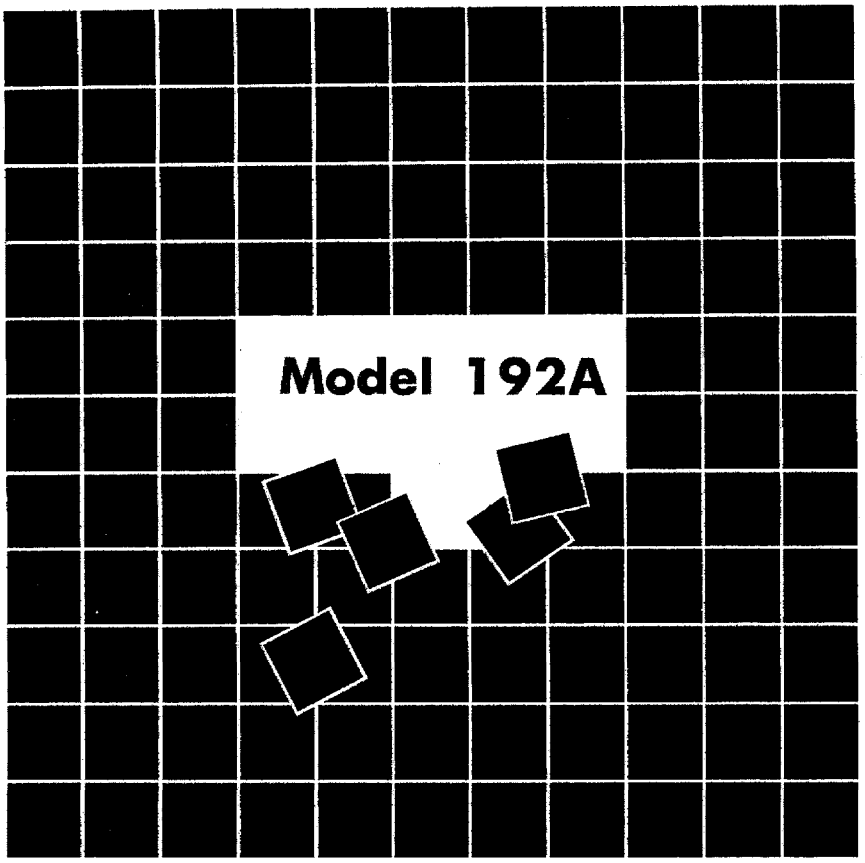
LEADER

AUDIO TESTER

INSTRUCTION MANUAL



LEADER ELECTRONICS CORP.

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1. DESCRIPTION

The Model 192A is a combination of a wideband audio generator and a wide-range AC millivoltmeter.

This instrument is specially useful in testing and servicing audio circuits, monaural and stereo, for frequency response and gain charactristics. The generator frequency range is 10Hz to 1MHz and the output is controllable from 0 to −120dB in 1dB steps into a 600Ω load.

The AC millivoltmeter covers a voltage range from 150μV to 500Vrms in the 10Hz to 1MHz range. The AC millivoltmeter has two channels with an easy-to-operate double-shank switch for range selection. The two channels can be set up independently or interlocked with the required level difference. A separate decibel scales, at 0dB = 0.775Vrms and 0dB = 1Vrms can be used when comparing signal levels.

2. SPECIFICATIONS

Audio Generator Section

Frequency Range	10Hz to 1MHz in five decade ranges.
Calibration Accuracy	±(3% + 1Hz).
Output Characteristics	
Sine Wave	Voltage: over 3Vrms into 600Ω Flatness: within ± 0.5dB into 600Ω (at maximum output) Distortion, 500Hz to 20kHz 0.05% 50Hz to 200kHz 0.4% 20Hz to 500kHz 0.8% 10Hz to 1MHz 1.5%
Control	Variable: 0 to over 3Vrms. Attenuator: 120dB in 1dB steps at 600Ω; 40dBX2, 20dB, 10dB, 1dBX10 accuracy within ±1.5%.

