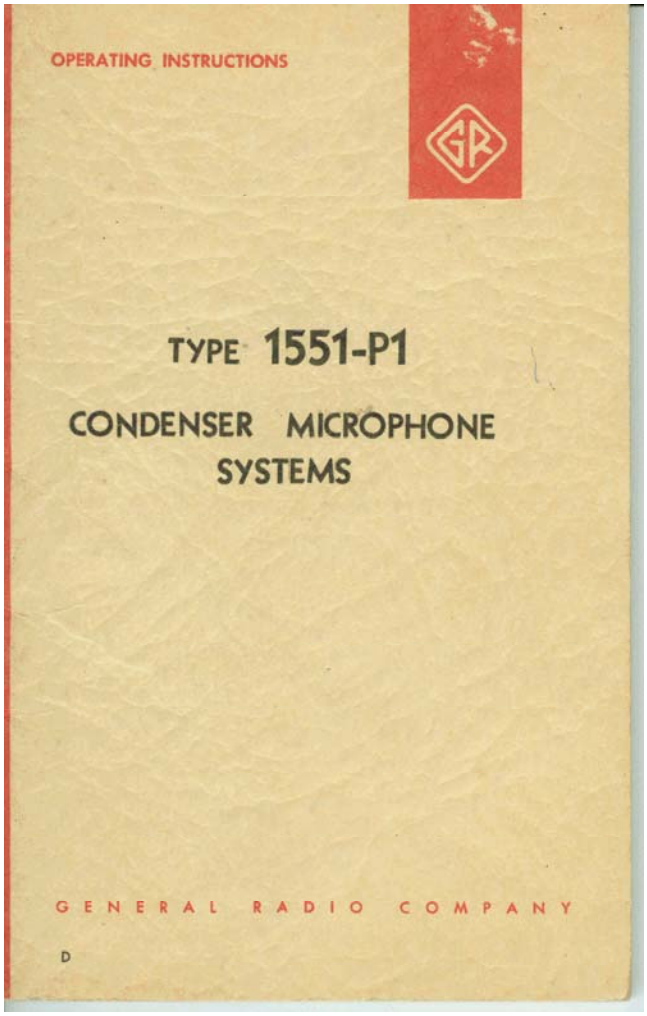

GR 1551-P1 Condeser Microphone System.max

OPERATING INSTRUCTIONS

TYPE 1551-P1

CONDENSER MICROPHONE SYSTEMS

Form 1551-0120-D
January, 1962

GENERAL RADIO COMPANY
WEST CONCORD, MASSACHUSETTS, USA

GR 1551-P1 Condeser Microphone System.max

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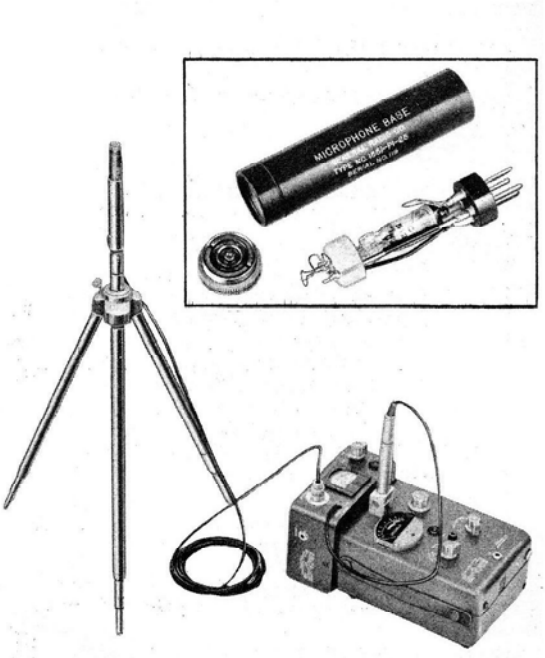

Figure 1. Type 1551-P1 Condenser Microphone System. (Inset shows microphone base disassembled.)

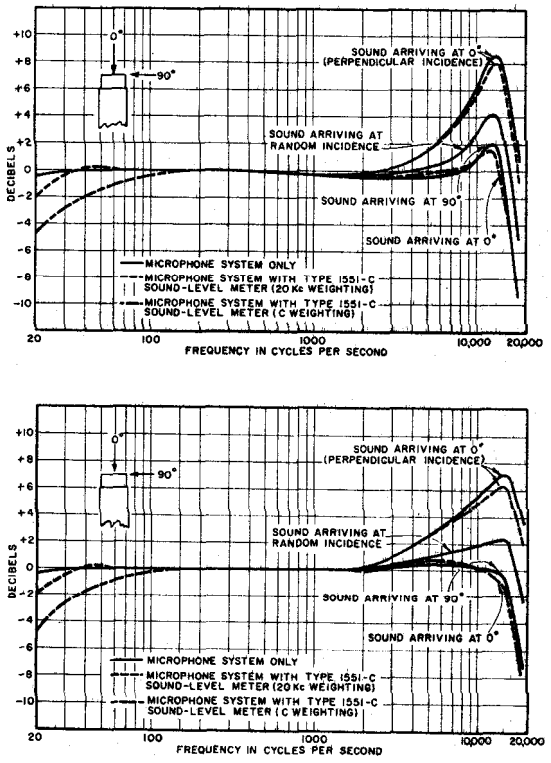

Figure 2. Typical Response Curves for Type 1551-P1 Condenser Microphone Systems.

TYPE 1551-P1
CONDENSER MICROPHONE SYSTEMS

Sections 1, 2, and 3 of these instructions apply to both the Types 1551-P1L and 1551-P1H Systems, except that paragraphs designated by an asterisk (*) in the margin apply only to the Type 1551-P1L System. Section 4 applies only to the Type 1551-P1H System. Users of the Type 1551-P1H System should, upon encountering a paragraph marked *, refer to Section 4 for corresponding instructions for that system.

Section 1 INTRODUCTION

1.1 PURPOSE. The Type 1551-P1 Condenser Microphone System (Figure 1, page iii) is designed for use with the Type 1551 Sound-Level Meters. It is especially useful for measurements over wide frequency ranges and at frequencies above 5 kc.

