TRANSMISSION AND NOISE MEASURING SYSTEM—J94005 (SD-95900-01)

GENERAL DESCRIPTION

BARNETT, R. G. 0
GHEEN, R. F. 0
KINSLEY, D. J. 0
KLEIN, P. N. 0
MOORE, H. T. 0
MUELLER, A. 0
MURPHY, E. 0
SHARFF, H. C. 0
THOMAS, R. 0

CONTENTS

1. GENERAL

1.01 This section describes the combined Transmission and Noise Measuring System per J94005 (SD-95900-01) provided at testboards, circuit patch bays, repeater bays, carrier terminal bays, switching maintenance centers, and other locations.

1.02 This section is reissued to include circuit changes in the measuring arrangements and in the J64001U amplifier-rectifier and the addition of Switched Maintenance Access System (SMAS) circuits. Arrows normally used to indicate changes have been omitted. This reissue does not affect Equipment Test Lists.

1.03 The system provides automatic selection of a 600-ohm, 900-ohm, or high-impedance measuring mode and includes sources of milliwatt and variable-frequency testing power, means for calibration checks at each position, and arrangements for direct measurements of gains or losses in dB and noise levels in dBrnc, without the need for correction factors.

1.04 The figures included in this section are for the purpose of illustrating the testing arrangements. Table A of SD-95900-01 specifies the drawing figures and options which can be combined to form a measuring system. The

drawing also includes application schematic drawings showing typical combinations of figures and options.

1.05 Figure 1 shows the basic layout of circuits for the combined transmission and noise measuring system. Most of the circuit units are mounted in one or two bays in or near the testing area. The circuit units of the transmission and noise measuring bay(s) include common equipment units used by all testboards or testing positions served by a system, and individual position equipment used by a particular testboard or testing position. Meter control circuits are also located in the bay(s) and can be used to serve the output meters of the testing area. Other circuits of the measuring system are located at each testboard or testing position bay to provide access to and control of the circuits in the transmission and noise measuring bay(s).

1.06 The sending and receiving paths of the system are connected to the sending power sources or to the receiving inputs of the amplifier-rectifiers by means of jack- or key-controlled relays. Relays for each testboard or testing position connect the measuring path to the common J64001U amplifier-rectifier (1U panel) for transmission measurements. Other relays for each testboard or testing position connect the measuring path to the common J64001W noise amplifier-rectifier (1W panel) for noise measurements. Battery cutoff relays and busy lamps are provided to prevent simultaneous use of the receiving portion of the measuring system and to indicate that the corresponding equipment is busy. The output of the 1U or of the 1W panel is extended by relays to an output meter, where the results of transmission or noise measurements can be read. Lamps are used to show when the meter circuit is busy.

1.07 The system, in conjunction with a testboard or testing bay, is arranged to measure outgoing, incoming, and two-way trunks. In some applications, measurements can also be made on station lines.

1.08 For most testboard applications, when tests are made on outgoing trunks or on the outgoing mode of two-way trunks, position test cords are connected to the test jack of the circuit under test and to the TST MEAS jack of the measuring system. The TST-101 key operated to TST inserts a fixed test pad of proper value. Tests on incoming trunks, or on the incoming mode of two-way trunks, are made after the incoming end of the trunk to be tested has been switched to a 101 test trunk by a call from a distant office. The test trunk (code 101 call) is answered and

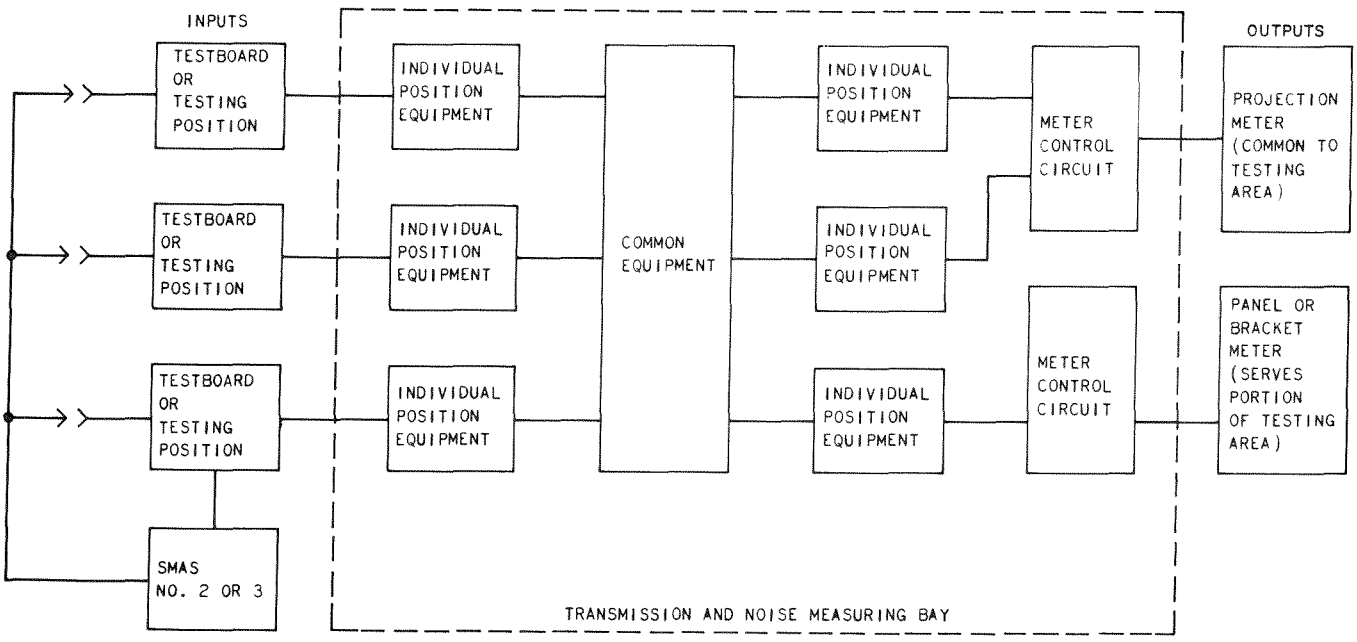


Fig. 1—Basic Layout

extended to the 101 MEAS jack by the position test cord. The TST-101 key operated to 101 inserts a fixed test pad of proper value. In some applications, the TST-101 key in its normal position is used to insert a fixed test pad of proper value for testing station lines. The test procedures for adjusting the fixed test pads, in both the sending and receiving paths, are covered in the sections of practices on the individual testboards.

