

PRIMARY NUMBER NETWORK LEADS AND
 LINE NUMBER VERIFICATION

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1. GENERAL INFORMATION

1.1 This section describes the tests to be made to verify cabling between number network and identifier frames, number network and distributing frames, operational tests of line cross connection assignments and tests of miscellaneous circuits at the identifier frame. The circuits covered are:

- SD-95810-01 Identifier Ckt
- SD-95813-01 Primary Number Network
- SD-95814-01 Secondary Number Network
- SD-95825-01 Misc. Ckt - Identifier Frame

1.2 Electrical tests of primary and secondary number networks are performed by the shop and the local multiple of vertical and horizontal buses on the number network frame is verified by the shop. These circuits should be in operating condition when received at the job.

1.3 The tests of Paragraph 4 check the leads between the NN frame and the identifier frame. When working near the TP (-) relays to check these leads, extreme care should be taken in removing and replacing relay covers to prevent bending and transposition of contact springs. Covers should be stored in a safe place and replaced as soon as the tests are completed.

1.4 Sleeve leads between the NN frames and the distributing frame may be connected to the primary number networks, but the distributing frame end should be left open until the tests of Paragraph 5 are performed. These tests check the sleeve leads for crosses and opens.

1.5 Primary number network cross connections may be installed on the job per telephone company assignments or may be wired completely by the shop on a frame basis. When shop wired, all networks on a frame will be strapped for ring party assignment. Any changes in assignment on this basis will require removal of the shop straps and job replacement of the changed straps.

1.6 At least one identifier must be in working condition to perform the line verification tests of Paragraph 6.

2. RECORDS AND REQUIREMENTS

2.1 Records

2.11 Forms ID-1313 and ID-1315 are required for recording the results of these tests. For further information on preparing records refer to Handbook 50, Section 3.

2.2 Requirements

2.21 The tests of this section conform with the performance requirements for ANI installations as outlined in BSP AA632.006, AA632.007 or AA632.008.

3. TEST EQUIPMENT

3.1 Test Sets

<u>Amt</u>	<u>Code</u>	<u>Description</u>
1	ITE-4442	Volt-Ohmmeter
1	ITE-4570	ANI Test Set
1	ITE-4511	Transistorized Whistler

3.2 Cords

<u>Amt</u>	<u>ITE</u>	<u>Lgth</u>	<u>Cdrs</u>	<u>One End</u>	<u>Other End</u>	<u>With ITE</u>
2	9547	12'	1	ITE-2455 Plug	ITE-2455 Plug	Accessory Set
5	9962	12'	10	Jones Plug	10-ITE-2461 Sockets	4570
1	9536	12'	1	ITE-2174 Pick	Alligator Clip	4570
2	9639	12'	3	310 Plug	3-ITE-2455 Plug	Accessory Set
2	9606	12'	3	310 Plug	3-Spade Tips	Accessory Set

3.3 Accessories

<u>Amt</u>	<u>ITE</u>	<u>Description</u>	<u>With ITE-</u>
50	4085	Push-On Clip	4570
2	8507	Alligator Clip	Accessory Set

4. LEADS FROM NUMBER NETWORK TO IDENTIFIER FRAME

NOTE 1: The number network frames provide the primary or subscriber networks which are arranged within a bus system, 100 numbers high and 100 numbers wide for a complete 10,000 number office. Each N.N. frame includes two vertical groups of 1000 numbers each, arranged on ten 313A panels. Each panel is equipped with 20 vertical "cards" located on the rear of the panel and each having ten networks for ten numbers.

The ten panels on the left of the frame are in one thousand group, and the ten panels on the right side of the frame are in the next thousand group, thus N.N. frame 0 is associated with thousands 0 and thousands 1. Five N.N. frames provide the ANI facilities for a complete office.

NOTE 2: Tests of the vertical bus leads should be made from the bottom of the frames, thus assuring their continuity through higher numbered panels and into the identifier frame. Tests of the horizontal bus leads should be made from the right front side of the highest numbered number network frame thus assuring the continuity of the buses through all N.N. frames from the highest numbered frame down through N.N. frame 0 and then to the identifier frame.