1.2 DESCRIPTION.

*1.2.1 GENERAL. The System comprises: an Altec Lansing Type 21-BR-150 Condenser Microphone, a Type 1551-P1-25 Microphone Base, a Type 1551-P1-30 Power Supply, a 10-foot cable (~~1551-P1-260~~ 1560-P14), a tripod (1560-P32), and a leather carrying case (1551-P1-42).

1.2.2 MICROPHONE. The condenser microphone is well suited for measurements over wide frequency ranges. Its frequency response to random-incidence sounds (those striking its diaphragm from many directions at once) is smooth and essentially flat from below 20 cps to 8 kc, and remains flat within 3 db up to 18 kc. The response to sounds of random incidence is shown by the center solid curve of Figure 2, page iv. Also shown in Figure 2 are curves showing response to sounds arriving parallel to the diaphragm (grazing or 90-degree incidence) and to sounds normal to its diaphragm (perpendicular incidence). As shown by these curves, the small size of the microphone keeps variations in response due to changes in the angle of incidence of the sound striking the diaphragm to less than 6 db at frequencies up to 10 kc. For many measurements, then, microphone response

*Applies only to Type 1551-P1L. Users of Type 1551-P1H System refer to Section 4.

is relatively independent of microphone orientation. For comparison, the difference between grazing- and perpendicular-incidence response for the Type 1560-P2 Dynamic Microphone or the Type 1560-P3 Ceramic Microphone, usually used with the Sound-Level Meter, is 6 db between 5.5 and 6 kc. For the Western Electric Type 640-AA Laboratory Standard Microphone the difference exceeds 6 db just beyond 7 kc.

When the microphone is used with a Type 1551 Sound-Level Meter, the over-all response for sounds of perpendicular incidence is very uniform at frequencies up to 14 kc with the Sound-Level Meter weighting switch set on C (see lower broken curve, Figure 2). For sounds of random or grazing incidence, best response is obtained with the weighting switch set at 20 kc (upper dotted curve, Figure 2, shows small effect of Sound-Level Meter when it is used in 20-kc weighting position).

The output impedance of the microphone is that of a 6-$\mu\mu$f capacitor.

1.2.3 MICROPHONE BASE. The Type 1551-P1-25 Microphone Base (inset, Figure 1) acts as a mounting for the condenser microphone and houses a subminiature tube (Type CK512AX) connected as a cathode follower. The tube transforms the high output impedance of the microphone down to a level that can be used satisfactorily at the Sound-Level Meter input. The

output impedance of this tiny preamplifier is less than 7500 ohms, so that extension cables of moderate length can be used with no effect on frequency response.

1.2.4 POWER SUPPLY. The battery-operated Type 1551-P1-30 Power Supply provides the filament and plate supply for the preamplifier tube and the 200 volts necessary to polarize the condenser microphone. The power supply, packaged in a simple aluminum case, may sit near the Sound-Level Meter, or, if a permanent setup is desired, it can be attached to the end frame of the meter (as in Figure 1).

The Type 1551-P1-25 Microphone Base can be plugged directly into the MICROPHONE socket on the power supply. However, to avoid effects of nearby objects on frequency response and receive all the benefits of the small size and excellent characteristics of the condenser microphone, the extension cable should be used between the microphone base and the MICROPHONE socket.

The power supply connects to the microphone socket on the Sound-Level Meter by means of the short flexible cable attached to the power supply. The power supply also has a phone jack labeled OUTPUT to facilitate connection of the microphone system to the input of instruments such as the Type 1550-A Octave-Band Noise Analyzer or the Type 1554-A Sound and Vibration Analyzer.

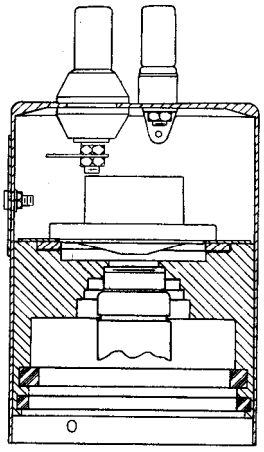

Figure 3. Cross-Section Drawing Showing Type 1552-B Calibrator with Microphone and Preamplifier in Place.

The Type 1552-B Sound-Level Calibrator can be used to check the 400-cycle level of the microphone system. The microphone fits within the Calibrator (Figure 3) in the first or top step in the stepped microphone receptacle. Be sure no foreign matter comes between the microphone and the mating lip in the Calibrator.

Section 2 OPERATING PROCEDURE

2.1 INSTALLATION. The microphone is normally screwed into the top of the microphone

base. The microphone is shipped in this position, and it is recommended that it be kept on the base unless it becomes necessary to service the preamplifier or the microphone. (Refer to paragraph 3.3.) If it is necessary to remove the microphone, be careful not to damage the spring contacts in the microphone base. The center spring should set in the small post in the center of the microphone and the outer spring should contact the guard ring, halfway between the center post and the outer locking ring in the microphone.

Use the extension cable to connect the microphone base to the MICROPHONE socket on the power supply. The short cable (labeled SOUND-LEVEL METER) from the power supply plugs into the Sound-Level Meter in place of the ceramic microphone normally supplied.

Turn the Type 1551 Sound-Level Meter on by lifting the microphone post to its upright position. Set the weighting switch to 20 kc, and turn on the Condenser Microphone System by turning the OFF-ON-BAT switch to ON. The meter in the power supply should read upscale, and should read about 100 within 10 to 30 seconds. For correct setting of the microphone polarizing voltage, set the small, thumb-operated control below the OFF-ON-BAT switch to give a meter reading of 100. The complete system is now ready for operation.

For occasional use, the power supply can be set beside the Sound-Level Meter. When ex-

tended use of the system is anticipated, however, it may be more convenient to attach the power supply to the end of the Sound-Level Meter. The procedure is as follows:

a. Remove the two binder-head screws (A, Figure 4) from the tapped inserts in the microphone end of the Sound-Level Meter case.

b. Remove the power-supply cover by removing the panel screw from the rear center of the cover and sliding the cover downward.

c. There are two 1/4-28 binder-head screws, mounted in holes in the front face of the power supply, which line up with the inserts (A, Figure 4) when the power supply is placed against the end of the Sound-Level Meter.

d. These two screws can be removed and used to secure the power supply to the end of the Sound-Level Meter.

