J64043A (43A) NOISE MEASURING SYSTEM
DESCRIPTION

CONTENTS

1. GENERAL

1.01 This section prepared by the Bell Telephone Laboratories, Inc., describes the equipment, the circuit and the operating features of the 43A Noise Measuring System.

1.02 The 43A is a non-portable measuring system intended primarily for measuring overall circuit noise and crosstalk volume at voice-frequencies. It can also be used with a suitable disturbing source for crosstalk coupling measurements.

1.03 The 43A System can be installed at primary and secondary testboards, repeater bays, or other desirable locations in the toll office including the 4-wire voice-frequency patching bays of the broad-band carrier systems. It is jack terminated and the jacks can be multipled to other testing positions, the panel equipment being mounted in available space elsewhere. It employs the same db meter as the 40B Transmission Measuring System and where both transmission and noise measurements are required, one meter or set of meters is used for both noise and transmission. The general features of the noise measuring system are illustrated in Fig. 1.

1.04 Message weighting is the only type available in the 43A Noise Measuring System and is obtained from the electrical characteristics of the amplifier circuit. No provision has been made for varying this characteristic.

1.05 Noise measurements differ from transmission loss measurements in that the received current which is introduced into the measuring circuit is much smaller and necessitates the use of a more sensitive amplifier. Since no sending power is employed and since no unusual terminations are required at the distant end of the circuit being tested, noise and crosstalk volume measurements can be made on a bridging basis with normal circuit terminations during the momentarily idle periods

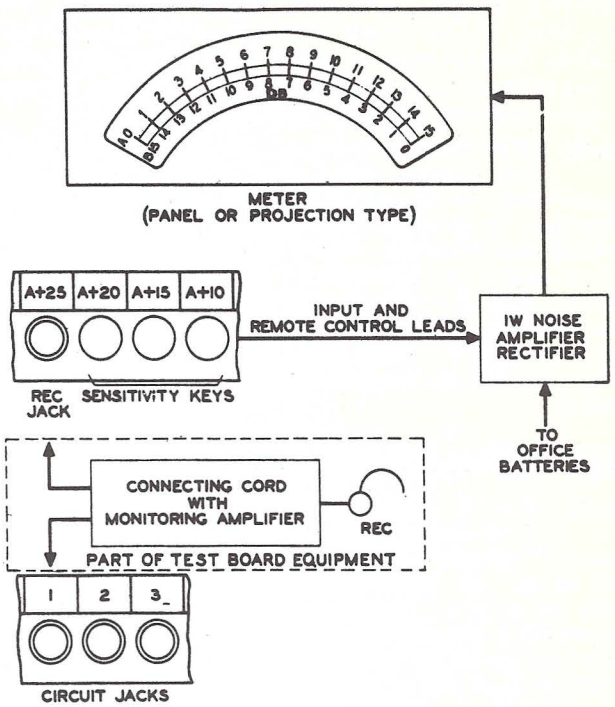

Fig. 1 - Schematic Showing the Principal Features of the 43A Noise Measuring System

while the circuits are in service. The usual 600-ohm measuring circuit is also provided for general purposes.

1.06 Use of the high impedance monitoring amplifier and receiver which are parts of the toll testboard circuits is recommended when measuring noise and crosstalk volume.

1.07 The range of measurements for the 43A system is from 10 db to 40 db above reference noise (or higher if additional losses are connected externally). When provided at voice-frequency testing bays of types C, J and K carrier systems the range is from 10 to 50 db above reference noise. The noise to ground range for primary testboard positions is the same as for metallic circuit noise.

2. DESCRIPTION OF EQUIPMENT

2.01 The 43A Noise Measuring System comprises a 1W noise amplifier-rectifier panel, a db meter located separately from the panel, and

one or more sets of receiving jacks and sensitivity controls of the measuring range. The receiving jacks and sensitivity controls can be multipled so that measurements can be made at more than one testing position using the same noise amplifier-rectifier. Busy indications are provided when necessary to warn against simultaneous use of the system. The panel, meters, and the input equipment are located in the test room in accordance with local requirements. Detailed information and recommended arrangements are described in another Section of Bell System Practices.

2.02 With the exception of the meter, connecting relays, receiving jacks, etc., the apparatus comprising the 43A Noise Measuring System is mounted on a panel which has been coded the J64001W Noise Amplifier-Rectifier. This panel is hereafter referred to as a 1W Noise Amplifier-Rectifier. While the panel may be mounted in any available 19" rack space, it is preferable for calibration purposes to locate it within visible range of an associated meter.

(A) 1W Noise Amplifier-Rectifier

2.03 The 1W Noise Amplifier-Rectifier Panel contains a vacuum tube amplifier assembled on a 7" panel for 19" rack mounting, a face view of which is shown in Fig. 2. This view shows the principal features of interest from the operating standpoint, including two screw-operated adjustable resistances "SENS ADJ" and "SCALE ADJ" which are provided for purposes of calibration, and a filament circuit jack. Three vacuum tubes are employed in the circuit, the codes being designated on the panel near the sockets. The 1W panel contains four relays, three of which can be operated to change the sensitivity or measuring range, and one to change the high input impedance to 600 ohms.