NOTE 3: The "X" number network frames are not equipped with either horizontal or vertical buses.

4.1 Number Network frames may be provided either without straps or fully shop strapped for ring party assignment. Shop strapped frames may be ordered as an option by the operating company. Cable leads between N.N. frames and Identifier frames are checked for continuity and crosses where practicable in either case.

4.2 Cross Connections Not Installed

4.21 When cross connections are not in at the number network frame, the vertical and horizontal buses are connected by cable to the contacts of relays TP (0-19) at the identifier frame. The leads from the vertical buses (TH-, U-) connect to relays TP (0-9). The leads from the horizontal buses connect to contacts of relays TP (10-19).

4.22 Using the ohmmeter scale of the ITE-4442, set resistance scale on RX1. Verify that meter reads zero when the test leads are connected together.

4.23 Connect one lead of the ohmmeter to ground. Connect other lead to MAKE contact of relay TP (-) shown in Table 1. Meter will read open circuit. At the bottom of the first number network frame, connect ground momentarily to each of the Tip Party leads TTH (-), U (-) of the vertical bus multiple. At the N.N. frame, these are the buses at the left of the group of three which are shown in Figure 1 of this section. For N.N. Frame 0, the leads are designated TTH (0), U (0-9) and TTH (1), U (0-9) running from left to right at the front of the N.N. panel.

4.24 As each lead is grounded, the associated contact of the TP (-) relays will be grounded, and the ohmmeter will read approximately zero.

4.25 After checking all tip bus connector leads, repeat test for the ring bus connector leads. The ring bus is at the right of the group of three shown in Figure 1 of this section. With the TP (-) relays normal, all ring bus leads appear solidly grounded through the "G" indicator of SD-95814-01-B2. To remove ground from the ring bus leads, momentarily operate the TP (-) relay to open the break contact. With the break contact open, the ohmmeter should indicate an open circuit. Momentarily connect ground to each ring bus connector lead shown in Table 1, and check that the ohmmeter reads approximately zero.

4.26 After checking ring bus leads, repeat tests on the horizontal bus connector leads. These leads should be checked from the right front side of the highest numbered N.N. frame. The panels are designated H (0), T(0-9) to H(9), T (0-9) from bottom to top.

4.27 Perform tests as outlined above except that the tip bus leads are the lower terminals of each pair as shown in Figure 1 of this section. The ring bus leads are the upper terminal of each pair. Connect ground to leads and test at contacts of TP (-) relays as shown in Table 2.

4.28 Verify that the multiparty buses are multiplied together on each N.N. frame as shown in SD-95813-01-2. Verify that each PY (-) lead (two per N.N. frame) reads approximately zero ohms to ground (actually 0.25 ohm plus cable lead resistance) at the number network end.

4.3 Primary Number Network Cross Connections - Shop Installed

4.31 When frames are received with shop wired cross connections, all number networks will be cross-connected as ring party assignments. With this arrangement, the RTH (-) U(-) and RH (-) T (-) leads are connected to ground through a nominal 205 ohms, resulting from the parallel connection of one hundred individual paths of 20,511 ohms to ground. The TTH (-) U (-) and TH (-) T (-) leads will be open as in the tests described in Paragraph 4.23.

4.32 Perform the tests as outlined in Paragraphs 4.23 and 4.24 without change. Perform the tests as outlined in Paragraphs 4.25 to 4.27. The indications will be similar except that the individual lead resistance will read approximately 200 ohms on each of the ring bus connector leads (RTH (-) U (-) and RH (-) T (-) leads) with the associated TP (-) relay held operated. When the lead is grounded at the number network frame end, the reading should drop to approximately zero at the identifier frame with the ohmmeter connected to the TP (-) relay contact.