1.09 In other applications, such as the 21A testboard, the fixed test pads are provided in access trunks to the switching system and in the 101-type trunks and are therefore omitted from the measuring system. Only one MEAS jack is provided in such cases and the TST-101 key is omitted.

1.10 At testboards and at some maintenance centers associated with two-wire and four-wire switching systems, the measuring system is arranged to test trunks that are measured with a 2-dB test pad (TP2). The access for test is made at the outgoing end of the trunk by using a jack in multiple with outgoing switch appearance, or by an access trunk to the switching system. Signaling (code 101) from a distant office extends the incoming end of the trunk through the switching system to an outgoing switch appearance of a 101 test trunk for measurements. During measurements, the measuring system (or access trunk) extends the actual measuring points to include the 2-dB test pad (TP2), or equivalent. The fixed test pads (TP2) are adjusted to automatically compensate for the average office wiring and equipment losses between the measuring points and the outgoing switch appearances of the trunks or of the 101 test trunks. This arrangement eliminates the need for manual corrections of the measurements. With this design arrangement, the actual measured loss (AML) of the trunk, as indicated by the measuring system, can be compared directly with the expected measured loss (EML) shown on circuit and trunk layout record cards. In other maintenance centers which have not been equipped to measure with TP2, no arrangements have been made to automatically compensate for the loss in the access paths. In such cases, corrections must be determined and, if appreciable, applied to the results of all measurements.

1.11 Switching A pads are used in the intertoll and some other trunks of many No. 4-type offices to offset the losses in high-loss toll connecting trunks. When a trunk with a switching A pad in a single pad office is connected to the measuring system of the testboard for tests, the pad loss in the incoming or outgoing end of the trunk is removed, as the measuring system provides pad simplex controls equivalent to those of a high-loss toll connecting trunk. The measuring system is arranged to replace the A pads removed from the trunk under test with A-type pads of equal value. The A-type pads are in tandem with the fixed test pads (see 1.08), so the advantage of direct and accurate measurements with the equivalent of TP2 is retained. When the A pad control keys in the measuring system are depressed, the A pad loss is transferred from the measuring system to the trunk. This arrangement permits direct check of A pad operation and direct comparison of pad values by observing the amount of change on the meter scale.

1.12 When SMAS is provided, the measuring system used at the testboard position is shared (under key control) with the Maintenance Line Control Panel (MLCP) of the SMAS.

A. Transmission Measuring Features

1.13 Transmission measurements of gains or losses are direct readings in dB, based on a transmitting test power of 1 milliwatt (0 dBm). The 1U amplifier-rectifier and the associated output meter are capable of measuring from −35 to +25 dBm at any frequency in the range from 35 to 15,000 Hz. At most testboards, however, sensitivity control keys of the measuring system limit the range to between −35 and +15 dBm. In one application, the 22A testboard, an external gain of 10 dB is used in tandem with the 1U amplifier-rectifier to increase the range to −45 dBm.

1.14 Transmission measurements can be made on a 600-ohm terminated, 900-ohm terminated, or high-impedance bridging basis. The bridging impedance is about 60,000 ohms. For testing of trunks on open-wire lines that may be subject to low-frequency induction, 600- and 900-ohm terminations with key-controlled high-pass filters may be provided. The actual impedance used for a measurement is selected automatically by the system when a measuring jack is used or a key is operated at the testing position. However, 600- and 900-ohm measurements are not combined in a single testing position. The proper termination is connected in

the receiving path of the measuring system by the operation of a relay.

1.15 The measuring accuracy of the system depends on the 1U amplifier-rectifier and the associated output meter, and is a function of the level and frequency of the signal being measured. Where the system is calibrated at −16, 0, and +7 dBm, the accuracy at these levels at 1000-Hz will be as good as that of the milliwatt supply (about ±0.05 dB), provided that adjustments are made so that the meter reads these exact values during calibration. For other frequencies at levels between −35 and +15 dBm, the accuracy is equal to or better than those shown in Table A.

TABLE A

FREQUENCY (Hz)	ACCURACY (dB)
35 to 50	±0.65
50 to 400	±0.35
400 to 4,000	±0.15
4,000 to 8,000	±0.35
8,000 to 15,000	±0.65

B. Noise Measuring Features

1.16 Noise measuring features are optional. However, they are normally provided at testboards and at other trunk testing positions.

1.17 Noise measurements are direct readings in dB above reference noise, using C-message weighting (dBrnc). The 1W noise amplifier-rectifier and the associated output meter(s) are capable of measurements in the range from 15 to 55 dBrnc. This range is used when testboards are provided with NM/A+40 keys and "extended range" sensitivity keys to meet the needs of the testing area. This range (from 15 to 55 dBrnc) is reduced to a range from 15 to 45 dBrnc when the NM/A+30 keys, and sensitivity keys without extended range, are provided.

1.18 Noise measurements can be made on a 600-ohm terminated or 900-ohm terminated basis. The actual termination mode used for measurements is selected automatically by the system when a measuring jack is used or a key is operated at the testing position. However, 600- and 900-ohm measurements are not combined in a single testing position. The proper termination for noise measurements is connected in the receiving path of the measuring system by the operation of the noise measuring key (NM/A+__). For noise calibration, a special circuit located in the bay with the 1W noise amplifier-rectifier is used to provide the termination. This termination is applied by the operation of a CAL NOISE key, located in the bay with the 1W panel, when the 1W panel is calibrated. It is also applied when the NM CAL CK key, located at each testing position, is operated to check the noise calibration from the testing position.

1.19 The noise measuring accuracy of the system depends on the 1W noise amplifier-rectifier and the associated output meter adjustments. Due to a slight nonlinearity of the meter when used with the 1W panel, noise readings are better in the 5- to 15-dB range on the A scale, the sensitivity control keys should be depressed accordingly. In this range the accuracy is equivalent to that of the 3-type noise measuring set, or about ±1 dB.