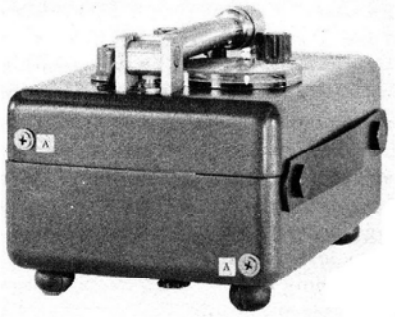

Figure 4. Type 1551-C End View, Showing Location of Inserts (A).

*2.2 CALIBRATION WITH TYPE 1552-B SOUND-LEVEL CALIBRATOR. With the Condenser Microphone System ready for operation, place the calibrator over the microphone and microphone base, as shown in Figure 3. With 2.0 volts at 400 cycles applied to the Type 1552-B Calibrator, the sound-pressure level at the condenser microphone should be 121 ±1 db. To complete calibration, set the Sound-Level Meter to read 121 db by means of the CAL control. The sensitivity of the Type 1560-P3 Microphone normally supplied with the Sound-Level Meter is between −56 and −60 db (re 1 volt per μbar), while the sensitivity of the Type 1551-P1L Condenser Microphone System is also between −56 and −60 db (re 1 volt per μbar); thus, the gain of the amplifier in the Sound-Level Meter is almost the same for either the normal ceramic microphone or the Type 1551-P1L Condenser Microphone System.

*2.3 INTERNAL CALIBRATION SYSTEM OF TYPES 1551-C AND -B SOUND-LEVEL METERS. The internal calibration system of the Type 1551-C and -B Sound-Level Meters can be used when the Type 1551-P1L System replaces the Type 1560-P3 or Type 1560-P1 Microphone supplied with their instruments. Before using the internal calibration system, however, set the

*Applies only to Type 1551-P1L. Users of Type 1551-P1H System refer to Section 4.

microphone sensitivity adjustment in the Sound-Level Meter to indicate the Type 1551-P1L System level. (Refer to paragraph 4.8, Type 1551-C Operating Instructions or paragraph 3.8, Type 1551-B Operating Instructions). The system level of Type 1551-P1L is recorded on the curve inside the back cover of this booklet.

*2.4 INTERNAL CALIBRATION SYSTEM OF THE TYPE 1551-A SOUND-LEVEL METER. Use of the internal 60-cycle calibration system of this Sound-Level Meter requires the determination of a correction factor. After the Sound-Level Meter has been set to read 121 db with the Type 1552-B Sound-Level Calibrator, proceed as outlined under CHECKING CALIBRATION in the Type 1551-A Sound-Level Meter Operating Instructions, but do not reset the CAL control as directed. Record the difference in meter readings obtained. Once this difference has been determined, the internal calibration system can be used as before, except that the difference in meter reading is maintained by readjustment of the CAL control instead of by maintaining the equal meter readings for the two positions of the CAL switch. The difference obtained above can be between +4 and -4 db.

*Applies only to Type 1551-P1L. Users of Type 1551-P1H System refer to Section 4.

2.5 CALIBRATION OF TYPE 1551-A WITHOUT TYPE 1552-B SOUND-LEVEL CALIBRATOR. If a Type 1552-B Calibrator is not available, adjust the level of the Sound-Level Meter for use with the Condenser Microphone System as follows:

a. Determine the sensitivity or level of the Shure Type 9898 crystal microphone for which the Sound-Level Meter is adjusted. (This level is recorded on a small tag attached to the side of the microphone well of the Sound-Level Meter. It can be obtained from General Radio Company, or it can be determined as outlined in paragraph 2.6).

b. From the level of the Shure microphone subtract the level of the Condenser Microphone System as listed on the frequency-response chart supplied with the instrument.

* c. Calibrate the Sound-Level Meter with the 60-cycle internal calibration system (refer to paragraph 2.4), using as the difference in meter readings the decibel difference determined in step b. If this difference is plus, set the CAL control so that the meter reads higher than the reference level. (The reference level on the Sound-Level Meter is obtained when the weighting switch is held in the CAL position.)

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*Applies only to Type 1551-P1L. Users of Type 1551-P1H System refer to Section 4.

EXAMPLE 1:

Level of Type 9898 Microphone -58 db
Level of Type 1551-P1L System -59 db
Difference -58 db -(-59 db) = +1 db
(Therefore, the CAL control should be adjusted so that the meter reads 1 db above the reference level.)

EXAMPLE 2:

Level of Type 9898 Microphone -58 db
Level of Type 1551-P1L System -56 db
Difference -58 db -(-56 db) = -2 db
(Therefore, the CAL control should be adjusted so that the meter reads 2 db below the reference level.)

2.6 LEVEL OF TYPE 9898 MICROPHONE. The sensitivity of the microphone for which the Type 1551-A Sound-Level Meter has been adjusted can be determined as follows:

a. Calibrate the Sound-Level Meter by means of the internal 60-cycle calibration system.

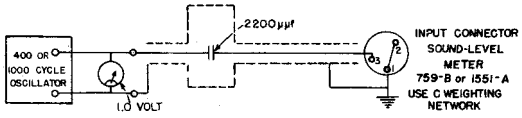

Figure 5. Circuit Diagram of Calibration System for Determining Sensitivity of Type 1551-A Sound-Level Meter.

b. Supply 1.0 volt, at 400 or 1000 cps to the input of the Sound-Level Meter through a well-shielded 2200-$\mu\mu$f capacitor (see Figure 5).

c. Determine the microphone sensitivity for which the instrument has been adjusted by means of the following table.

Type 9898 Microphone Sensitivity in db (re 1 volt per μbar)	Decibel Reading of Sound-Level Meter
-60	134
-59	133
-58	132
-57	131
-56	130

2.7 WEIGHTING SWITCH POSITION. To derive full benefit from the wide range of the microphone, the weighting switch on the Sound-Level Meter should normally be set in the 20-kc position. (See paragraph 1.1 and Figure 2.) The other weighting-switch positions can, however, be used to perform their usual functions whenever desired. The 20-kc position should always be used in place of the C position, unless the microphone is pointed toward the source of a highly directional sound. Refer to the Sound-Level Meter Operating Instructions and the HANDBOOK OF NOISE MEASUREMENT for notes on operation and use of weighting networks. When recording data, always note the weighting-switch

position used for any measurement or series of measurements.