Frequency Characteristics:

Accuracy	dB range	Frequency
±0.5dB	0 to 60	to 500kHz
	60 to 120	to 150kHz
±2dB	0 to 60	to 1MHz
±6dB	60 to 120	to 500kHz
±10dB	60 to 120	to 1MHz

Square Wave	Output: Over 3Vp-p into 600Ω Rise time 200ns. Sag 5% or less
Impedance	600Ω Internal termination and external termination change-over system.
SYNC Signal Terminal	Input Impedance: Approx 10kΩ Control range: ±1%/V

AC Millivoltmeter Section

Voltage Range	1.5mV (0.15mV min.) to 500Vrms full scale in 12 ranges.
Decibel Range	−80 to +55dB (0dB = 0.775V) −80 to +54dB (0dB = 1V) in 12 ranges.
Accuracy	Within ±2% of full scale. (1kHz or 400Hz ref.)
Frequency Range	20Hz to 100kHz within ±2% ref: 1kHz. 5Hz to 1MHz within ±10%

Input Impedance	10MΩ; less than 50pF: 1.5 to 500mV range less than 35pF: 1.5 to 500V range
Amplifier Output Votlage	Approx. 1Vrms at full scale
Distortion	Less than 1% at 1kHz, full scale
Output Frequency Response	10Hz to 300kHz, −3dB (Connected input resistance 10MΩ and capacitance 50pF to output terminal)
Power Supply	100V, 120V, 200V, 220V, 240V 50/60Hz; approx.10VA.
Size and Weight	300(W) x 150(H) x 250(D)mm; 5.9kg.
Accessories, supplied	
Lead, clip to banana plug	2ea.
Lead, pin plug to pin plug	2ea.
Lead, earphone plug to pin plug	1ea.
Spare fuse	1ea.

3. CONTROLS AND CONNECTORS

3.1 AC Millivoltmeter Section, see Fig.3-1.

① Meter: With scales calibrated for Volts (rms) and decibels. There are three scales: volts, dBV and dBm. The black pointer indicates CH 1 readings and the red pointer indicates CH 2 readings.

②③ Mechanical zero adjuster for the meter.

④ Independent/interlock indicator
When knob ⑥ is pulled out, the lamp will light red and two ranges can be set up independently for CH 1 and CH 2. When the knob is pushed in, the lamp will light green and the two channels will become interlocked.

⑤ and ⑥ Range
This switch is used to select the voltage and decibel range of the AC millivoltmeter. The voltage for each range represents the full-scale value of that range. The dB represents the absolute level of the 0dB each range. When knob ⑥ is pulled out, both knobs can be operated independently, in which case ⑤ will be used as the knob for CH 1 and ⑥ as the knob for CH 2. When knob ⑥ is pushed in, both channels will become interlocked.

Side view of the knob	Function	Lamp color
	Interlock	Green
	Independent	Red

⑦⑪ INPUT terminal(red): For the high potential side. ⑦ CH 1, ⑪ CH 2.

⑧⑫ INPUT terminal (black): For the low potential side; this is "floated" from the chasis with a 0.22μF capacitor, ⑧ CH 1, ⑫ CH 2.

⑨ Input jack for CH 1 signal of stereo input. This jack is connected to the input terminals internally.

⑩ Input jack for CH 2 signal of stereo input. This jack is connected to the input terminals internally.

3.2 AF Signal Generator Section, see Fig.3-1.

⑬ ATTENUATION dB switches: For attenuating the AF output signal; range is 0 to 110dB.

⑭ Attenuator switch: Adjusts the AF output signal in 1dB steps.

⑮ OUTPUT IMPEDANCE switch: Selects the output load impedance; 600Ω.

⑯ OUTPUT jacks: For use with the pin plug lead.

⑰ Ground terminal (chassis connection).

⑱ OUTPUT terminal: For the AF output signal (connected in paralled with pin jack ⑰).

