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COMMON SYSTEMS TRANSMISSION AND NOISE MEASURING CIRCUIT USING 1U AND 1W AMPLIFIER RECTIFIER

CHANGES

A. Changed and Added Functions

A.1 Provides for connection to a 4-wire 6 HR impulse counter at testboard No. 17C.

A.2 Provides for making noise and transmission measurements at testboards No. 21A or 17C when associated with Switched Maintenance Access System (SMAS) No. 2A or No. 3 type, respectively.

A.3 Provides for sending test tone 10 dB below normal testing levels, under control of a send key at testboards No. 17B, 17C, 17D, 17E, 18B, 19A, 20A, or 21A.

A.4 Provides for making high-impedance noise measurements when sharing of the 1W amplifier may be required with a VF patch bay, N-type carrier bay, or a testboard No. 22A.

B. Changes in Apparatus

B.1 Added

Jack IN XMT, 246 Type Jack IN RCV, 246 Type Jack MON RCV, 246 Type Jack MON XMT, 249 Type Resistors R86, R87 - 227A, 600 ohms	Fig. 88 (new)
Relay MWT-AF79 Resistors R88, R90 - 106C, 1732 ohms, XD option Resistors R88, R90 - 106C, 1155 ohms, XE option Resistors R89, R91 - 106C, 640 ohms, XD option Resistors R89, R91 - 106C, 427 ohms, XE option	Fig. 89 (new)
Jack AUX RCV-XMT, 246 Type Jack AUX RCV-RCV, 249 Type	Fig. 91 (new)
Key DOWN 10DB, 547B Lamp DOWN 10DB, 2Y	Fig. 92 (new)
Key SEND, SMA-RCV, RCV G1BC —	Fig. 94 (new)
Relays SEN, RCV - AK-4 Networks SEN, RCV - 185A Resistors R92, R93 - 227A, 600 ohms	Fig. 95 (new)
Relay NC - AF-147 Network NC - 185A	Fig. 96 (new)
Capacitors C16, C17 - KS-19827, L5 - 400μF	Fig. 97 (new)
Capacitors C18, C19 - KS-19827, L5 - 400 μF	Fig. 98 (new)
Relay NM1 - AF115 Network NM1 - 185A	Fig. C (new)

D. Description of Changes

D.1 The drawing sheets are renumbered to put them in a sectionalized format, ie, A-, B-, etc, and the application schematic Fig. 101 through 114 are redesignated BD-1 through BD-14 and will now appear as H- sheets with a record of the old numbering scheme maintained on the drawing for record purposes.

D.2 Fig. 88 is added, for connection to a 6 HR impulse counter at a testboard No. 17C.

D.3 Fig. 89 and 92 are added for sending test tone 10 dB below normal testing levels, for use at testboards No. 17B, 17C, 17D, 17E, 18B, 19A, 20A, or 21A.

D.4 Table F is added for resistor values required with new Fig. 89.

D.5 Fig. 91 is added for use in conjunction with existing Fig. 90 when use of auxiliary transmission measuring equipment is to be used in place of the 1U-1W amplifier rectifier at testboards No. 17B, 17C, 17D, 17E, 19A, and 21A.

D.6 Fig. 95, 97, and 98 are added for use at a testboard No. 19A, to be used in conjunction with Fig. 90 and 91 when auxiliary transmission test equipment is to be used.

D.7 Fig. 96 is added to permit high-impedance noise measurements when sharing of the 1W amplifier may be required with a VF patch bay, N-type carrier bay, or a testboard No. 22A.

D.8 Fig. A, B, and C are added as modifications to Fig. 58 when Fig. 96 is to be provided.

D.9 Fig. 94 is added for use at a test-board No. 21A to associate the 1U-1W amplifier rectifier with the Switched Maintenance Access System (SMAS) No. 2A equipment.

D.10 Fig. 99 is added for use at a test-board No. 17C to associate the 1U-1W amplifier rectifier with the SMAS (No. 3 type) equipment.

D.11 In Fig. 1, connecting information at leads T, R, T1, and R1 is enlarged to include "or Fig. 37."

D.12 In Fig. 8, connecting information is enlarged to include "or Fig. 88."

D.13 In Fig. 16 and 24, connecting information is enlarged to include "or Fig. 72."

D.14 In Fig. 21, connecting information at lead STR is enlarged to include "or Fig. 95."

D.15 In Fig. 26, connecting information is enlarged to include "or D2 Channel Banks SD-99478-01, or VF Test Circuit SD-99476-01," and lead CA is added (XL option).

D.16 In Fig. 25, connecting information is changed to delete "Fig. 57, LOC10F7."

D.17 In Fig. 27, the circuit is changed to add leads N and V to Fig. 89; also to enlarge the connecting information to include "to Fig. 89 if provided."

D.18 In Fig. 28, the circuit is changed to add lead A1 to Fig. 58.

D.19 In Fig. 29, connecting information is enlarged to include "or Fig. 72 or 95."

D.20 In Fig. 31, the circuit is changed to add lead G1 to Fig. 37; also the connecting information is enlarged to add reference to "Fig. 73" at lead G, and "or (CONC)" at leads T, R, T1, and R1.

D.21 In Fig. 32, the rating "Mfr Disc." and reference to "See Note 120" are added to the title.

D.22 In Fig. 37, the circuit is changed to add lead G1 to Fig. 31; also the connecting information is enlarged at leads T, R, T1, and R1 to add "to Fig. 1 or Fig. 25 for (SUB)."

D.23 In Fig. 34, connecting information is enlarged to include "or Fig. 95" at leads STR and also at TR, RR, and STS; also to add "to Fig. 97" at leads TS and RS and "to Fig. 98 if provided" at leads TR and RR, and also to add lead TM to "Fig. 99."

D.24 In Fig. 40, connecting information is enlarged to add "to Fig. 96 if provided" at leads J, K and T, R; also lead F1 is now shown going only to Fig. 28.

D.25 In Fig. 46 and 59, the B3 ballast lamp 121B is designated XF option and rated Mfr Disc., and a new type 120A is added as XG option and rated Standard; also in these figures, -24V is added as XK option, ZR option is removed and partially replaced by XJ option, and reference to "see Note 121" is added.

D.26 In Fig. 52, the title is changed to read "Connecting Circuit for Test-board No. 20A (Provide One per Two Positions)."

D.27 In Fig. 53, the circuit is changed to add a P lead to Fig. 92; also leads 6 and 9 are added "to Fig. 89 (see BD-11A)."

D.28 In Fig. 54 and 65, the VF IN JACK designation is assigned option XH, rated Mfr Disc., and a new designation AUX XMT is added as XI option, rated Standard.

D.29 In Fig. 56 and 57, the connecting information is enlarged to add "if provided" after Fig. 40 and to add reference to Fig. 96.

D.30 In Fig. 58, leads 1 through 6 are added to new Fig. A, B, or C; lead A1 is added to Fig. 28; lead 9 is added to Fig. 40; lead NA is added to Fig. 96; and the connecting information is enlarged at leads T, R to add "to Fig. 96 if provided," and at leads CA, CB to add "to Fig. 26."

D.31 In Fig. 59, "See Note 305" is added to the title, and reference is added at leads J and K to now connect "to Fig. 96 if provided;" also existing wiring of leads RA and RD to the 1W amplifier rectifier is designated XM option, and option XN is added to now run these leads through contacts 6 and 8 of relay NMC1.

D.32 In Fig. 63, YO option was incorrectly shown as YD option at the 248-type jack.

D.33 In Fig. 66, 68, and 69, reference to "See Note 208" is added to the title.

D.34 In Fig. 71, the connecting information at lead G is enlarged to add "or Fig. 94."

D.35 In Fig. 72, the circuit is changed to add leads RR, STR, and T3 to Fig. 94 and 99; also connecting information at leads S and R is enlarged to add "or Fig. 16 or 94;" and at leads T, R, T1, and R1 to add "to Fig. 29 (for TEST), Fig. 24;" also stubs off these leads are added "to Fig. 29 (for 101)."

D.36 In Fig. 73 the connecting information at lead G is enlarged to add "to Fig. 31;" also reference "to Fig. 95" is added at leads R, S.

D.37 In Fig. 74, 75, and 76, the rating Mfr Disc. is added to the titles.

D.38 In Fig. 90, connecting information is enlarged at leads TR, RR, and N to add "to Fig. 91;" also "to Fig. 98 if provided" is added at leads TR, RR to Fig. 34.

D.39 Circuit Note 101 is changed to add Fig. 96 to fuse A, Fig. 95 and C to fuse L, and Fig. 89 to fuse N, all -48 volts, and a new fuse C (-24V) is assigned; also at fuse I (-48V), option ZR is removed and option XJ is added.

D.40 Circuit Note 102 (Feature or Option) is enlarged to add new Fig. 89 (with options XD and XE) and Fig. 91, 92, and 99; also Fig. A, B, and C for use with Fig. 58.

D.41 Circuit Note 102 is changed at Fig. 26 and 59 to add new options XJ, XK, and XL.

D.42 Circuit Note 102 is also changed at dc blocking capacitors (Fig. 25) to add Fig. 97 or 98; at send-receive circuit 4-wire (Fig. 32) to add Fig. 72 or 95; at high-impedance XMSN, etc, Fig. 70, to add Fig. 96; and to remove Mfr Disc. Fig. 72, 73, 74, 75, and 76; also to substitute AUX XMT for VF IN at Fig. 65.

D.43 Circuit Note 102 is also changed at Send-Receive Key Circuit for the 19A Testboard to list the latest standard Fig. 73 and remove Fig. 76; options YU and YY are added for use with Fig. 48 (meters) to make this note agree with Table A.

D.44 Circuit Note 104 is enlarged to add Fig. 89, 91, 92, 94, 95, 96, 97, 98, 99, A, B, and C and options XD, XE, XF, XG, XJ, XK, and XL, all added on this issue.

D.45 Circuit Note 113 is rated Mfr Disc., and Circuit Notes 116, 117, 118, 120, and 121 are added.

D.46 Equipment Note 210 is changed and 211 is added; also, Information Notes 305 and 306 are added.

