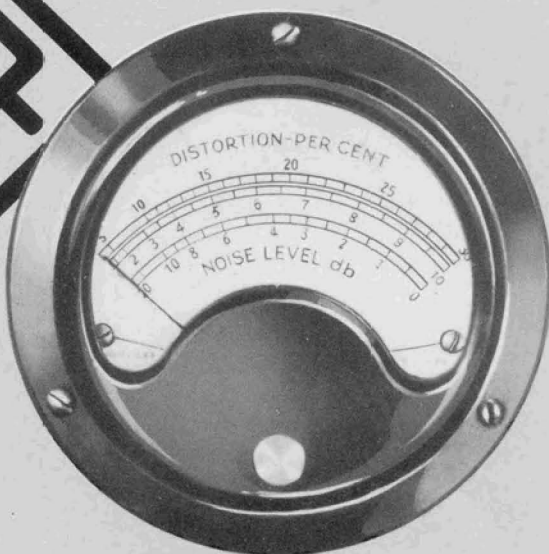


CLASS 730

TRANSMISSION MONITORING ASSEMBLY



FOR
BROADCASTING STATIONS

GENERAL RADIO COMPANY

CAMBRIDGE, MASSACHUSETTS

NEW YORK

LOS ANGELES

U. S. A.



Panel view of Class 730-C Transmission Monitoring Assembly. The instruments, from top to bottom, are TYPE 608-A Oscillator, TYPE 731-B Modulation Monitor, TYPE 732-B Distortion and Noise Meter and TYPE 732-P1 Range Extension Filters.

INTRODUCTION

It is well recognized that the maximum operating efficiency of a broadcasting transmitter cannot be readily attained without the use of proper measuring apparatus to guide the engineer in his adjustment of the equipment. All too often the capabilities of a transmitter are not utilized to their fullest extent because the existing conditions are not known. Many times, too, it has been assumed that, because the broadcast equipment is of well-known and reliable manufacture, it continues to operate month after month with the same degree of fidelity as it did when originally installed and adjusted.

Experience has proved the usefulness of the modulation monitor and distortion measuring equipment with all types and makes of broadcasting transmitters. It has been found that the operation of even the best transmitters may be seriously impaired because of slight misadjustments, failing vacuum tubes, or other faulty circuit elements.

A modulation monitor is required in every United States broadcasting station, by the regulations of the Federal Communications Commission, and a certain amount of measuring equipment is in use in all stations, but the determination of percentage distortion, carrier noise and hum level, etc., is not always undertaken as routine maintenance. To a certain extent this operating procedure has been justified because of the lack of suitable measuring equipment and because of the fact that, generally speaking, the radio-transmitting system was considerably better than the receiving system. The rapidly increasing interest in so-called high-fidelity reception and the appearance of receiving sets capable of faithful reproduction have placed a definite responsibility upon the broadcaster to maintain his station in the very best operating condition. This situation is well recognized by most broadcast engineers.

The equipment described in this bulletin has been designed specifically for use in broadcasting stations. It is reasonably priced, accurate, easily installed, and simple to operate. It is a-c operated and relay-rack mounted, and all quantities under measurement are indicated on direct-reading meter.

Two arrangements are available, the one providing a single distortion measurement at 400 cycles, and the other providing measurements at the six frequencies in the audio-frequency spectrum.

Distortion measurements with the Class 730-B Transmission Monitoring Assembly are made at the test frequency of 400 cycles and have proved to be extremely useful for transmitter maintenance. For the best results, however, distortion measurements are preferably made at several test frequencies well spaced in the audio-frequency band. The U. S. Federal Communications Commission recommends test frequencies of 50, 100, 400, 1000, 5000 and 7500 cycles. These are covered by the Class 730-C Transmission Monitoring Assembly.

The Class 730-B Transmission Monitoring Assembly consists of three units: (1) modulation meter and over-modulation indicator, (2) distortion and noise meter, (3) 400-cycle oscillator. Briefly, the equipment is capable of measuring:

1. Percentage modulation on both positive and negative peaks.
2. Program monitoring with high-speed volume indicator meter.
3. Carrier shift upon the application of modulation.
4. Carrier noise and hum level.
5. Combined audio-frequency harmonic distortion of modulation envelope (measured at 400 cycles).

6. Modulation peaks exceeding a predetermined, desired degree of modulation (i.e. over-modulation indicator).
7. Combined audio-frequency harmonic distortion (measured at 400 cycles) present in speech-input amplifier and other station equipment.
8. Noise and *hum* level of audio amplifiers and other station equipment, including wire lines to remote pick-up points and to transmitter.