⑲ FREQ. RANGE switches: Five pushbuttons for selecting the range of the output frequency.

⑳ Frequency dial, Hz: Calibrated from 1 to 10Hz; actual output frequency depends on the range setting.

㉑ OUTPUT LEVEL control: For continuous adjustment of output.
㉒ Switch for output waveform selection, sine or square, as marked.
㉓ Pilot lamp: Indicates when the AC power is on.
㉔ POWER switch: Push on the AC power.

3.3 Rear Connections, see Fig.3-2.

㉕ SYNC terminals: For connection to an external frequency control source; black terminal is for ground.
㉖ Shorting-link: Normally connected across the SYNC terminals when the synchronizing input signal is not used.
㉗ AC inlet.
㉘ Fuseholder for the AC line.
㉙ Serial number plate.
㉚ ㉛ Amplifier output terminal (㉚ for CH 1, ㉛ for CH 2).
Approx. 1Vrms output voltage will be available from this terminal when meter indication is full scale.
By using output from this terminal, monitering of the waveform under test on oscilloscope is available.

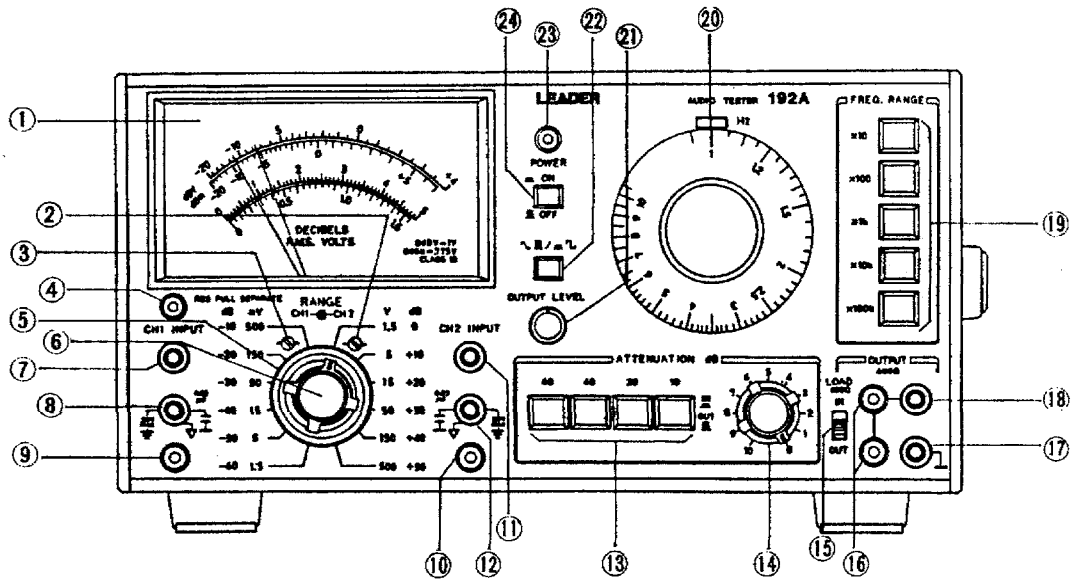


Fig. 3-1 Front panel controls and connectors.