*2.8 MAXIMUM LEVEL. The Altec Type 21-BR-150 Condenser Microphone used in the Type 1551-P1L System is not damaged by high sound levels, and its high-level limit is determined only by the amount of distortion permissible. At high sound levels, the motion of the diaphragm is great enough to cause nonlinearity of the output voltage with respect to the input sound pressure. Distortion from this effect is generally less than one percent at levels up to 135 db, increasing with level to about 10 percent at 155 db. Sound levels up to 150 db can be measured directly with Types 1551-C or -B Sound-Level Meters and sound levels up to 140 db can be measured directly with the Type 1551-A Sound-Level Meter.

2.9 TEMPERATURE COEFFICIENT. The temperature coefficient of sensitivity of instruments of the Allen Type 21BR Microphone is -0.02db/°F.

2.10 MAXIMUM TEMPERATURE. The maximum temperature at which the microphone and microphone base can safely be operated is 100 C. Above this temperature, the vacuum tube in the microphone base will not function properly. Life of the batteries in the power supply will be

*Applies only to Type 1551-P1L. Users of Type 1551-P1H System refer to Section 4.

shortened if this part of the system is subjected to very high or very low temperatures; therefore, keep the power supply apart from the microphone and microphone base when the latter must be subjected to extremes.

2.11 CABLE CORRECTION.

2.11.1 No cable correction is necessary for the 10-foot cable supplied for use between the microphone base and the power supply. When greater distance between the microphone and the Sound-Level Meter is necessary, a 25-foot cable such as the Type 759-P30 can be used between the power supply and the Sound-Level Meter. For such a cable, a correction must be added, which is a function of frequency and which depends on the output impedance of the preamplifier and the total capacitance appearing across this output.

To determine the correction for an extension cable, multiply the frequency by T to get λ (the abscissa of Figure 6). Then read the db correction from the solid curve of Figure 6.

$T = RC \times 10^{-6}$ microseconds

R = output impedance of preamplifier in ohms (determined as outlined in paragraph 3.4)

C = total capacitance across Type 1551-P1 output - in $\mu\mu f$

$= C_1 + C_2 + C_3 + C_x$

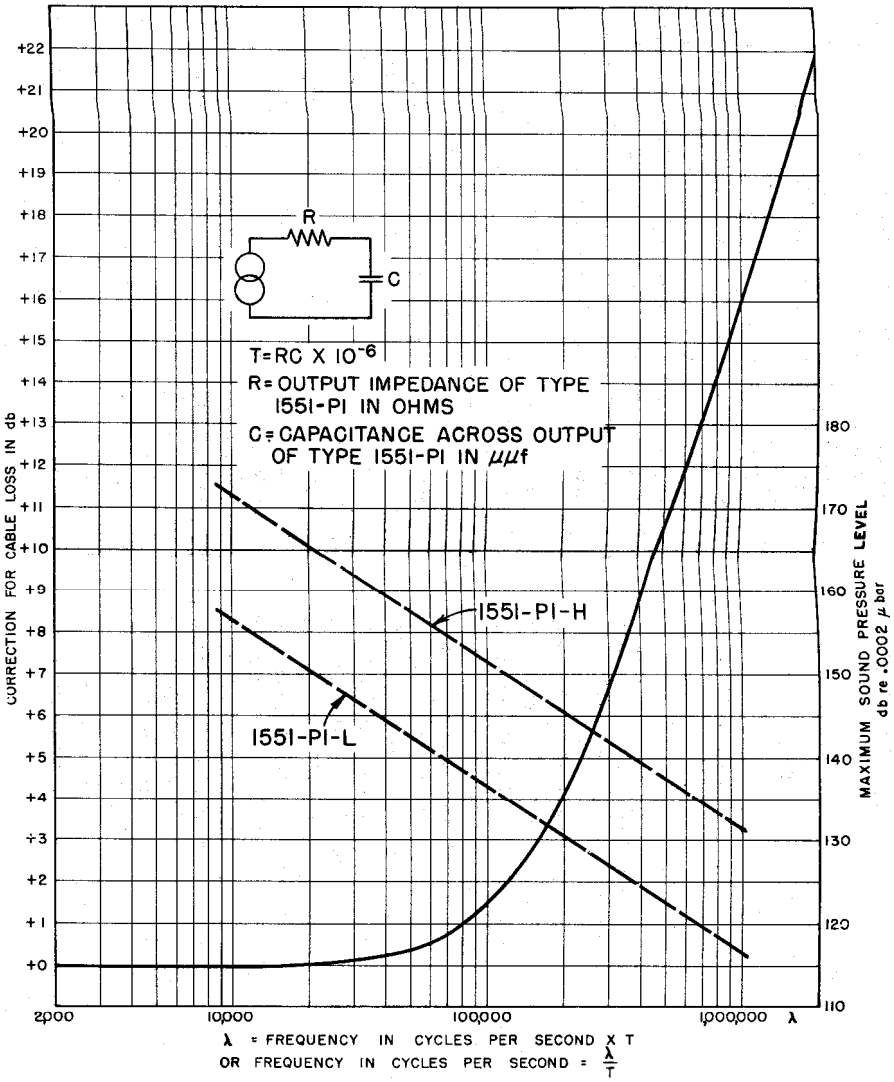

Figure 6. Cable-Correction Curve.

ıere C_1 = capacitance of Type 1560-P74 ~~1551-P1-260~~
10-foot cable
= 500 $\mu\mu$f**

C_2 = wiring capacitance of Type 1551-P1
= 150 $\mu\mu$f**

C_3 = input capacitance of Sound-Level Meter
= 50 $\mu\mu$f** for Type 1551-~~P1~~

C_x = capacitance of additional cable between power supply and Type 1551-~~P1~~

As an example, assume that the Type 759-P30 25-foot Cable is used between the power supply and the Sound-Level Meter, and that R is determined to be 6500 ohms (paragraph 3.4). The sum of C_1, C_2, and C_3 is 700 $\mu\mu$f, and C_x equals 675 $\mu\mu$f**; therefore C equals 1375 $\mu\mu$f. T equals 6500 times 1375 times 10^{-6}, or 8.95. When the frequency in cycles is multiplied by T (equals 9) the proper value of λ is obtained. For the correction to be applied at 15,000 cycles, then, consult the curve (Figure 7), and note that at 135,000 (which is 9 times f) the correction is +2.4 db.