The alternate system, Class 730-C Transmission Monitoring Assembly provides for distortion measurements at 50, 100, 400, 1000, 5000 and 7500 cycles. In addition to the modulation monitor and the distortion and noise meter, this assembly includes (1) an audio-frequency oscillator supplying a number of fixed frequencies, and (2) an auxiliary filter panel containing filters for the additional frequencies.

With the multi-frequency audio oscillator, it is also possible to measure:

9. Transmitter audio frequency response.
10. Audio amplifier and equipment frequency response.
11. Wire line frequency response.

The quantities measured are read directly from the instrument, and no calculations whatsoever are necessary. Neither is it necessary to effect any difficult and critical adjustments or balances.

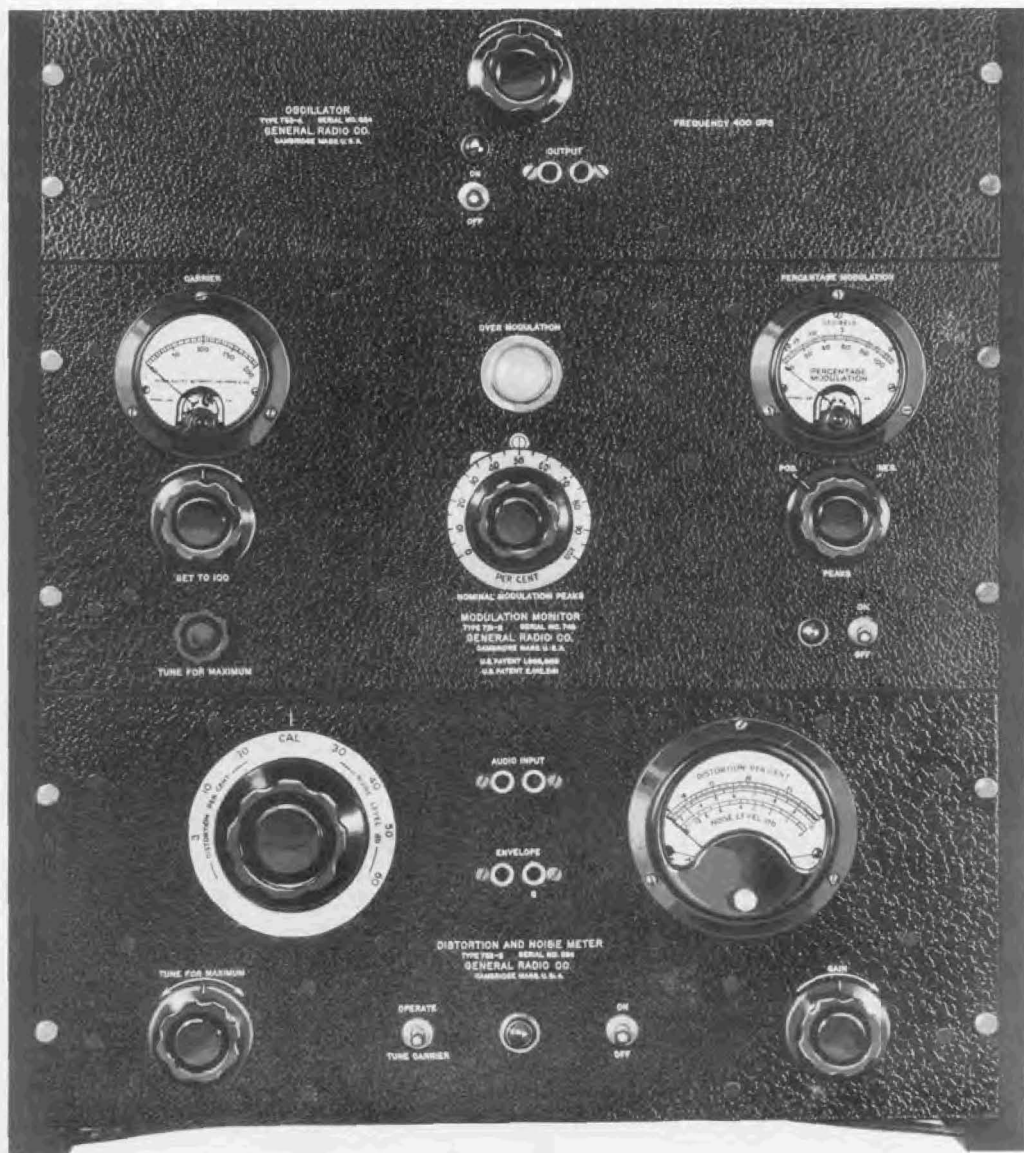
During tests conducted by broadcast engineers, the apparatus has been used to determine the characteristics of various types of radio transmitters, ranging from 50-watt, portable, remote pick-up transmitters to 50,000-watt broadcast transmitters, and also on high-frequency broadcast transmitters operating at frequencies up to 60 megacycles. Measurements on audio equipment are also possible with this equipment, and it has been tested on everything from portable field amplifiers to program amplifiers, line amplifiers and public address equipment.