(B) Meter

2.04 The conventional and the projection type meters which are employed in the 43A Noise Measuring System were developed for transmission gain and loss measurements. When used for noise measurements, the upper, or gain scale (Scale A) is read and added to a number of db designated on the jacks, keys, or dial switch to obtain the measured result in db above reference noise. Either type meter can be used, the choice depending on the number of testing positions to be served and their locations with regard to visibility. The conventional meter can be mounted in the keyshelf of the test and control board No. 8, or on a panel or bracket for attachment to the framework of the toll testboards Nos. 5, 16, 17B and 18E. The projection type meter and projector are fastened to cable rack or superstructure in accordance with standard instructions. The meters are substantially alike in performance and can be used interchangeably. The resistance of either type meter is about 180 ohms and the direct current required for a SCALE A reading of 15 db is about 1.5 milliamperes. Additional information concerning these meters is contained in Part 4 and in other sections of practices. The meter scale ranges and sensitivity

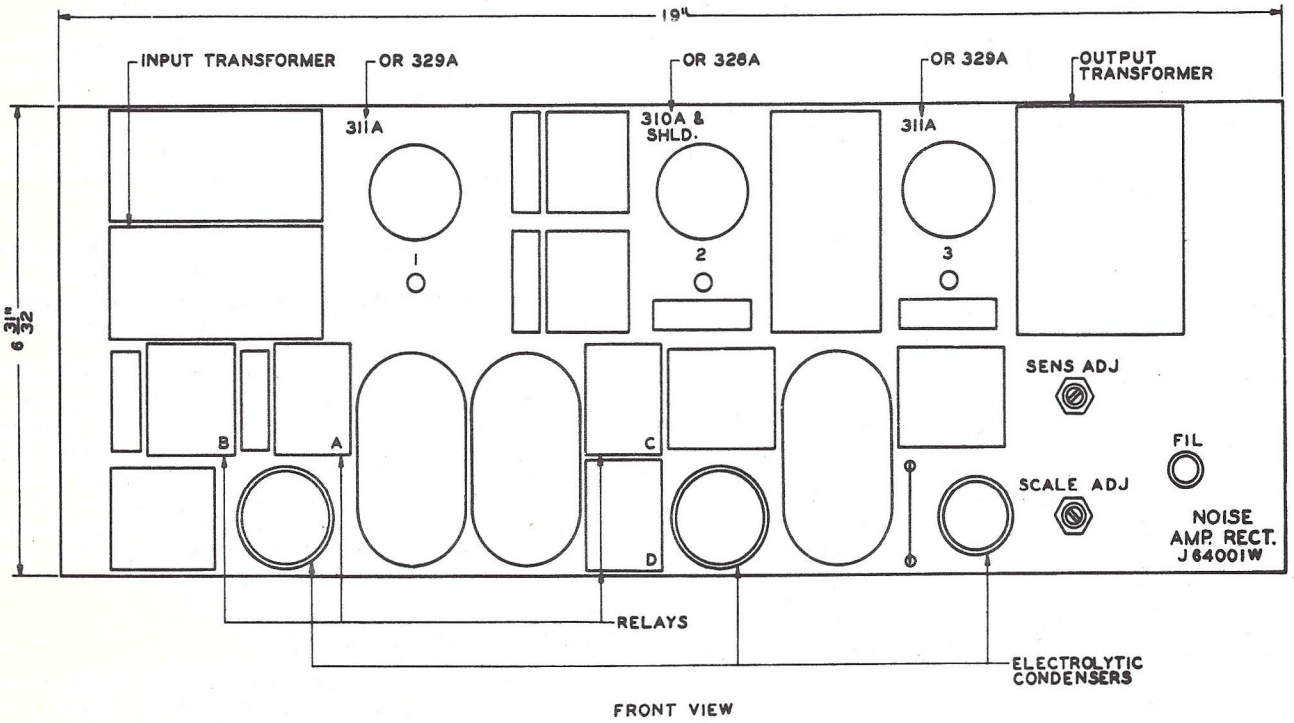

Fig. 2 - Face View of 1W Noise Amplifier-Rectifier Panel

control keys as provided at a testboard are illustrated in Fig. 1.

(C) Receiving Jacks and Sensitivity Control Equipment

2.05 The receiving jacks and the sensitivity control keys or dials provide similar functions but vary in types at the different testboards and testing positions. The arrangement pictured in Fig. 1 is representative of a 17B Toll Testboard position. At a 4-wire voice-frequency patching bay of a type C, J or K carrier system terminal a dial switch is used for sensitivity control as illustrated in Fig. 3. In both cases separate receiving jacks are provided in the noise measuring system for high impedance or bridging connections and for 600-ohm terminating measurements.

3. DESCRIPTION OF CIRCUIT

3.01 The circuit arrangements provided for the 43A Noise Measuring System are given in detail on Drawing SD-64378-01. The schematic diagram shown in Fig. 3 is a combination noise and transmission measuring arrangement employing two meters and serving a 17B Toll Testboard position and a 4-wire voice-frequency patching bay at a carrier system terminal. The monitoring arrangements are provided as parts of the testing positions in each case. Busy indications warn against simultaneous use.

3.02 Receiving circuits with associated keys, dials and relays are provided for application at toll testboards Nos. 5, 16, 17B, 18B, the No. 8 test and control board, and the 4-wire voice-frequency testing bays of J, K and C5 carrier telephone equipment. Connection of the meter and the jacks at any position to the amplifier-rectifier is made by relays which also provide for the use of the same meters for both transmission and noise measuring. These vary in detail for the different testboard or testing bay locations. Figs. 3 and 4 illustrate the general switching method and the principal operating features, which are substantially the same at all testing positions, except for the noise-to-ground feature.