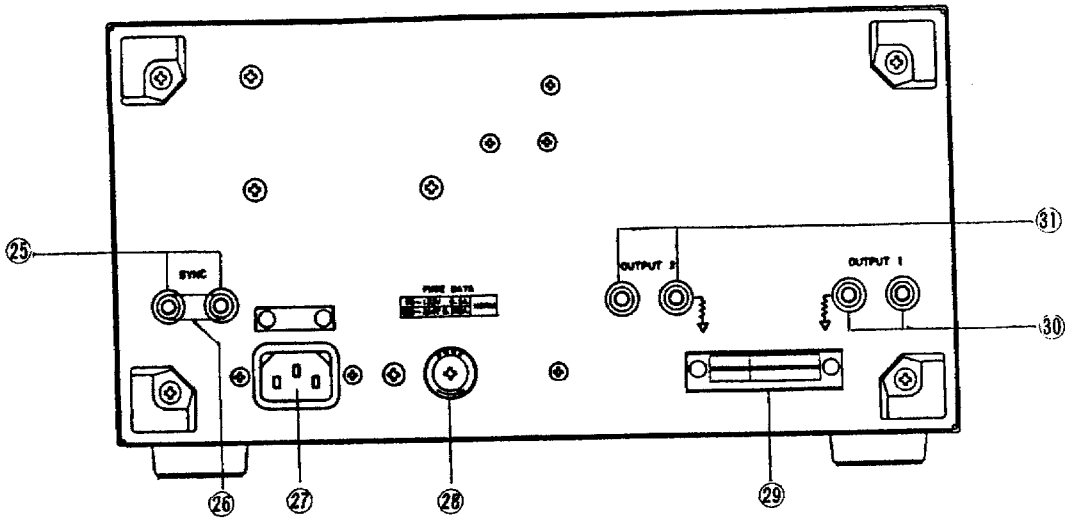


Fig. 3-2 Rear panel controls.

4. OPERATION

4.1 Initial Checks

Check the 0 pointer setting on the meter. If not zeroed at the left end of the scale, adjust the zero-set screws on the panel below the meter.(See Fig.3-1)
The power supply voltage for must be within ±10% of the rated voltage.

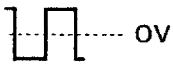
4.2 AF Signal Generator

4.2.1 PRECAUTIONS

1. The output should not be connected to a circuit in which voltage over 10Vrms, is present to prevent damage to the attenuator system. If DC voltage is present, connect it through a capacitor to eliminate DC voltage.
2. Square wave
   The waveform shown below

   When need the square wave as shown below, connect the capacitor to OUTPUT terminal in series.

3. Output connection leads should be as short as possible. Long leads are liable to pick up noise when used at low output levels.
   Using a shielded cable at the output will affect the output at high frequencies into high impedance loads due to the shunt capacitance effect.

4. Sine waves which appear immediately after power is turned on are sometimes clipped in the lower and upper part. However, the waves will return to normal 20 to 30 seconds later.
5. Output voltage changes due to the ambient temperature
   Since a thermistor is used to control oscillating voltage, it is affected by ambient temperatures. If a constant output is desired when there are abrupt temperature changes, use a voltmeter to monitor and adjust the voltage to a constant output.
6. Frequency range selector
   Make certain that only one of these switches is pressed at a time. If two or more switches are simultaneously pressed, or if all switches are not depressed, the tester will not work properly.
7. Impedance matching
   When connecting an object to be measured to the output terminals, match the impedance of that object to the 600Ω output impedance of this tester before measuring.

4.2.2 CONTROL ADJUSTMENTS

1. Set the POWER switch at ON. Allow about 30 seconds for warm-up.
2. Frequency setting:
   The output frequency is set with the frequency dial and the FREQ. RANGE switches.

FREQ. RANGE SETTING (Multiplier)	OUTPUT FREQUENCY RANGE
x10	10 to 100Hz
x100	100 to 1000Hz (1kHz)
x1K	1 to 10kHz
x10K	10 to 100kHz
x100K	100 to 1000kHz (1MHz)

3. Connections
   a. Ground lead to the black OUTPUT terminal.
   b. "Hot" lead to the red OUTPUT terminal, or pin plug to the pin jack (both outputs are in parallel).
   c. Output leads to the input of the test circuit.
4. Output Level Setting:
   The OUTPUT LEVEL control is normally used to set the reference output level. The attenuators — pushbuttons and the rotary switch — are set as required. The signal attenuation is the sum of the markings on the attenuators. The marking on the attenuator is referred to the 600Ω load.