D.47 In Table A, item 27 is added for the 6 HR impulse counter at a testboard No. 17C, item 29 is added for the manual test frame that will be used in the No. 4A toll crossbar offices, and item 39 is added for a testboard No. 17C with connection to Switched Maintenance Access System (SMAS) No. 3 type.

D.48 In Table A, items 1 and 8 are changed to delete testboard 17B (WADS), reference to "see Note 305" is added at items 8 and 9, and item 16 is enlarged to add SD-99476-01 and SD-99478-01.

D.49 In Table A, items 22 and 24, the wording in the Remarks column is changed and "see Note 2" is added.

D.50 In Table A, items 17 and 18 (testboard 19A) are changed to add new Fig. 23, 89, 90, 91, 92, 93, 95, 97, or 98 and options; also items 20, 21, 26, 31, and 33 are enlarged to add reference to "see Note 116;" and item 26 is changed to delete Fig. 23 and options H and ZK; also items 20 (testboard 17C and 17D) and 21 (testboard 17C) Fig. 23, 72, 89, 90, 91, and 92 are added and Fig. 24 and 32 are removed; at items 30 and 32 (testboard 17B or 18B) Fig. 22, 89, 90, 92, and 93 are added.

D.51 In Table A, item 35 is changed to add new Fig. 89 and 92 and options XE and XD; also item 42 is changed to add "or D2 Channel Banks or VF Test Circuit," Fig. 96 and XL option; at item 44 the word "WADS" is deleted and "only for testing TWX trunks" is added, along with a change in figures and options, and reference to "see Note 116."

D.52 In Table A, item 47 (testboard 17E) Fig. 23, 89, 90, 91, and 92, and two Fig. 51 are added and options are changed; also item 49 (testboard 21A) Fig. 23, 89, 90, 91, and 92 are added, and No. 2A is added after SMAS; and item 56 is changed to add "or crosstell."

D.53 CADs 1, 2, 4, 5, 6, 7, 8, 10, 12, 13, 15, 16, 17, 18, 19, and 20 are changed; and CADs 23, 24, 25, 26, 27, 28, 29, 30, 31, and 32 are added.

D.54 Key tops are added for new Fig. 92 and 94.

D.55 Circuit Application Diagram BD15 is added.

D.56 The following circuits are added in this CD under Section III, 4. Connecting Circuits.

(a) VF Test Circuit - SD-99476-01.

(b) D2 Channel Banks - SD-99478-01.

(c) 6 HR Impulse Counter - SD-99481-01.

(d) Manual Test Frame (No. 4 Crossbar) - SD-68587-01.

(e) Switched Maintenance Access Circuit (SMAS No. 2A) - SD-99776-01.

(f) Access Circuit (SMAS No. 3 Type) - SD-99542-01.

D.57 For description of operation, see CD Issue 8A.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 4631-JEK-EGS

COMMON SYSTEMS
TRANSMISSION AND NOISE
MEASURING CIRCUIT
USING 1U and 1W AMPLIFIER RECTIFIER

CHANGES

A. Changed and Added Functions

A.1 Provides for connection to auxiliary transmission measuring equipment in place of the 1U or 1W amplifier rectifier, under control of a key at testboard No. 22A.

B. Changes in Apparatus

B.1 Added

Jack AUX RCV - 249 Type, YO option, Fig. 93
Jack AUX RCV - 241 Type, YP option, Fig. 93
Relay AR - AF115, Fig. 90
Network AR 185A, Fig. 90

D. Description of Changes

D.1 The following changes are being applied only to testboard No. 22A. Similar changes for other testboards will be applied on a subsequent B issue.

D.2 Fig. 90 (YP option) and 93 are added to permit connection to auxiliary transmission measuring equipment rather than the 1U and 1W amplifier rectifier.

D.3 In Fig. 86 the send A-B and RCV A-B key contacts are rewired to change the numbering as follows:

Old	New
1	6
2	5
3	4
4	3
5	2
6	1

D.4 In Fig. 87, relay RC contact M1, lead designation is changed from A to A-.

D.5 In Fig. 87, relay RC contact EBM2, lead designation RCV is changed to RCV-, and a multiple strap is removed.

D.6 In Fig. 87, relay RC contact EMB4, lead R- is removed from connection to the testboard No. 22A position circuit and a direct ground is added at this point; also a multiple strap is added to lead R "to Fig. 72."

D.7 In Fig. 87, relay SD contact EBM11, lead designation SEND is changed to SEND-.

D.8 In Fig. 87, relay SD contact M12, lead S- is removed from connection to the testboard No. 22A position circuit and a direct ground is added at this point; also a multiple strap is added to lead S "to Fig. 72."

D.9 In Fig. 28 and 34, connecting information is enlarged to add reference to new Fig. 90.

D.10 Circuit Note 101 is enlarged to add an N fuse (-48V) for use with new Fig. 90, and existing fuse L (-48V) is enlarged to include two Fig. 87.

D.11 In Fig. 22 and 23 the title is changed to add "or auxiliary transmit;" also the existing jack designation VF IN is assigned XH option, rated Mfr Disc., and a new designation "AUX XMT" is added as XI option, rated Standard.

D.12 In Fig. 22 and 36 the contact numbering of the 241 jack (YP option) was incorrectly shown when this jack was added on issue 16B. Circuit Note 119 is added for the difference between the 241 and 249 type jacks, with reference to this note added in both Fig. 22 and 36.

D.13 Circuit Notes 102 and 104 are enlarged to include the new Fig. 90 and 93, and options XH and XI added on this issue; also Equipment Note 206 is changed.

D.14 In Table A, item 53, new Fig. 90 and 93 are added and reference to Fig. 21 is deleted; also under item 53 in the Remarks column, reference is added to a new Sheet Note 1 and the following is added: "For connecting to a 1W noise measuring amplifier rectifier at each testboard No. 22A, provide an item 8 or 8A per Table A (see Note 109)."

D.15 In Fig. 84, key symbols were incorrectly shown as locking type instead of nonlocking type.

D.16 The application schematic for the testboard No. 22A (Fig. 113) is updated to add new Fig. 90 and 93 and to make other miscellaneous changes per this issue.

D.17 CADs 20 and 22 are changed.

D.18 For description of operation, see CD issue 8A.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 4631-JEK-EGS

COMMON SYSTEMS
TRANSMISSION AND NOISE
MEASURING CIRCUIT
USING 1U and 1W AMPLIFIER-RECTIFIER

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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 This circuit provides a combined Transmission Measuring Circuit and Noise Measuring Circuit. A common meter is connected to the 1U or 1W Amplifier-Rectifier circuit output, according to the type of test being made.

2. GENERAL DESCRIPTION OF OPERATION

2.01 The circuit is composed of small figures (building blocks) assembled and tailored for the particular installation as covered by the items shown in Table A of the schematic drawing. Block diagrams BD-1 to BD-15 inclusive, show typical 4-wire and 2-wire arrangements of these items.

2.02 The noise measurement feature is optional; however, as a general rule, the descriptions herein assume its provision. Variable frequency sending is also optional since it usually is not provided on each position.

2.03 The 1U Amplifier-Rectifier is used for making transmission tests. The readings are usually read on the B scale of the meter, with ability to change the sensitivity or to change to the A scale under control of keys at each receive or measure location.

2.04 The 1W Amplifier-Rectifier is used for making noise measurements. The readings are read on the A scale of the meter, with sensitivity control keys at each measuring location.

2.05 Additional control keys are provided for various functions as determined for the particular job.

2.06 Panel, bracket, projection-type, keyshelf, or vertical meters are provided according to local option.

2.07 Two types of appearances of the system are provided. These are receive jacks at circuit patch bays or test frames and measure jacks for both sending or receiving at testboard positions.

2.08 The typical measuring procedure at a 17B, 17B (TWX), 17C, 17D, 18B, 19A, 20A, 21A, or 22A testboard, when a test is to be made over a 101-type circuit, is described in paragraphs 2.09 to 2.17.

2.09 The 101 (incoming) circuit is answered with the TST cord, and the CONN cord is connected to the 101 MEAS jack of this system. The pad switching key is then operated to its 101 position, resulting in the insertion of the correct average pad for testing 101-type circuits. When tests are made on outgoing-type circuits, the CONN cord is connected to the TST jack, and the TST cord is connected to the TST MEAS jack of this system. The pad switching key is operated to its TST position, causing the correct average pad for testing outgoing-type circuits to be inserted. When testing subscriber lines at the 19A testboard, the pad switching key is left at its normal (middle) position, which results in the insertion of the correct average pad for testing subscriber lines. Operation of the SEND or RCV key sets the system for sending or receiving, respectively.

2.10 When making 101 (incoming) tests at the 17E or 21A testboard, the 101 circuit is answered with the CONN cord and the TST cord is connected to the MEAS jack of this system. At the 17E testboard, the 101 (incoming) jack circuit has the tip of the No. 2 jack grounded and connected to the tip of the No. 2 jack of the MEAS jack on this system via the associated cord circuit. The 101 jack circuit operates the 101 relay, inserting the correct average pad for testing 101-type circuits. At the 17E testboard when testing outgoing-type circuits, the CONN cord is connected to the MEAS jack of this system, and the TST cord is connected to the TST jack of the circuit under test. The TST jack of the outgoing circuit does not have a ground on the tip of the No. 2 jack. Therefore, the 101 relay remains released, and the correct average pad for testing outgoing circuits is inserted.

2.11 At the L1A testboard when testing outgoing type circuits, the CONN cord is connected to the MEAS jack of this system, and the TST cord is connected to the TST jack of the access trunk to be tested.

2.12 At the 17B, 17B (TWX), 17C, 17D, 17E, 18B, 19A, or 20A testboard, operation of the SEND or RCV key sets the system for sending or receiving, respectively. At the 21A and 22A testboard there are separate SEND and RCV keys which permit sending or receiving or making loop-back tests where simultaneous sending and receiving tests are required.

2.13 Operation of the SEND key closes 1000-Hz tone over the transmitting path to the circuit under test. Operation of the RCV key, provided the 1U Amplifier-Rectifier is idle, will cause the TM relays for this position to operate and cut in the amplifier-rectifier and the correct meter. The tone power received is read on the meter.