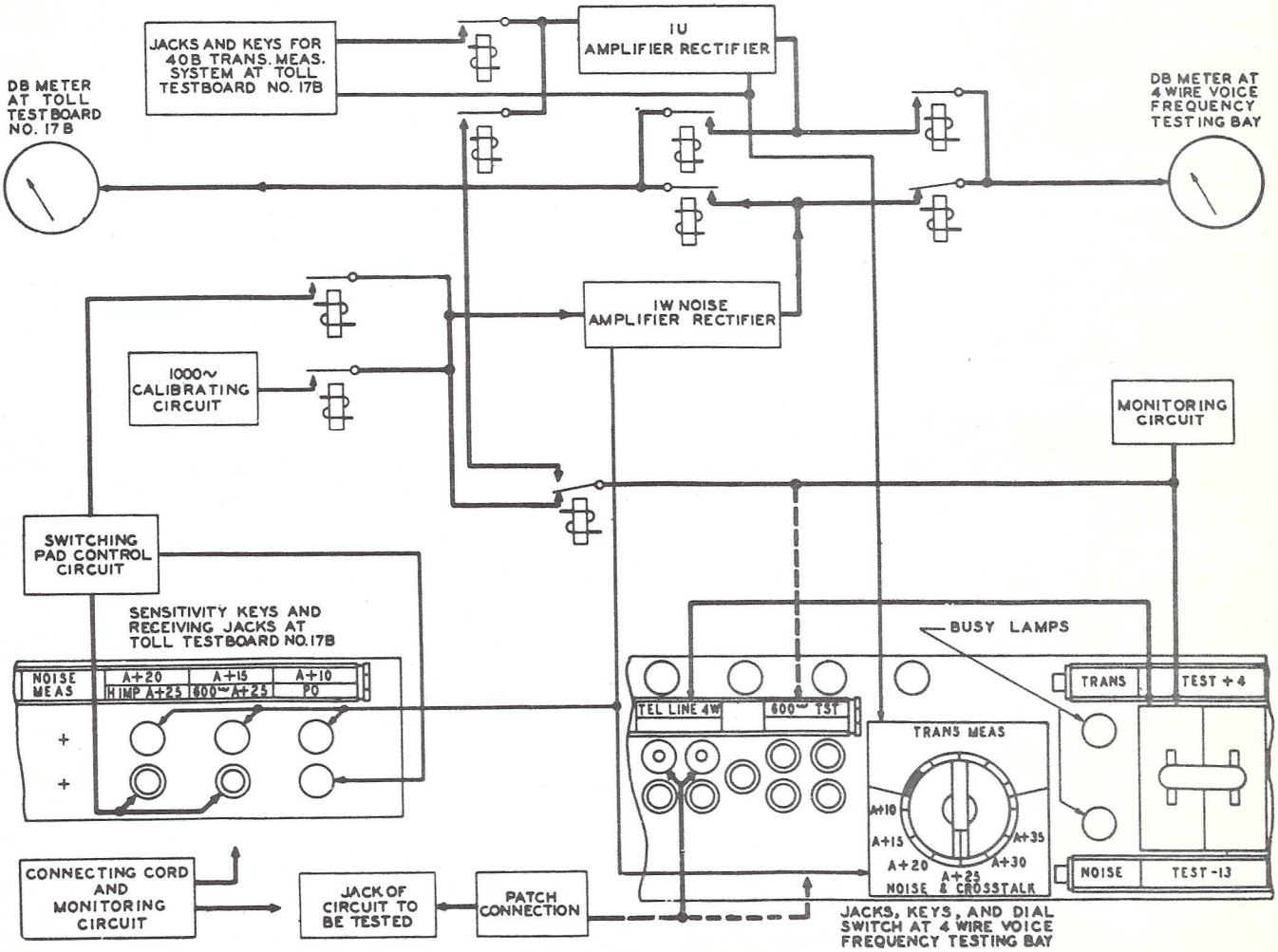

Fig. 3 - Schematic Showing Typical Connecting Relay Arrangement for Either Noise or Transmission Measurements at Two Separated Points

