 115/230 volts, 50-60 cycles.

Dimensions: Height 11½", Width 7⅜", Depth 10½".

Weight: 20 pounds.

SIGNAL GENERATOR TYPE 202-D: FM-AM



Frequency Range 175-250 MC

DESCRIPTION

The Type 202-D Signal Generator is a precise and reliable instrument well suited to the specialized requirements of telemetering engineers for rapidly analyzing overall system performance. It is very similar in design and appearance to the 202-B FM-AM Signal Generator but it has a frequency coverage of from 175-250 mc., provided in a single range.

An internal audio frequency oscillator furnishes eight modulation frequencies ranging from 50 cycles to 15 kilocycles, any one of which may be selected by a rotary type switch for either amplitude or frequency modulation.

Three deviation ranges: 0-24 kc., 0-80 kc., and 0-240 kc. are available for frequency modulation, and amplitude modulation settings may be made at 30% and 50%. By means of an external audio oscillator amplitude modulation to substantially 100% may also be obtained and a front panel jack permits the connection of an external modulation source for pulse and square wave modulation.

The Type 202-D Signal Generator is finished in grey wrinkle enamel with engraved panel and is supplied complete with tubes and standard Type 501-A output cable.

SPECIFICATIONS

RF Range: Overall frequency coverage 175-250 megacycles in one range, accurate to ±0.5% after a warm-up period of one hour. The main frequency dial is also calibrated in 24 equal divisions for use with the vernier frequency dial.

Vernier Frequency Dial: The vernier frequency dial is divided into 100 equal scale divisions and is coupled to the main frequency dial by a 24:1 gear train, providing a total of 2400 logging divisions over the tuning range of the instrument. The approximate frequency change per vernier division is 35 kc.

RF Output Voltage: The maximum open circuit output voltage from the BNC type RF output jack at the front panel is about 0.4 volt. With the standard output cable (type 501-A) attached, the maximum calibrated output voltage at the cable terminals is 0.2 volt. When the RF monitor meter is set to the red calibration line and the standard output cable attached, the RF output attenuator is direct reading in microvolts and continuously adjustable from 0.1 microvolt to 0.2 volt.

RF Output Impedances: The RF output impedance of the signal generator as seen looking in at the BNC type front panel connector is 53 ohms resistive. With the standard output cable attached, the R-F output impedance as seen looking in at the output cable terminals is 26.5 ohms resistive.

Frequency Modulation: Three frequency deviation ranges, 0-24 kc., 0-80 kc. and 0-240 kc. are provided, each continuously adjustable. The 0-24 kc. deviation scale is calibrated in increments of 1 kc., the 0-80 kc. scale in increments of 5 kc. and the 0-240 kc. scale in increments of 10 kc.

Amplitude Modulation:

1. Internal Modulation: Utilizing the internal audio oscillator, amplitude modulation may be obtained over the range of 0-50%, with meter calibration points provided at 30% and 50% modulation points.

2. External Modulation: By using an external audio oscillator, the RF carrier may be amplitude modulated to substantially 100%. For this purpose the modulation meter has a scale calibration point at 100%.

3. Pulse Modulation: A front panel jack is provided which permits direct connection of an external modulation voltage source to the screen of the final stage for pulse and square wave modulation. When this connection is made the modulation meter and internal circuits are disconnected from the screen element.

Distortion:

1. FM: The overall FM distortion at 75 kc. is less than 2% and at 240 kc. less than 10%.

2. AM: The distortion present at the RF output for 30% amplitude modulation is less than 3% and for 50% AM less than 6.5. At 100% the distortion is 12% to 15% depending upon the modulating frequency.

Spurious RF Output: All spurious RF output voltages are at least 25 db. below the desired fundamental. Total RMS spurious FM from the 60 cycle power source is down more than 50 db., with 75 kc. deviation as a reference level.

Fidelity Characteristics: The deviation sensitivity of the FM modulation system as a function of frequency is constant from D.C. to 100 kc. At 200 kc. the deviation as indicated on the modulation meter is about 0.5 db. higher than the true value.

The amplitude modulation system, with the modulation potentiometer at maximum position, is substantially flat from 30 cycles to 100 kc. At 200 kc. the indicated percent modulation is approximately 1 db. higher than the actual carrier modulation. With the modulation potentiometer at one-half of full rotation setting, the amplitude modulation system is within 1.0 db. from 100 cycles to 10 kc. At 30 cycles and at 70 kc. the indicated per cent modulation is approximately 1.0 db. higher than the actual carrier modulation.

Direct connection to the screen element of the final output stage permits square wave or pulse modulation to be applied from an external voltage source. Under these conditions the rise time of the modulated carrier envelope is less than 0.25 microseconds and the decay time less than 0.8 microseconds.

Internal AF Oscillator: The internal AF Oscillator may be switched to provide either frequency or amplitude modulation; it may also be switched off. External binding posts permit the use of an external AF oscillator for either AM or FM. The internal oscillator and an external AF oscillator may be used simultaneously, thus producing either FM or AM at two modulation frequencies simultaneously. With the internal oscillator switched for AM, an external AF oscillator may be used simultaneously to frequency modulate the AM signal.

The internal AF oscillator provides eight fixed frequencies which may be selected by a rotary type switch — 50, 100, 400 cycles and 1, 5, 7.5, 10, 15 kilocycles, accurate to within 5%. Harmonic distortion, in general, is less than 0.5%.

The output voltage of the internal oscillator is available at the external binding posts for synchronizing or other purposes.

External Modulation Requirements:

1. Frequency Modulation: The deviation sensitivity is 50 kc. per volt. For external FM the input impedance is 1500 ohms.

2. Amplitude Modulation: Approximately 45 volts are required for 50% modulation and 100 volts for 100% modulation. For external AM the input impedance is 7500 ohms.

3. Audio Voltage for External Use: There is available at the FM external oscillator binding posts about 5 volts a.c. maximum; at the AM external oscillator binding posts, 50 volts maximum.

Tube Complement:

Audio Oscillator	6AU6, 6V6GT/G	(V1, V2)
Rectifier	5Y3GT/G	(V3)
Voltage Regulator	OD3/VR-150	(V4)
Reactance Modulator	6AK5*	(V5)
R-F Oscillator	6C4	(V6)
Doubler Stage	6AK5*	(V7)
Doubler and Output	6AK5*	(V8)
Ballast Resistor	6H-6	(R18)

*Specially Selected

Power Requirements: The 202-D FM Signal Generator is designed for use with 115 volts, 50-60 cycles. It will operate satisfactorily, however, over a voltage range from 105-125 volts without changing the R-F frequency by more than 0.05%. Power consumption is 65 watts.

Dimensions and Weight: Outside cabinet dimensions: 17" high, 13½" wide, 11½" deep. Weight: 35 pounds.

UNIVERTER TYPE 207-B

Frequency Range 0.1 MC to 55 MC

DESCRIPTION

The Type 207-B Univerter, a frequency converter accessory with unity gain, is designed for use with the Type 202-D FM-AM Signal Generator to provide additional frequency coverage from 0.1 mc to 55 mc. Since the 202-D FM-AM Signal Generator covers a frequency range from 175 to 250 megacycles, the 207-B Univerter provides an easy way to obtain the additional coverage of commonly used intermediate frequencies and radio frequencies.

This instrument also enables the frequency and amplitude modulation features of the 202-D instrument, as well as the attenuator calibration feature of the instrument, to be utilized at these lower frequencies without causing any appreciable distortion. The Univerter consists essentially of a semi-fixed frequency 175 mc heterodyne oscillator, a wide band amplifier, and a self-contained regulated power supply. In operation, the internal heterodyne oscillator beats with the output signal of the 202-D FM-AM Signal Generator, and the difference in frequency is passed through the wide band amplifier to the output system.

The Univerter requires that the frequency of the 202-D FM-AM Signal Generator be used from 175 mc to 230 mc. The output frequency of the Univer-

ter is easily determined by subtracting the 175 mc from the frequency dial reading of the 202-D FM-AM Signal Generator. The heterodyne oscillator may be continuously varied over a narrow frequency range of ±300 kc by means of a front panel incremental frequency control calibrated at 5 kc intervals, thereby enabling selectivity measurements to be made.

Internal adjustments are provided for setting the overall gain of the instrument to unity, and for adjusting the center frequency of the local oscillator to zero beat with the 175 mc dial calibration of the 202-D FM-AM Signal Generator.