C. Meter Arrangements

1.20 Panel-, bracket-, keyshelf-, or vertically-mounted meters may be provided where multiple testing appearances in the main testing area are so closely adjacent that the meter scale can be easily read from all testing positions. Projection meters are usually provided in aisles having multiple testing appearances, such as aisles containing a large number of testboard or other testing positions. Projection meters may be provided at each end of a testboard lineup, with alternate positions using the meters at the opposite ends of the lineup. The above meters, when used in the main testing area, are called regular meters, as they are normally read during measurements at the testing positions. Panel-, bracket-, and projection-type meters may also be provided at auxiliary testing appearances located in aisles remote from the main testing area. These meters are called auxiliary meters and are used when levels must be adjusted and observed at the remote location. At the transmission and noise measuring bay, a bracket-mounted meter is normally provided for calibration of the 1W noise amplifier-rectifier in the bay. This meter is usually referred to as the noise calibration meter.

D. References

1.21 Other sections of practices describe parts of the measuring system as follows:

SECTION	TITLE
103-231-101	1U Amplifier-Rectifier
103-231-102	1W Noise Amplifier-Rectifier with C-Message Weighting
103-231-103	Projection Meter, Projector and Screen

2. CIRCUIT AND EQUIPMENT FEATURES IN THE TRANSMISSION AND NOISE MEASURING BAY(S)

2.01 The system is made up of circuit units which are wired and assembled in various combinations to meet the requirements of the testing area. The units provide measuring and calibrating features for the common equipment of the measuring system and for each testboard or testing position served by the system. The common equipment in the transmission and noise measuring bay(s) includes connection to the milliwatt supply, transmission terminations, a 1U amplifier-rectifier, noise terminations, a 1W noise amplifier-rectifier, and a noise calibration circuit. The units which are individual to the testboard or testing position served by the system include blocking capacitors, pad switching circuits, test pads, A-type pads and A pad control circuits, and various relays for access to and control of the system. The layout of the bays is such that all measuring and calibrating paths are nearly equal in length. Typical arrangements of the bays for various testing areas are shown on ED-95037-01. Other units of the system (such as jacks, keys, lamps, etc) are located in the miscellaneous jackfields or keyshelves of the testboard or testing positions. The regular and auxiliary meter circuit units in the bay(s) extend the output of the measuring system to the output meters.

3. CIRCUIT AND EQUIPMENT FEATURES OF THE MEASURING PATHS

A. General

3.01 Figure 2 shows the circuits of a 17C testboard measuring path from the MEAS jacks and from the SMAS 3 MLCP to the common measuring circuits. Figure 3 shows the circuits of a 21A testboard measuring path from the MEAS jacks and from the SMAS 2 MLCP to the common measuring circuits. Figure 4 shows the basic equipment in the measuring paths from typical testboard MEAS jacks, testing position RCV B jacks, and SMAS panels, to the common equipment. It also shows the common equipment and the basic equipment in the paths to the output meters. The circuit and equipment features are discussed in 3.02 through 3.17.

B. Test Power Supplies

3.02 The 1000-Hz, 1-mW (0 dBm) test power for each testboard position of the system is supplied by individual taps from the Milliwatt Distributing System. The individual taps are used to supply test power to the sending paths of MEAS jacks, to milliwatt jacks, and for calibration. Milliwatt jacks designated 1000 0 600 or 1000 0 900 are provided in the measuring system used at testboards for the purpose of checking the level of the milliwatt supply with an external reference meter. A CAL MW jack located in the transmission and noise measuring bay is also provided for the purpose of checking the level, with an external reference meter, of the supply used for noise calibration. A limit of 2 ohms maximum loop resistance is specified for the leads between the milliwatt sending relay in the transmission and noise measuring bay and the milliwatt jack in the testing position. Failure to meet this limit will compromise the accuracy of measurements. The milliwatt jacks can also be used for applying tone to external circuits or meters but are not used for connections to trunks under test, as this would bypass the test pads and cause a measurement error. At positions other than testboards, the test power supply is provided in accordance with other drawings.

3.03 In testboard applications of this circuit, a feature is provided for reducing the test power level by 10 dB. This feature is only used when it is necessary to apply test power for an extended period of time. While the SEND key is in its operated position, the DOWN 10DB key is momentarily depressed. The DOWN 10DB lamp lights to indicate that a 10-dB pad has been inserted in the milliwatt supply to the send circuit. Release of the SEND key removes the pad and extinguishes the DOWN 10DB lamp.

3.04 Applications of −16 and +7 dB, 1000-Hz tone to a circuit via SMAS is accomplished by operation of keys in the SMAS MLCP. In SMAS 2A, these are designated SEND −16 MW and SEND +7 MW. In SMAS 3, one key designated SEND is provided which automatically transmits the proper level depending on the testing mode selected by other keys.

3.05 Variable frequency (VF) test power for the system is not usually provided at each position, but is so located that the test power can be reached by test cords from adjacent positions. When a testboard position or bay is arranged for VF sending, the KS-19260 oscillator, arranged for either 600- or 900-ohm impedance, is used to supply an OSC jack. When the OSC jack is patched to an AUX XMT or VF IN jack and the CAL key is operated, the test power is extended to the measuring system for oscillator level adjustment. With the CAL key released, the test power is extended to the sending paths of MEAS jacks by the operation of the SEND or SEND-RCV key to SEND. The oscillator is described in another section of practices.