Once the equipment has been installed, it is possible, in less than ten minutes, to make a complete run on a transmitter and determine the positive and negative modulation peaks, the percentage distortion and the noise or hum level throughout the range of audio input the transmitter is capable of handling.

In some actual instances, with the aid of this measuring equipment, the positive and negative peaks of a transmitter have been balanced and the distortion reduced to half its former value. What is more important is the fact that, as a result of these improvements, it is possible to increase the program input level to the transmitter quite considerably without causing as much distortion as existed before the adjustments were effected. When it is considered that an increase in audio input level of only 3 decibels results in an increased signal intensity at the listener's radio set equivalent to *doubling* the power of transmitter, the importance of such improvements is obvious.

Class 730-B Transmission Monitoring Assembly consists of the following instruments:

	<i>Price</i>
TYPE 731-B Modulation Monitor.....	\$195.00*
TYPE 732-B Distortion and Noise Meter.....	245.00
TYPE 733-A Oscillator.....	62.00
	<hr/> \$502.00



Panel view of the Class 730-B Transmission Monitoring Assembly. The instruments, in the order from top to bottom, are TYPE 733-A Oscillator, TYPE 731-B Modulation Monitor, TYPE 732-B Distortion and Noise Meter.

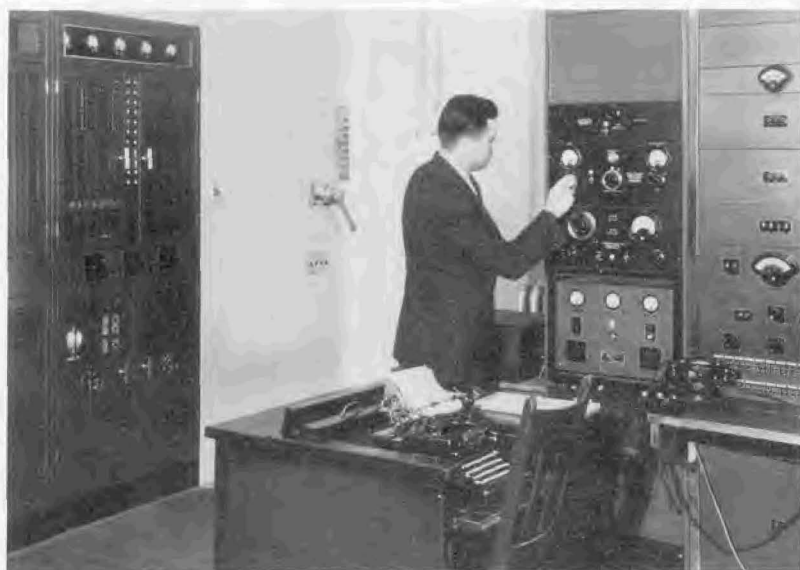
Class 730-C Transmission Monitoring Assembly consists of:

	<i>Price</i>
TYPE 731-B Modulation Monitor.....	\$195.00*
TYPE 732-B Distortion and Noise Meter.....	245.00
TYPE 732-P1 Range Extension Filters.....	150.00
TYPE 608-A Oscillator.....	260.00
	\$850.00

If an oscillator of sufficiently good waveform (less than 1% distortion) is already available at the station, the oscillator listed in either assembly can be omitted with a corresponding saving in cost.

Detailed specifications for each instrument are given on the pages following.

*Required by the U. S. Federal Communications Commission. The Type 731-B has FCC approval No. 1551.



A Class 730 Transmission Monitoring Assembly in use in a broadcasting station. The operator is shown using the modulation monitor.

TYPE 731-B MODULATION MONITOR

USES: The modulation monitor is used to measure and to indicate continuously the percentage modulation of broadcast and other radio-telephone transmitters. It meets the requirements for modulation monitors specified in Rule 139, amended, of the Federal Communications Commission. It has been approved by the Commission and assigned Approval No. 1551.

The following specific measurements can be made with the TYPE 731-B Modulation Monitor:

1. Measurement of percentage modulation on either positive or negative peaks.
2. Program level monitoring.
3. Measurement of carrier shift when modulation is applied.
4. Indication of modulation peaks exceeding a predetermined degree of modulation (i.e., over-modulation indicator).
5. Transmitter audio-frequency response.

DESCRIPTION: TYPE 731-B Modulation Monitor consists of three essential elements: (1) a linear diode rectifier which gives an instantaneous output voltage proportional to the carrier envelope, (2) a peak voltmeter which gives a continuous indication of the peak modulation, and (3) a trigger circuit which flashes a light whenever the modulation momentarily exceeds any value which has been previously set by the operator.