If it is desired to know at what frequencies the correction is less than, say 1 db, multiply the value of λ for a 1-db correction by $\frac{1}{T}$. In the

**Nominal values; for greatest accuracy, measure capacitance of cables and instruments actually used.

example just cited, the correction is 1 db or less at all frequencies below 8900 cycles.

The above procedures can be used to determine the corrections required for any length of extra cable.

The Type 1560-P73 Cable has a capacitance of 24 $\mu\mu$f per foot. When longer cables are required, the correction can be kept low by the use of low-capacitance, single-conductor shielded cable between the power supply and the Sound-Level Meter. (RG-62-U cable, for instance, has a capacitance of 13.5 $\mu\mu$f per foot.)

*2.11.2 The use of a long cable not only requires a frequency correction, but also imposes a limit on the maximum sound-pressure level that can be accurately measured. This limit is due to the loading effect of the long cable on the small cathode-follower-type preamplifier in the microphone base. The limits imposed can be determined from the dotted curves of Figure 7. Using the example above, where C equals 1375 and T equals 9, we find that if measurements include high-level components up to 15 kc, λ equals 135,000, and the maximum sound-pressure level that can be accurately measured with the Type 1551-P1L System is 134 db. On the other hand, if the high-level components consist of moderately high frequencies (say nothing above 5 kc),

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*Applies only to Type 1551-P1L. Users of Type 1551-P1H System refer to Section 4.

the limits would be determined by λ = 8 times 5000 = 45,000, and would be 143 db. At frequencies below 1300 cycles where λ is less than 12,000, no limit is imposed by the cable.

2.12 LOCATION OF MICROPHONE. For a brief note on microphone placement, refer to the Type 1551 Operating Instructions. For a more detailed treatment of microphone location, refer to the HANDBOOK OF NOISE MEASUREMENT.

*2.13 USE WITH ANALYZERS AND RECORDERS. When noise analysis is required, or when a tape recording of the sound is desired, the analyzer or recorder is usually connected to the output of the Sound-Level Meter. There are instances, however, where it is not necessary or desirable to use the Sound-Level Meter between the condenser microphone system and the analyzer or recorder. When sounds with components between 50 and 135 db are to be measured, the output of the Type 1551-P1L Condenser Microphone System can be connected directly to the input of the Type 1554-A Sound and Vibration Analyzer. To make this connection, plug the cable supplied with the analyzer into the OUTPUT jack, located on the side of the power supply. In a similar manner, sounds with compo-

*Applies only to Type 1551-P1L. Users of Type 1551-P1H System refer to Section 4.

nents between 50 and 130 db can be measured by connecting the output of the Type 1551-P1L directly to the input of the Type 1550-A Octave-Band Noise Analyzer. When levels exceeding 130 are encounted, a 200,000-ohm resistor connected in series with the analyzer input will make the useful range of the system from 90 to 150 db. Many tape recorders can be operated directly from the Type 1551-P1L Condenser Microphone system. If the input impedance of the tape recorder is 20,000 ohms or more, output can be taken at the OUTPUT jack, as for the analyzer, and the values given above apply. If the input impedance of the tape recorder is 5 megohms or more , connection can be made at the short cable labeled SOUND-LEVEL METER, and the output will be useful up to 150 db.

The Type 1552-B Sound-Level Calibrator can be used to determine the level of readings obtained with an analyzer or recorder.

Section 3 SERVICE AND MAINTENANCE

3.1 GENERAL. The two-year warranty given with every General Radio instrument attests the quality of materials and workmanship in our products. When difficulties do occur, our service engineers will assist in any way possible.

In case of difficulties that cannot be eliminated by the use of these service instructions, please write or phone our Service Department, giving full information of the trouble and of steps taken to remedy it. Be sure to mention the serial and type numbers of the instrument.

Before returning an instrument to General Radio for service, please write to our Service Department or nearest district office (see back cover), requesting a Returned Material Tag. Use of this tag will ensure proper handling and identification. For instruments not covered by the warranty, a purchase order should be forwarded to avoid unnecessary delay.

3.2 BATTERIES. One Type D flashlight cell supplies the filament power for the Type CK-512AX preamplifier in the Type 1551-P1-25 Microphone Base. One 300-volt B battery (Eveready 493 or Burgess V-200) supplies the plate power for the preamplifier and the 200-volt polarizing voltage for the condenser microphone. The filament battery should give 150 hours of operation at 8 hours per day, or 300 hours at 2 hours per day. The plate battery should give 200 hours of operation at 8 hours per day, or 400 hours at 2 hours per day.

Replace the filament battery when the meter reads below 100 with the OFF-ON-BAT switch at BAT. Replace the plate battery when it fails to meet the tests prescribed in paragraph 3.3.4.

3.3 TROUBLE-SHOOTING.

3.3.1 GENERAL. The meter on the power supply will normally read approximately 100 shortly after the OFF-ON-BAT switch is turned to ON, and it should be possible to set the meter reading to 100 by means of the thumb control below the switch. The defects listed in the following paragraphs are indicated by a low reading on the panel meter of the power supply with the switch at ON. If the meter reads low, first check the filament battery as described in paragraph 3.2.

3.3.2 LEAKAGE ACROSS MICROPHONE INSULATION. During periods of high humidity, the insulation resistance in the microphone may occasionally be lowered by leakage to a point where the CK512AX preamplifier is unable to build up the required grid bias for proper operation. To check this, turn the OFF-ON-BAT switch to OFF, remove the microphone from the microphone base, and turn the switch to ON again. If the meter can now be set to 100, the insulation resistance in the rear of the microphone is too low. Occasionally, if the leakage resistance of the microphone is low enough, removal of the low leakage resistance by removal of the microphone will not be enough to restore the small preamplifier to its proper bias. In such instances, it is possible to restore normal bias by momentarily touching the grid terminal (center spring) to the filament or cathode terminal (outer spring) with the finger tip.

Placing the microphone in a desiccator overnight will usually increase the leakage resistance to a satisfactory level.