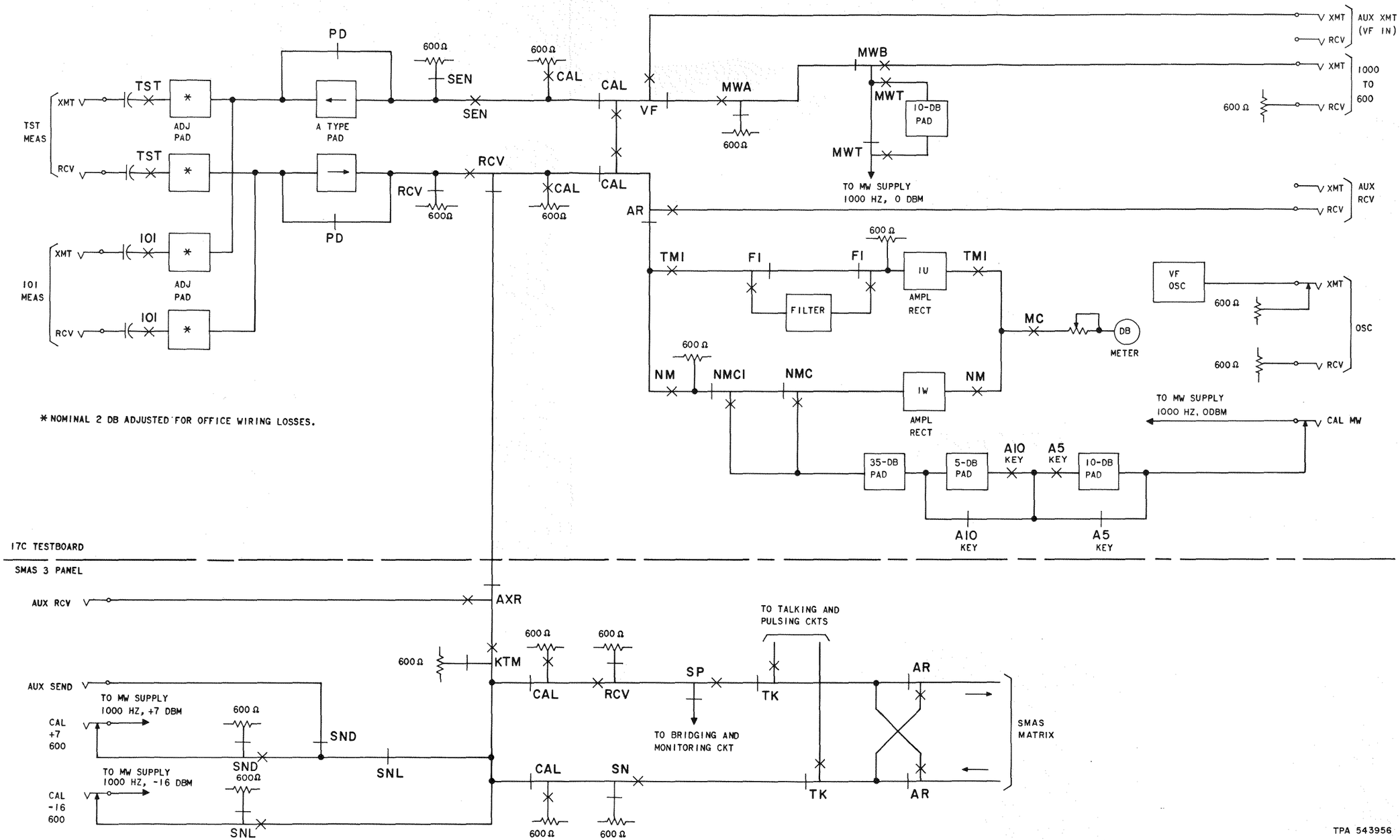
C. Measuring Circuits

3.06 The measuring jack at the testboard or the receiving jack at other testing positions provides access to the measuring system. Measuring jack circuits designated MEAS, TST MEAS and 101 MEAS are used for sending test power or for receiving transmission or noise levels to be measured. Receiving jacks designated RCV are used only for receiving transmission levels to be measured. Both types have blocking capacitors to block direct current from the sending and receiving paths of the measuring system. The receiving path of both types is extended to the common equipment and output meter by a transmission- or noise-measuring relay.

3.07 Measuring jacks of SD-95900-01 are used to test incoming and outgoing trunks at 2- and 4-wire testboards. Two-wire measuring jacks are provided at 17B, 17E, and 18B testboards. The position cords of the 22A testboards connect directly to the 2-wire or 4-wire input of the measuring system. Four-wire measuring jacks are provided at 17C, 17D, 19A, and 21A testboards. The measuring jacks are usually identified by MEAS in their designation. At 17B, 17C, 17D, 18B, and 19A testboards, TST-101 keys are used for connecting the circuit under test to TST-MEAS or 101-MEAS jacks. At 19A testboards, SUB-MEAS jacks are used, with the TST-101 key unoperated, for measurements on station lines. At 17E testboards, a MEAS 1 jack and a MEAS 2 jack are used for measurements. At this testboard, the measuring system is arranged to test outgoing trunks (TST) when the 101 relay is not operated. When a connection is made to a 101-type trunk, ground is automatically applied through the MEAS 2 jack to operate the 101 relay and to condition the measuring system for incoming trunk (101) measurements. At 21A testboards, an incoming trunk to be tested is switched via a code 101 trunk and is extended to a MEAS jack through the position cord circuit. Outgoing trunks to be tested at the 21A testboard are reached through an access circuit and are extended to the MEAS jack by the position cord circuit. In the 21A testboard, test pads are in the 101 and access circuits and are not provided by the measuring system. At 21A testboards, arranged for amplitude sensitive transmission (AST) switch response measurements, an AST MEAS jack is also provided for trunk tests. The AST MEAS jack in conjunction with a RCV jack is used with a dual trace oscilloscope for making sensitivity and time response measurements. The measuring jacks of each testboard are extended through other input circuitry to the common equipment and output meter.

3.08 The MEAS jacks of 17B, 17C, 17D, 17E, 18B, and 19A testboards connect to a pad circuit which is used for providing the proper test pads required for measurements. These test pads are adjusted for the average difference in level between the outgoing switch appearance of the trunks and their TST jack appearances, or for the average wiring and equipment loss of the 101 trunks used in measuring incoming trunks. At 17B, 17C, 17D, 18B, and 19A testboards, the TST-101 key operated to TST causes the circuit to connect test pads to both the transmit and the receive measuring paths for outgoing trunk measurements. Similarly, when an incoming trunk is to be tested, the TST-101 key operated to 101 causes the circuit to connect other test pads to both the transmit and the receive measuring paths. At 19A testboards, the circuit connects test pads for tests on station lines when the TST-101 key is normal. Procedures are provided in other sections for checking and adjusting the test pad values.