In the output of the linear rectifier is a d-c meter which indicates the carrier level at which the instrument is operating and also shows any carrier shift during modulation.

Terminals are provided so that remote percentage modulation indicators or over-modulation indicator lamps can be connected to the instrument externally. Provision is also made for connecting a peak counter or a recorder. The modulation monitor will operate at frequencies between 0.5 Mc and 60 Mc. Two sets of plug-in coils are used to cover the complete range. One set is supplied with the instrument.

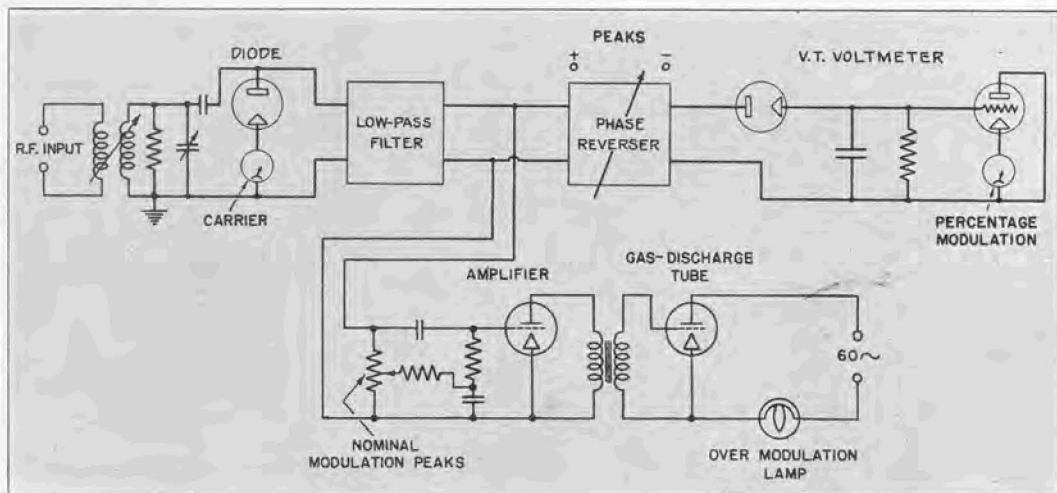
The meter which reads modulation percentage has a high-speed movement. It is used in conjunction with electrical delay circuits to give a rapid upswing and a slower return.

The flashing lamp is extremely useful as a monitoring device. It is set to flash with moderate frequency when the transmitter is operating normally. If the flashing rate changes markedly, the operator is made aware that something is wrong.

FEATURES: Speed and simplicity of operation, essential for monitoring instruments, are available in this instrument. It operates over a wide carrier-frequency range, and a tuned input circuit is provided to facilitate coupling to the transmitter.

The biasing circuit which controls the operation of the over-modulation indicator is so designed that the accuracy of the lamp is entirely independent of shifts in carrier amplitude.

The type of movement used in the direct-reading meter is extremely easy to follow with the eye and is the most satisfactory thus far devised.



Functional schematic diagram of TYPE 731-B Modulation Monitor.

SPECIFICATIONS

Range: Modulation percentage, 0 to 110% indicated by meter on positive peaks, 0 to 100% on negative peaks; flashing incandescent lamp adjustment, 0 to 100% on negative peaks.

Carrier Frequency Range: The monitor is designed to operate at any carrier frequency between 0.5 and 60 Mc. This range is covered by two sets of coils. A single set of coils (either for the 0.5- to 8-Mc or 3- to 60-Mc range) is supplied with the instrument unless both sets are specifically ordered. The sets are readily interchangeable. (See price list.)

Accuracy: The over-all accuracy of measurement at 400 cycles is $\pm 2\%$ of full scale at 0% and 100% and $\pm 4\%$ of full scale at any other modulation percentage.

Audio-Frequency Response: The frequency response of the meter indication is constant within 0.5 db between 40 and 15,000 cycles.

Power Supply: 115 volts, 40 to 60 cycles.

Meters: Rectified-carrier meter and high-speed per cent modulation meter are provided. The latter has a decibel scale as well, which is useful when adjusting transmitter input. It can also be used for taking over-all fidelity characteristics.

Controls: Controls are included for tuning the MONITOR input circuit to resonance with the carrier and for adjusting the carrier amplitude. A switch is provided for measuring the positive or the negative peaks, as desired. A NOMINAL MODULATION PEAKS dial, calibrated, and continuously variable from 0 to 100%, is provided.

An ON-OFF switch with pilot lamp controls the power input.

Vacuum Tubes: The following tubes are used: two 1-V, one 6C6, one 75, one 885, and one 84. All are supplied with the instrument.

Lamp: The OVER-MODULATION lamp will flash at the instant when the modulation exceeds the value to which the NOMINAL MODULATION PEAKS dial is set, and will remain lighted so long as this condition persists. An incandescent lamp is used, giving a brilliant light.