To use the Univerter with the 202-D FM-AM Signal Generator, it is necessary only to connect the input cable of the Univerter to the RF output BNC panel connector of the 202-D FM-AM Signal Generator and transfer the output cable from the Signal Generator to the X1 output JACK of the Univerter. Since the output impedance of the Univerter at the BNC type X1 OUTPUT JACK is approximately 53 ohms, the output cable of the driving signal generator suffices for use with either instrument. The Univerter has in addition to the X1 OUTPUT JACK a 1.5 volts maximum output jack marked HIGH OUTPUT, which is useful in making relatively high level measurements.

The 207-B Univerter operates from a power source of 95 to 130 volts, 60 cycles per second only. If this power source is not available the 207-BP, which operates from 115 or 230 volts, 60 cycles per second, should be ordered. Since the 207-BP has an unregulated power supply, it is recommended that a constant voltage transformer Type 162-A, mentioned elsewhere in this catalog, should be purchased as an external attachment. The use of the external transformer makes it possible to obtain the same performance characteristics from the 207-BP that are available in the 207-B.

The 207-B and the 207-BP Univerters match the 202-D Signal Generator in style and finish and are supplied complete with tubes and instruction books.

SPECIFICATIONS

(When used with FM-AM Signal Generator Type 202-D)

Frequency Range: 0.1 mc to 55 mc (0.3 mc to 55 mc with 200 kc carrier deviation.)

Frequency Response: Flat within ± 1 db over frequency range.

Frequency Increment Dial: This dial is calibrated from plus 300 kc through zero to minus 300 kc in increments of 5 kc.

Frequency adjust: Front panel control allows calibration of local oscillator in 207-B with output frequency of 202-D.

Output: X1 Jack reproduces calibrated output voltage of 202-D FM-AM Signal Generator over continuous range of 0.1 to 100,000 microvolts under control of attenuator of Signal Generator.

High Output: Uncalibrated output approximately 1.5 volts under control of attenuator of 202-D Signal Generator.

Internal Impedance: The output impedance at the X1 jack is approximately 53 ohms; the impedance looking into a terminated 53 ohm cable connected to the jack is 26.5 ohms.

The impedance at the HIGH OUTPUT jack is approximately 330 ohms.

Distortion: No appreciable FM distortion at any level. No appreciable AM distortion at carrier levels below 0.05 volt and modulation of 50%.

Spurious RF Output: At least 30 db down at input levels less than 0.05 volts.

Tube Complement:

1 6C4
1 6AB4
2 6AK5
1 6AH6

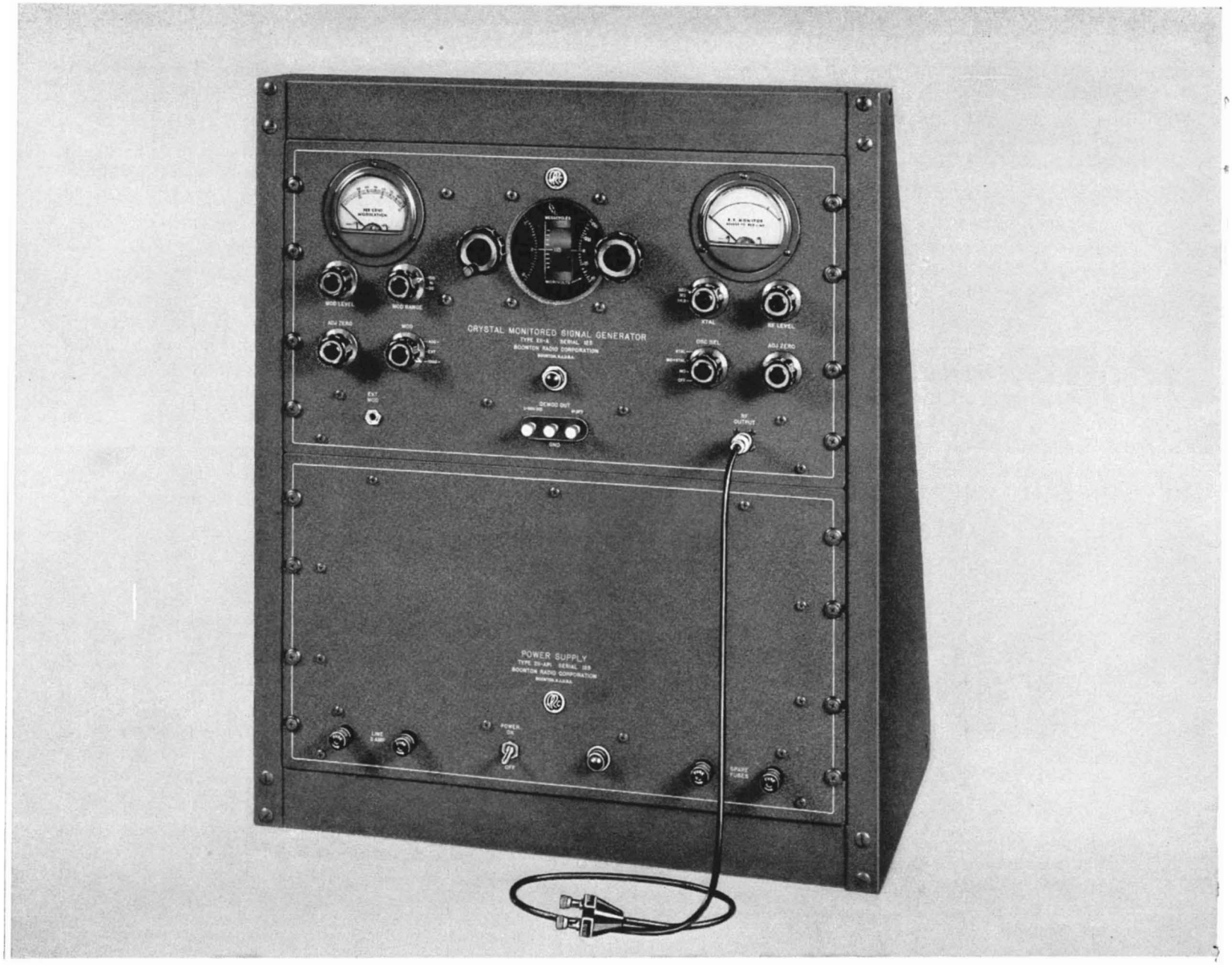
Power Supply: 90-130 volts 60 cycles 45 watts approximately.

Note: 207-BP available for 115/230 volts 50-60 cycles.

Dimensions: Height 11½"; width 7⅜"; depth 10½".

Weight: 20 pounds.

CRYSTAL MONITORED SIGNAL GENERATOR TYPE 211-A



Frequency Range 88-140 MC

DESCRIPTION

The Type 211-A Signal Generator is specifically designed for the testing and calibrating of omni-range radio receiving equipment operating within the frequency range of from 88-140 megacycles. It may also be used for laboratory and development work where a precision type amplitude modulated R.F. signal source is required.

A conventional master oscillator, doubler, and doubler-output arrangement is employed to cover continuously the frequency range from 88-140 megacycles. In addition, a crystal oscillator is incorporated within the instrument which may be switched on in place of the master oscillator to provide output frequencies of 110.100 or 114.900 mc., each accurate to $\pm .0035\%$. If desired, the master oscillator and crystal oscillator may be operated simultaneously permitting the output frequency of the

master oscillator to be standardized to an accuracy approaching that of the crystal itself at numerous beat points which occur throughout the tuning range of the instrument.

A demodulator stage is included within the 211-A Signal Generator which supplies to front panel binding posts a portion of the demodulated R.F. carrier. This feature permits checking the actual modulation process within the instrument and enables the identification of beat points by the use of earphones in standardizing the master oscillator against harmonics of the crystal frequencies.

An internal audio oscillator provides two modulation frequencies, 400 and 1000 cycles, each of which may be selected by means of a front panel switch. If desired, an external audio oscillator may be plugged in at the front panel to obtain amplitude modulation at various other frequencies.

Two amplitude modulation ranges are available, 0-30% and 0-100%, each continuously variable from a front panel control.

A calibrated piston type of R.F. attenuator is used, the range of which is 0.1 microvolts to 0.2 volts. Direct settings in microvolts are made by means of the front panel attenuator dial after the output level has been standardized by adjusting the pointer of the output meter to a single calibration line on the meter scale.