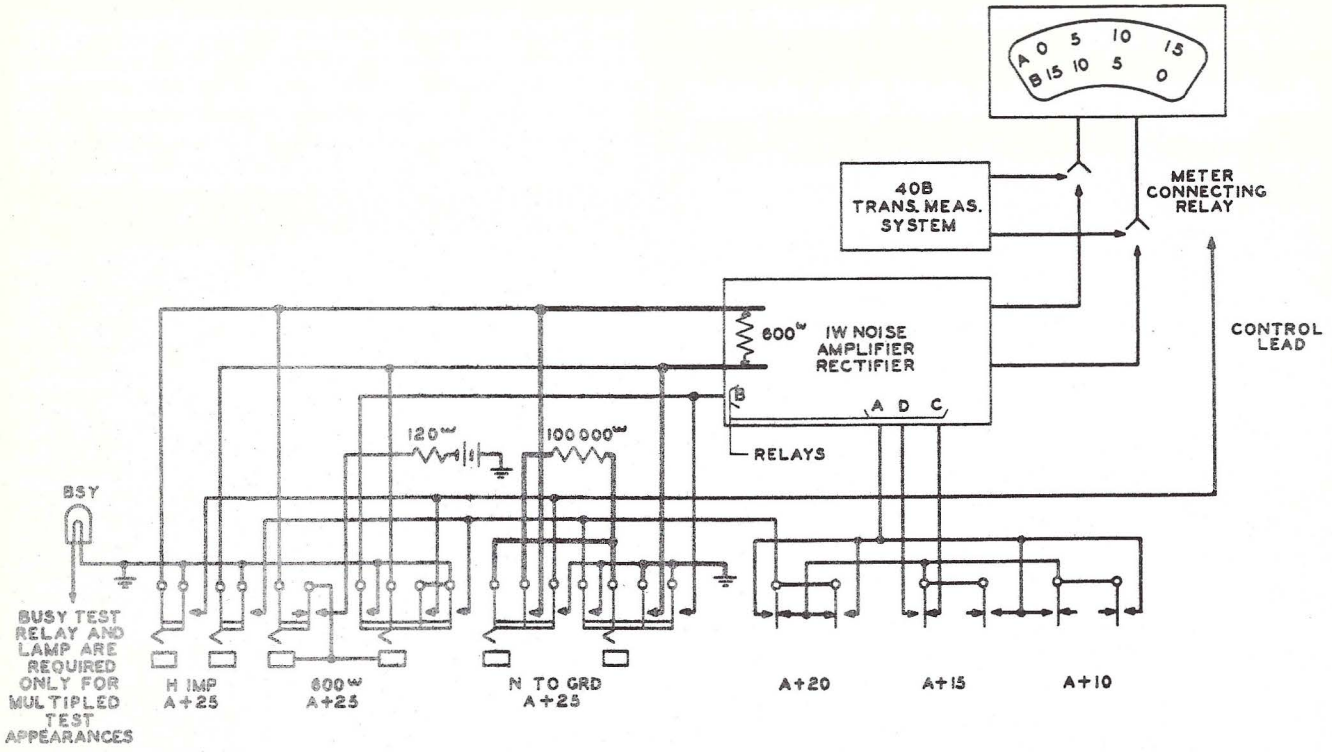

Fig. 4 - Schematic Circuit Showing Noise-to-Ground Measuring Feature which would be furnished at No. 5 Primary Testboard Position

3.03 Noise-to-ground measurements involve an additional set of measuring jacks and are provided only at primary testboards. For a noise-to-ground measurement the two line wires are shorted and connected to ground through a 100,000-ohm resistance and in series with the receiving terminating 600-ohm resistance of the noise measuring system as shown in Fig. 4. The result is indicated in db above reference noise to ground. The range is from 10 to 40 db above 10^{-12} watts.

3.04 The circuit details of the 1W Noise Amplifier-Rectifier are shown on Drawing SD-95102-01, a schematic of which is shown in Fig. 5. The circuit includes principally a three-tube amplifier, with frequency weighting obtained from characteristics of interstage coupling and a varistor type rectifier.

3.05 Since the received noise current usually includes components which cause varying amounts of transmission impairment, a frequency

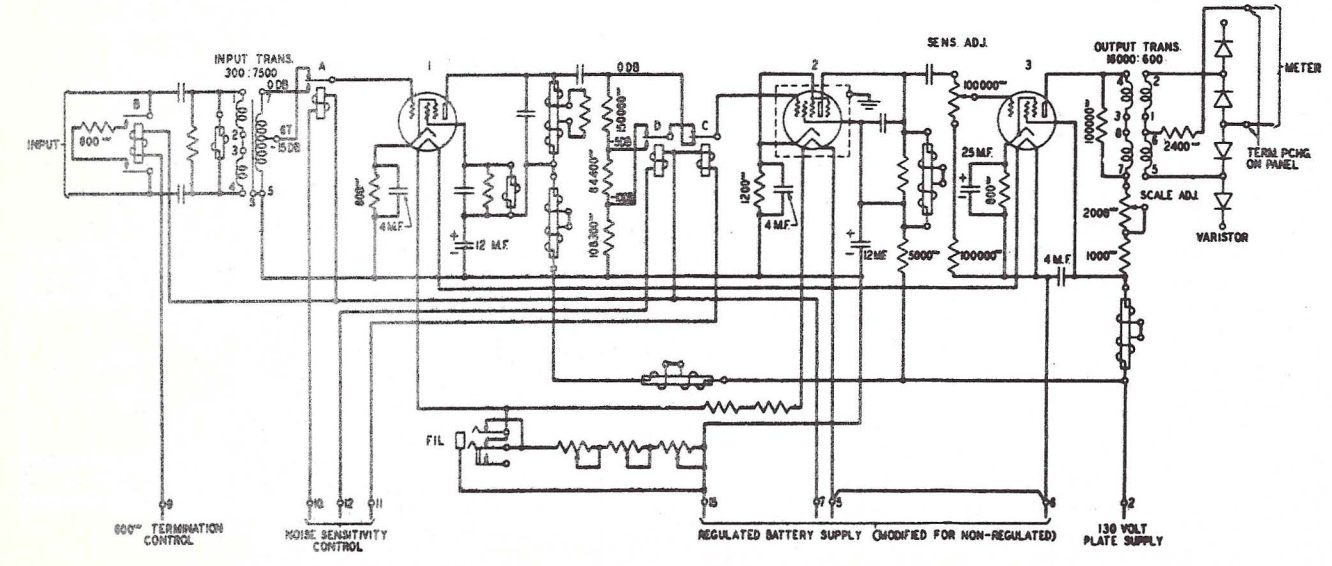

Fig. 5 - Schematic Circuit of Noise Amplifier-Rectifier

discrimination is provided in the circuit of the amplifier to reduce the amplifier gain at frequencies above and below about 1000 cycles as described in Part 4. The amplified current is then rectified by a varistor and supplied to the d-c meter. The rectification characteristic is between square law and linear. While the meter scale with uniform db divisions as shown in Fig. 1 is intended primarily for transmission measurements and is based on a linear rectification characteristic the results are substantially correct for noise measurements over a good part of the scale range. This, also is described in greater detail in Part 4.

3.06 The B relay, when operated, provides a 600-ohm termination for the line under test and is controlled by the measuring jack. When the measuring circuit is operated on a high impedance or bridging basis, the B relay is not operated and the circuit at the point of test normally includes a low impedance termination.

3.07 The sensitivity or gain of the amplifier is adjustable by means of relays in 5 steps of 5 db so that the total measuring range, including the meter scale covers from 10 db to 50 db above reference noise. Only 10 to 40 db of this range is made available at testboards. Losses of from 0 to 25 db from maximum amplifier gain are introduced by the A, C and D relays as indicated in Fig. 5 and change the sensitivity in accordance with the following table.