3.3.3 TUBE BURN-OUT. If, after the microphone is removed, the meter cannot be set to 100, remove the cover from the power supply. If neon lamps V2, V3, and V4 are glowing, it is likely that the CK512AX tube V1 in the microphone base has burned out. This burn-out can occur if the guard electrode in the microphone base is accidentally shorted to ground when the microphone is screwed in place with the OFF-ON-BAT switch at ON.

3.3.4 DEFECTIVE B BATTERY. If V2, V3, and V4 are not glowing, and the meter cannot be set to 100 with the microphone removed from the microphone base, replace the 300-volt B battery.

3.4 OUTPUT IMPEDANCE. The output impedance of the Condenser Microphone System should be 7500 ohms or less. When the system is used with cables up to 25 feet, this output impedance should be checked from time to time to make sure that the high-frequency response of the system is not being lost due to higher-than-normal output impedance. This condition could occur over a period of time with the aging of the CK512AX tube, and give no hint of possible trouble. A simple method of determining the output impedance is as follows:

a. With the system set up for operation with the Sound-Level Meter, obtain a reading on the Sound-Level Meter, using the Type 1552-B Sound-Level Calibrator as a source.

b. Connect a 10,000-ohm resistor across the output of the condenser microphone system at the OUTPUT jack on the side of the power supply, and note the decrease in reading.

c. Refer to the following table to find the output impedance corresponding to the decrease in reading:

Decrease (db)	Output Impedance (ohms)
4	6000
5	8000
6	10,000

d. In general, V1 should be replaced if the decrease in meter reading exceeds 5 db.

3.5 VOLTAGE CHECKS. Under normal operting conditions, the d-c voltage between terminals 5 and 1 of V1 (terminals 2 and 1 of J2) is under +20 volts, and the d-c voltage from terminal 3 (ground) to terminal 2 of J2 is +200 volts. When the instrument is first turned on (before V1 has had time to arrive at normal bias), the full 300 volts of the plate battery tends to appear across terminals 2 to 1 of J2, but this voltage is limited to 170 volts by V2, V3, and V4.

Section 4

TYPE 1551-P1H CONDENSER MICROPHONE SYSTEM

The information given in preceding sections of this book applies to both the Types 1551-P1L and 1551-P1H Condenser Microphone Systems, except as indicated below. The paragraphs in this section apply to the Type 1551-P1H System, in place of correspondingly numbered paragraphs in other sections.

1.2.1 GENERAL. The System comprises: an Altec Lansing Type 21-BR-180 Condenser Microphone, a Type 1551-P1-25 Microphone Base, a Type 1551-P1-30 Power Supply, a 10-foot cable (~~1551-P1-260~~), a tripod (1560-P32), and a leather carrying case (1551-P1-42).

2.2 CALIBRATION WITH THE TYPE 1552-B SOUND-LEVEL CALIBRATOR. With the Condenser Microphone System ready for operation, place the calibrator over the microphone and microphone base, as shown in Figure 3. With 2.0 volts at 400 cycles applied to the Type 1552-B Calibrator, the sound-pressure level at the condenser microphone should be 121 ±1 db. The sensitivity of the microphone will be too low for you to get a meter reading of 121 db by means of the CAL control of the Sound-Level Meter.

Therefore, set the CAL control so that the meter reads 101 db, and thereafter add 20 db to all measurements with the Type 1551-P1H System. The sensitivity of the Type 1560-P3 Ceramic Microphone normally supplied with the Sound-Level Meter is between -56 and -60 db (re 1 volt per μbar), while the sensitivity of the Type 1551-P1H Condenser Microphone System is from -70 to -76 db (re 1 volt per μbar); thus, a level adjustment of -20 db for the condenser microphone will keep the Sound-Level Meter amplifier gain almost the same for either the normal crystal microphone or the condenser microphone system.

2.3 INTERNAL CALIBRATION SYSTEM OF THE TYPES 1551-C AND -B SOUND-LEVEL METERS. The internal calibration system of the Types 1551-C and -B Sound Level Meters can be used when the Type 1551-P1H System replaces the Type 1560-P3 or Type 1560-P1 Microphone supplied with these instruments. Before using the internal system, however, set the microphone sensitivity adjustment in the Sound-Level Meter to indicate the Type 1551-P1H System level plus 20 db. i.e. If the Type 1551-P1H System level is -74 db, set the sensitivity adjustment dial to -54 db. (Refer to paragraph 4.8 of the Type 1551-C Operating Instructions or paragraph 3.8 of the Type 1551-B Operating In-

structions.) The system level of Type 1551-P1H is recorded on the curve inside the back cover of this booklet.

2.4 INTERNAL CALIBRATION SYSTEM OF THE TYPE 1551-A SOUND-LEVEL METER. Use of the internal 60-cycle calibration system of this Sound-Level Meter requires the determination of a correction factor. After the Sound-Level Meter has been set to read 101 db with the Type 1552-B Calibrator, proceed as outlined under CHECKING CALIBRATION in the Type 1551-A Sound-Level Meter Operating Instructions, but do not reset the CAL control as directed. Record the difference in meter readings obtained. Once this difference has been determined, the internal calibration system can be used as before, except that the difference in meter reading is maintained by readjustment of the CAL control instead of by maintaining equal meter readings for the two positions of the CAL switch. The difference obtained above is usually between -2 and -8 db.

2.5 CALIBRATION OF TYPE 1551-A WITHOUT TYPE 1552-B SOUND-LEVEL CALIBRATOR.

c. Calibrate the Sound-Level Meter with the 60-cycle internal calibration system (refer to paragraph 2.4), using as the difference in meter readings the decibel difference determined in

step b, minus 20 db. Since this difference is usually minus, set the CAL control so that the meter reads lower than the reference level. (The reference level on the Sound-Level Meter is obtained when the weighting switch is held in the CAL position.)

EXAMPLE:

Level of Type 9898 Microphone -58 db
Level of Type 1551-P1H System -72 db
Difference -58 db -(-72 db) -20 db = -6 db
(Therefore, the CAL control should be adjusted so that the meter reads 6 db below the reference level.)

When making measurements, remember to add 20 db to all readings to obtain true levels.