4.33 Perform test of multiparty bus connector leads as shown in Paragraph 4.18.

1/2 NO. NETWORK FRAME 0

NO. NETWORK FRAMES 1-3

1/2 NO. NETWORK FRAME 4

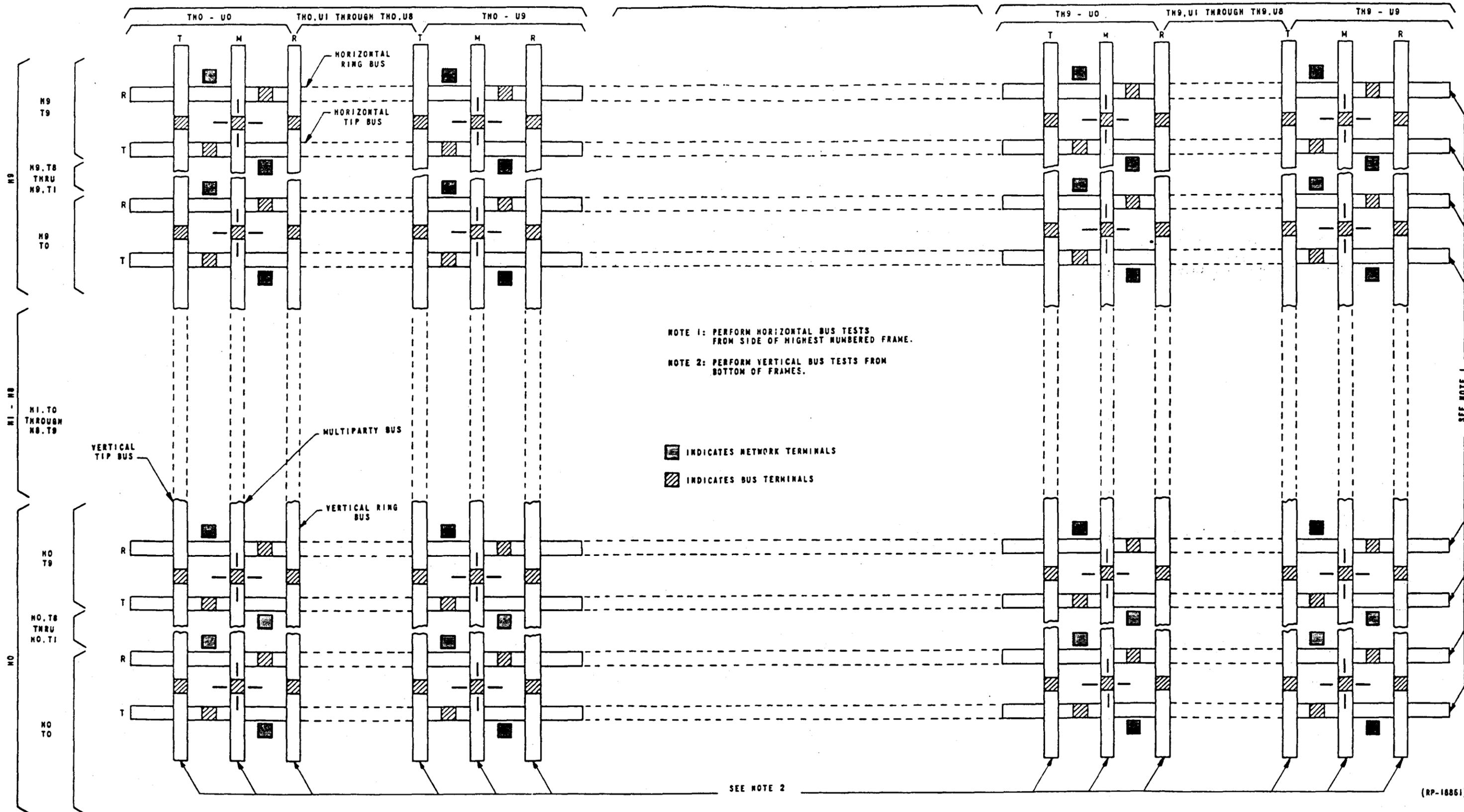


FIG. 1 ARRANGEMENT OF PRIMARY NUMBER NETWORKS

(RP-18851)