3.09 At 17C and 17D testboards, an A-type pad and an A pad control circuit are provided



TPA 543956

Fig. 2—Simplified Diagram of Transmission and Noise Measuring Circuits per SD-95900-01—17C Testboard With SMAS-3 (Single Line per Pair)

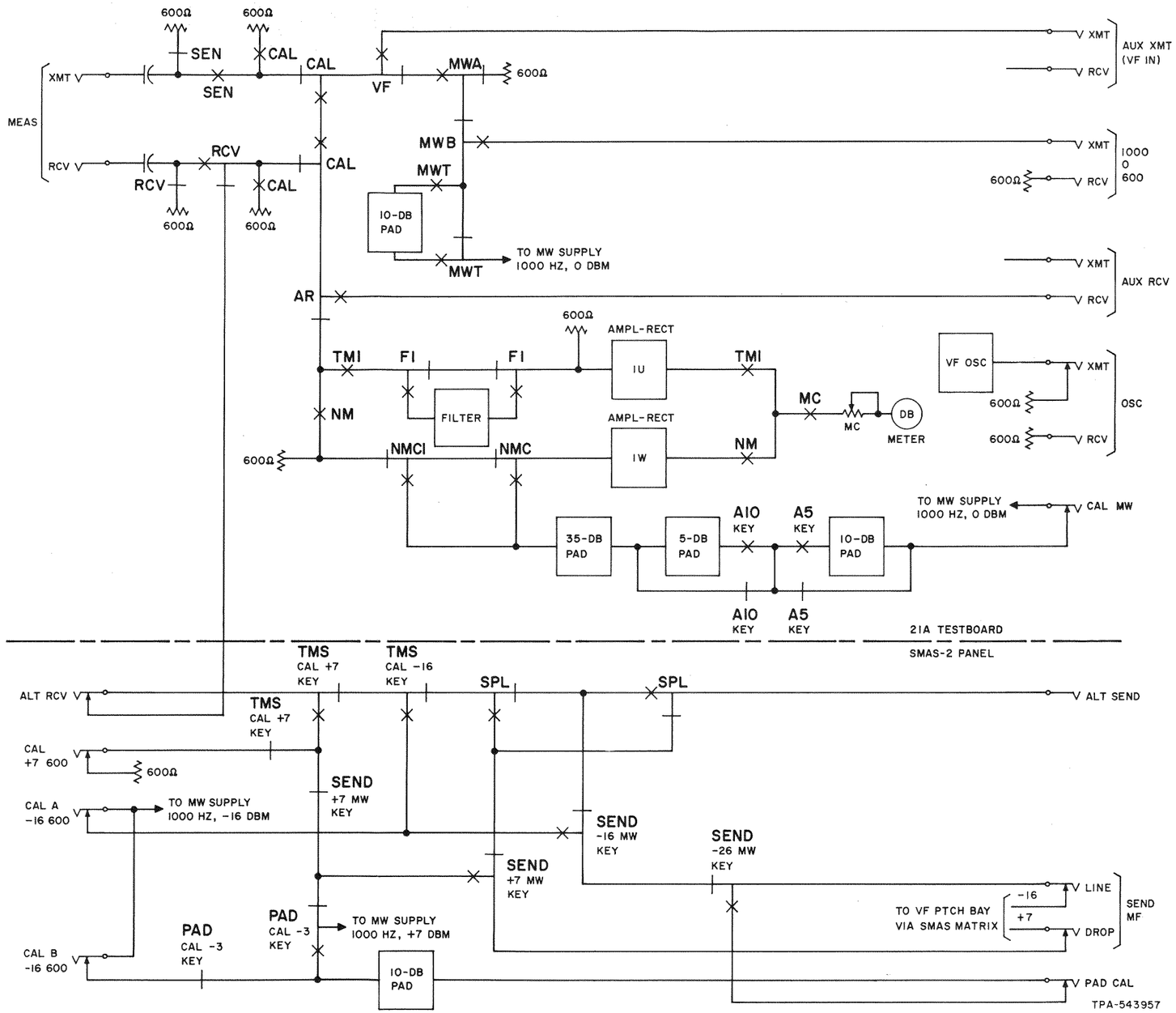
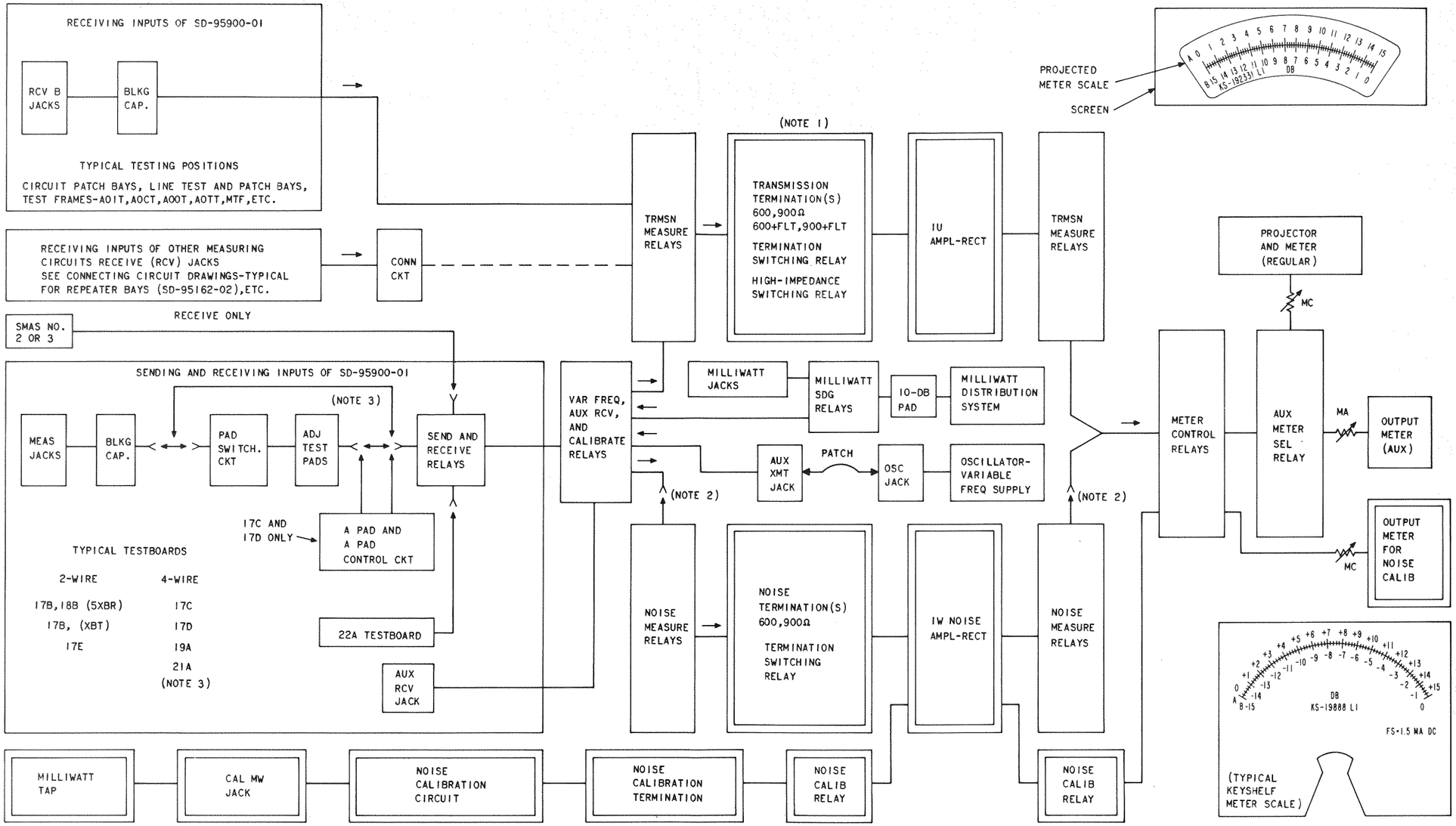