2.14 At the 19A testboard, when making envelope delay and attenuation response measurements, the 25A test set is patched to the 25A IN jacks; TST MEAS, 101 MEAS, or SUB MEAS is connected via a 19A testboard cord circuit to the circuit under test. (Mfr Disc.) The standard arrangement for making the above measurements now requires a No. 25 type test set, or equivalent, with connection made via the auxiliary receive and auxiliary transmit jacks. (Figs. 23 and 91.)

2.15 At the 21A testboard, when making sensitivity and response time measurements, the AST MEAS jacks of Fig. 77 are connected via a 21A testboard cord circuit to an access trunk. The trunk gains access to the input port of the multiaddress bridge circuit. The INT OUT jacks are connected to another access trunk which gains access to an output port of the multiaddress bridge circuit. By patching a scope to Fig. 78, which is connected to Fig. 77, one can perform a visual test on the AST switch of the multiaddress bridge circuit.

2.16 At the 22A testboard, operation of the SEND and RCV keys and other keys at the position connect a cord in the 22A testboard to the transmission and noise measuring circuit. On 4-wire circuits simultaneous send and receive functions can be performed using dual cord operation.

2.17 At test position No. 50A proper key operation connects the transmission and noise measuring circuit to the circuit under test.

SECTION II - DETAILED DESCRIPTION

1. JACK CIRCUITS

MEASURING JACKS - FIG. 1, 2, 66, AND 71

1.01 Fig. 1 and 71 (4-wire), Fig. 2 (2-wire MEAS jack) and Fig. 66 (2-jack MEAS jack circuit), connect the circuit under test to the measuring system.

1.02 When a plug is inserted into the MEAS, TST MEAS, or 101 MEAS jack of Fig. 1 or 2, ground is closed to the A or B lead of Fig. 30 or 31 when the TST or 101 key of Fig. 20 is operated. The transmission path is closed to Fig. 25 or 31, as the case may be.

1.03 When Fig. 66 is used (the plug inserted into the MEAS jack for a 101 measurement), a ground on the tip of the associated No. 2 jack (of the 101 jack) grounds the 101 lead and operates the 101 relay of Fig. 67, closing a transmission path to the 101 pad, Fig. 51.

1.04 When Fig. 71 is used and the associated TST cord is inserted into the MEAS jack, or if the CONN cord is inserted into the MEAS jack, the ground, which permits control of sending and receiving (using SEND or RCV keys) is supplied only when a TST or CONN cord is inserted.

1.05 Where Fig. 1 and 2 are used, unless the plug is in the 101 MEAS jack and the key thrown to 101, no reading appears on the meter. This protects against use of the wrong pad TST or 101, which has been adjusted for the average office wiring loss of the outgoing or incoming trunks, respectively.

RECEIVE JACKS - FIG. 3 AND 4

1.06 Fig. 3 (4-wire) and Fig. 4 (2-wire receive jack), connect the circuit under test to the receiving portion of the measuring system.

1.07 When a plug is inserted into the jack, ground is closed to the TM lead of the associated Fig. 28. The transmission path or receive leads are closed to Fig. 25. Fig. 3 provides a 600-ohm termination for the transmitting leads.

VARIABLE FREQUENCY JACKS - FIG. 5, 6, 22, 23, 54, 62, 63, 64, 65 AND 69

1.08 Fig. 5 (Mfr Disc) and Fig. 62, 600-ohm impedance, 4-wire; Fig. 6 (Mfr Disc) and Fig. 63, 600-ohm impedance; Fig. 64, 900-ohm impedance jack circuit; and Fig. 69, 2-jack, 900-ohm impedance, provide access to the variable frequency oscillator.

1.09 Fig. 62 and 63 or 69 are intended to be patched to the AUX XMT or VF-IN jack circuit of Fig. 23 or 22, respectively.

1.10 When a patch cord is put up between these jacks (in Fig. 69 a single ended patch cord inserted in the No. 1 jack), ground is closed through the operated springs of the AUX XMT or VF-IN jack to the VF lead of Fig. 34, operating the VF relay. The tone from the oscillator is closed through transfer contacts of the VF relay.

1.11 Fig. 54 (Mfr Disc) and Fig. 65 are provided for use at the 20A toll testboard and perform the same functions as explained for Fig. 22. However, when relay IS of Fig. 53 is operated by a ground on the 9 lead from the data cord circuit, the sending and calibration circuit on Fig. 34 is connected to the 900-ohm impedance of the variable oscillator circuit, Fig. 61.

MILLIWATT JACKS - FIG. 35, 36, AND 68

1.12 Fig. 35, 36, and 68 provide means for checking the power level of the milliwatt supply, as covered in BSP 103-335-512. When patched to the measure jack, they provide a means for checking the value of the test, 101, subscriber, or concentrator pads. A maximum conductor loop resistance of 2 ohms is required when connected to Fig. 27. Fig. 35, 36, and 68 may also be used for external sending of 1000-Hz tone. Fig. 35 is provided with a 600-ohm termination for the receiving leads.

SLEEVE RESISTORS - FIG. 8 AND 9

1.13 Fig. 8 provides a sleeve resistor to ground for Fig. 1, 35, or 62; Fig. 9 provides a sleeve resistor to battery for Fig. 2, 6, 36, 63, 64, 66, 68 and 69. These resistors, via the connected patch cord, enable the connected sleeve relays.

6HR IMPULSE COUNTER - FIG. 88 - FOR TESTBOARD NO. 17C

1.14 To measure noise impulses on a circuit under test a patch with a crossover cord is made from the AUX REC jacks to the 6HR CTR IN jacks.

1.15 To monitor on the circuit while the impulse counter is in use, a position test cord can be inserted in the 6HR CTR MON jack to connect in the testboard telephone circuit. Resistors R86 and R87 provide a 600-ohm termination.

AUXILIARY RECEIVE JACKS - FIG. 91 AND 93

1.16 Transmission or noise measurements can be made using auxiliary measuring equipment in place of the 1U and 1W Amplifier-Rectifier circuits. Inserting a 4-wire patch cord into the AUX RCV jacks (Fig. 91) or a 2-wire patch cord into the AUX RCV jack (Fig. 93), will cause the auxiliary receive control relay AR (Fig. 90) to operate over lead N.

1.17 Relay AR in operating will:

(a) Disconnect receive leads TR and RR, normally connected to the 1U or 1W amplifier via Fig. 28, and now terminate these leads on the AUX RCV jacks.

(b) Open lead TM to prevent operating the transmission control relay TM (Fig. 28).

1.18 The other end of the patch cord now in the AUX RCV jacks is then patched to suitable portable transmission measuring equipment. At a No. 17C testboard these jacks may also be used to patch to the 6HR impulse counter.

2. KEY AND LAMP CIRCUITS

PAD CONTROL KEYS - FIG. 10, 12, AND 13

2.01 Fig. 10 provides an A-pad-in (API) control key for single A pad offices where S = 2. The G lead is closed to ground when a cord is inserted into the measure jack which operates the PD relay of Fig. 24.

2.02 Operation of the API key releases relay PD and opens the ground from the pad control simplex of Fig. 24, which inserts the A 2 pad into the trunk and removes the A pad from the measuring circuit. When no plug is in the jack, the G lead is opened, preventing current drain by the PD relay.

2.03 Fig. 12 provides an A-pad-out (APO) control key and a 2-dB pad in (2PI) key for split A pad offices. With the keys normal, the 11,000-ohm ground on the pad control simplex causes the 2-dB portion of the A pad in the circuit under test to be removed.

2.04 Operation of the APO key removes the entire A pad by shunting the R5 resistor to ground and, over the A lead, operates relay PD.

2.05 Operation of the 2PI key with the APO key normal, causes the trunk under test to cut in the 2-dB portion of the A pad. Operation of the PD relay inserts the A 2 pad into the measuring circuit.

2.06 Fig. 13 provides a fixed-pad-in (FPI) control key for use with Fig. 10 or 12 when ring down intertoll auxiliary trunks are tested.

2.07 Operation of the FPI key transfers the pad control simplex of Fig. 24 to battery, which causes the trunk under test to insert the fixed pad. The pad in the measuring circuit is not affected.

FILTER KEY AND LAMP - FIG. 14

2.08 When provided, operation of the FLT key after the 1U Amplifier-Rectifier is connected operates the F1 relay of Fig. 41 or the F2 relay of Fig. 42, depending upon circuit provisions and whether the TS relay of Fig. 40 is operated or released. See paragraph 11.22.

2.09 When the filter is cut in, the FLT lamp lights.

SENSITIVITY KEYS AND LAMPS FOR 1U AMPLIFIER-RECTIFIER - FIG. 15 OR 83

2.10 In the normal condition, the 1U Amplifier-Rectifier is arranged for use on the B scale of the meter.

2.11 Operation of the B+10 key closes ground to the E lead to change the 1U Amplifier-Rectifier output so that the measurement is equal to the meter reading plus 10.

2.12 Operation of the B+20 key closes ground to the F lead of the 1U Amplifier-Rectifier to change its output so that the measurement is equal to the meter reading plus 20.

2.13 Operation of the B+30 key (Fig. 83) closes ground to the F lead and closes ground to the AR2 lead to the No. 22A testboard position circuit.

2.14 Operation of key A closes ground to the B and E leads of the 1U Amplifier-Rectifier, and readings are read on the A scale of the meter.

2.15 Operation of the GRD key closes ground to the V lead. This provides a center tap ground on the meter termination. Any appreciable change in reading with this key operated indicates a circuit unbalance to ground.

2.16 The TMB lamp lights when the 1U amplifier is in use.

2.17 The meter busy (MB) lamp lights when the meter associated with the particular position is busy.

SENSITIVITY CONTROL AND BUSY LAMP FOR 1W AMPLIFIER-RECTIFIER WITHOUT EXTENDED RANGE -FIG. 17

2.18 Noise measurements are normally read on the A scale of the meter. The RC lead is grounded with all keys normal, and when key NM (A+30), (YT option Fig. 21) is operated, the amplifier is conditioned for adding 30 to the reading.