Shielding: The modulation monitor is well shielded so that it may be operated in radio-frequency fields encountered in the operating room.

Terminals: A pair of binding posts at the rear is provided for the radio-frequency input. Terminals are provided on the multipoint connector at the rear for connecting an additional remote "over-modulation" indicator lamp, or a remote high-speed modulation meter. Provision is also made for connecting a peak counter or recorder.

Other Accessories Supplied: Spare pilot lamps and fuses, multipoint connector, and cord-and-plug assembly for the a-c line connection.

Mounting: The instrument is relay-rack mounted. The panel is aluminum with the standard General Radio black-crackle lacquer finish.

Dimensions: Panel, (length) 19 x (height) $8\frac{3}{4}$ inches; depth behind panel, 12 inches.

Net Weight: 30 pounds.

Type	Description	Code Word	Price
731-B	Equipped for 0.5- to 8-Mc Carrier Range	EXIST	\$195.00
731-B	Equipped for 3- to 60-Mc Carrier Range	ENTRY	195.00
731-P5-1 } 731-P5-2 }	Set of Coils for 0.5- to 8-Mc Carrier Range	CAROM	10.00
731-P6-1 } 731-P6-2 }	Set of Coils for 3- to 60-Mc Carrier Range	CALYX	10.00

TYPE 732-B DISTORTION AND NOISE METER

USES: The TYPE 732-B Distortion and Noise Meter is intended for use in radio broadcasting stations to measure audio-frequency distortion, noise, and hum level in the transmitter output as well as in the audio-frequency portion of the transmitting equipment. It can be used for similar measurements on other types of audio-frequency equipment, such as lines, amplifiers, etc. It finds many uses in the laboratory and production testing of radio receivers where, as a wide-range, highly sensitive voltmeter, it is invaluable for such tests as signal-to-noise ratio, AVC characteristic, and hum level.

DESCRIPTION: This instrument consists of a linear rectifier, a filter, an amplifier, and a vacuum-tube voltmeter. The meter reads distortion directly in per cent of fundamental voltage and reads carrier noise or hum level directly in decibels with respect to normal modulating input to the transmitter.

Provision has been made, by the inclusion of front-panel jacks, for using the equipment with audio-frequency inputs.

The output of the linear rectifier is also

available from panel jacks so that a wave analyzer may be used to analyze the wave-forms of the carrier envelope over the complete audio-frequency range. A TYPE 736-A Wave Analyzer is recommended for this purpose.

The test is made at a single frequency, 400 cycles. Where tests at other frequencies are desired, the TYPE 732-P1 Range-Extension Filter can be used. For a single-frequency test, TYPE 733-A Oscillator is recommended as a source of test voltage. When TYPE 732-P1 Range-Extension Filters are used, TYPE 608-A Oscillator is recommended.

ADVANTAGES: Speed and convenience of operation have been emphasized in the design of this instrument. Only a few seconds are required for a single measurement. The range of distortion which can be measured is wide, from below 1 per cent up to 30 per cent. While a single-frequency test yields adequate information for most purposes, the TYPE 732-P1 Range-Extension Filter provides a convenient means of making multi-frequency tests.

SPECIFICATIONS

Distortion Range: Distortion is read directly from a large meter. Full-scale values of 30%, 10%, 3%, and 1% are provided, and are selected by a multiplier switch. The range for carrier-noise measurement is from 30 to 70 db below 100% modulation or 65 db below an audio-frequency signal of zero level.

Audio-Frequency Range: 380 to 420 cycles for distortion measurements; 30 to 24,000 cycles for noise or hum measurements. For extending the distortion measurements range, see TYPE 732-P1 Range-Extension Filters, page 171.

Carrier Frequency Range: The TYPE 732-B Distortion and Noise Meter is designed to operate at any carrier frequency between 0.5 and 60 megacycles. This range is covered by two coils. A single coil (either for the 0.5- to 8-Mc range or for the 3- to 60-Mc range) is supplied with the instrument unless both coils are specifically ordered. The coils are readily interchangeable. (See price list.)

Accuracy: The over-all accuracy of measurement of each distortion range is better than $\pm 5\%$ of full scale $\pm 0.1\%$ distortion.

Meter: A Weston Model 643 Meter, calibrated directly in per cent distortion and decibels noise level, is provided. Zero adjustment of the meter is made by a knob projecting from the meter face.

Controls: A carrier control is provided for tuning the

input circuit of the instrument to resonance with the carrier. A switch is provided for selecting the proper distortion or noise range. An amplifier gain control and an ON-OFF switch with pilot lamp are also provided.

Vacuum Tubes: One 37, two 6C6, one 1-V, and one 84 are supplied.