Relays Operated	db Correction to be Added to Meter Scale A	Measuring Range Covered by Meter Scale in db Above Reference Noise
None	35	35 - 50
D Only	30	30 - 45
C Only	25	25 - 40
A Only	20	20 - 35
A and D	15	15 - 30
A and C	10	10 - 25

3.08 The sensitivity and measuring range of the circuit is based on an adjustment of the amplifier gain so that with a specified input power the desired meter indications are obtained. The gain adjustment is made by means of the SENS ADJ potentiometer and the adjustments for the meter scale by means of the SCALE ADJ resistance on the 1W panel. The input power used is 40 db below 1 MW at a frequency of 1000 cycles per second (50 db above 1 micro-microwatt). The frequency of greatest sensitivity is normally closer to 1050 cycles as given later. Sensitivity adjustments for meter scale readings of 10 db and 5 db are made with the A10 or the A5 keys operated. The circuit features are shown in schematic form in Fig. 6.

4. PERFORMANCE

4.01 The 43A System measures noise and cross-talk volume on either a 600-ohm or a high impedance basis in the range between 10 db and 40 db above reference noise (50 db at 4-wire voice-frequency bays). The range is adjustable in 5 db steps. When used on a high impedance basis the bridging impedance is about 6000 ohms and the loss introduced on a 600-ohm circuit being tested is about .4 db. The electrical characteristics of the circuit with respect to addition of frequencies and rectification are similar to those of the 2A or 2B Noise Measuring Set when used for line measurements. The ballistic characteristics of the meters used in the 43A System are so close to those of the meter in the 2B set that comparable results are obtained with the two arrangements when used in accordance with instructions given in Part 5.

4.02 All measurements are given in terms of a decibel scale. The reference point or zero of this scale is the same for both metallic-circuit noise and noise-to-ground, and is 10^{-12} watt (one micro-microwatt or 90 db below 1 milliwatt) of 1000-cycle power. When the circuit is terminated by the 600-ohm resistance in the measuring circuit, the 10^{-12} watt is

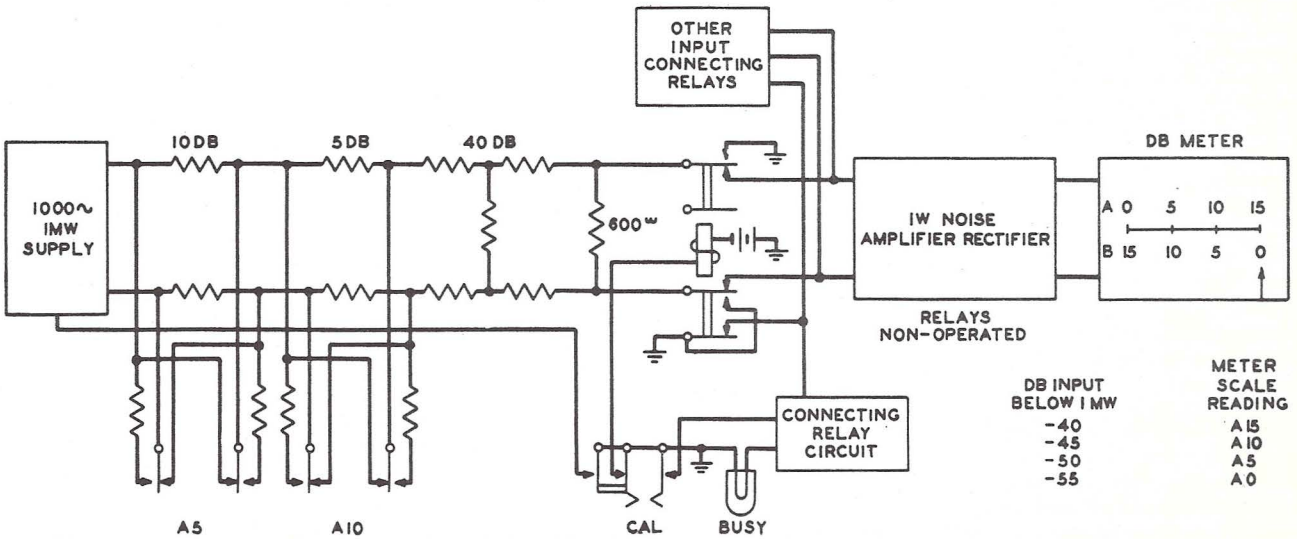

Fig. 6 - Schematic of Calibrating Circuit

considered to be dissipated in the terminating resistance. When "bridged" on a circuit, the 10^{-12} watt is considered to be dissipated in the circuit across which the measuring circuit is bridged. This is normally about 600 ohms. For circuits with materially different impedances, a correction should be made as described in Part 5. When noise-to-ground measurements are made, the 10^{-12} watt is considered to be dissipated in the 600-ohm input of the measuring circuit, which is connected in series with 100,000 ohms.

4.03 The frequency weighting characteristic of the measuring system in comparison with the design objectives is shown in Fig. 7.

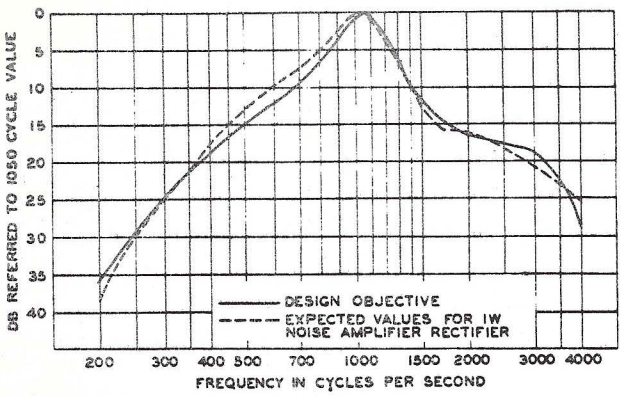

Fig. 7 - Frequency Weighting Characteristic

4.04 The solid curve in Fig. 7 has been adopted as a design objective by the Joint Subcommittee on Development and Research of the Edison Electric Institute and Bell Telephone System. This weighting is used for all measurements of noise on message telephone circuits (those circuits used for ordinary telephone conversations, as distinguished from program circuits, v.f. telegraph, etc.) except those made at subscriber telephone receivers. It takes account of the relative interfering effects of different noise frequencies in a reference telephone receiver and also of the distortion in propagating the noise from the point of measurement on the telephone line to the telephone receiver. The circuit assumed in ascertaining this distortion was a representative central office cord circuit, subscriber loop and telephone set. Since most of this distortion occurs in the telephone set a single weighting may be used for measurements at any point in the circuit except at the receiver itself. For measuring noise-to-ground which acts on unbalances within telephone sets, a different weighting would theoretically be desirable but this is not warranted in practice.