   Example: Pushbuttons at 20 and 10
   Rotary switch at 6
   Total attenuation = 20 + 10 + 6 = 36dB

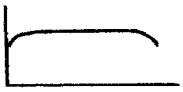
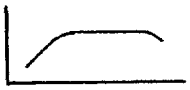
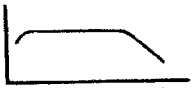
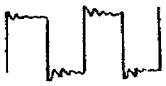
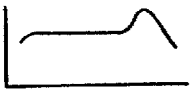
4.2.3 Square Wave Output

Square wave signals are useful in the rough determination of response characteristics of amplifiers at high and low frequency.

The interconnections are identical with those for sine wave operation, see Fig.4-1.

The scope for waveform observation should have fast rise time characteristics.

The chart given below shows the waveforms at the amplifier output for different responses.

Waveshape	Amplifier Response	Condition
RECTANGULAR 	 FLAT	SATISFACTORY
SAG 	 DEFICIENT LOW FREQUENCIES	INCORRECT VALUES OF THE COUPLING ELEMENTS
ROUNDING 	 DEFICIENT HIGH FREQUENCIES	HIGH DISTRIBUTED CAPACITANCE IN CIRCUIT
RINGING 	 PEAKING AT HIGH FREQUENCY	MALADJUSTMENT IN THE NEGATIVE FEEDBACK CIRCUIT; INCORRECT CONSTANTS; INSTABILITY

For an amplifier with good characteristics, the response will be flat up to about the 11th harmonic of the input fundamental. As an example. If a 1kHz square wave is reproduced without distortion, the amplifier response is flat to about 11kHz.

NOTES:

1. Output voltage settings are initially made with the OUTPUT LEVEL controls and the waveform switch set at the sine wave position.
   The indicated value on the scope will be equal to the peak-to-peak output voltages.
   The waveform selector switch is then set at the square wave position. Disregard the voltmeter reading.
   If in doubt, check the p-p output voltage with a calibrated scope.
2. It is advisable to check the input waveform on a scope before application.
3. Connection from the SYNC output terminal to the scope sync input will make adjustments easier when displaying waveforms.

The low frequency response will start to fall off at about 1/11 of the fundamental when there is a sag, or droop, in the displayed waveform.

4.2.4 Use of SYNC Connections

A. General

The sync connections, on the rear panel, can be used in several applications as discribed below.

The "input" or "output" impedance is approximately 10kΩ.

B. Output Frequency Control

The oscillator frequency can be synchronized with an accurate source over a range of

±1% per rms volt input, see Fig.4-1.

For example, when the oscillator is set at some point between 990 and 1010Hz, and a signal of exactly 1000Hz is applied, the oscillator will automatically lock in at 1000Hz. Thus, high accuracy can be achieved with the use of a precision frequency standard.

In another application, a distorted waveform can be "purified", or filtered, by passing it through the oscillator.

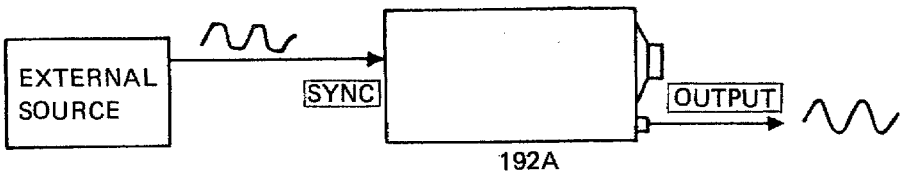


Fig. 4-1 Use of the SYNC terminals.

C. SYNC Output Application

The sync output voltage, approximately 2.5Vrms, should be sufficient to synchronize or trigger the sweep in a scope or to operate a frequency counter. This voltage is not affected by the setting of the OUTPUT LEVEL control.