2.19 Operation of the A+15 key also closes ground to lead RA to condition the amplifier for adding 15 to the reading.

2.20 Operation of the A+20 key removes ground from lead RC and closes ground to leads RA and RD to condition the amplifier for adding 20 to the reading.

2.21 Operation of the A+25 key removes ground from the RC lead and closes ground to the RA lead to condition the amplifier for adding 25 to the reading.

2.22 When the 1W Amplifier-Rectifier is in use, the NMB lamp lights as a busy indication.

SENSITIVITY CONTROL FOR 1W AMPLIFIER-RECTIFIER WITH EXTENDED RANGE - FIG. 84

2.23 Noise measurements are normally read on the A scale of the meter. Leads RA, RC and RD are not grounded with all keys normal, and when key NM (A+40), (YR option Fig. 21) is operated, the amplifier is conditioned for adding 40 to the reading.

2.24 Operation of the A+15 key closes ground to the RA and RC leads to condition the amplifier for adding 15 to the meter reading.

2.25 Operation of the A+20 key closes ground to the RA and RD leads to condition the amplifier for adding 20 to the meter reading.

2.26 Operation of the A+25 key closes ground to the RA lead to condition the amplifier for adding 25 to the meter reading.

2.27 Operation of the A+30 key closes ground to the RC lead to condition the amplifier for adding 30 to the meter reading.

2.28 Operation of the A+35 key closes ground to the RD lead to condition the amplifier for adding 35 to the meter reading.

2.29 When the 1W Amplifier-Rectifier is in use, the NMB lamp lights as a busy indication.

AUXILIARY METER SELECTION KEY - FIG. 18

2.30 When provided, operation of meter selection key MS- causes the operation of relay MA-, which transfers the output of the 1U Amplifier-Rectifier from the regular meter to the selected auxiliary meter.

CALIBRATE KEY - FIG. 19

2.31 Operation of calibrate key CAL closes ground to operate relay CAL of Fig. 34, (paragraph 10.05).

KEY FOR SWITCHING PAD FOR INCOMING OR OUTGOING TRUNK TESTS - FIG. 20

2.32 The TST-101 key is provided for switching in the pad which is adjusted in the following ways:

(a) For the average difference in level between the outgoing switch appearance of the trunks and their TST jack appearance.

(b) For the average wiring loss of the test linkage of the 101 trunks used in measuring the incoming trunks.

2.33 When testing a trunk circuit via the TST MEAS jack, operate the TST key, which operates the TST relay of Fig. 30 or 31. When testing via a 101 trunk, operate the 101 key, which operates the 101 relay of Fig. 30 or 31.

2.34 With the keys normal, and a plug inserted into the SUB-MEAS jack on a 19A toll testboard, the SUB relay of Fig. 37 operates.

TEST - 101 RELAY SWITCHING CIRCUIT - FIG. 67

2.35 When Fig. 67 is provided, switching from a TEST pad (Fig. 51) to a 101 pad (Fig. 51) is done automatically under control of the trunk being tested rather than with key control as in Fig. 20. When lead 101 is grounded, relay 101 operates to connect a 101 pad into the transmission path. This pad will have been adjusted as in 2.32(b).

2.36 When lead 101 is not grounded, relay 101 does not operate and the TEST pad remains connected in the transmission path. This pad will have been adjusted as in 2.32(a).

KEY FOR SWITCHING FROM TRANSMISSION TO NOISE MEASUREMENTS - FIG. 21

2.37 The NM key, YS option, or NM (A+30) key (without extended range), YT option and the NM (A+40) key (with extended range), YR option are furnished when noise measurements are required. Operation of the key transfers the ST lead from the TM relay of Fig. 28 to the NM relays of Fig. 44, (Mfr Disc) or Fig. 58. The A+30 or A+40 indicates the number to be added to the meter reading if the sensitivity keys, Figs. 17 or 84, are left normal. Key NM, YS option (Mfr Disc), assumed the addition of 25 to the meter reading.

SEND-RECEIVE SWITCHING KEY - FIG. 16

2.38 Operation of the SEND key closes ground to operate the SEN relay of Fig. 32, 33, or 72. Operation of the RCV key closes ground to operate the RCV relay of Fig. 32, 33, or 72.

NM CAL CK KEY - FIG. 60

2.39 Operation of the NM CAL CK key closes ground to operate the NM relay of Fig. 58. This key is provided for each associated position and is used to check the calibration of the 1W Amplifier-Rectifier when making noise measurements.

SEPARATE SEND AND RECEIVE KEYS - FIG. 73, 82 (MFR DISC), OR 94

2.40 Operation of the SEND key in Fig. 73 or 94 closes ground to operate the SEN relay of Fig. 72. Operation of the RCV key closes ground to operate the RCV relay of

Fig. 72. A CONN cord or a TST cord must be inserted into the MEAS jack to supply the ground which the SEND and RCV keys control.

2.41 (Mfr Disc.) - Operation of the SEND key in Fig. 82:

(a) Closes ground to the SEND lead to Testboard No. 22A Position Circuit.

(b) Closes the circuit between the SEN relay in Fig. 72 and the S lead to Testboard No. 22A Position Circuit.

Operation of the RCV key in Fig. 82:

(a) Closes ground to the RCV lead to Testboard No. 22A Position Circuit.

(b) Closes the circuit between Fig. 28 and the A lead to Testboard No. 22A Position Circuit.

(c) Closes the circuit between the RCV relay in Fig. 72 and the R lead to Testboard No. 22A Position Circuit.

2.42 At a Testboard No. 21A arranged for testing switched maintenance access system (SMAS) No. 2A equipment, a SMA RCV key (Fig. 94) will be provided. Operation of this key will connect the SMAS circuits via leads SM1 and SM2 to the 1U Amplifier-Rectifier if it is idle, so receive measurements can be made.

SEPARATE SEND AND RECEIVE KEYS - DUAL SEND AND RECEIVE OPERATION - TESTBOARD NO. 22A POSITION CIRCUIT - FIG. 86 AND (2) FIG. 87 (BD-13)

2.43 A Testboard No. 22A Position Circuit is equipped with two test cords designated A and B, that are used for testing on 2-wire or 4-wire circuits. On 4-wire circuits dual send and receive functions can be performed by sending over cord A on the transmit side while simultaneously making measurements using cord B on the receive side of the same or subsequent circuit. On a 2-wire circuit a test cord may be used to either send or receive at any one time.

2.44 Operation of the SEND A-B key to the SEND A position places a ground on lead SA causing relay SD-(A), associated with sending on the A cord, to operate. Relay SD-(A) operated will:

(a) Connect a ground on lead SEND-(A) to Testboard No. 22A Position Circuit.

(b) Connect ground on lead S to operate the SEN relay in Fig. 72.

2.45 Operation of the SEND A-B key to the SEND B position places a ground on lead SB causing relay SD-(B), associated with sending on the B cord, to operate. Relay SD-(B) operated will:

(a) Connect a ground on lead SEND-(B) to Testboard No. 22A Position Circuit.

(b) Connect ground on lead S to operate the SEN relay in Fig. 72.

2.46 Operation of the RCV A-B key to the RCV A position places a ground on lead RA causing relay RC-(A), associated with receiving on the A cord, to operate. Relay RC-(A) operated will:

(a) Connect a ground on lead RCV-(A) to Testboard No. 22A Position Circuit.

(b) Close lead A-(A) from the No. 22A position circuit to lead A of Fig. 28, for operating the high impedance transmission and termination switching relay TC (Fig. 70), if required.

(c) Connect ground on lead R to operate the RCV relay in Fig. 72.

2.47 Operation of the RCV A-B key to the RCV B position places a ground on lead RB causing relay RC-(B), associated with receiving on the B cord, to operate. Relay RC-(B) operated will:

(a) Connect a ground on lead RCV-(B) to Testboard No. 22A Position Circuit.

(b) Close lead A-(B) from the No. 22A position circuit to lead A of Fig. 28, for operating the high impedance transmission and termination switching relay TC (Fig. 70), if required.

(c) Connect ground on lead R to operate the RCV relay in Fig. 72.

MILLIWATT TEN DB DOWN KEY - FIG. 92

2.48 Operation of the send key prepares this circuit to transmit the milliwatt tone on the circuit under test.

2.49 To reduce the sending level during such testing, the DOWN 10DB key is operated, causing relay MWT (Fig. 89) to operate over lead P under control of relay MWA.

2.50 Relay MWT operated will:

(a) Open leads T and R from the milliwatt supply, to now connect the milliwatt to the circuit under test through a 10dB pad consisting of resistors R88, R89, R90 and R91.

(b) Light the DOWN 10DB lamp to indicate transmission of the milliwatt at a reduced level.

(c) Lock operated under control of relay MWA.

2.51 Release of the SEND key will release relays MWA and MWT to remove the 10dB pad.

3. CONNECTION CIRCUITS

CONNECTION CIRCUIT FOR JOINT USAGE OF THE 1U AND 1W AMPLIFIER-RECTIFIER CIRCUITS WITH OTHER CIRCUITS - FIG. 26

3.01 When joint usage of the 1U and 1W Amplifier-Rectifier circuit is required for a receiving appearance at the Telephone and Transmission Measuring Circuit for VF Patch Bays, a Fig. 26 is provided for each circuit to connect the two circuits.

CONNECTION CIRCUIT FOR USE OF EXISTING MEASURING CIRCUITS - FIG. 50 (MFR DISC) AND FIG. 55

3.02 When positions are added to existing installations and the older transmission and noise measuring circuits are provided, Fig. 50 or 55 provides the connections thereto without the provision of the common equipment in this circuit.

CONNECTION CIRCUIT FOR NO. 20A (TWX) TESTBOARD - FIG. 52

3.03 When Fig. 52 is provided, separate send and receive functions are controlled by keys via the data test cord circuit.

CONNECTION CIRCUIT FOR TEST POSITION NO. 50A - FIG. 85

3.04 Provides means for connecting this circuit to test position No. 50A with proper lead designations.

CONNECTION CIRCUIT FOR USE WITH ACCESS CIRCUIT (SMAS NO. 3 TYPE) - FIG. 99

3.05 When joint usage of the 1U and 1W Amplifier-Rectifier circuits may be required by a Testboard No. 17C and an Access Circuit (SMAS No. 3 Type), Fig. 99 is required.