4.05 The amplifier contains three vacuum tubes which operate from the usual repeater supply. While not a negative feedback amplifier, its amplification is sufficiently stable that a periodic calibration is adequate. The gain variation at 1000 cycles is about .1 db per volt change of plate voltage.

4.06 The readings should ordinarily be practically proportionate to input, the error with different sensitivity settings being normally well under .5 db, and the error due to using various points on the meter scale being normally under .5 db in a 15 db range except for noises of extreme wave shape and except for measurements at extreme temperatures.

5. OPERATING FEATURES

5.01 The 43A Noise Measuring System is normally provided for operation in the same general manner as an ordinary voltmeter. The battery supply is normally connected so that the heater type tubes are stable in performance. The general procedure consists in patching the input circuit to a circuit to be tested, usually on a bridging basis, adjusting the measuring range to obtain a scale indication by means of sensitivity keys or a dial switch. For measurements on a 600-ohm terminating basis or for noise-to-ground measurements the patch is made to a separate set of receiving jacks. The result is indicated in db above reference noise. Working limits for circuits to be tested usually take into account the normal circuit level at the point of test, otherwise corrections must be made to the measurements. The normal use of the noise measuring system is for measuring overall circuit noise and crosstalk volume at voice-frequencies. As described later the arrangements can also be used for crosstalk coupling measurements.

5.02 Busy indications must be observed when more than one testing position is equipped, or when the meter is used jointly with a transmission measuring system. In some locations the projector serves as a busy indication. In others, a lamp signal or a sleeve circuit test must be observed, before patching into the measuring circuit jacks. Where switching pads are provided, normally they will be connected in the circuits during the tests. A "pad out" key is provided at the measuring positions involved.

5.03 Monitoring arrangements which are normally part of the testing bay equipment are used during noise measurements. The monitoring should be on a high impedance or bridging basis in order to avoid introducing losses in the circuit. At secondary testboard positions a monitoring circuit is provided in the test or connecting cord when the keys are in specified positions. At these positions the circuits usually are suitably terminated so that measurements can be made on a high impedance basis during momentarily idle periods while they are in service. It is undesirable, of course, to attempt noise measurements while a circuit is being used for speech transmission, as the speech current would probably overload the measuring system.

5.04 Some measurements should be made during periods of relatively heavy traffic load at times when the circuit under measurement is momentarily idle. The testboard attendant should monitor while the measurement is being made to identify the type of disturbance. Monitoring aids in determining the type or character of a noise. For example, in making noise and crosstalk volume measurements it permits distinguishing between noise and crosstalk. It is an aid in locating the source of a noise by means of its tonal character. In other words, Morse thump can be distinguished from hum. It should be noted that the volume of noise as heard in the monitoring receiver is about constant because the monitoring circuit is in no way associated with the measuring amplifier. The volume or character of the noise may not be the same as would be heard in a telephone set receiver, since the monitoring receiver is connected at the output of an amplifier the gain of which has been adjusted for local conditions. The monitoring volume should be loud enough to permit of easy listening in a fairly noisy room.

(A) General Precautions While Measuring

5.05 The measuring circuit has been connected to the jacks at the testboards so that the largest amount of noise will be measured directly without changing the sensitivity, it being necessary to operate a sensitivity key when a smaller amount of noise is to be measured. The sensitivity keys should be released when a measurement is completed in order to minimize the chance of overloading the meter when ringing power or speech is received. In any case, if the circuit being measured should become busy, the patching cord plug should be removed from the receiving jack.

5.06 For noises which are not steady the method of reading the meter deflection will depend to some extent on the kind of noise being measured In reading rapidly varying noises the meter may be more easily and accurately read if the meter deflection is kept small most of the time. In reading comparatively steady noises of very peaked wave shape it may sometimes be found that a change of 5 db in the sensitivity produces less than 5 db change in the meter reading; in these cases, readings made at the middle of the meter scale are more nearly accurate.

(B) Correction Data

5.07 Consideration should, of course, be given to the transmission level at which a noise measurement is made. A measurement made at one transmission level (e.g., at the output of a repeater) may be referred to another transmission level (e.g., at the receiving toll switchboard) by directly adding to (or subtracting from) the measured noise the difference in level between the two points. Measurements can be made at the testboard, the test and control board or the drop side of repeating coils of voice-frequency circuits or on the drop side of carrier terminal equipment of carrier circuits or at the toll switchboard. Unless otherwise covered in instructions all overall circuit measurements should be corrected to the toll switchboard level. If measurements are made at a point in the circuit away from the toll switchboard where there is any loss between this point and the toll switchboard, the readings will be higher than would be obtained at the switchboard by the amount of this loss. In these cases it will be necessary to subtract this loss from the actual reading in order to obtain the value which would be read at the switchboard.