4.3 AC Millivoltmeter

4.3.1 PRECAUTIONS

1. Maximum input voltages: To prevent damage to the input circuit, application of excessive voltages must be avoided.
   AC peak + DC = 600V
2. Low voltage measurements: When measuring voltages in the millivolt ranges, the RANGE switch should be set at a high range and lowered as required.
   If the input leads are at the open, or "free" condition, the meters pointers may go off scale; always set the RANGE switches at a high range. Due to the high input impedance, stray voltage picked up cause this effect.
3. The RANGE switches should be set where the readings can be taken above 1/3 of full scale length (except on the lowest range). This will result in higher accuracy of the readout.
4. Since the millivoltmeter gives readings based on the average value of the input waveform, and the scale is graded in root mean square (rms) for the sine wave, there will be reading errors if the input waveform is distorted.
5. Induced noise
   When the voltage being measured is very small and the voltage source has a relatively high impedance, reading errors may occur due to induction of external noises, such as from the power source. In such a case, shield the signal path completely and avoid using exposed cables as much as possible.

4.3.2 PREPARATION

1. Set the RANGE switches at 500V and turn on the POWER switch.
2. When the power is turned on (or off), the meter pointers may fluctuate; this is a normal condition.
   The millivoltmeter is ready for use as soon as the pointers come to rest.

3. Connect the input leads to the terminals, black for the low potential and the red for the "high" side.
   When stereo outputs are under measurement, connect the signal inputs to the CH 1 and CH 2 pin jack respectively.

4.3.3 VOLTAGE MEASUREMENTS

1. Connect the input lead tips to the test point or the output of the test circuit.
2. The RANGE switches should be set where the readings can be taken above 1/3 of full scale. This will result in higher accuracy of the readout.
3. The voltage range at the different settings of the RANGE switch is given in the following table.

RANGE SWITCH	VOLTAGE RANGE, V or mV	SCALE	SCALE MULTIPLIER	V or mV, PER DIV.
500	0 to 500	0 to 5	100	10
150	0 to 150	0 to 1.5	100	5
50	0 to 50	0 to 5	10	1
15	0 to 15	0 to 1.5	10	0.5
5	0 to 5	0 to 5	1	0.1
1.5	0 to 1.5	0 to 1.5	1	0.05

4.3.4 dB (DECIBEL) MEASUREMENTS

The dB scale is calibrated with reference to 0dB = 0.775Vrms(1mW) into 600Ω.
The dB range at the different settings of the RANGE switch is given in the following table.

RANGE SETTING	dBm	dBV
+50	+30 to +56	+30 to +54
+40	+20 to +46	+20 to +44
+30	+10 to +36	+10 to +34
+20	0 to +26	0 to +24
+10	−10 to +16	−10 to +14
0	−20 to + 6	−20 to + 4
−10	−30 to − 4	−30 to − 6
−20	−40 to −14	−40 to −16
−30	−50 to −24	−50 to −26
−40	−60 to −34	−60 to −36
−50	−70 to −44	−70 to −46
−60	−80 to −54	−80 to −56

* The dB range is the algebraic sum of the RANGE marking and the scale reading.

4.3.5 How to use OUTPUT terminals

When the meter indicates full-scale, 1Vrms can be obtained from OUTPUT terminal regardless of RANGE settings. Then, an oscilloscope can be connected to this terminal to monitor the waveform of the signal to be measured or the terminal can be used as a pre-amplifier. The degrees of amplification available when the OUTPUT is used as a pre-amplifier are given in the table below.

Range Setting (dB)	−60	−50	−40	−30	−20	−10	0	10	20	30	40	50
Gain	60	50	40	30	20	10	0	−10	−20	−30	−40	−50

4.4 Typical Applications

4.4.1 USE OF THE ATTENUATORS

The output impedance of the attenuator system is designed to match the 600Ω load. The correct attenuation, or sum of the marked settings, holds only for the 600Ω condition.

When other load impedances are used, there will be a mismatch in which the actual voltage attenuation depends on the load.