Fig. 3—Simplified Diagram of Transmission and Noise Measuring Circuit per SD-959001-01—21A Testboard With SMAS-2 (Single Line per Pair)



NOTES:
1. DOUBLE BOXES INDICATE COMMON EQUIPMENT OF SYSTEM.
2. NOISE MEASURING FEATURES ARE NOT ALWAYS PROVIDED.
3. PADS FOR 21A TESTBOARDS NOT REQUIRED IN SD-95900-01.

Fig. 4—Simplified Diagram of Transmission and Noise Measuring Equipment per SD-95900-01

in the measuring system if the office is equipped with switching A pads (high-loss operation). The circuit is used to switch pad losses to the trunk under test or to the measuring system. This arrangement and its key controls are described in Part 4.

3.10 The MEAS jacks of SD-95900-01 can be used to send 1000-Hz tone to the circuit under test, or to receive from the circuit under test the transmission or noise levels to be measured. When the SEND key or the SEND-RCV key is operated to SEND, the send relay closes the transmitting path from the tone supply to the transmitting test pads, when provided, and to the circuit under test. When the RCV key or the SEND-RCV key is operated to RCV, the receive relay closes the receiving path from the circuit under test, through the test pads, when provided, to the common measuring equipment and output meter. When 4-wire MEAS jacks are involved, the send relay also terminates the receiving path to the circuit under test and the receive relay terminates the transmitting path. When simultaneous sending and receiving tests are required, as in 21A and 22A testboards, separate SEND and RCV keys are provided.

3.11 When SMAS 3 is provided with a 17C testboard, the measuring system is connected to the SMAS MLCP when the SEND-RCV key on the testboard is in the normal position. When SMAS 2 is provided with a 21A testboard, this connection is made when the RCV-SMA RCV key is operated to the SMA RCV position. The measuring system is disconnected from the SMAS MLCP when the RCV-SMA RCV or SEND-RCV key is operated to the RCV position.

3.12 When variable-frequency send and calibrate features are provided, the MEAS jacks of SD-95900-01 are also used to send variable-frequency tone to the circuit under test. When a patch is made to the AUX XMT or VF IN jack, the variable-frequency relay transfers the sending circuit from the 1000-Hz supply to the variable-frequency supply. The operation of the CAL key and calibrate relay extends the variable frequency supply to the common equipment and output meter, so that the oscillator level can be adjusted to the desired level. After the output level at a particular frequency is adjusted, the CAL key is released. The operation of the SEND key or SEND-RCV key to SEND connects the variable-frequency supply to the circuit under test over the same paths discussed in 3.10 for the milliwatt supply.

3.13 The receiving jacks of SD-95900-01 are provided at circuit patch bays, line test and patch bays, outgoing test frames, and various other test frames (AOIT, AOCT, AOOT, AOTT, MTF, etc). The jacks are usually identified by RCV in their designation, such as RCV B. Noise measuring features are also available at most test frames.

3.14 Two connecting circuits of SD-95900-01 provide interconnection between the receiving circuit of SD-95900-01 and input circuits covered by other drawings. These connecting circuits are provided for use with telegraph test- and service-boards, outgoing trunk and master test frames, repeater bays, private line testboards, voice-frequency patch bays, N2 and N3 carrier terminals, D2 channel bank bays, etc. Noise measuring features are also provided for use at voice-frequency patch bays at N2 and N3 carrier terminal, and similar locations.

3.15 Portable or auxiliary transmission measuring equipment may be used in place of the 1U or 1W amplifier-rectifiers by connecting the equipment to the AUX RCV jacks and operating the RCV key. Such equipment may, for example, consist of a 6-type impulse counter 27-type P/AR meter receiver, or a 3-type noise meter (when required to make flat weighted noise measurements). Connection of the receiving sections of portable or auxiliary test equipment, except for the 58-type echo suppressor measuring system (ESMS), is made to the AUX RCV jacks when the J94005 transmission measuring system is used in a No. 17C or similar testboard or testing position containing test pads in the measuring system. Detailed instructions for connecting the portable or auxiliary transmission measuring equipment are contained in the sections applicable to the testboard or test position in which the AUX RCV jacks are mounted.