4. A-TYPE PAD AND CONTROL CIRCUIT - FIG. 24

4.01 In No. 4-type toll offices Fig. 24 is furnished, if required, for test control of the A pads. This figure functions with Fig. 10, or 12 and 13.

4.02 When lead B is grounded from Fig. 10 or 12, or connected to battery when Fig. 13 is provided a simplex potential is formed that removes the A pad or the A2 pad from the associated trunk circuit. In the case of Fig. 13, the battery potential causes the insertion of the fixed pad into the associated ringdown intertoll auxiliary trunk circuit.

4.03 When ground is applied to the A lead from the pad control keys of Fig. 10 or 12, relay PD operates. Operation of relay PD cuts in a pad equal to the A pad cutout of the trunk under test. The pad values are covered in Table B of the schematic drawing. This feature prevents overloading of the carrier or repeater circuit.

4.04 Proper use of the pad control keys enables the craftsman to determine the values of the pads in the circuit under test. Fig. 24 also provides DC blocking capacitors for the transmission path.

4.05 If the toll office does not require switchable pads, capacitors per Fig. 25 may be provided in lieu of Fig. 24 as outlined in Table A of the schematic drawing.

5. DC BLOCKING CAPACITORS - FIG. 25, 97 AND 98

5.01 Fig. 25 provides DC blocking in the transmission path of measuring circuits and receive appearances of the system.

5.02 Fig. 97 and 98 provide DC blocking in the transmission path of a No. 19A testboard and are used in place of the capacitors of Fig. 25.

6. FIXED PADS AND CONTROL

ADJUSTABLE PAD - FIG. 29

6.01 Adjustable pads provide compensation for office wiring loss for most measuring appearances of this system as covered in Table A of the schematic drawing. In those cases, where Fig. 29 is not provided, the pad equivalent is provided in the 101 trunk or the cord circuit.

6.02 The pad values and adjustments are covered in Table C of the schematic drawing. The nominal values of the pads are 2 dB with option X and 4 dB with option W. The pads are adjusted to compensate for the average office wiring loss to the point where the circuits are normally switched, such as the outgoing link frame for outgoing trunks. The checking and adjustment of these pads are covered in 10.06.

4W PAD SWITCHING CIRCUIT - FIG. 31

6.03 Four Fig. 29s are associated with each Fig. 31 for switching into the transmission path under control of the TST relay for outgoing trunks on concentrators, or the 101 relay for incoming trunks. These relays are operated under control of the TST-101 key of Fig. 20.

2W PAD SWITCHING CIRCUIT - FIG. 30

6.04 Two Fig. 29s are associated with each Fig. 30 and are switched as described for Fig. 31 in paragraph 6.03.

4W PAD CIRCUIT FOR SUBSCRIBER LINE TESTS - FIG. 37

6.05 Two Fig. 29s are required with each Fig. 37 and are switched into the transmission path, when provided, by insertion of a plug into the SUB-MEAS jack when a subscriber line test is being performed. This operation closes ground to the ST1 lead operating relay SUB. Operation of the SUB relay is prevented if either the TST or 101 key of Fig. 20 is operated.

7. SEND OR RECEIVE SWITCHING CIRCUIT

4W SEND-RECEIVE CIRCUIT - FIG. 32 (MFR DISC) AND 72

7.01 The operation of the SEND or RCV key of Fig. 16, 73, or 82, or relays SD-

or RC- operating in Fig. 87, closes the S or R lead to operate the SEN or RCV relay, respectively.

7.02 Operation of the SEN relay closes the transmission path and grounds the STS lead for the sending portion of the system, (paragraph 8.01).

7.03 Operation of the RCV relay closes the transmission path and grounds the STR lead for the receiving portion of the system.

7.04 The STR lead is shifted to either noise measuring or transmission measuring by the position of the (NM / A+30) or the (NM / A+40) key in Fig. 21, when provided.

7.05 When Fig. 32 is used, resistor R31 terminates the portion of the 4W circuit not in use. When Fig. 72 is used, R76 and R77, respectively, terminate the portion of the 4W send and receive circuit not in use.

4W SEND-RECEIVE CIRCUIT - NO. 19A TESTBOARD - FIG. 95

7.06 The operation of the SEND or RCV key of Fig. 73 closes the S or R lead to operate the SEN or RCV relay, respectively.

7.07 Operation of the SEN relay will:

(a) Close the transmission path through DC blocking capacitors of Fig. 97.

(b) Ground the STS lead for starting the sending portion of the system, (paragraph 8.01).

(c) Remove 600-ohm termination resistor R92.

7.08 Operation of the RCV relay will:

(a) Close the transmission path through DC blocking capacitors of Fig. 98.

(b) Ground the STR lead for starting the receiving portion of the system.

(c) Remove 600-ohm termination resistor R93.

2W SEND-RECEIVE CIRCUIT - FIG. 33

7.09 The operation of the SEND or RCV keys of either Fig. 16 or at a No. 20A testboard (via Fig. 52) closes the S or R lead to operate the SEN or RCV relay, respectively.

7.10 Operation of the SEN relay closes the transmission path and grounds the STS lead for the sending portion of the system, (paragraph 8.01).

7.11 Operation of the RCV relay closes the transmission path and grounds the STR lead for the receiving portion of the system.

8. SENDING CIRCUITS

MILLIWATT (1000-Hz) SENDING CIRCUIT - FIG. 27

8.01 When the STS lead is grounded by the SEN relay operation, relay MWA operates. Relay MWA operated closes ground to the ST lead of the milliwatt supply (where required) and closes the tone leads to the transmitting pair via Fig. 34.

8.02 When the ST lead is grounded by the insertion of a plug into the milliwatt jack of Fig. 35, 36, or 68, relay MWB operates, grounding the ST lead to the milliwatt supply and closing the tone to the jack instead of to the sending portion of the measuring system.

8.03 When either relay MWA or MWB operates, idle circuit termination resistor R34 is removed from the T and R of the milliwatt supply. For this reason, the MW or the MEAS jack should be terminated in a meter or circuit in order to present the same load on the supply after R34 is removed.

9. IMPEDANCE CONVERTER - FIG. 7 (MFR DISC)

9.01 A repeating coil per Fig. 7 is provided in series with the VF sending power for conversion from 600- to 900-ohm impedance on a 900-ohm position.

IMPEDANCE SWITCHING - FIG. 53, YC OPTION (MFR DISC)

9.02 Impedance switching is done by the operation of relay IS (Fig. 53). When the IS relay is not operated, this circuit is arranged to test 600-ohm circuits; when operated, 900-ohm circuits. The IS relay is operated by a ground, over lead 9, from the data test cord circuit.

9.03 Relay IS operated:

(a) Removes a short from across the 300-ohm section of resistors R33 and R65 of Fig. 34.

(b) Places a ground on lead 9 for operating relay TS or Fig. 40, if ZM option is provided.

(c) Removes a series resistor R73 and R74 and inserts the impedance converter (Fig. 7) in series with the AUX XMT or VF-IN jack (Fig. 54).

(d) Transfers the TS, RS, and STS leads of Fig. 34 from a Fig. 27 associated with a 600-ohm impedance milliwatt supply to a Fig. 27 associated with a 900-ohm milliwatt supply.

IMPEDANCE SWITCHING - FIG. 53, YD OPTION

9.04 Impedance switching is done by the operation of relay IS (Fig. 53).

When the IS relay is not operated, this circuit is arranged to test 600-ohm circuits; when operated, 900-ohm circuits. The IS relay is operated by a ground over lead 9 from the data test cord circuit.

9.05 Relay IS operated:

(a) Removes a short from across the 300-ohm section of resistors R33 and R65 of Fig. 34.

(b) Places a ground on lead 9 for operating relay TS of Fig. 40, if ZM option is provided.

(c) Connects the T9 and R9 leads directly to the 900-ohm impedance of the variable frequency oscillator, Fig. 65.

(d) Transfers the TS, RS, and STS leads of Fig. 34 from a Fig. 27 associated with the 600-ohm impedance milliwatt supply to a Fig. 27 associated with a 900-ohm milliwatt supply.

9.06 When the IS relay of Fig. 53 is non-operated, the T and R leads are connected to the AUX XMT or VF-IN jack of Fig. 65. This permits 600-ohm impedance connection, via a patch cord between the OSC and AUX XMT or VF-IN jack of Fig. 65, to the variable frequency oscillator.

10. VARIABLE FREQUENCY SENDING AND CALIBRATION, AND CHECK OF ADJUSTABLE PAD - FIG. 34

VARIABLE FREQUENCY OSCILLATOR SUPPLY CIRCUIT - FIG. 61

10.01 Fig. 61 provides a variable frequency oscillator with two possible output impedances, 600 ohms and 900 ohms.

(a) Frequency range is from 100 Hz to 10 kHz. A particular frequency is selected from two push button ranges with a vernier overlap between push button values.

(b) A vernier attenuator is provided for adjusting to a transmission level value from -30 to +10 dB.

VARIABLE FREQUENCY SENDING

10.02 When a cord is patched from the OSC jack (Fig. 5 and 6, which are rated Mfr Disc, or Fig. 62, 63, 64, or 69) to the AUX XMT or VF-IN jack (Fig. 54, rated Mfr Disc, Fig. 22 or 23) or OSC jack to AUX XMT or VF-IN jack of Fig. 65, the VF relay operates to ground on contacts of the AUX XMT or VF-IN jack.

10.03 The VF relay operated:

(a) Opens the STS lead to the milliwatt supply, preventing the operation or release of the MWA relay.

(b) Tranfers the sending path from 1000-Hz tone to the variable frequency oscillator.

CALIBRATION OF THE VARIABLE FREQUENCY SUPPLY

10.04 When the circuit is arranged for VF sending, operation of the CAL key (Fig. 19) operates relay CAL.

10.05 Relay CAL operated:

(a) Closes ground to the TM lead to operate the TM and TM1 relays of Fig. 28.

(b) Closes the VF tone supply to the receiving circuit T and R leads.