Other Accessories Supplied: Spare fuses and pilot lamps. Two dummy plugs to be used if the TYPE 732-P1 Range-Extension Filters are not connected. One carrier input coil.

Terminals: In addition to the radio-frequency input binding posts at the rear, two normal-through Western Electric output double jacks are provided on the panel, one at high impedance for the modulated envelope from the rectifier, and one at 500 ohms for use in audio-frequency testing.

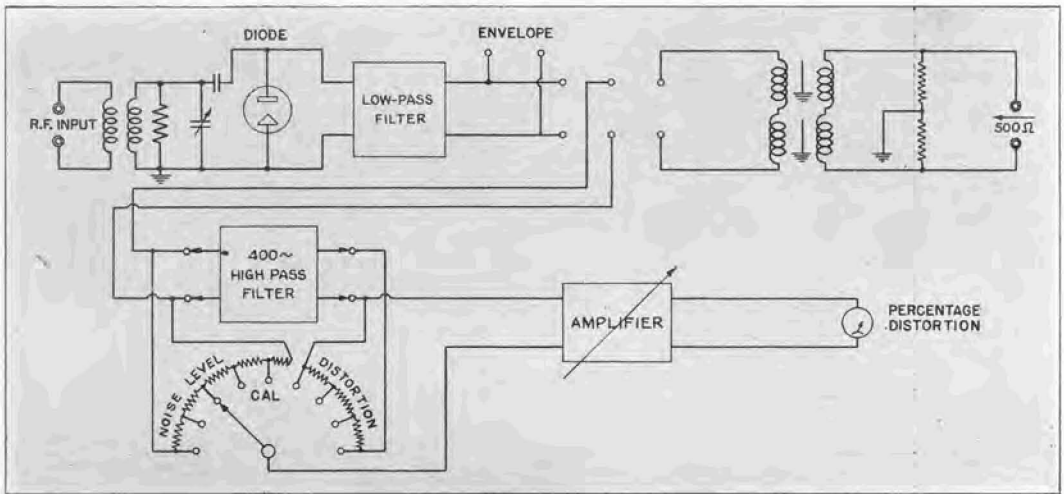
Power Supply: 115 or 230 volts, 40 to 60 cycles.

Mounting: The instrument is relay-rack mounted. The panel is aluminum with the standard General Radio black-crackle lacquer finish.

Dimensions: Panel, 19 x 8 $\frac{3}{4}$ inches; depth behind panel, 12 inches.

Net Weight: 40 pounds.

Type	Description	Cods Word	Price
732-B	Equipped for 0.5- to 8-Mc Carrier Range	EXPEL	\$245.00
732-B	Equipped for 3- to 60-Mc Carrier Range	EQUAL	245.00
732-P5	Coils for 0.5- to 8-Mc Carrier Range	CULER	10.00
732-P6	Coils for 3- to 60-Mc Carrier Range	CYNIC	10.00



Functional schematic diagram of TYPE 732-B Distortion and Noise Meter

TYPE 733-A OSCILLATOR

USES: The function of this oscillator is to provide a 400-cycle test voltage for distortion measurements with the TYPE 732-B Distortion and Noise Meter.

DESCRIPTION: The oscillator is a-c operated

and is designed for relay-rack mounting. A filter to eliminate harmonics is provided.

FEATURES: The important feature of this oscillator is the excellent waveform of the output voltage.

SPECIFICATIONS

Frequency: 400 cycles $\pm 2\%$. The frequency of the oscillator does not change by more than 1% because of heat dissipation in the unit or changes in ambient temperature. The design of the filter of the TYPE 732-B Distortion and Noise Meter with which this oscillator is used is such that much wider changes than this would have entirely negligible effect.

Output Power: 30 milliwatts.

Internal Output Impedance: 50, 500, or 5000 ohms. This is obtained by changing a connection between the output terminals and the filter. These values of output impedance enable a wide range of impedances to be connected to the oscillator without large mismatch loss.

Waveform: 0.1% to 0.2% distortion, depending upon

load. The distortion is less than 0.1% when the load is 5 milliwatts and is 0.05% at no load.

Controls: There is an output volume control and an ON-OFF switch.

Tubes: One 76 and one 25Z5 are supplied.

Terminals: A Western Electric output double jack is provided on the panel and binding posts at the rear.

Power Supply: 115 volts, 40 to 60 cycles, ac.

Mounting: The instrument is relay-rack mounted. The panel is aluminum with the standard General Radio black-crackle lacquer finish.

Dimensions: 19 x 5 $\frac{1}{4}$ x 8 inches deep.

Net Weight: 18 pounds.

Type	Description	Code Word	Price
733-A	Oscillator.....	EXTOL	\$62.00

TYPE 732-P1 RANGE-EXTENSION FILTERS

USES: This assembly of filters is designed specifically for use with TYPE 732-B Distortion and Noise Meter to extend the frequency range for distortion measurements.