The unit is finished in grey wrinkle enamel with engraved panel and is supplied complete with power supply, tubes, and standard output cable.

SPECIFICATIONS

RF Output: 0.1 microvolt to 0.2 volt across a 53 ohm load. Monitored by a set-to-line type meter. Type BNC output jack.

Master Oscillator:

a. Output frequency range — 88 to 140 mc.
b. Initial frequency accuracy — better than ±0.1%.
c. Standardized accuracy — substantially equivalent to that of the crystal oscillator.
d. Frequency-temperature stability — better than 0.005%/°C.
e. Spurious frequency modulation — less than 2.5 kc deviation at 100% AM.

Crystal Oscillator:

a. Output frequencies — 110.100 mc or 114.900 mc.
b. Frequency-temperature stability — better than ±0.0035% from 10° C. to 50° C.

Spurious RF Output Voltages from Master or Crystal Oscillator: better than 40 db below the carrier output level.

Amplitude Modulation:

a. Modulation capability — 0 to 100%, using either internal 400 or 1000 cycle source, or external audio source.
b. Input requirements from external source — max. of 2V or more into 100,000 ohms.
c. Modulation meter (actuated by demodulated carrier) — two ranges, 0-30% and 30-100%.
d. Internal AF oscillator — 400 or 1000 cycles at 1.0% or less distortion.

Overall Audio Characteristics: (from modulation input to demodulated output)

a. Frequency fidelity — ±0.5 db from 30 to 11,000 cycles. ±0.1 db from 90 to 150 cycles. ±0.1 db from 9500 to 10,500 cycles.
b. Total harmonic distortion — 5% or less at 95% modulation.
c. Phase distortion — less than 0.25° at 30 cycles — less than 10° at 11,000 cycles.
d. Audio test voltage — at 50% modulation: approx. 4.6 V RMS at "+20V DC" post. Approx. 3.0 V RMS at "4 μf" post.

Mechanical:

a. Panel dimensions: Standard 19" relay rack panel, 10½" high.
b. Overall dimensions, including dust cover. Width 19½", height 10½", depth 9½".
c. Weight including dust cover: 28 lbs.

Power Supply Type 211-AP1:

Power Input:
105 to 125 V, 50-60 cycles, 150 watts.
Power Output:
a. Regulated DC to 211A Generator — 200 V at 35 ma.
b. Regulated DC to 211A Generator — 575 V at 50 ma.
c. Unregulated AC to 211A Generator — 7.4 V at 2.65 amp.
Mechanical:
a. Panel dimensions: Standard 19" relay rack panel, 10½" high.
b. Overall dimensions, including dust cover. Width 19½", height 10½", depth 9½".
c. Weight including dust cover: 35 lbs.

Tubes:

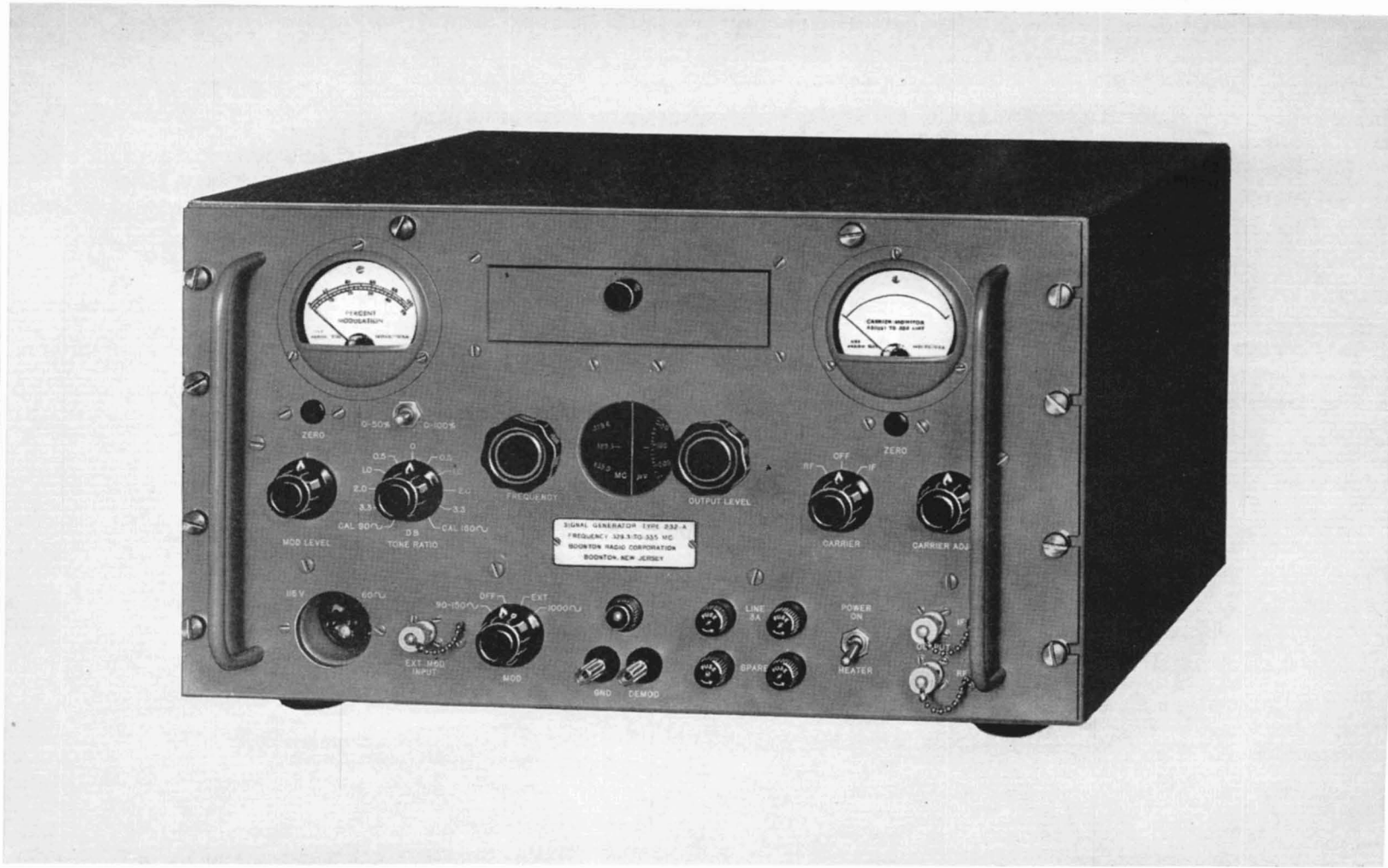
1—OA3/VR75	3—6B4G
2—2C51/396A	1—6V6GT/G*
1—5R4GY	
5—6AK5 or 5654*	1—6X5GT/G
2—6AU6	2—12AX7

Specially selected.

Accessories:

1. Adapter "BNC" to "N" BRC Type 504-A
2. Adapter "BNC" to "N" BRC Type 505-A
(53-ohm 6db "T" pad)
3. Patching cable, 6 ft.
"BNC" to "BNC" BRC Type 506-A

GLIDE SLOPE SIGNAL GENERATOR TYPE 232-A



Frequency Range 329.3 to 335 MC

DESCRIPTION

The CAA Instrument Landing System for aircraft includes a Glide Slope Receiver for indicating the proper rate of descent. The Glide Slope Signal Generator Type 232-A was designed for use in testing and calibrating these Glide Slope Receivers.

The Type 232-A includes two complete generators: an RF generator; and an IF generator. Each is capable of being modulated to a depth of 100% by self-contained modulation sources or by an external modulation source. Both generators use a common carrier monitor meter to indicate output level and a Percent Modulation meter to indicate percent modulation. The output of each generator is adjusted by a common knob and indicated in microvolts on a common Attenuator Dial. The RF Generator supplies twenty crystal controlled frequencies from 329.3 mc to 335 mc in 0.3 mc steps and the IF Generator supplies one crystal controlled frequency. The IF frequency is 18.9 mc., but can be changed to other frequencies from 15 to 30 mc by a change of crystals and internal adjustments. The power supply is internally regulated.

The Glide Slope Receiver in an aircraft receives two carriers of the same frequency: one is modulated with 90 cps audio; and the other is modulated with 150 cps audio. The airplane's position is indicated at the output of the receiver by the relative levels of these two modulations. The RF carrier from the 232-A can be internally modulated with 90 and 150 cps audio simultaneously, and the rela-

tive amounts of modulation can be varied by a front panel switch. This provides a test of the sensitivity and course correctness of the receiver under test.