(d) If a circuit is under test, closes a termination to each of the transmitting and receiving leads from the measuring circuit.

(d) Closes ground to STS lead when relay VF is normal.

CHECK OF THE TST, CONC, 101, OR SUB PADS

10.06 The TST, CONC, 101, or SUB pads may be checked by patching from the MW jack to the respective MEAS jack. When the RCV key is operated, the meter reading shows the pad value since the MW jack output is 1 milliwatt.

CALIBRATION OF METERS - FIG. 45, 47, 48, AND 49

10.07 The measuring circuit is not used to check the level of the MW tone. This must be done in accordance with BSP procedures (103-335-300), using the test equipment called for therein.

10.08 The meters may be calibrated by operating the SEND key to close the milliwatt sending circuit and operating the CAL key. This connects 0 dBm to the meters associated with this position; the MA or MC potentiometer is then adjusted to give a reading of zero on the meter. The adjustment of the 1U Amplifier-Rectifier is covered in BSP sections (103-231-500).

11. RECEIVING CIRCUITS - TRANSMISSION AND NOISE MEASURING

TRANSMISSION CONTROL RELAY AND 1U AMPLIFIER-RECTIFIER CIRCUIT - FIG. 28 AND 43

11.01 Each receiving jack circuit and each positional measuring circuit is equipped with transmission control relays TM and TM1, per Fig. 28, for gaining access to the 1U Amplifier-Rectifier circuit per Fig. 43, which is provided on the basis of one per system.

11.02 With a plug in one of the receive jacks or with a measuring circuit in

the receive condition, ground is closed to the TM or STR lead of Fig. 28 from Fig. 3, 4, 21, 32, 33, or 34. The battery for the TM relays is connected only if the 1U Amplifier-Rectifier and the meter used by the position or bay are idle. Assuming the idle condition, relay TM operates. Relay TM operated:

(a) Locks to battery on its own contact.

(b) Closes ground which operates relay TCO of Fig. 43.

(c) Closes ground which operates relay TM1.

11.03 Relay TM1 operated:

(a) Closes the T and R leads via the termination circuits to the input of the 1U Amplifier-Rectifier.

(b) Closes the F1, FL, V, and 9 leads from various parts of the circuit through to the termination circuits.

(c) Closes the sensitivity control leads B, E, and F through to the 1U Amplifier-Rectifier.

(d) Closes the ST lead of the meter circuit.

(e) Closes the output leads M1 and M2 from the 1U Amplifier-Rectifier to the meter control and meter circuit.

11.04 Relay TCO operated:

(a) Opens the battery supply for operating all associated TM relays.

(b) Closes battery to lead MB, which lights the associated TMB lamps as a busy indication.

(c) Closes 48-volt battery, option R, or 24-volt battery, option Q, to the CY lead of Fig. 26 as a busy indication to circuits making joint usage of the 1U Amplifier-Rectifier.

11.05 When the RCV key is restored, relay TM is released, in turn releasing relays TM1 and TCO. Release of relays TM1 and TCO leaves the 1U Amplifier-Rectifier free for use by another position or circuit.

NOISE CONTROL RELAY AND 1W AMPLIFIER-RECTIFIER - FIG. 44 AND 46 (MFR DISC) OR 58 AND 59

11.06 When noise measuring is provided, operation of the NM key of Fig. 21 causes the receiving setup to operate the NM relay over the N lead instead of the TM relay. The battery for the NM relays is under control of the meter circuit and the 1W Amplifier-Rectifier circuit; battery is closed only when both circuits are idle.

11.07 Relay NM operated:

(a) Locks to battery on its own contact.

(b) Operates relay NCO of Fig. 46 or 59.

(c) Closes ground to the ST lead of the meter circuit.

(d) Closes T and R leads to the input of the 1W Amplifier-Rectifier.

(e) Closes the output leads M1 and M2 from the 1W Amplifier-Rectifier to the meter circuit.

(f) Closes the RA, RC, and RD sensitivity control leads from Fig. 17 through to the 1W Amplifier-Rectifier.

(g) Closes resistor R64 across the T and R leads as a termination in Fig. 44.

11.08 Relay NCO operated:

(a) Removes battery from all NM relays (NB lead).

(b) Closes battery to the NB lead of Fig. 17 to light the NMB lamps as a busy indication.

11.09 Restoration of the RCV key releases relay NM and in turn NCO, thereby freeing the 1W Amplifier-Rectifier for use by another position.

11.10 If high impedance noise measurements are not required then the wiring shown in Fig. A must be provided in conjunction with Fig. 58. Relay NM (contact 3) in operating prepares a path for operating relay TS (Fig. 40), if required.

11.11 If high impedance noise measurements are required, then either Fig. B or Fig. C must be provided in conjucntion with Fig. 58 (see circuit note 118).

11.12 With Fig. B provided, relay NM (contact 3) in operating closes the path for operating relay NC in Fig. 96 if required, via lead A1 from Fig. 28.

11.13 With Fig. C provided, relay NM (contact 3) in operating closes the path for operating relay NM1. Relay NM1 in operating will close the path for operating relays NC (Fig. 96) and TS (Fig. 40), if these relays are required to be operated during testing.

CALIBRATION OF THE NOISE MEASURING CIRCUIT - FIG. 46 (MFR DISC) OR 59

11.14 Provision is made at the bay where the 1W Amplifier-Rectifier is mounted for calibration. The calibration keys (Fig. 46 or 59), a milliwatt supply, and pads make up the calibration circuit. The meter connection

for calibration may be to a separate meter mounted at the bay, or the meter may be common with other circuits or bays in the same lineup, as in the case of a projection meter.

11.15 If the meter and the Noise Measuring Circuit are idle, operation of the CAL NOISE key operates relay NMC. Relay NMC operated:

(a) Locks to battery on its own contact.

(b) Operates relay NCO.

(c) Closes ground to the ST lead of the milliwatt supply.

(d) Closes ground to the ST lead of the meter circuit.

(e) Closes the milliwatt supply through the 35-dB pad to the input T and R leads of the 1W Amplifier-Rectifier.

(f) Closes the output leads M1 and M2 from the 1W Amplifier-Rectifier circuit to the meter circuit.

11.16 Resistor R40 or R72 acts as an impedance matching termination for the amplifier-rectifier and the 35-dB pad. The A10 and A5 keys control pads which are used in calibrating the 1W Amplifier-Rectifier circuit.

CALIBRATION CHECK OF THE NOISE MEASURING CIRCUIT FROM EACH ASSOCIATED POSITION - FIG. 59

11.17 Provision is made for checking the calibration of the Noise Measuring Circuit at each associated position by the operation of the NM CAL CK key (Fig. 60). Operation of the NM CAL CK key at a position closes a ground to operate relay NM (Fig. 58), which operates relays NMC1 and NCO of Fig. 59.

11.18 Relay NMC1 operated:

(a) Closes ground to the ST lead of the milliwatt supply.

(b) Closes the milliwatt supply through the 35-dB pad to the input T and R leads of the 1W Amplifier-Rectifier. The CAL MW jack provides means for calibrating the milliwatt supply to the calibrating circuit for the noise measuring system.

(c) Opens lead RC, and leads RA, RD (XN option) from the sensitivity control keys or switches, to the 1W Amplifier-Rectifier.

TERMINATIONS AND FILTERS FOR THE 1U AMPLIFIER-RECTIFIER - FIG. 38, 39, 41 AND 42

11.19 A 600- or 900-ohm termination, or both, is required for each 1U Amplifier-Rectifier, per Fig. 43, as determined by the needs for the particular office. Where both 600- and 900-ohm terminations are used, Fig. 40 is provided for switching from 600 to 900 ohms under control of a ground on lead 9 from the Fig. 2 that is connected.

11.20 Fig. 38 provides a 600-ohm termination and Fig. 39 provides a 900-ohm termination. Where open-wire lines may be involved in the make-up of circuits to be tested, a 180 Hz filter is required. Where filters are required Fig. 41 is used in place of Fig. 38, and Fig. 42 is used in place of Fig. 39.

11.21 The V lead in these terminations is used to put an AC ground on the center of the terminations. Any noticeable change in the meter reading is an indication of imbalance to ground.

11.22 The filter may be cut in on either Fig. 41 or 42 by operating the FLT key of Fig. 14. This operates either the F1 or F2 relay, whichever is provided or closed by Fig. 40. Operation of either of these relays adds a filter to the termination. When either relay is operated, battery is closed to light the FLT lamp as an indication that the filter is connected.

TERMINATIONS FOR THE 1W AMPLIFIER-RECTIFIER - FIG. 56 AND 57

11.23 A 600- and/or 900-ohm termination is provided for each 1W Amplifier-Rectifier, as determined by the needs of the particular office. Where both 600- and 900-ohm terminations are used, Fig. 40 is provided for switching from 600 to 900 ohms under control of ground on lead 9. Fig. 56 provides a 600-ohm termination and Fig. 57 provides a 900-ohm termination.

12. METER CIRCUITS

METER CONTROL RELAY CIRCUIT - FIG. 45

12.01 Each meter circuit with its regular and auxiliary meters, when provided (bracket- or panel-type, per Fig. 48, or projection-type, per Fig. 49), requires a meter control (MC) relay, per Fig. 45.

12.02 The operation of a TM or NM relay grounds the ST lead, and relay MC operates.

12.03 Relay MC operated:

(a) Closes the output leads of the particular amplifier-rectifier connected to the meter.

(b) Closes battery to the B lead to light the MB lamp as a meter busy indication.

(c) Opens the battery supply to the NM and TM relays, which use the same meter circuit.

(d) Closes ground to the G lead of the meter selection keys, where auxiliary meters are furnished.

12.04 When the TM or NM relays release as described in 11, relay MC releases, restoring the meter circuit to the idle condition.

AUXILIARY METER SELECTION CIRCUIT - FIG. 47

12.05 When a meter circuit is furnished with auxiliary meters, a meter auxiliary (MA-) relay (per Fig. 47) is required for each auxiliary meter. Operating the meter selection key MS- operates the associated MA- relay. Relay MA- operated transfers the meter input leads M1 and M2 and the ST lead from the regular meter to the selected auxiliary meter.