2.8 MAXIMUM LEVEL. The Altec Type 21-BR-180 Condenser Microphone used in the Type 1551-P1H System is not damaged by high sound levels, and its high-level limit is determined only by the amount of distortion permissible. At high sound levels, the motion of the diaphragm is great enough to cause nonlinearity of the output voltage with respect to the input sound pressure. Distortion from this effect is generally less than one percent at levels up to 150 db, increasing to about 10 percent at 170 db. When the Sound-Level Meter is adjusted for the Type 1551-P1H System as outlined in paragraph 2.2, 2.3, 2.4, or 2.5, sound levels up to 170 db, can be measured with the Type 1551-C or -B Sound-

Level Meter and sound levels up to 160 db can be measured with the Type 1551-A Sound-Level Meter.

2.11.2 The use of a long cable not only requires a frequency correction, but also imposes a limit on the maximum sound-pressure level that can be accurately measured. This limit is due to the loading effect of the long cable on the small cathode-follower-type preamplifier in the microphone base. The limits imposed can be determined from the dotted curves of Figure 6. Using the example, where C equals 1375 $\mu\mu$f and T equals 9, we find that if measurements include high-level components up to 15 kc, λ equals 135,000, and the maximum sound-pressure level that can be accurately measured with the Type 1551-P1H System is 149 db. On the other hand, if the high-level components consist of moderately high frequencies (say nothing above 5 kc), the limit would be determined by λ = 9 times 5000 = 45,000, and would be 158 db. At frequencies below 1300 cycles where λ is less than 12,000, no limit is imposed by the cable.

2.13 USE WITH ANALYZERS AND RECORDERS. When noise analysis is required, or when a tape recording of the sound is desired, the analyzer or recorder is usually connected to the output of the Sound-Level Meter. There are instances, however, where it is not necessary or desirable to use the Sound-Level Meter between

the condenser microphone system and the analyzer or recorder. When sounds with components between 65 and 170 db are to be measured, the output of the Type 1551-P1H Condenser Microphone System can be connected directly to the input of the Type 1554-A Sound and Vibration Analyzer. To make this connection, plug the cable supplied with the analyzer into the OUTPUT jack, located on the side of the power supply. In a similar manner, sounds with components between 85 and 145 db can be measured by connecting the output of the Type 1551-P1H directly to the input of the Type 1550-A Octave-Band Noise Analyzer. When levels exceeding 145 db are encountered, a 620,000-ohm resistor connected in series with the analyzer input will make the useful range of the system 110 to 170 db. Many tape recorders can be operated directly from the Type 1551-P1H Condenser Microphone System. If the input impedance of the tape recorder is 20,000 ohms or more, output can be taken at the OUTPUT jack, as for the analyzer, and the values given above apply. If the input impedance of the tape recorder is 5 megohms or more, connection can be made at the short cable labeled SOUND-LEVEL METER, and the output will be useful to 170 db.

The Type 1552-B Sound-Level Calibrator can be used to determine the level of readings obtained with an analyzer or recorder.

SPECIFICATIONS

Frequency Response: Typical frequency-response curves are given in Figure 2. Perpendicular-incidence frequency response of the microphone associated with the system is supplied separately. Figure 10 shows the corrections necessary to convert the perpendicular-incidence response to random-incidence response or to parallel-incidence response.

Calibration: The output level of the microphone system is measured against a standard microphone[1], which is calibrated periodically by primary calibration techniques[2] and by the National Bureau of Standards. The measured level of the system is tabulated on the curve sheet supplied. Calibration can be checked by means of the Type 1552-B Sound-Level Calibrator.

Dimensions: Microphone: Altec 21BR150 5/8 in. diameter, 13/32 in. long, (16.7 by 10.2 mm).

Microphone base: 3/4 in. diameter, 3 in. long, (19 by 76 mm).

Power supply: 7 in. high, 3-1/4 in. long, 7-1/2 in. wide (178 by 83 by 190 mm).

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[1]American Standard Specifications for Laboratory Standard Pressure Microphone. Z 24.8 - 1949.

[2]American Standard Method for the Pressure Calibration of Laboratory Standard Pressure Microphones. Z 24.4 - 1949.

SPECIFICATIONS (Cont.)

Net Weight: Microphone: less than 1 oz. (28 gr)
Microphone and base: 1.2 oz. (34 gr)
Power supply: 3 lb., 11 oz. (1.67 kg)
Complete system in carrying case:
7 lb., 6 oz. (3.34 kg)

PARTS LIST

		GR No.
B1	BATTERY, 1½-v Burgess No. 2 or equiv	
B2	BATTERY, 300-v Eveready No. 493 or equiv	
C1	CAPACITOR, Wax, 0.47 μf ±10%, 400 dcwv	COW-25
C3	CAPACITOR, Wax, 0.47 μf ±10%, 400 dcwv	COW-25
J1	JACK	CDSJ-820
J2	RECEPTACLE, Wall	CDMS-17
J3	SOCKET	CDMS-16
M1	METER, 0-300 μa	MEDS-65
M11	MICROPHONE (for Type 1551-P1L only), Altec 21-BR-150 or equiv	1551-P1-150
M11	MICROPHONE (for Type 1551-P1H only), Altec 21-BR-180 or equiv	1551-P1-180
PL1	PLUG	1551-2250
PL2	PLUG	CDMP-19
PL3	PLUG	1551-P1-40
R1	RESISTOR, Film, 1.33 M ±1%, 1 w	REF-75
R2	RESISTOR, Composition, 6.8 k ±5%, ½ w	REC-20BF
R3	RESISTOR, Variable composition, 1 M ±20%	POSC-18
R6	RESISTOR, Composition, 68 ohms ±10%, ½ w	REC-20BF
R7	RESISTOR, Composition, 5.6 k ±10%, ½ w	REC-20BF
S1	SWITCH	SWRW-90-2