FEATURES

The Glide Slope Generator Type 232-A provides twenty crystal controlled RF output frequencies and one crystal controlled IF output frequency. An internal alternator driven by a synchronous motor modulates either the RF or IF Generator simultaneously with 90 and 150 cps audio. The modulation depth resulting from each tone can be independently adjusted to equality and the relative levels subsequently varied. A 1000 cps audio oscillator is included for general purpose work. A continuously variable attenuator calibrated in microvolts controls the output of the RF or IF generator. Demodulated output from the RF or IF Generator is available at front panel terminals.

USES

The Glide Slope Generator Type 232-A is designed for use in calibrating and testing Glide Slope Receivers used in Aircraft Instrument Landing Systems. It provides calibrated signals for measuring the sensitivity and for aligning the RF and IF section of the receiver. The sensitivity and centering of the receiver system for indicating vertical course position of the airplane can also be measured and calibrated. General study of the receiver characteristics can be made by use of the 1000 cps modulated carriers.

SPECIFICATIONS

Freauency Range: RF Generator. 20 crystal controlled frequencies in increments of 0.3 mc in the range of 329.3 to 335.0 mc.

IF Generator. Supplied with crystal controlled frequency of 20.7 mc. Other frequencies can be obtained between 15 and 30 mc by change of crystal and internal adjustments.

Frequency Accuracy: ±0.0065% for both RF and IF signals.

Output Level:

RF Generator 1 to 200,000 microvolts
IF Generator 1 to 200,000 microvolts

Output Level Accuracy: Approximately ±10%

Output Impedance:

RF Generator 53 ohms
IF Generator 53 ohms

Output Monitor: RF and IF Generator; Set-to-line type meter.

Modulation: RF and IF Generator; 0 to 100% continuously variable and indicated by panel meter. 90-150 cps Tone Signal obtained from alternator driven by a 60 cps synchronous motor. 90-150 cps DB Tone Ratio Switch; steps at ±0 db, ±0.5 db, ±1.0 db, ±2.0 db, ±3.3 db, infinite db (calibrate positions).

1000 cps Modulation: An internal 1000 cps oscillator is provided.

External Modulation: Approximately 1.5 volt across 100,000 ohms is required at the EXT. MOD. jack for 100% modulation.

Demod-Gnd-Posts: Provides demodulated output at front panel through 2.0 mfd blocking capacitor.

Tubes:

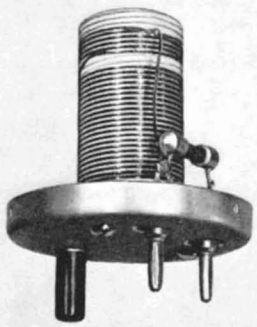
4 6AU6	2 6X4W
1 6AQ5W/6005	1 6AS7G
5 12AT7	1 OB2
1 6173	1 R113
1 5726	

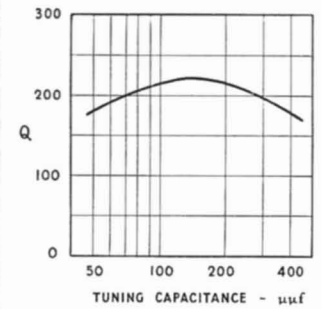
Power Supply: 105-125 volts 60 ± 1 cps 150 watts. Power supply internally regulated.

Dimensions: Length 20⅞"; width 16 3/16"; depth 11⅜".

Weight: 64 pounds.

INDUCTORS TYPE 103-A





Illustrating construction, also relationship between Q and tuning capacitance for typical inductor.

DESCRIPTION

These inductors are designed specifically for use in the Q circuit of the Type 160-A and 260-A Q-Meters, for measuring the radio-frequency characteristics of condensers, insulating materials, resistors, etc.

Each Type 103-A Inductor consists of a high Q coil mounted in a convenient shield and provided with plug terminals which plug directly into the coil terminals of the Q-Meter to facilitate the quick interchange of inductors for measurements at various frequencies.

Complete shielding eliminates errors in measurement due to coupling between the inductor and the test component and again with nearby objects, which coupling might alter the Q circuit constants during a measurement. Perfect shielding provides the desired stability.

The coils for these inductors are wound on specially treated forms. They are thoroughly protected against moisture absorption, resulting in unusual stability in inductance and Q under all weather conditions. The low inductance inductors are wound with solid wire on threaded forms. The high inductance inductors have a specially developed winding of Litz wire wound on carefully designed forms.

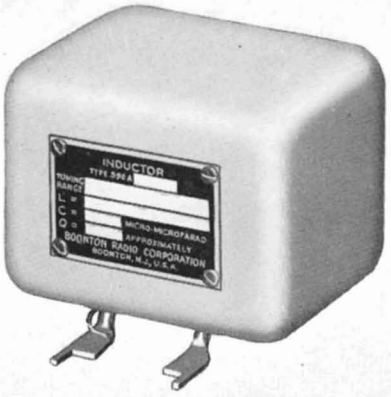
The Q of the majority of the Type 103-A Inductors is in the region of 200, over the normal range of tuning capacitance of from 50 to 400 micro-microfarads. The approximate variation in Q with tuning capacitance of a typical 103-A Inductor is shown in the above curve. A few of the higher inductance inductors have a Q of less than 200. The approximate Q of each inductor is listed below.

The true inductance of types A1 through A42 is adjusted to within 2 per cent of their nominal value. Tolerance on other coils slightly wider. The total distributed capacitance varies from 6 to 9 micro-microfarads as indicated below.

For convenience in selecting the correct inductance, the approximate frequencies at which each inductor resonates with three different tuning capacitances is included in the following list.

Type	Inductance	Approximate resonant frequency for tuning capacitance of:			Approx. Q	Capacitance μμf
		400 μμf	100 μμf	50 μμf		
103-A1	1 μh	8	16	20 mc	180	6
103-A2	2.5 μh	5	10	14 mc	200	6
103-A5	5 μh	3.5	7	10 mc	200	6
103-A11	10 μh	2.5	5	7 mc	200	6
103-A12	25 μh	1.5	3	4.5mc	200	6
103-A15	50 μh	1.1	2.2	3 mc	200	6
103-A21	100 μh	800	1600	2000 kc	200	6
103-A22	250 μh	500	1000	1400 kc	200	6
103-A25	500 μh	350	700	1000 kc	170	7
103-A31	1 mh	250	500	700 kc	170	7
103-A32	2.5 mh	150	300	450 kc	170	8
103-A35	5 mh	110	220	300 kc	160	8
103-A41	10 mh	80	160	200 kc	140	9
103-A42	25 mh	50	100	140 kc	110	9
		100 mmf		35 mmf		
103-A50	0.5 μh	20 mc		35 mc	225	5.5
103-A51	0.25 μh	30 mc		50 mc	225	5.5
103-A52	0.1 μh	45 mc		75 mc	225	5.5

INDUCTORS TYPE 590-A



DESCRIPTION

Inductors Type 590-A are designed specifically for use in the Q Circuit of the Q meters Type 170-A and 190-A for measuring the radio-frequency characteristics of condensers, resistors, and insulating materials. They have general usefulness as reference coils. The coils may be used for periodic checks to indicate any considerable change in the performance of the Q Meters.