OFFICE WIRING COMPENSATION FOR METER CIRCUITS

12.06 The MC potentiometer for the regular meter and the MA potentiometer for auxiliary meters are provided to calibrate the various meters to read zero when 0 dBm is applied, as covered in paragraph 10.08.

METERS - FIG. 48 OR 49

12.07 Panel and bracket meters (per Fig. 48) do not require a start lead and are usually furnished on a one-per-position basis or so that two adjacent positions share one meter.

12.08 Projection-type meters (per Fig. 49) have a start lead which is grounded by the MC relay, causing the operation of the PL relay. Operation of the PL relay lights the projection lamp and turns on the cooling fan motor. Projection meters are usually provided on a two-per-lineup basis, with alternate positions using meters at opposite ends of the lineup.

13. HIGH IMPEDANCE SWITCHING CIRCUITS

TRANSMISSION MEASURING AND TERMINATION - FIG. 70

13.01 When such circuits as SD-59432-01, SD-95162-01, and SD-95463-01 use, either jointly or separately, the 1U Amplifier-Rectifier and meter of this circuit, and provision for high impedance-unterminated transmission measurements are required, one Fig. 70 is required for the system.

13.02 Fig. 70 is arranged to terminate the 1U Amplifier-Rectifier in 600 or 900 ohms when the associated A lead is grounded. When the associated A lead is not grounded, an unterminated connection to the 1U Amplifier-Rectifier is provided.

NOISE MEASURING AND TERMINATION - FIG. 96

13.03 When such circuits as a VF patch bay, N-Type carrier bay or a No. 22A testboard jointly share the use of a 1W Amplifier-Rectifier and meter of this circuit, and provision for high impedance-unterminated noise measurements are required, one Fig. 96 is required for the system.

13.04 Fig. 96 is arranged to terminate the 1W Amplifier-Rectifier in 600 or 900 ohms when the associated NA lead is grounded. When the associated NA lead is not grounded, an unterminated connection to the 1W Amplifier-Rectifier is provided.

14. TESTBOARD NO. 19A - ENVELOPE DELAY AND ATTENUATION RESPONSE MEASUREMENTS FROM THE NO. 25 TYPE TEST SET (BD-9A)

4-WIRE, 25A INPUT JACK CIRCUIT - FIG. 75 (MFR DISC) AND 76 (MFR DISC)

14.01 The 25A IN jacks are used to patch the No. 25 type test set to the No. 19A testboard for the above measurements. The insertion of the plug partially closes the operate path of the 25S relay.

14.02 When a plug is inserted in the SUB MEAS jacks, ground is connected to relay SUB causing it to operate. When a plug is inserted in either the TST MEAS or the 101 MEAS jacks and the TST or 101 key of Fig. 20 operates, ground is connected to the TST or 101 relay, respectively, causing it to operate.

14.03 Operation of either the SUB, 101, or TST relay connects ground through normal contacts of the 25R relay, normal contacts of the SEND RCV keys of Fig. 76 and make contact of the XMT jack of Fig. 75 to the 25S relay, which operates it.

25A SWITCHING CIRCUIT - FIG. 74 (MFR DISC)

14.04 Operation of the 25S relay operates the 25A indicating lamp and connects ground to the 25R relay operating it. Both relays operated connect tip and ring leads of Fig. 1 directly to the 2 dB pads of Fig. 29 by short-circuiting the blocking capacitors of Fig. 25.

14.05 The originating 19A testboard attendant calls the far end over a 101 trunk to set up the proper means for performing the envelope delay and attenuation response test.

14.06 Standard Arrangement (BD-9B). Envelope delay and attenuation response measurements can now be made by patching a No. 25 type test set, or equivalent, into the AUX REC and AUX XMT jacks (Figs. 23 and 91). Simultaneous send and receive testing can be controlled by means of Fig. 73 SEND RCV key, Fig. 95 4W, send and receive circuit and Figs. 97 and 98, DC blocking capacitors.

15. TESTBOARD NO. 21A - SENSITIVITY AND RESPONSE TIME MEASUREMENTS OF THE AST SWITCH IN THE MULTIADDRESS BRIDGE CIRCUIT

AMPLITUDE SENSITIVE TRANSMISSION (AST) MEAS JACKS - FIG. 77

15.01 Fig. 77 is connected to the blocking capacitors of Fig. 25, which, in turn, connect to the SCOPE TRACE (RCV) jack of Fig. 78. By inserting the CONN end of the TST-CONN cord into Fig. 77 and the TST end into access trunk No. 1 (number used for clarification only) the code of the input port of the multiaddress bridge circuit is key pulsed into the access trunk.

SCOPE TRACE JACKS - FIG. 78 AND SCOPE CONNECT CORDS - FIG. 81

15.02 Fig. 81 is used to connect a dual trace scope to Fig. 78 for observing the test.

AST SWITCH RESPONSE MEASUREMENT INTERRUPTER CIRCUIT - FIG. 79

15.03 The interrupter circuit of Fig. 79, in conjunction with the variable frequency oscillator of Fig. 61, provide an interrupted 1000-Hz test tone (approximately 50 msec on and 260 msec off) which is used in testing the AST switch.

15.04 The interrupter circuit is started by relay IO, which operates when a CONN cord is inserted into the INT OUT jacks of Fig. 80. The IO relay operated connects ground to the No. 5 terminals of the A and B D3 timers.

15.05 Battery connected through relay B normal to terminal 2 of the A timer and ground connected to its No. 5 terminal cause the A relay to operate almost immediately. When relay A operates, it transfers battery from terminal 1 to 2 of the B timer, causing it to start timing. After approximately 50 msec, the B relay operates. The B relay operated transfers battery from terminal 2 to 1 of the A timer causing it to turn off and release relay A. Relay A released transfers battery from terminal 2 back to terminal 1 of the B timer, causing it to turn off and release relay B. Relay B released transfers the battery from terminal 1 back to terminal 2 of the A timer.

15.06 At this point, the A timer starts timing and, approximately 260 msec later, relay A operates. The circuit continues to repeat the above operation as long as the IO relay remains operated.

15.07 The time between two operations of relay A represents one complete cycle and approximately consists of a 50-msec on (tone) period and a 260-msec off period.

15.08 The output of the variable frequency oscillator of Fig. 61 connects to transfer contacts on the IO relay, which, when normal, terminate the oscillator in the R82 resistor. When the IO relay operates, it transfers the output 1000-Hz tone to contacts on the II relay. When relay A operates and relay B is normal, the oscillator output is connected through normal contacts on the B relay to the INT OUT (XMT) jack of Fig. 80 and to the XMT jack of Fig. 78, which is used as a reference trace on the dual-trace scope. When relay B operates, the oscillator output is removed from the INT OUT (XMT) jack of fig. 80 and is terminated in resistor R81. The INT OUT (XMT) jack of Fig. 80 is also terminated, however, in resistor R80.

INTERRUPTER JACK CIRCUIT - FIG. 80

A. INT OUT Jacks

15.09 When the CONN end of the TST-CONN cord is inserted into the INT OUT jacks, ground is connected through a make contact on the XMT jack to the IO relay, operating it. IO relay operated connects ground to the A and B D3 timers and partially completes the path between the variable frequency oscillator of Fig. 61 and the XMT jack of Fig. 80. The TST end of the TST-CONN cord is patched to access trunk No. 2 (number used for clarification only.) The code of an output port in the multiaddress bridge circuit is then key pulsed into the access trunk.

B. INT IN Jacks

15.10 The INT IN jacks of Fig. 80 provide a means of patching portable test equipment into the interrupter circuit. With this arrangement, an interrupted output is provided as described in paragraph 15.03.

15.11 When a plug is inserted into the INT IN jacks, relay II operates. This transfers the input to the interrupter circuit (A and B relay contacts) from the variable frequency oscillator to the XMT jack of the INT IN jacks and terminates the variable frequency oscillator in resistor R82.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

None.

2. FUNCTIONAL DESIGNATIONS

2.01 KEYS

(a) TST-101	For shifting from the fixed pad for testing outgoing trunks (TST) to the fixed pad for testing incoming trunks (101).
(b) SEND-RCV	For changing the measuring circuit to sending or receiving.
(c) NM, NM A+(30) or NM A+(40)	For changing the receiving circuit from transmission to noise measuring.
(d) CAL	For checking the sending power of the variable frequency tone.
(e) MS-	For selection of auxiliary meters.
(f) FLT	For connection of the 180 Hz filter into the 1U Amplifier-Rectifier termination to eliminate interference on open-wire circuits when making transmission measurements.
(g) NM CAL CK	For checking the calibration of the 1W Amplifier-Rectifier at each associated position.
(h) API	A-PAD-IN, pad control single A pad offices.
(i) APO	A-Pad-Out, when normal removes the 2dB portion of the A pad in the circuit under test.
(j) FPI	Fixed Pad In, pad control ringdown intertoll trunks.
(k) 2PI	2dB Pad In, pad control split A Pad offices.
(ℓ) A+( )	Noise measurement sensitivity control for A scale readings, add number in parenthesis to meter reading.
(m) B+( )	Transmission measurement sensitivity control for B scale readings, add number in parenthesis to meter reading.
(n) A	Transfers transmission meter readings to the A scale.
(o) GRD	Provides a center tap ground on the meter termination during unbalance tests.
(p) SEND A-B, RCV A-B	At a testboard No. 22A, permits dual send and receive operation.
(q) SMA-RCV	At a testboard No. 21A, permits receive measurements on a SMAS No. 2A equipment.
(r) DOWN 10DB	Reduces the milliwatt sending level to -10dB by means of a pad.

2.02 LAMPS

(a) FLT	180 Hz filter connected
(b) MB	Meter circuit busy
(c) NMB	Noise measuring busy (1W Amplifier-Rectifier)
(d) TMB	Transmission measuring busy (1U Amplifier-Rectifier)
(e) 10DB DN	Milliwatt transmitted at -10dB.