5.08 Impedance corrections must be considered when measuring with a high impedance receiving circuit at points where the impedance differs from 600 ohms. These corrections are covered in sections of the E series of Bell System Practices, a few of which are given in the following table:

Impedance Across Which Measuring System is Bridged	Subtract from Noise Reading
600 ohms in series with 1 mf.	0 db
1200 ohms in series with .5 mf.	2.5 db
2000 ohms (172B Relay)	4 db

5.09 Reflection loss corrections are required when measuring with the 600-ohm receiving circuit on a circuit, the impedance of which differs materially from 600 ohms. The correction should be added to the noise reading to obtain the noise which the circuit would deliver to an impedance equalling its own. The following table summarizes these:

Circuit Impedance	Add to Noise Reading
1200 ohms	.5 db
1600 ohms	1.0 db
2000 ohms	1.5 db

5.10 When measuring crosstalk volume an appreciable part of the reading on the meter may be contributed by noise on the circuit under test. Allowance for this may be made by making a reading when the crosstalk is absent (as determined by monitoring), in addition to the reading when both crosstalk and noise are present, and subtracting from the latter a correction obtained from the following table:

db Difference Between Reading on Crosstalk and Noise and Reading on Noise Alone	db Correction (Subtract from Reading on Crosstalk and Noise to Give Crosstalk Volume in db Above Reference Noise)
1	5
2	4
3	3
4-5	2
6-8	1
Over 8	0

(C) Crosstalk Coupling Tests

5.11 Crosstalk coupling measurements using an appropriate source as a disturbing element may be made between two circuits. In the case of carrier systems, however, this type of measurement is only applicable between channels having the same frequency allocation. Crosstalk between channels of dissimilar frequency allocation should be measured as noise. The general procedure provides for connecting a disturbing source of a predetermined magnitude to the disturbing circuit. The crosstalk volume in the disturbed circuit is measured and the result subtracted from the input to the disturbing circuit to obtain the crosstalk coupling. This is expressed as a db loss.

(D) Measuring Procedures

5.12 Corrections to measurements should be made when necessary to cover the effects of impedances, terminations, and circuit levels as covered above.

Note: These procedures assume the jack and key arrangements normally provided at a testboard position. A variation of this procedure employing a dial switch is given in a section of this series of Practices describing the monitoring and testing arrangements at 4-wire voice-frequency testing bays.

5.13 Procedure for Measuring Metallic Circuit Noise

(1) During a momentarily idle period patch the circuit to the measuring system NOISE H IMP A + 25 jacks for bridging measurements or to the NOISE 600^{W} A + 25 jacks, when it is desired to use the 600-ohm termination in the 43A System. In this latter case the circuit will be seized from traffic as soon as it is connected.

CAUTION: If, while making bridging measurements the circuit becomes busy, the cord plug should be removed from the measuring jack to minimize the effect of speech current on the meter needle.

(2) If the meter needle indications are not in the range from 5 to 15 db on Scale A, operate the sensitivity keys in 5 db steps until an approximately average reading does fall in this range.

(3) For steady noise note the scale reading representing the average indication. An occasional swing beyond this average may be disregarded. For variable noise or crosstalk, adjust the sensitivity to result in as high a scale reading as possible yet with only an occasional swing reaching full scale (15 db on the A scale). For combinations of noise and crosstalk follow the needle deflections throughout the range of variation and mentally determine the average. For rapid variations follow the peak fluctuations of the meter needle with the eye for a period of 10 to 15 seconds. Locate a point on the scale which is representative of the average of the peaks of the needle swings.

(4) Note the setting of the sensitivity control key and add to it the meter scale indication as determined above in (3). This sum is the measured amount of noise.

5.14 Procedure for Measuring Noise to Ground

Note: Noise to ground measurements with the 43A System are made at the primary test position and must be made at a time when the circuit can be removed from service.

(1) Patch the circuit to be measured to the N TO GRD A + 25 jacks.

(2) If the meter indications are not in the range from 5 to 15 db on Scale A, operate the sensitivity keys in 5 db steps to increase the sensitivity until an approximately average reading does fall in this range. The method of reading the meter is described in 5.13.

(3) Note the setting of the sensitivity control key and add to it the meter scale indication in (2). The sum is the measured result in db above reference noise to ground.

5.15 Procedure for Making Crosstalk Coupling Measurements

Note: These are made using a crosstalk testing tone as the disturbing element. In the case of carrier systems this type of measurement is only applicable between channels having the same frequency allocation. The crosstalk testing tone supplied to the disturbing circuit at a zero level point should be adjusted to about 1 milliwatt or 90 db above reference noise. Similarly when

supplied at a -13 db level point it should be adjusted to about 77 db above reference noise. In order to determine this magnitude of noise it is necessary to provide an attenuator between the source and the measuring circuit. It is assumed in the following paragraphs that proper terminations for crosstalk measurements will be provided on the circuits in accordance with standard information.

Adjustment of Testing Tone

Note: The following procedure assumes that a 43A System is to be used to determine the magnitude of the testing tone to be supplied to the disturbing circuit for either near-end or far-end measurements. For far-end measurements where the 43A System is not available at the distant end the same general method may be followed with other standard testing equipment, in adjusting the source to supply an output testing tone equivalent to 1 MW at a zero level point.

(1) Patch the crosstalk testing tone through an attenuator to the 600^{W} NOISE A + 25 jacks.

(2) Adjust the output of the testing tone by means of the attenuator to full scale on the measuring system. If the output is exactly 1 MW the attenuator setting is 50 db.

(3) Remove the plug from the measuring jack (600^{W} NOISE A + 25) and decrease the loss of the attenuator by 50 db (37 db for tests at a -13 db level point).

(4) Connect the crosstalk testing tone and any remaining loss in the attenuator to the specified circuit jacks of the disturbing circuit. For this condition, the noise level on the disturbing circuit is 1 MW or 90 db above reference noise, and at a -13 db level point, the noise level on the disturbing circuit is 77 db above reference noise.

Measurement of Crosstalk Coupling

Note: This procedure assumes that the testing tone has been supplied to the circuit at either the near-end or the far-end in accordance with the above paragraph and that the circuits have been properly terminated.

(1) At the terminal where the crosstalk coupling is to be measured, patch the 600^{W} NOISE A + 25 jacks to the specified circuit jack of the "disturbed" circuit.