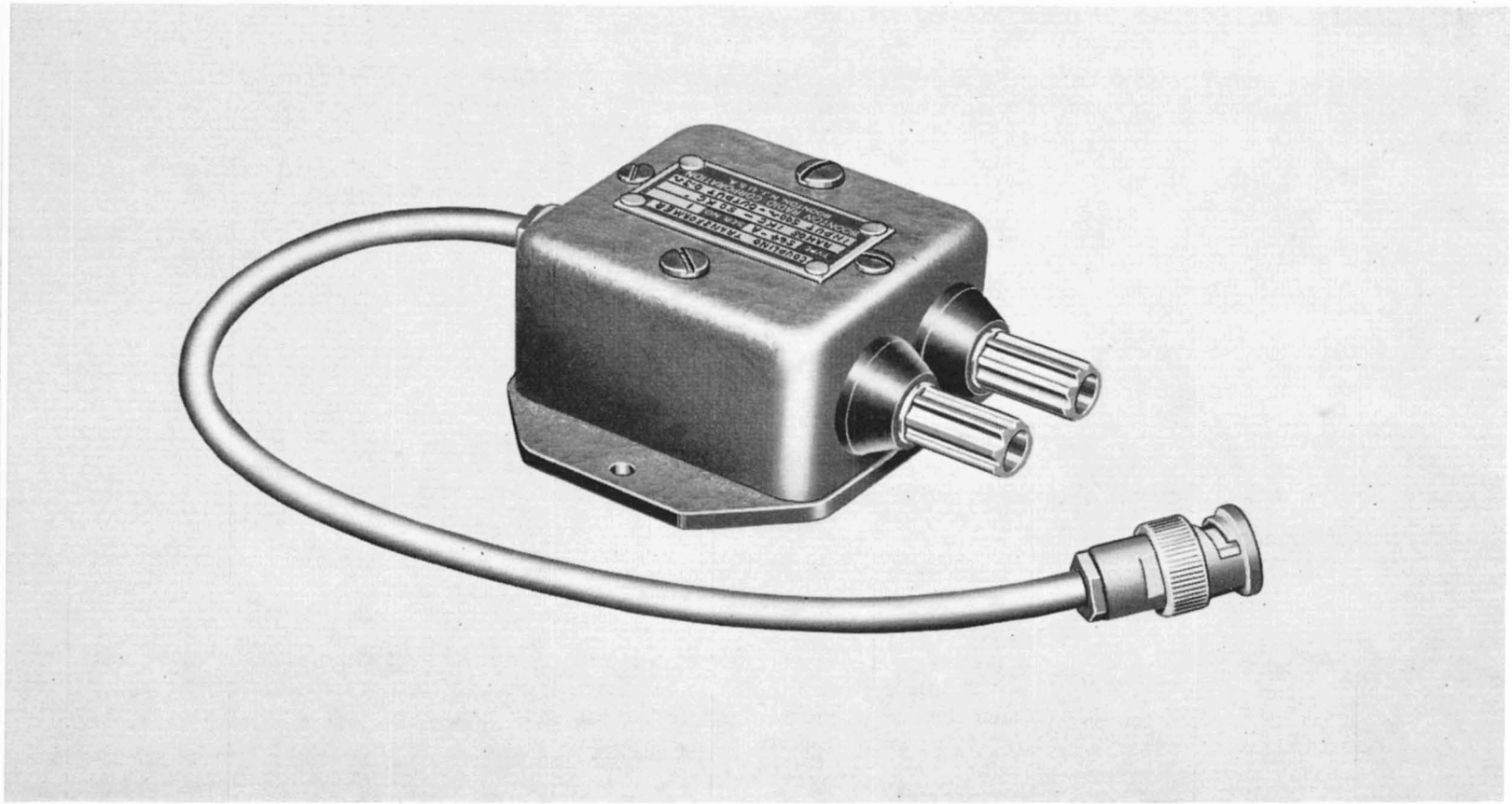
Each inductor Type 590-A consists of a high Q coil mounted in a shield and is provided with spade lugs for connection to the coil terminals of the Q Meters. The shield is connected to the lugs which connects to the Low Coil terminal in order to minimize any changes in characteristics caused by stray coupling to elements or to ground.

Where supports are required a low loss, stable material has been used to avoid variation in characteristics which could result from humidity and temperature effects. The coils are firmly mounted to eliminate the effect of relative mechanical motion. The shield cans have been designed to eliminate seams in the path of the induced currents from the coil. This feature improves shielding and minimizes stray coupling effects.

The inductance of the coils is adjusted at the factory to within $\pm 2\%$ for Types 590-A2 through 590-A6 and to within $\pm 5\%$ for Type 590-A1. For your convenience in selecting the proper coil the following table includes the approximate frequency of resonance for two different tuning capacitances.

Type	Inductance μh	Capacitance μμf	Approximate Resonant Freq. mc	Approximate Q	Approximate Distributed C μμf
590-A1	0.05	8.0 — 95.0	70 — 230	320	1.5
590-A2	0.1	10 — 100	50 — 160	350	1.8
590-A3	0.25	8.0 — 80.0	30 — 100	310	2.3
590-A4	0.5	7.5 — 80.0	25 — 70	340	2.4
590-A5	1.0	7.5 — 65.0	20 — 50	300	2.9
590-A6	2.5	9.0 — 25.0	20 — 30	300	2.9

COUPLING UNIT TYPE 564-A



DESCRIPTION

The Coupling Transformer Unit Type 564-A has been designed primarily to couple the output of an external oscillator into the Q-Meter Type 260-A for the purpose of extending the operating range of the Q-Meter to the lower frequency region. The low frequency limit of the Q-Meter internal oscillator is 50 kilocycles. By means of the Coupling Unit and a suitable auxiliary oscillator, the Q-Meter may be operated down to a low frequency limit of 1 kilocycle. The auxiliary oscillator should be capable of supplying a variable voltage of 22 volts max. to the primary of the coupling unit.

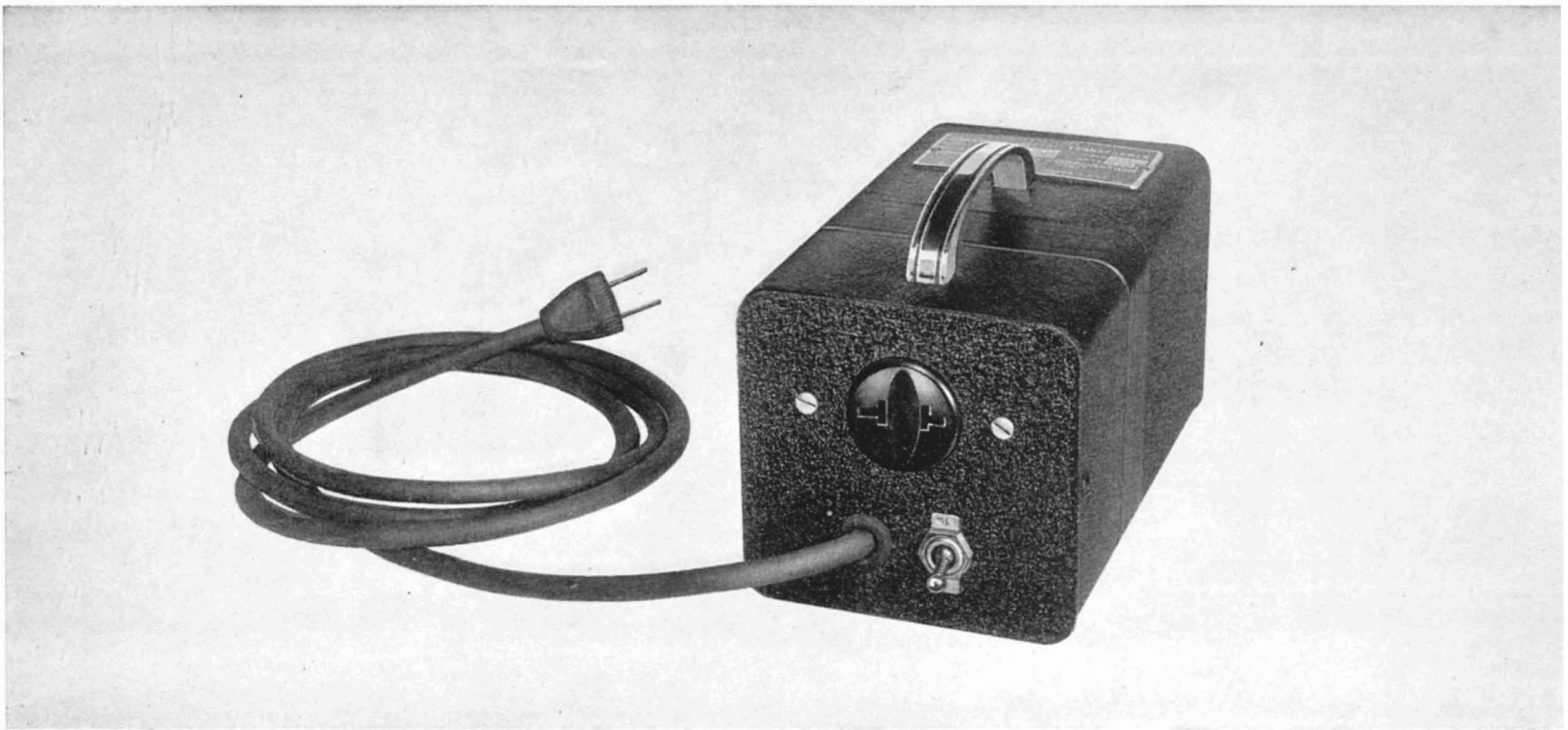
The impedance of the primary of the 564-A Coupling Unit is approximately 500 ohms when the secondary is connected to an impedance of 0.3 ohm (the impedance presented by the thermocouple unit within the Q-Meter). The coupling unit covers the range of 1 kc to 50 kc with less than 2 db variation in frequency response.