D. Terminations

3.16 For measurements and calibration, terminations external to the 1U and 1W panels are used to provide the required 600- or 900-ohm termination of the circuit to be measured. The transmission termination and the noise termination are common to all testing positions served by the panels. The terminations are extended to the individual testing position by a transmission measure relay, or by a

noise measure relay when the noise measure key (NM) is operated. When all circuits served by a single 1U or 1W panel are to be measured at 600-ohm impedance, a fixed external resistor is provided across each common receive measuring path. For 900-ohm measurements, fixed external resistors are also provided. The termination, in this case for transmission measurements, is a voltage divider so designed that the calibration of the 1U panel is common for both the 600- and the 900-ohm terminations. A separate noise termination is used for calibration of the 1W panel. When both 600- and 900-ohm positions are served by a single 1U or 1W panel, a termination switching relay, a 600-ohm termination, and a 900-ohm termination are provided. When 900-ohm measurements are made, a ground (lead 9) from the 900-ohm inputs (MEAS, RCV B, or REC jacks; keys; relays) causes the 900-ohm termination to be substituted across the measuring paths. In offices where the 1U panel is used for measurements of trunks using voice-frequency open-wire facilities, a 600-ohm termination with filter, a 900-ohm termination with filter, or both with a termination switching relay, may be provided. The filter is switched into the measuring path by the operation of the FLT key at the testing position, and an FLT lamp indicates that the filter is in the measuring path. The midpoint of each transmission termination, or combination of transmission terminations, is connected through a capacitor to a lead which can be grounded by depressing the GRD key at the testing position. Any appreciable change in output meter reading, when the key is depressed and released, is an indication of an ac circuit unbalance to ground in the measuring system or in the circuit under test. The termination arrangements and controls are such that the system reads directly in dBm or in dBrnc for either 600- or 900-ohm measurements, without the need for correction factors.

3.17 Some of the connecting circuits to the measuring system (such as private line testboards, 22A testboards, voice-frequency patch bays, N2 and N3 carrier terminals, and repeater measuring bays) may require high-impedance bridging measurements in addition to the terminated measurements. When the 1U and/or 1W panel serves any testing position requiring high-impedance measurements, an impedance switching relay (TC) or (NC) is provided to control the termination of the measuring path. At testing positions arranged for high-impedance measurements, the testing jacks or keys used during these measurements do not provide a ground to the A lead and the TC or NC relay remains released to condition the system for unterminated measurements. When the testing jacks or keys are used at these positions for terminated measurements, a ground on the A lead operates the TC or NC relay which connects a termination across the measuring path. When 600- and 900-ohm terminated measurements are required at a testing position in addition to high-impedance measurements, the termination switching functions are similar to those discussed in 3.16. At testing positions arranged only for terminated measurements but served by the same 1U and/or 1W panel, a wiring option is provided to ground the A lead and to operate the TC or NC relay.

E. Output Meter Circuits

3.18 The outputs of the 1U and 1W panels usually share an output meter. When receive measurements are made in the main testing area or when transmission calibrations are made, the rectifier outputs are extended to the regular meter by the meter control circuit and by the auxiliary meter selection circuit. For noise calibration, the 1W panel output is extended to the noise calibration meter by noise calibrate relays and the meter control circuit. When the results of the measurements are required in a remote area (for example, to aid in making adjustments), the meter selection key (MS-) is operated and the auxiliary meter selection circuit functions to transfer the output to the auxiliary meter at the remote location.

3.19 Potentiometers (0 to 10 ohms) are provided in the transmission and noise measuring bay(s), to compensate for variations in the length of meter leads between the bay and the output meters. The MC- potentiometers for the regular meters and the MA- potentiometers for the auxiliary meters are adjusted to make all output meter readings match as nearly as possible the reading of the meter used for transmission calibration of the 1U panel.

4. MEASUREMENT CONTROL FEATURES AT THE TESTBOARDS AND TESTING POSITIONS

A. General

4.01 The basic measurement control features provided for the system, after the measuring paths have been established to the circuit under test, include means to control transmission and

noise measuring sensitivity, checks of A pad operation and A pad values. These features are discussed in 4.02 through 4.09.

B. Transmission Measuring Sensitivity Controls

4.02 The sensitivity keys (A, B + 10, B + 20, and B + 30) used for transmission measurements are pushbutton keys which control, from the testing position or bay, the sensitivity of the 1U amplifier-rectifier. With none of the keys depressed, the measuring range is usually −15 dBm to 0 dBm on the B scale of the output meter. Depressing the B + 10 key changes the sensitivity so that the measurement is arithmetically equal to the B scale meter reading plus 10. Depressing the B + 20 key changes the sensitivity so that the measurement is arithmetically equal to the B scale meter reading plus 20. Depressing the B + 30 key (provided only in the 22A testboard) changes the sensitivity to that of the B + 20 and adds a fixed 10-dB gain to the measuring path so that the measurement is arithmetically equal to the B scale meter reading plus 30. Depressing the A key changes the sensitivity so that the measuring range is 0 dBm to +15 dBm on the A scale of the output meter.

C. Noise Measuring Sensitivity Controls

4.03 The sensitivity keys (A + 15, A + 20, A + 25, A + 30, and A + 35) used for noise measurements are pushbutton keys which control, from the testing position or bay, the sensitivity of the 1W noise amplifier-rectifier. Two arrangements may be found, one having a range of 15 to 55 dBrnc (extended range) and the other a range of only 15 to 45 dBrnc. In the extended range case, the noise measuring key is designated NM/A + 40, whereas with the earlier limited range, it is designated NM/A + 30. With the NM/A + 40 key operated and none of sensitivity keys depressed, the noise measurement is arthmetically equal to the A scale meter reading plus 40. With the NM/A + 30 key operated and none of the sensitivity keys depressed, the noise measurement is arithmetically equal to the A scale reading plus 30. Depressing any one of the sensitivity keys changes the sensitivity so that the measurements are arithmetically equal to the A scale meter reading plus the number appearing in the key designation.

D. Pad Measuring and Controls—General

4.04 A key, designated API, is provided in 17C and 17D testboards in No. 4-type switching offices which have switching A pads (high-loss operation) to check. An additional key (FPI) is provided when outgoing auxiliary intertoll trunks for ringdown use are served by the switching office.