DESCRIPTION: The instrument consists of five high-pass filters to pass harmonics of 50, 100, 1000, 5000, and 7500 cycles, respectively. These filters are mounted behind a relay-rack

panel. Selection is controlled by a panel switch. Cables for connecting to the TYPE 732-B Distortion and Noise Meter are provided.

ADVANTAGES: This panel provides an extremely simple and economical method of extending the range of the TYPE 732-B. No critical adjustments are necessary.

SPECIFICATIONS

Audio-Frequency Range: 50, 100, 1000, 5000, and 7500 cycles $\pm 5\%$.

Accuracy: At distortions greater than 0.5%, the error is less than 10% of the true value $\pm 0.15\%$ distortion.

Accessories: Two shielded cables are supplied for connecting the TYPE 732-P1 Range-Extension Filters to a TYPE 732-B Distortion and Noise Meter.

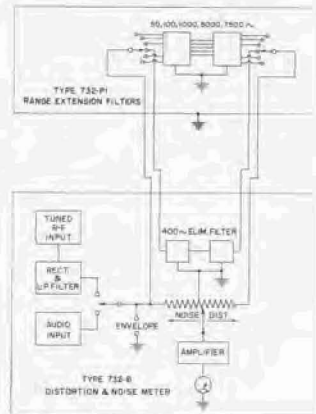
Test Voltage: TYPE 608-A Oscillator is recommended as a source of test voltage.

Controls: A single control is provided for selecting the proper filter.

Mounting: The instrument is relay-rack mounted. The panel is aluminum with the standard General Radio black-crackle lacquer finish.

Dimensions: Panel, 19 x 5 $\frac{1}{4}$ inches; depth behind panel, 12 inches.

Net Weight: 25 pounds.



Type	Description	Code Word	Price
732-P1	Range-Extension Filters	ESSAY	\$150.00

TYPE 608-A OSCILLATOR

USES: The TYPE 608-A Oscillator was designed particularly for use as a tone source for distortion measurements and a power source for bridge measurements at audio frequencies. Because of the large number of frequencies at which this oscillator will operate, it is also satisfactory for measuring frequency characteristics and for use as a general laboratory oscillator.

The output frequencies obtainable include those generally used in distortion measurements on broadcast transmitters.

The unusually pure waveform delivered by this oscillator at low frequencies makes distortion measurements possible at considerably lower frequencies than have hitherto been practicable.

DESCRIPTION: This oscillator operates on the inverse feedback principle. By means of a resistance capacitance network all frequencies except the oscillation frequency are fed from the output of an amplifying circuit back into the input in such a manner as to cancel the gain at all but the oscillation frequency. Sufficient regeneration is introduced into the circuit to produce self-oscillation and, since this is controlled by the resistance-capacitance network, no inductances or transformers are required in the oscillating circuit. A functional block diagram of the circuit is shown on the next page.

The amount of feedback is controlled from the panel, and an electron-ray tube is used to indicate the strength of oscillations and the harmonic content.

The desired frequency is selected by push-button switches. Another push-button switch

determines the output impedance. An output control is provided for regulating the output voltage.

FEATURES: Both electrically and mechanically the design of this oscillator is new and represents a considerable advance over previous practice.

In the electrical circuit, the principle of inverse feedback is applied to the production of electrical oscillation with the result that a high power output is obtained with low distortion. Since the feedback circuit is highly selective, the frequency of the oscillator is unusually stable. The absence of iron-core inductances minimizes the amount of power-supply hum picked up by the circuit elements.

An outstanding mechanical feature is the push-button system for selecting the frequency.

The TYPE 608-A Oscillator will operate at any one of 27 frequencies, ranging from 20 to 15,000 cycles per second, and the frequency can be changed rapidly and simply by means of the push-button switches.

Provision is made for obtaining frequencies within the range, but other than those for which push-buttons are provided, by merely plugging in three external resistances.

For any additional frequency three resistors are required, and for any set of three resistors, three frequencies, in decade steps, can be obtained.

A harmonic control and electron-ray tube are provided so that the unit can be adjusted for minimum distortion under all conditions of operation.

SPECIFICATIONS

Frequency Range: 20 to 15,000 cycles.

Frequency Control: The frequency is controlled by two push-button switches. The first provides frequencies of 20, 25, 30, 40, 50, 60, 75, 100, and 150 cycles, while the second multiplies these frequencies by 1, 10, and 100. The frequencies included cover practically the entire audible range in increments small enough so that oscillator may be used for measuring frequency characteristics. Furthermore, these frequencies include all important standard bridge and broadcast test frequencies.

Other frequencies within the operating range of the instrument may be obtained by plugging in external resistances.