The Coupling Unit Type 564-A is supplied complete with a 12-inch coaxial cable, the shield of which is grounded to the housing, terminated by a BNC connector. The unit may be connected to a suitable audio frequency oscillator by means of the two ungrounded binding posts provided, and the BNC connector may be attached to the injection circuit connector located inside the removable panel on the rear of the Q-Meter cabinet. When so connected, with the Q-Meter oscillator frequency range switch set to an open position, the output of the auxiliary oscillator is adjusted so that the "Multiply-Q-By" Meter indicates X1.

The Coupling Unit may be readily mounted on the top of the Q-Meter cabinet by means of the drilled mounting flange provided.

Dimensions: Approx. 1¼" x 2½" x 3¾", including mounting flange, binding posts and cable fitting.

CONSTANT-VOLTAGE TRANSFORMER TYPE 162-A



DESCRIPTION

The large fluctuations of power-line voltage frequently encountered in factories and in industrial centers necessitate a means for stabilizing this voltage for satisfactory operation of measuring instruments employed in such localities. The type 162-A Constant-Voltage Transformer (Line Voltage Regulator) has been developed for this purpose.

This instrument is recommended for the operation of the types 100-A, 160-A and 170-A Q-Meters under the above conditions for most accurate measurements in general and particularly for the measurement of the Q or power factor of high-quality dielectrics. This latter type of measurement, involving as it does the accurate determination of a small difference in Q values (i.e., small $\triangle$ Q), requires a high order of stability of operation of the Q-Meter. This, in turn, necessitates the constant power-supply voltage which is furnished by the type 162-A Constant-Voltage Transformer.

The type 162-A Constant-Voltage Transformer is supplied complete with input power cable; on-off switch; output receptacle, handle and rubber feet. Attractively finished. Small, compact, readily portable.

SPECIFICATIONS

Dimensions: 8" x 5¾" x 4¼" over-all.

Weight: 12 lbs. (approx.)

The type 162-A Constant-Voltage Transformer is available for the following voltages and frequencies:—

Type 162-A160 C V Transformer, input 95-125 v., 60 cy. output 115 v.* 60 volt-amps.

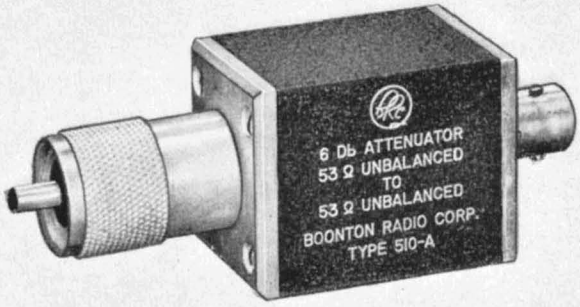
Type 162-A150 C V Transformer, input 95-125 v., 50 cy. output 115 v.* 60 volt-amps.

Type 162-A250 C V Transformer, input 190-250 v., 50 cy. output 230 v.* 60 volt-amps.

When ordering, use type numbers associated with particular input and output voltage and frequency desired.

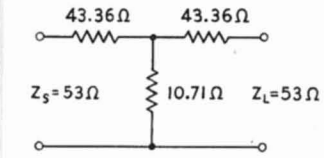
***Note:** The total variation of output voltage is less than plus or minus 1 per cent over the total range of rated input voltages.

500 SERIES ACCESSORIES

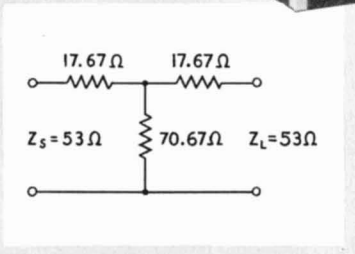


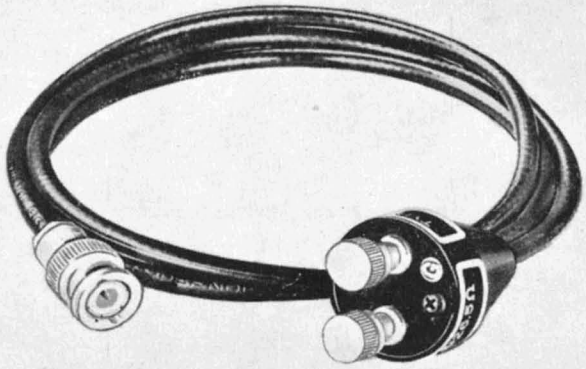
TYPE 510-A ATTENUATOR

TYPE 509-A ATTENUATOR



TYPE 505-A ATTENUATOR





TYPE 501-A CABLE

APPLICATION

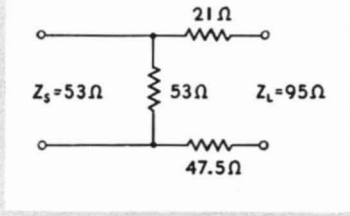
The 500 series accessories have been developed to facilitate signal generator connections to various types of receiver equipment. Since all signal generators listed within this catalog are equipped with BNC type output connectors, it is merely necessary to employ a patching cable having identical BNC plugs at each end to attach to the various adapters and attenuators all of which have BNC connectors at the input end. The output ends of these adapters and attenuators have specialized fittings depending upon the application for which each unit is to be used.

In certain cases it may be advantageous to attach the adapter or attenuator directly to the R.F. fitting of the receiver under test while other applications having space restrictions may require the insertion of a short cable length between adapter and RF input fitting.

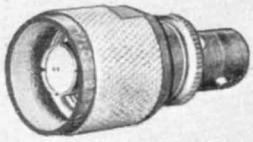
Where appropriate, units are finished in grey wrinkle enamel, engraved to indicate type and usage.