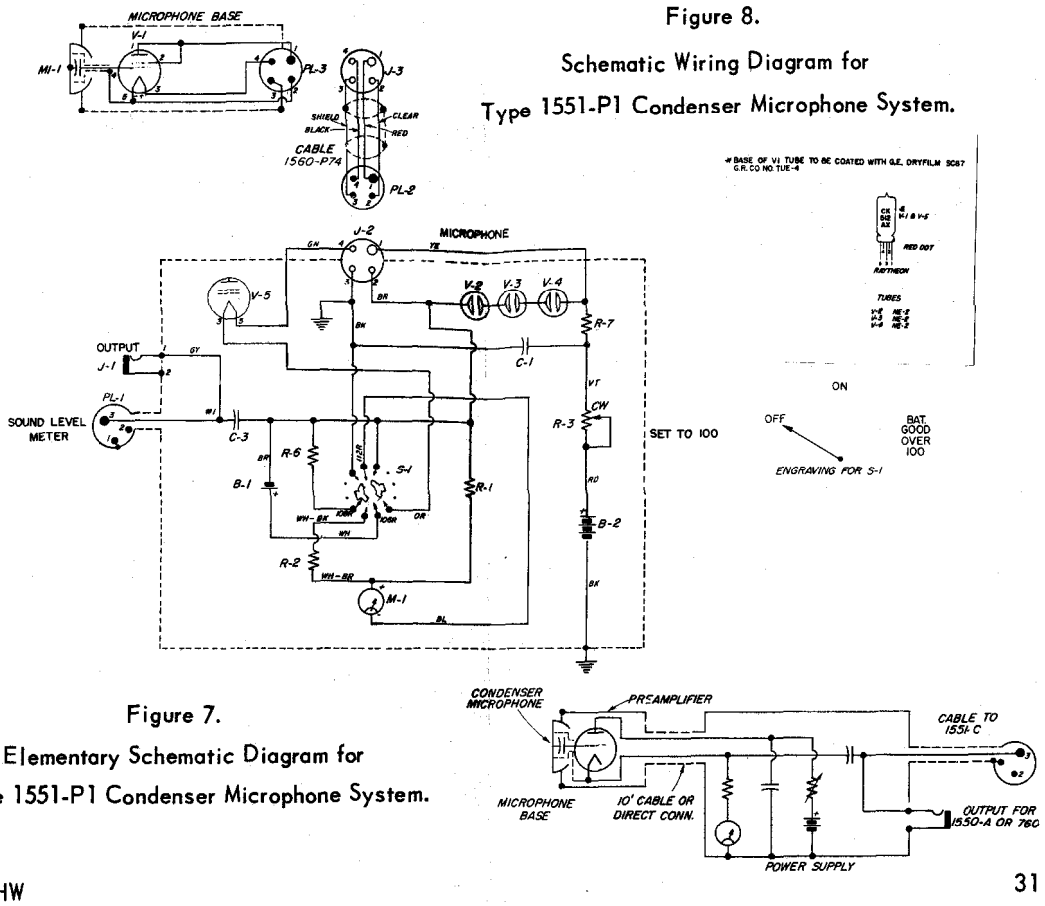

Figure 8.

Schematic Wiring Diagram for

Type 1551-P1 Condenser Microphone System.

Figure 7.

Elementary Schematic Diagram for

Type 1551-P1 Condenser Microphone System.

GR 1551-P1 Condeser Microphone System.max

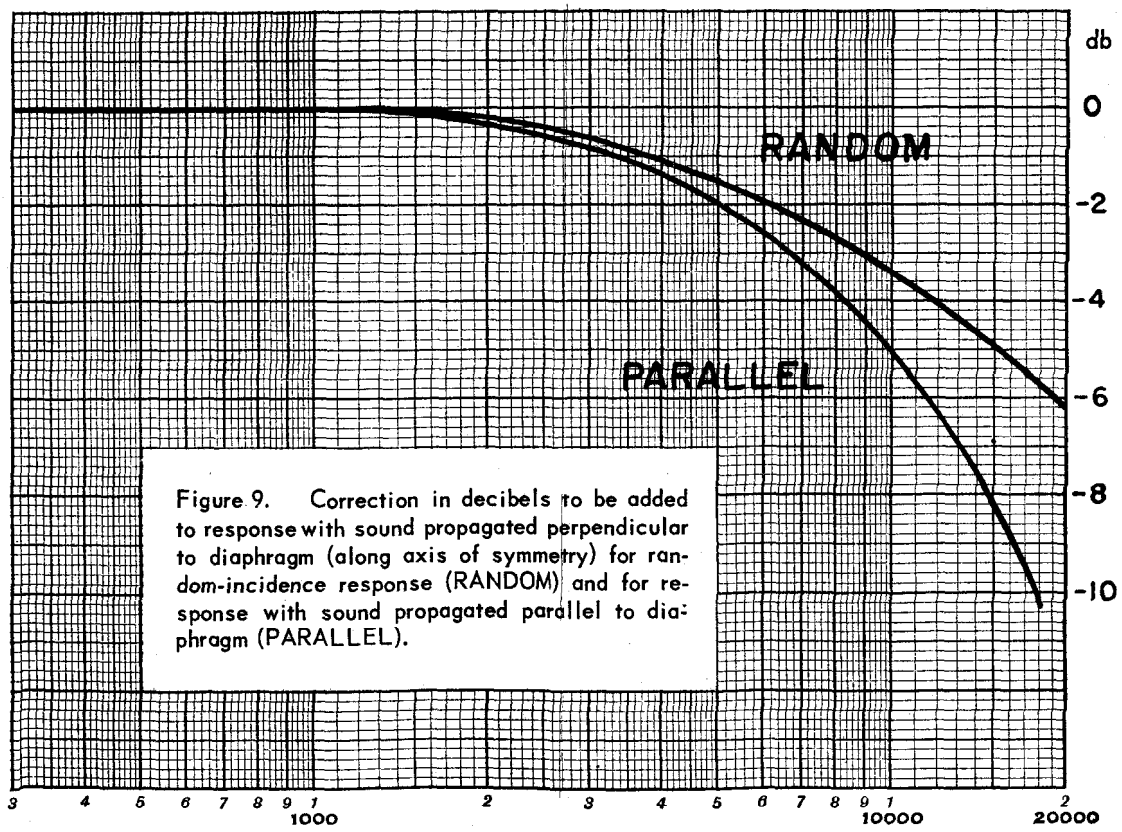

Figure 9. Correction in decibels to be added to response with sound propagated perpendicular to diaphragm (along axis of symmetry) for random-incidence response (RANDOM) and for response with sound propagated parallel to diaphragm (PARALLEL).

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