Frequency Calibration: Each instrument is adjusted within $\pm 2\%$ or 1 cycle, whichever is the greater, of the frequency engraved on the panel. The best accuracy is secured when the harmonic control is adjusted for low distortion.

Frequency Stability: When this oscillator is operated at normal room temperatures, the frequency will not drift by more than 1% over a period of several hours. The harmonic control provides a means whereby the operating conditions of the oscillator may be brought back to the correct values regardless of ordinary changes in load or line voltage.

Output Impedance: Three output circuits are provided. Selection among them is obtained by means of a push-button switch on the panel. The output impedances are as follows:

1. 500-ohm balanced to ground.
2. 500-ohm unbalanced.
3. 5000-ohm unbalanced.

The volume control is a potentiometer in the 5000-ohm circuit. The actual output impedance of the 5000-ohm output circuit will vary between 1000 and 8500 ohms, depending upon the setting of the volume control. Suitable resistance pads keep the impedance of the 500-ohm output circuit between 400 and 600 ohms regardless of the volume control setting.

Output Power: The 5000-ohm output circuit provides an output power of approximately 0.5 into a matched load watt when the instrument is operated on a 115-volt line. The maximum power obtainable from the 500-ohm output circuit is approximately 80 milliwatts.

Waveform: With the harmonic control turned full on, and the oscillator delivering its maximum power output, the harmonics will be approximately 5% of the output voltage.

The harmonic control provides a means of obtaining unusually pure waveform at some sacrifice in output voltage. When this control is adjusted to reduce the output voltage by approximately 10%, the total harmonic content will be reduced to approximately 0.2% of the fundamental voltage. A further reduction in the output voltage reduces the total harmonic content to less than 0.1% for all output frequencies on the 5000-ohm output circuit. Because of the impedance-matching transformer, the harmonic distortion on the 500-ohm output terminals is slightly greater at frequencies below 50 cycles.

Hum Level: When the oscillator is properly grounded

and operated from a 60-cycle line, the hum level is less than 0.05% or 0.1 millivolt, whichever is the greater.

Controls: In addition to the push-button switches for adjusting the frequency and the output impedance, harmonic output controls are provided on the panel. An electron-ray tube provides a means for adjusting the harmonic control correctly under all conditions of operation. Except where minimum harmonic distortion is an absolute necessity, the harmonic control need not be readjusted.

Terminals: Jack-top binding posts with standard $\frac{3}{4}$ -inch spacing are provided for the output connection. A ground terminal is also provided.

Mounting: The instrument is designed for either table or relay-rack mounting. The wooden ends supplied with the oscillator are removed when it is used on a relay rack. A perforated metal shield is provided.

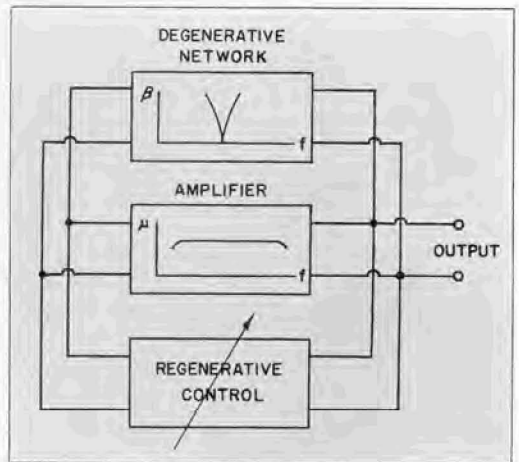
Power Supply: 110 to 120 volts, 25 to 60 cycles, ac. A simple change in the connections to the power transformer allows the instrument to be used on 220 to 240 volts. The total power consumption is approximately 60 watts.

Tubes: The following tubes are used: 1 6F5G, 1 6Y6G, 1 6X5G, 1 6E5. A complete set of tubes is supplied with each instrument.

Accessories: A 7-foot connecting cord and spare fuses and pilot bulbs are supplied.

Dimensions: (Length) $19\frac{1}{2}$ x (depth) $11\frac{1}{2}$ x (height) $7\frac{3}{8}$ inches, over-all. Panel, 19 x 7 inches.

Net Weight: 35 pounds.



Functional schematic diagram of TYPE 608-A Oscillator. The amplifier, which has a propagation constant μ , is made degenerative, except at the frequency of oscillation, by means of the network with propagation constant β , thus providing a sharply selective circuit. Sufficient regeneration is provided to cause self-oscillation.

Type	Code Word	Price
608-A	ORBIT	\$260.00



OTHER G-R INSTRUMENTS FOR BROADCASTING STATIONS

Frequency Monitors
Power Level Indicators
Volume Controls
Attenuators
Wave Analyzers
Antenna Measuring Equipment
Oscillators, Bridges and Meters for General Testing

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