500 SERIES ACCESSORIES

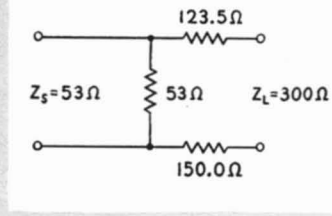
TYPE 507-A ADAPTER

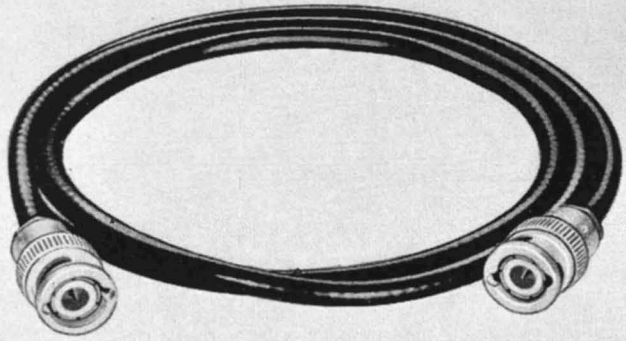


TYPE 508-A ADAPTER



TYPE 504-A ADAPTER





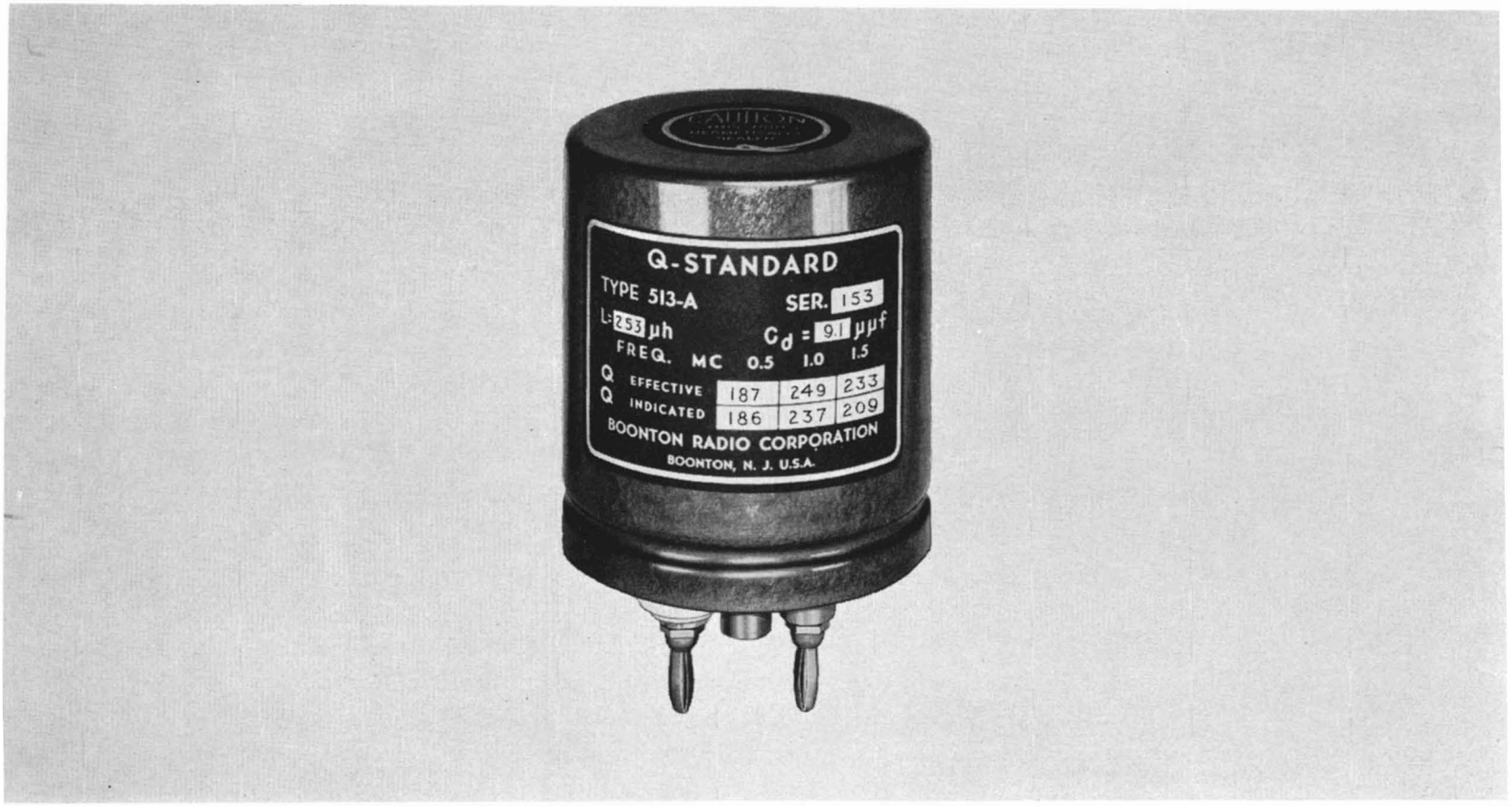
TYPES 502-A AND 506-A CABLES

SPECIFICATIONS

BRC Type	Description	Effective Output Impedance (Ohms)	Open Circuit Output Voltage*	FURNISHED WITH — Instrument Type Numbers
501-A	Output Cable, 3'3", BNC-Binding Posts.	26.5	E	202-B, C, D 212-A
502-A	Patch Cable, 3', BNC-BNC.			212-A
504-A	Adapter, BNC-N.	53	2E	211-A
505-A	6 db. T Pad, 53 Ohms—53 Ohms, BNC-N.	53	E	211-A
506-A	Patch Cable, 6', BNC-BNC.			211-A
507-A	53 Ohms Unbal. to 95 Ohms Bal., BNC-Small Twin UHF.	95	E	212-A
508-A	53 Ohms Unbal. to 300 Ohms Bal., BNC-Binding Posts.	300	E	
509-A	20 DB T Pad, 53 Ohms—53 Ohms, BNC-BNC.	53	E/5	
510-A	6 DB T Pad, 53 Ohms—53 Ohms, BNC-UHF.	53	E	

*E = Signal Generator Attenuator Dial Reading.

Q-STANDARD TYPE 513-A



DESCRIPTION

The Q-Standard Type 513-A is a shielded reference inductor which has accurately-measured and highly-stable inductance and Q characteristics. Specifically designed for use with Q-Meters Type 260-A and 160-A, the Q-Standard is particularly useful as a check on the overall operation and accuracy of these instruments, as well as for providing precisely-known supplementary Q-circuit inductance desirable for many impedance measurements by the parallel method.

The Q-Standard consists of a specially-designed, high-Q coil of Litz wire, wound on a low-loss Steatite form. The coil is hermetically sealed inside a copper shield can which is filled with an inert gas under pressure. The desired Q-versus-frequency characteristics are provided by a carbon film resistor shunted across the coil. Two replaceable banana plug connectors mounted on the base serve to connect the unit to the Q-Meter circuit. The Q-Standard is supplied in a convenient wooden carrying and storage case.

Each unit is individually calibrated and marked with its true inductance (L), distributed capacity (C_d), and effective Q (Q_e) and indicated Q (Q_i) at 0.5, 1.0 and 1.5 mc, respectively. (Tolerances: L, ±1% - C_d - ±2% - Q_e - ±3% measured at 22°C.) Q_i is an average Q-Meter reading. Any instrument deviating more than ±7% from the marked value is not operating in accordance with original specifications.

Nominal values are as follows:

$L = 250\mu h$ $C_d = 8\mu\mu f$

	0.5 mc	1.0 mc	1.5 mc
Q_e	190	250	220
Q_i	183	234	200

Actual values of all these quantities are marked on the name plate of the Q-Standard.

With the unit in the Q-circuit, approximate resonant frequencies of 500, 1000 and 1400 kc are obtained with tuning capacitances of 400, 100 and 50$\mu\mu$f, respectively.

Temperature coefficients:

L and C_d — Negligible

Q_e —

freq.	%ΔQeff/°C
0.5 mc	–0.23
1.0	–0.15
1.5	–0.08

Overall Q-Standard Dimensions: 3″ diam. x 4½″ h. (approx.)

Net Weight (including case): 28 oz. (approx.)

Engineering Representatives of Boonton Radio Corporation in the United States and Canada

For additional information about Boonton Radio instruments, call our representative nearest you. Feel free to ask him about prices, procurement, instrument uses and applications — or any questions of a general or technical nature regarding our equipment. He will be glad to help you.

Bivins and Caldwell
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High Point, North Carolina
Telephone: High Point 3672

Alfred Crossley & Associates
4501 North Ravenswood Avenue
Chicago 40, Illinois
Telephone: UPtown 8-1141

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53 Park Avenue
Dayton 9, Ohio
Telephone: Oxmoor 3594

Alfred Crossley & Associates
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P. O. Box 8042
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P. O. Box 6573
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San Diego, California
Telephone: Bayview 8106

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2830 Geary Boulevard
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Telephone: WAlnut 1-2361