E. Pad Controls—Single A-Pad Office

4.05 When an intertoll trunk in a No. 4-type crossbar offices having a switchable A pad is connected to the measuring system for tests, the A pad loss is removed from the trunk by the measuring system and is replaced by an equivalent pad loss in the A pad control circuit of the measuring system. The A PAD IN key (API), when depressed, restores the loss in the trunk and removes it from the measuring system. When a ringdown trunk is connected for tests, the fixed pad loss is removed from the trunk. When the fixed pad in key (FPI) is depressed, the fixed pad loss is added in the ringdown trunk. The pad control keys are used to shift the pad losses to the trunk or measuring system, so that pad operation and the pad values in the trunk can be checked. This control arrangement, together with the adjustable test pads in the measuring system, provides for measurements with a net test pad of 2 dB (TP2).

4.06 Table B shows the pad control keys, simplex, and pad arrangements when the A pad control circuit is provided in the measuring system.

F. Pad Controls—Offices Formerly Operated as Split-Pad Offices

4.07 In offices which formerly operated as split-pad offices, some of the trunks may still contain the split pads. Operation is identical with that of single pad offices (Table B), as the two sections (2, A-2) of the split pad are considered a single unit.

5. CALIBRATION FEATURES

A. General

5.01 Calibration features include a transmission calibrate key (CAL) and a noise calibrate check key (NM CAL CK) in the miscellaneous jack field of each testing position. These are used for initial calibration and during measurements for

TABLE B

CONDITION	MEASURING SYSTEM KEYS API	KEYS FPI	PAD SIMPLEX	CONTROLLABLE PAD	TRUNK CONTROLLABLE A PAD
DIAL INTERTOLL TRUNKS					
A	R	R	500G	A IN	A OUT
B	D	R	OPEN	A OUT	A IN
OUTGOING AUX. INTERTOLL TRUNKS (RINGDOWN)					
C	R	R	500G	A IN	OUT
D	R	D	500B	A IN	IN

CONDITION A & C — Normal for measurements.

" B — Checks pad operation in trunk.

" A & B — Compares value of controllable A pad in trunk with value of controllable pad value in measurable system.

" D — Checks pad operation in trunk.

" C & D — Compares transmission levels with FIXED pad in and out of trunk. Difference is value of FIXED pad in trunk.

calibration checks of the transmission and noise measuring circuits. For initial noise calibrations, three additional keys (CAL NOISE, A5, and A10) are provided in the 1W noise amplifier-rectifier bay.

5.02 When SMAS is provided, calibration of the 1U amplifier-rectifier at the −16 and +7 dBm 1000-Hz levels is required in addition to the normal calibration at 0 dBm. The 1U amplifier-rectifier must have been modified for this purpose as discussed in Section 103-231-101. Calibration at these additional levels is done by utilizing the TMS-CAL-16 and TMS CAL +7 keys on the SMAS MLCP. In the case of SMAS 2A, the RCV-SMA RCV key on the 21A testboard keyshelf must also be operated to SMA RCV during this calibration.

5.03 Each testing position used for calibration also has a 1000 0 600 (or 900) jack to which a 22A milliwatt reference meter can be connected for checking the milliwatt supply level at the position. The 1W noise amplifier-rectifier bay has a CAL MW jack for the same purpose. The output at each of these jacks is checked in accordance with Sections in the 103-335-ZZZ series.

B. Transmission Calibration

5.04 The CAL key, when depressed, connects the milliwatt supply associated with the testing position to the external termination and to the input of the 1U amplifier-rectifier.

5.05 At variable frequency testing positions, the CAL key is also used to check the output level of the oscillator. When a patch is made from an oscillator jack (OSC) to the variable frequency in jack (AUX XMT or VF IN), the send path is transferred from the milliwatt supply to the oscillator supply associated with the testing position. After the patch is made, the CAL key is depressed to check the output level of the oscillator.

C. Output Meter Readings

5.06 The MC potentiometer of the regular meter used for calibration of the 1U amplifier-rectifier is usually set to its midrange position during the calibration procedure. This setting provides a range to compensate for variations in meter lead lengths of other regular or auxiliary meters served by the 1U panel. After calibration of the 1U panel, the MC potentiometers of other regular meters and the MA- potentiometers of auxiliary meters are adjusted to make the meter readings match the reading of the meter used for calibration of the 1U panel.

D. Noise Calibration

5.07 The NM CAL CK key is used at the testing positions to check the calibration of the noise measuring system. The milliwatt supply associated with the CAL MW jack (5.03) and a 35-dB pad at the 1W bay provide the test power for this check. The NM CAL CK key, when depressed, results in the application of −35 dBm at 1000 Hz (equivalent to 55 dBrnc at 1000 Hz) to the input of the 1W noise amplifier-rectifier and extends the output of the 1W panel to the meter used by the position at which the NM CAL CK key is operated.

5.08 The CAL NOISE key provides means for calibration of the 1W noise amplifier-rectifier at the bay where the 1W panel (and usually the noise calibration meter) is located. This key, when operated, also results in the application of −35 dBm at 1000 Hz (55 dBrnc) to the input of the 1W panel, the same as discussed in 5.07. In addition, 5- and 10-dB pads controlled by keys (A10, A5) respectively, are provided in the 1W bay. When the A5 key is depressed, a 10-dB pad loss is added in the path to the 1W panel and the input level is reduced to −45 dBm (45 dBrnc) which should provide a reading of 5 on the meter A scale. Similiarly, the A10 key, when depressed, adds a 5-dB pad loss to bring the input level to −40 dBm (50 dBrnc), equivalent to a reading of 10 on the meter A scale.

6. LIST OF DRAWINGS (Not Attached)

SD-64098-01	1U Amplifier-Rectifier Circuit
ED-95037-01	Typical Transmission and Noise Measuring Equipment
SD-95102-01	1W Noise Amplifier-Rectifier Circuit
SD-95102-02	1W Noise Amplifier-Rectifier Circuit
SD-95900-01	Transmission and Noise Measuring Circuit