For example, when working into an open circuit, or a high impedance, the output voltage will be 6dB above the 600Ω condition. Thus, this value must be subtracted from the marked settings. In other words, if the voltage is initially set at 1V, say at 0dB, into 600Ω, then at open circuit, the voltage will be 2V or 6dB higher. Under this condition, the attenuation will be −6dB and must be accounted for.

The table below shows the number of dB for voltage to be subtracted from the settings at different load impedances.

NUMBER OF dB TO BE SUBTRACTED	LOAD IN OHMS
0	600
1.9	1k
3.7	2k
5.0	5k
5.5	30k
5.9	60k
6.0	∞ (open)

Example:		
	Attenuator setting	35dB
	Load impedance	2kΩ
	Actual attenuation	35 − 3.7 = 31.3dB

If in doubt, the output voltage at each attenuation step can be measured with the voltmeter.

4.4.2 INPUT/OUTPUT CHARACTERISTIC

Generator settings:

Frequency at 400 or 1000Hz.

Attenuators at 0dB (pushbuttons at out and rotary switch at 0).

Connect the voltmeter to the OUTPUT.

Adjust the OUTPUT LEVEL control for the meter reading at, say 1V and do not touch the control during the measurements. Remove the connection.

Set the pushbutton for 60dB attenuation.

Connections:

Generator output to the amplifier input.

Voltmeter input across the load at the amplifier output, see Fig.4-3.

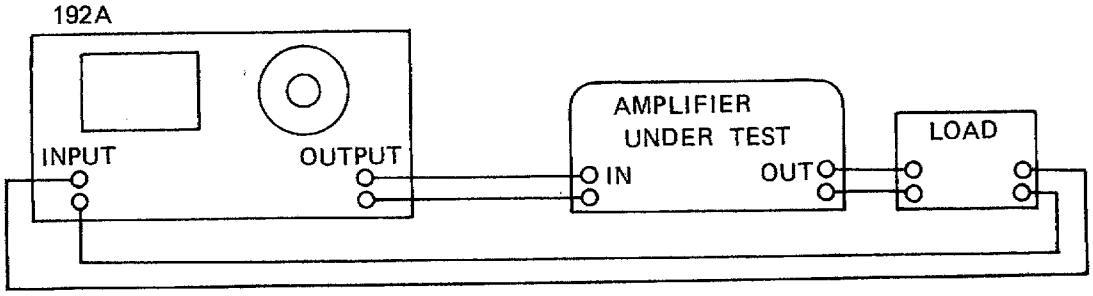


Fig. 4-3 Amplifier measurement

Adjustments:

Note the voltmeter reading as the attenuation is lowered (increase in the input voltage). The "overload" point will be reached when any increase in the input voltage will produce no further increase in the output. Normally the "undistorted" output is taken at some point on the linear portion of the plotted input/output curve.

The output power at this point is calculated from the relation.

$$P_{output} = \frac{(VOLTS)^2}{LOAD\ IN\ \Omega} \text{ watts.}$$

4.4.3 FREQUENCY RESPONSE

Using the same connections shown in Fig.4-3, a frequency run is made on the amplifier.

The method most commonly used — constant input VS. output level (voltage) — will be described.

The input to the amplifier is set at a voltage well below the overload point.

The generator frequency is varied over the desired range and the amplifier output voltage is plotted against the frequency. The generator output is flat for practical purposes and generally there will be no need to adjust the output at each test frequency.

When plotting the response in dB, it will be convenient to initially set the generator output so that the voltmeter reading is 0dB at 400 or 1000Hz. Then by varying the frequency and noting the dB scale reading, the relative response VS. frequency can be plotted on a semi-log paper.

5. MAINTENANCE

5.1 Fuse

The fuses for this tester are rated as shown in the table below. When the supply voltage is changed, replace the fuse according to the new voltage. If the fuse is blown, ascertain the cause and take proper safety precautions before replacing the fuse.

Power voltage	Fuse rating
100 to 120V	0.5A
200 to 240V	0.315A