E. A. Ossmann & Associates, Inc.
3 Juniper Street
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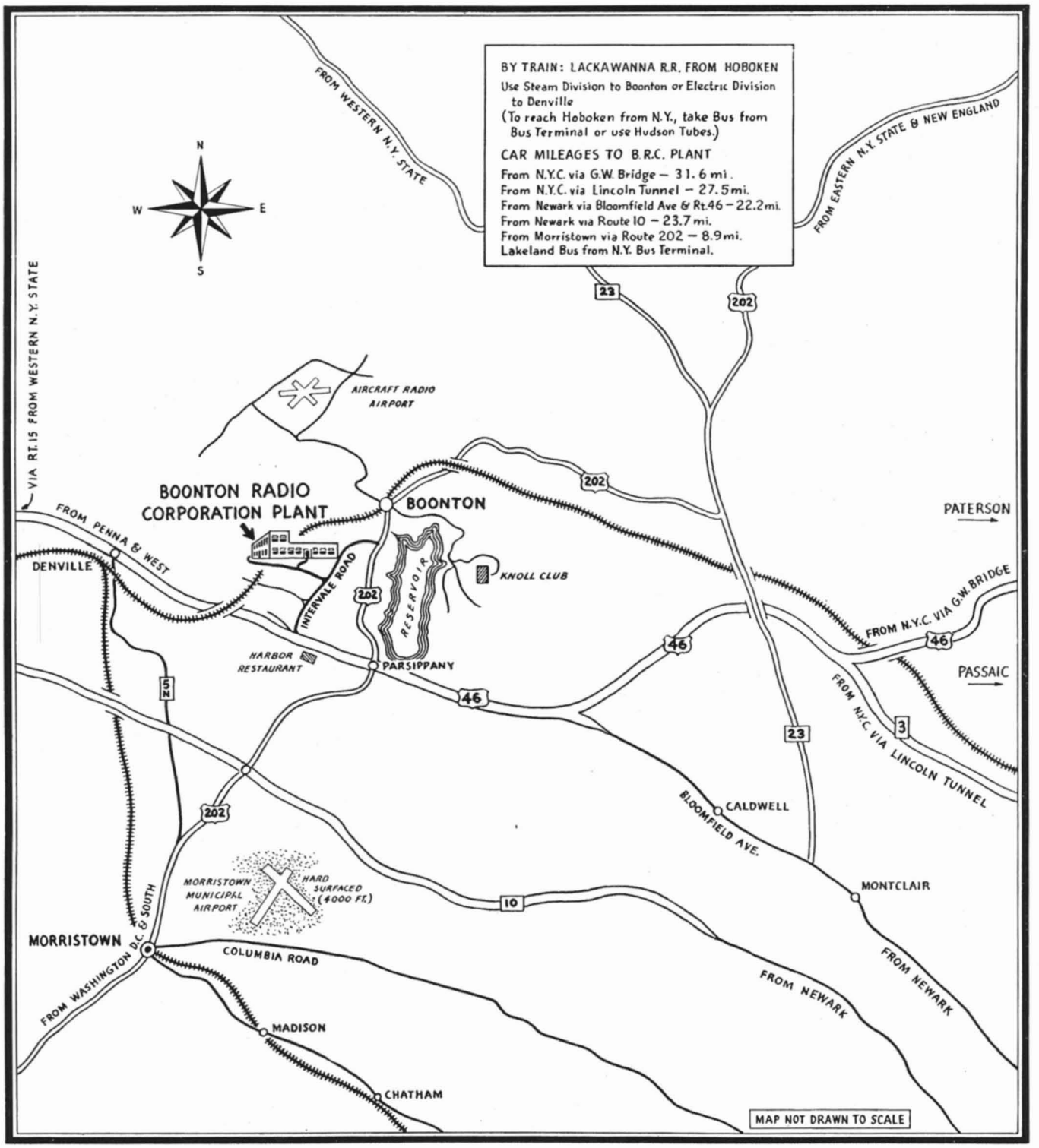
Telephone: Wellington 7551

BOONTON RADIO CORPORATION • BOONTON, NEW JERSEY

Telephone: BOonton 8-3200

HOW TO REACH BOONTON RADIO CORPORATION



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BOONTON RADIO CORPORATION

PRICE LIST

Effective March 1, 1954

INSTRUMENTS

Type	*Description*	*Unit Price f.o.b. Boonton, N. J.*
110-A	QX Checker (1)	$ 340.00
110-B	QX Checker (2)	415.00
190-A	Q Meter	625.00
192-A	G Meter (3)	1,875.00
202-B	FM-AM Signal Generator	975.00
202-C	FM-AM Signal Generator	1,090.00
202-D	FM-AM Signal Generator	980.00
207-A	Univerter	345.00
207-B	Univerter	345.00
211-A	Crystal Monitored Signal Generator	1,800.00
213-A	Phase Test Set	195.00
232-A	Glide Slope Signal Generator	1,500.00
250-A	RX Meter	1,250.00
260-A	Q Meter	725.00

NOTES: (1) Including any two Type 111-A Inductors.
(2) Including any two Type 111-B Inductors.
(3) Including either Type 529A1 or 529A30 Oscillator Unit.

ACCESSORIES

103-A	Inductors (1)	$ 11.00
111-A	Inductors	11.50
111-B	Inductors	15.00
112-A22	Condenser Unit	15.00
162-A	Constant Voltage Transformer	50.00
512-A	Adapter	30.00
513-A	Q Standard	75.00
560-A	L-C Dial Conversion Kit	10.00
564-A	Coupling Unit	27.50
590-A	Inductors (2)	10.00
592-A	Oscillator Units	105.00

NOTES: (1) Complete set of sixteen (16) for 260-A $160.00
Complete set of seventeen (17) for 160-A $170.00
(2) Complete set of six (6) for 190-A $55.00

RF OUTPUT FITTINGS

501-A	Output Cable	$12.00
502-A	Patching Cable	2.75
504-A	Adapter	2.25
505-A	Attenuator	15.00
506-A	Patching Cable	3.00
507-A	Adapter	17.50
508-A	Adapter	15.00
509-A	Attenuator	15.00
510-A	Attenuator	17.50
514-A	Output Cable	12.00

REPLACEMENT THERMOCOUPLES

107-A	Thermocouple Unit (for Type 100-A) (1)	$12.50
165-A	Thermocouple Unit (for Type 160-A) (1)	25.00
565-A	Thermocouple Unit (for Type 260-A) (1)	27.00

NOTE: (1) Serial number of Q Meter required.

(over)

SPECIAL REPLACEMENT TUBES

Type 100-A Q Meter

Tube Type	*Qty./Inst.*	*Unit Price*
102-A(1)	1	$ 2.00
105-A(1)	1	30.00

Type 110-A, B QX Checker

Tube Type	*Qty./Inst.*	*Unit Price*
101-C(1)	1	$ 2.75

Type 140-A B. F. Generator

Tube Type	*Qty./Inst.*	*Unit Price*
101-D(1)	1	$ 2.75
6L6-G(3)	1	3.40
6L7-G(3)	1	3.45
6V6-GT(3)	4	1.80

Type 160-A Q Meter

Tube Type	*Qty./Inst.*	*Unit Price*
102-A(1)	1	$ 2.00
105-A(1)	1	30.00

Type 170-A Q Meter

Tube Type	*Qty./Inst.*	*Unit Price*
9002(1)	1	$ 8.75
OS-VM-955(1)	1	7.75
Q-VM-955(1)	1	7.75

Type 190-A Q Meter

Tube Type	*Qty./Inst.*	*Unit Price*
OS-VM-9005(1)	1	$ 7.50
Q-VM-9005(1)	1	7.50

Type 192-A G Meter

Tube Type	*Qty./Inst.*	*Unit Price*
6AL5(1)	2	$ 3.15
5691(1)	1	7.00

Type 202-B, C, D Signal Generator

Tube Type	*Qty./Inst.*	*Unit Price*
6AK5(2)	3	$ 4.00
6C4(2)	1	1.50
3S6/5 Lamp	1	.35
6H-6 Ballast	1	2.15

Type 203-B Univerter

Tube Type	*Qty./Inst.*	*Unit Price*
6AG7(2)	1	$ 3.75
6J6(2)	3	2.50
4-25 Ballast	1	3.25

Type 206-A Signal Generator

Tube Type	*Qty./Inst.*	*Unit Price*
6AK5(2)	3	$ 4.00
6C4(2)	1	1.50
3S6/5 Lamp	1	.35
6N040 Relay	1	4.75

Type 211-A Signal Generator

Tube Type	*Qty./Inst.*	*Unit Price*
6AK5(2)	5	$ 4.00
3S6/5 Lamp	1	.35

Type 212-A Univerter

Tube Type	*Qty./Inst.*	*Unit Price*
12AT7(2)	3	$ 2.70
5654/6AK5W(2)	3	12.00

Type 215-E Signal Generator

Tube Type	*Qty./Inst.*	*Unit Price*
2C40(2)	1	$60.00

Type 250-A RX Meter

Tube Type	*Qty./Inst.*	*Unit Price*
6AB4(1)	1	$ 1.75
6H-6 Ballast	1	2.15

Type 260-A Q Meter

Tube Type	*Qty./Inst.*	*Unit Price*
105-A(1)	1	$30.00

Type 232-A Signal Generator

Tube Type	*Qty./Inst.*	*Unit Price*
CR1635-5 Ballast	1	$ 3.30

NOTES: (1) Specially Selected — Interchangeable.
(2) Specially calibrated for each individual instrument.
(3) Selected and matched for use as a set.

All prices are quoted f.o.b. Boonton, N. J. and subject to change without notice.

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