2.03 RELAYS

(a) A	Timer A (Fig. 79)
(b) AR	Auxiliary Receiving (Fig. 90)
(c) B	Timer B (Fig. 79)
(d) CAL	Calibrate (transmission) Fig. 34
(e) F1	Filter in, 600-ohm termination (Fig. 41)
(f) F2	Filter in, 900-ohm termination (Fig. 42)
(g) II	Interrupter in (Fig. 79)
(h) IO	Interrupter out (start) Fig. 79

(i) IS	Impedance switching (Fig. 53) 600 to 900 ohms.
(j) MA	Meter auxiliary (Fig. 47)
(k) MC	Meter control (Fig. 45)
(ℓ) MWA	Milliwatt (A side) Fig. 27
(m) MWB	Milliwatt (B side) Fig. 27
(n) MWT	Milliwatt, minus ten (Fig. 89)
(o) NC	Noise control, high impedance (Fig. 96)
(p) NCO	Noise cut-off (Fig. 46, 59)
(q) NM	Noise measure (Fig. 44, 58)
(r) NM1	Noise measure (slave) Fig. C
(s) NMC	Noise measure calibrate (Fig. 46, 59)
(t) NMC1	Noise measure calibrate (slave) Fig. 59
(u) PL	Projector lamp control (Fig. 49)
(v) RC, or RCV	Receive (Fig. 32, 33, 72, 87, 95)
(w) SD, or SEN	Send (Fig. 32, 33, 72, 87, 95)
(x) SUB	Subscriber (Fig. 37)
(y) TC	Transmission control, high impedance (Fig. 70)
(z) TCO	Transmission cut-off (Fig. 43)
(aa) TM	Transmission measure (Fig. 28)
(ab) TM1	Transmission measure (slave) Fig. 28
(ac) TS	Termination switching (Fig. 40)
(ad) TST	Test (Fig. 30 or 31)
(ae) VF	Variable frequency (Fig. 34)
(af) 25R	25A test circuit (receive) Fig. 74
(ag) 25S	25A test circuit (send) Fig. 74
(ah) 101	Code 101 test (Fig. 30, 31, 67)

2.04 JACKS

(a) AST MEAS	Amplitude sensitive transmission measure (Fig. 77)
(b) AUX REC	Auxiliary receive (Fig. 91, 93)
(c) AUX XMT	Auxiliary transmit (Fig. 22, 23)
(d) CONC MEAS	Concentrator measure (Fig. 1)
(e) INT IN	Interrupter in (Fig. 80)
(f) INT OUT	Interrupter out (Fig. 80)
(g) HIGH IMP RCV	High impedance receive (Fig. 3)
(h) MEAS	Measure (Fig. 2, 66, 71) for send and receive measurements
(i) OSC	Oscillator (Fig. 5, 6, 62, 63, 64, 65, 69)
(j) RCV or RCV B	Receive only measurements (Fig. 3, 4)
(k) Scope Trace	Oscilloscope connection (Fig. 78)
(ℓ) SUB-MEAS	Subscriber measure (Fig. 1)
(m) TST MEAS	Test measure (Fig. 1, 2)
(n) VF IN	Variable frequency input (Fig. 22, 23, 54, 65)
(o) 6HR CTR	Impulse counter (model 6HR) Fig. 88
(p) 25A IN	25A TEST SET INPUT (Fig. 75)
(q) 101 MEAS	CODE 101 TEST (Fig. 1, 2)
(r) 1000 0 600	Milliwatt, 0dB at 600 ohms (Fig. 35, 36)
(s) 1000 0 900	Milliwatt, 0dB at 900 ohms (Fig. 36, 68)

2.05 For simplicity, resistors and capacitors are designated numerically because of the large number involved.

3. FUNCTIONS

3.01 Provides for making transmission measurements at 600-, 900-ohms and high impedance (unterminated).

3.02 Provides for making noise measurements at 600-, 900-ohms and high impedance (unterminated), with "C message weighting."

3.03 Provides for sending a milliwatt (1000-Hz) at 600-, or 900-ohms, 0dBm or -10dBm or VF tones at a level from -30dB to +10dB.

3.04 Provides for combined sending and receiving appearances under the title of measure jacks or measure connections.

3.05 Provides for receiving only appearances.

3.06 Provides for joint use of the 1U and 1W Amplifier-Rectifiers with other circuits.

3.07 Provides for 600-, 900-, or combined 600- and 900-ohm impedances in the same office.

3.08 Provides fixed pads, adjustable to compensate for office wiring loss, which are cut into the circuit by operation of the correct key with a particular measure jack.

3.09 Provides busy lamps and control keys for the meters, 1U and 1W amplifier-rectifiers.

3.10 Provides for pad control for use with No. 4-type systems.

3.11 Provides for use with panel-, bracket-, projection-type, keyshelf, or vertical meters.

3.12 Provides for selection of an auxiliary meter under control of a key.

3.13 Provides for calibration of the meter.

3.14 Provides for 2-wire or 4-wire use.

3.15 Provides for connection to auxiliary transmission measuring equipment in place of the 1U and 1W amplifier-rectifiers.

3.16 Provides for jack access to the following test equipment:

(a) Oscilloscope.

(b) No. 25A gain and delay test set.

(c) 6HR impulse counter.

4. CONNECTING CIRCUITS

4.01 When this circuit is shown on a keysheet, the connecting information thereon is to be followed.

(a) 19C Oscillator Application Schematic - SD-64913-01 (Mfr Disc).

(b) Milliwatt Supply (2A Sending Panel) - SD-95000-01.

(c) Milliwatt Supply (Transistorized) - SD-95277-02.

(d) Variable Frequency Oscillator - KS-19260, List 1.

(e) No. 25A gain and delay test set SD-99756-01.

(f) Oscilloscope - TEKTRONIC Dual-trace (typical).

(g) 6HR Impulse Counter - SD-99481-01.

(h) Joint Access Circuits.

(1) Telephone and Test Circuit - SD-95463-01.

(2) Repeater Measuring Circuit - SD-95162-01.

(3) Transmission Measuring for VF Patch Bays - SD-59432-01.

(4) Transmission Measuring Circuit - SD-95135-01.

(5) Noise Measuring Circuit - SD-95136-01.

(6) Transmission Measuring 1000-Hz Outlets, Receiving Jacks, and Controls - SD-95162-02.

(7) Voice Frequency Test Circuit - SD-99476-01.

(8) D2 channel banks - SD-99478-01.

(i) Amplifier-Rectifiers

(1) 1U Amplifier-Rectifier (Transmission) - SD-64098-01.

(2) 1W Amplifier-Rectifier (Noise) - SD-95102-02.

(j) Test Termination Circuit - SD-96540-01.

(k) Testboard No. 20A, Data Test Cord Circuit - SD-56528-01.

(ℓ) DC Line, Loop, Leg, and Miscellaneous Cord Circuit - SD-70618-01.

(m) Miscellaneous Jack Circuit - SD-62889-01.

(n) Telegraph Testboard No. 10A - Position Circuit - SD-71032-01.

(o) Telegraph Testboard No. 10B - SD-71075-01.

(p) Testboard No. 19A, Cord Circuit - SD-56500-01.

(q) Testboard No. 18B, Secondary Cord Circuit - SD-55033-01.

(r) Testboard No. 17E, Cord Circuit - SD-56539-01.

(s) Testboard No. 17B or 20A, Cord Circuit - SD-64613-01.

(t) Testboard No. 17C, Cord Circuit - SD-68092-01.

(u) Testboard No. 21A, Cord Circuit - SD-56547-01.

(v) Test Unit No. 5A, Test Circuit - SD-68543-01.

(w) Testboard No. 17E, Jack Circuit - SD-56540-01.

(x) Testboard No. 17B (TWX) or 20A, Jack Circuit - SD-56526-01.

(y) Testboard No. 19A, Jack Circuit - SD-56498-01.

(z) Testboard No. 17C, Jack Circuit - SD-68122-01.

(aa) Testboard No. 17B or 18B, Jack Circuit - SD-64724-01.

(ab) Testboard No. 17B or 18B, Jack Circuit - SD-64545-01.

(ac) Testboard No. 21A, Jack Circuit - SD-56543-01.

(ad) Testboard No. 21A Access Circuit - SD-56545-01.

(ae) Testboard No. 22A Position Circuit - SD-99403-01.

(af) Test Position No. 50A Miscellaneous Circuit - SD-1C204-01.

(ag) D3 Timer - SD-32371-01.

(ah) Manual Test Frame (TOLL) - SD-68587-01.

(ai) Switched Maintenance Access System (SMAS) No. 2A - SD-99776-01.

(aj) Access Circuit (SMAS No. 3 Type) - SD-99542-01.

5. TAKING EQUIPMENT OUT OF SERVICE

5.01 By blocking the TCO or NCO relays operated, the transmission measuring or noise measuring portions, respectively, of this circuit may be taken out of service. The Circuit Requirements table for this circuit presupposes that all relays are normal and that tests are made during a low-usage period.

SECTION IV - REASON FOR REISSUE

A. Changed and Added Functions

A.1 Provides for separate send and receive functions for dual cord operation at a testboard No. 22A.

B. Changes in Apparatus

B.1

Superseded	Superseded By
Key - SEND, 552A Fig. 82	Key, SEND A-B, 552E Fig. 86
Key - RCV, 552B	Key, RCV A-B 552E

B.2 Added

Relay - SD 1/2 AK4 - Fig. 87 (new)

Relay RC 1/2 AK4 - Fig. 87

Diodes SD, RC 446F - Fig. 87

D. Description of changes

The following changes are made for use of this circuit at a testboard No. 22A.

D.1 Fig. 82 is rated Mfr Disc. and replaced by new Fig. 86, for separate send and receive keys.

D.2 Fig. 87 is added to provide separate send and receive relays, to work in conjunction with keys shown on Fig. 86 to provide for dual cord operation.

D.3 In Fig. 72, the connecting information is enlarged to add "or Fig. 87".

D.4 Circuit Notes 102 and 104 are enlarged to add reference to new Figs. 86 and 87; also note 102 is changed to add reference to Fig. 83 "with extended range" and words without extended range are added for use with existing Fig. 15, as this information was omitted from the previous issue.

D.5 In Table A, item 53 is changed to delete reference to Fig. 82, and to add reference to new Figs. 86 and 87.

D.6 CAD 20 is changed and CAD 22 is added.

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