(2) Adjust the sensitivity of the measuring system to the setting which results in approximately midscale meter deflection.

(3) Note the sensitivity setting and add to the meter indication to obtain the total magnitude of received noise and crosstalk volume at this point.

(4) The difference between the measurements on the disturbing circuit at the sending end (90 db or 77 db) and the measurement on the disturbed circuit at the receiving end is the crosstalk coupling. Under favorable noise conditions, values of crosstalk coupling up to 80 db can be measured. (Minimum measurable noise 10 db)

Note: When noise in the circuit is appreciable, it will be necessary to measure the noise separately and correct the readings in the manner covered in another section of Practices.

6. MAINTENANCE

6.01 Maintenance of the 43A Noise Measuring System consists primarily in verifying that the calibration of the 1W Noise Amplifier-Rectifier has not changed, and that the vacuum tubes are satisfactory.

(A) Calibration

6.02 The calibration of the System should be checked periodically by measuring an input 1000-cycle testing power which is 40 db below 1 milliwatt, (50 db above 10^{-12} watts). This input power is provided near the 1W panel for calibration purposes and is the maximum received power that can be measured in the noise range of the system. The meter scale adjustment should be checked at the same time by noting the effect of additional loss pads of 5 db and 10 db.

6.03 Procedure:

(1) At a time when the measuring System is not in use operate the CAL key which is located near the 1W panel.

(2) Readjust when necessary the SENS ADJ resistance in the 1W panel until the meter indication is 15 db on the A scale. If the range of the resistance is not sufficient, the vacuum tubes should be changed. If this does not result in a satisfactory adjustment the circuit should be investigated for trouble.

(3) Operate one at a time the A10 and the A5 keys noting the meter indications. If readings of 10 db and 5 db respectively are not obtained on the A scale and if no other trouble is indicated change the SCALE ADJ resistance on the 1W panel until a reading of 5 db is obtained with A5 operated. Need for a large change is usually an indication of trouble such as a defective vacuum tube. If the resistance is changed, (2) and (3) should be repeated until both readings are satisfactory.

(4) If (2) and (3) do not result in correct values to within ± .2 db the circuit should be investigated for trouble.

(5) Restore the A5, A10 and CAL keys when satisfactory adjustments have been made.

(B) Frequency Weighting Checking Test

6.04 Occasionally it is desirable to check the frequency characteristic of the 1W Noise Amplifier-Rectifier. This can be done when a multi-frequency oscillator is available together with suitable loss pads in the sending circuit such as provided at a 40B Transmission Measuring System multi-frequency testing position.

6.05 Procedure:

(1) At a time when the noise measuring system is idle, patch from the source of testing power to the 600-ohm NOISE A + 25 jacks of the 43A System.

(2) Adjust the oscillator frequency to about 1050 cycles and the sending power in the input to the noise measuring system to 50 db below 1 milliwatt in order to obtain a suitable meter scale reading.

(3) Vary the frequency from slightly below to slightly above 1050 cycles and determine the frequency giving the greatest reading on the A scale of the meter. This should be between 950 and 1100 cycles.

(4) Adjust the SENS ADJ resistance to give 5 db or 15 db on the A scale of the meter. This will be 15 db at a 4-wire voice-frequency testing bay of types C, J and K carrier systems, and 5 db at testboards.

(5) Vary the oscillator frequency to other values and compare the results with the curves shown in Fig. 7. At 400 cycles the meter indication should be 7.8 ± 1.5 db with a sensitivity setting of A + 15. At 2000 cycles the meter indication should be 6.0 ± 1.5 db with a sensitivity setting of A + 15.

(6) Remove the patch from the receiving jacks and recalibrate the amplifier at 1000 cycles as given in Paragraph 6.03.

(C) Check of Sensitivity Control

6.06 When it is desired to check the 5 db steps of the sensitivity control keys or dials for correct operation the following procedure can be used in connection with the procedure given in Paragraph 6.04.

6.07 Procedure:

(1) With the sending power adjusted to give a meter deflection at 5 db on Scale A, increase the sensitivity by operating the sensitivity key or dial in steps of 5 db. This should result in corresponding 5 db changes of the meter scale reading.

(2) Repeat with other magnitudes of sending power until each setting of the sensitivity control has been checked against a 5 db change of meter scale reading.

(3) Unless each step results in a 5 db change of reading, accurate to ± .3 db the circuit should be investigated for trouble.

Note: The sending power adjustment can be made by changing the frequency control to a setting below 1000 cycles of the output control, or with loss pads. The oscillator output should be free from excessive harmonics if frequencies below 1050 cycles are used.

(4) Restore the keys to normal and remove the patch between the testing power jacks and the receiving jacks.

(D) Trouble Testing

6.08 When trouble such as instability or non-uniformity of sensitivity steps with the meter scale is experienced while making any of the tests described above the circuit should be investigated for trouble. Circuit details are given on the drawings listed below. Vacuum tubes which are suitable for use in other amplifiers are satisfactory for use in the 1W Noise Amplifier-Rectifier provided the SENS ADJ resistance has adequate range for calibration purposes. Failure of circuit elements such as electrolytic condensers or the varistor may occasionally cause difficulty in meeting the calibration test.

6.09 Replacement of vacuum tubes in the 1W Noise Amplifier-Rectifier can be made in accordance with Fig. 2, as marked on the panel or as given in the following table:

Vacuum Tube Socket	Regulated Filament Battery Offices	Unregulated Filament Battery Offices
1	311A	329A
2	310A	328A
3	311A	329A

7. LIST OF DRAWINGS (Not attached)

SD-95102-01 - 1W Noise Amplifier-Rectifier Circuit

SD-64378-01 - Noise and Crosstalk Volume Measuring Circuit

SD-64355-01 - Transmission Measuring Circuit