TABLE 1

Leads Under Test	Number of Leads	TP Relay (In Order)	TP Relay Contact	TP Relay	
				Operated	Released
TTH(0)U(0-9)	10	0-9	2 Make		X
TTH(1)U(0-9)	10	0-9	3 Make		X
TTH(2)U(0-9)	10	0-9	4 Make		X
TTH(3)U(0-9)	10	0-9	5 Make		X
TTH(4)U(0-9)	10	0-9	6 Make		X
TTH(5)U(0-9)	10	0-9	7 Make		X
TTH(6)U(0-9)	10	0-9	8 Make		X
TTH(7)U(0-9)	10	0-9	9 Make		X
TTH(8)U(0-9)	10	0-9	10 Make		X
TTH(9)U(0-9)	10	0-9	11 Make		X
RTH(0)U(0-9)	10	0-9	2 Break	X	
RTH(1)U(0-9)	10	0-9	3 Break	X	
RTH(2)U(0-9)	10	0-9	4 Break	X	
RTH(3)U(0-9)	10	0-9	5 Break	X	
RTH(4)U(0-9)	10	0-9	6 Break	X	
RTH(5)U(0-9)	10	0-9	7 Break	X	
RTH(6)U(0-9)	10	0-9	8 Break	X	
RTH(7)U(0-9)	10	0-9	9 Break	X	
RTH(8)U(0-9)	10	0-9	10 Break	X	
RTH(9)U(0-9)	10	0-9	11 Break	X	

TABLE 2

Leads Under Test	Number of Leads	TP Relay (In Order)	TP Relay Contact	TP Relay	
				Operated	Released
TH(0)T(0-9)	10	10-19	2 Make		X
TH(1)T(0-9)	10	10-19	3 Make		X
TH(2)T(0-9)	10	10-19	4 Make		X
TH(3)T(0-9)	10	10-19	5 Make		X
TH(4)T(0-9)	10	10-19	6 Make		X
TH(5)T(0-9)	10	10-19	7 Make		X
TH(6)T(0-9)	10	10-19	8 Make		X
TH(7)T(0-9)	10	10-19	9 Make		X
TH(8)T(0-9)	10	10-19	10 Make		X
TH(9)T(0-9)	10	10-19	11 Make		X
RH(0)T(0-9)	10	10-19	2 Break	X	
RH(1)T(0-9)	10	10-19	3 Break	X	
RH(2)T(0-9)	10	10-19	4 Break	X	
RH(3)T(0-9)	10	10-19	5 Break	X	
RH(4)T(0-9)	10	10-19	6 Break	X	
RH(5)T(0-9)	10	10-19	7 Break	X	
RH(6)T(0-9)	10	10-19	8 Break	X	
RH(7)T(0-9)	10	10-19	9 Break	X	
RH(8)T(0-9)	10	10-19	10 Break	X	
RH(9)T(0-9)	10	10-19	11 Break	X	

4.4 Cross Tests

4.41 Cross tests can be performed only on tip bus or ring bus leads which have not been cross-connected at the number network frame. Where frames are received with ring party cross connections shop installed, only the tip bus connector leads can be tested, using the ITE-4511 Whistler Test Set, NOT modified for the sleeve lead tests of Paragraph 5.

4.411 Ring Bus Leads (Only on N.N. Frames Without Shop Cross Connections)

4.4111 Using an ITE-9547 cord equipped with alligator clips, or equivalent, connect ground to the (TP) lead at (C) T.S. terminal 47 at the identifier frame. This will cause all of

TP (0-19) relays to operate and remove secondary network ground from the ring bus leads. Using the ITE-4511, set switch at (W) and turn knurled control disc away from the (OFF) position.

4.112 Connect alligator clip lead to ground and touch probe to the first ring bus connector lead. Adjust frequency control for optimum response on ITE-4511 and touch probe to all remaining ring bus leads. The tone should be similar for all leads with some allowance made for the difference in cable length from the first to the last N.N. frame connections. This test will check the 200 ring bus connector leads for crosses.

4.113 After whistling all ring bus leads, disconnect ground from (C) T.S. terminal 47 at the identifier frame. All TP (-) relays should release.

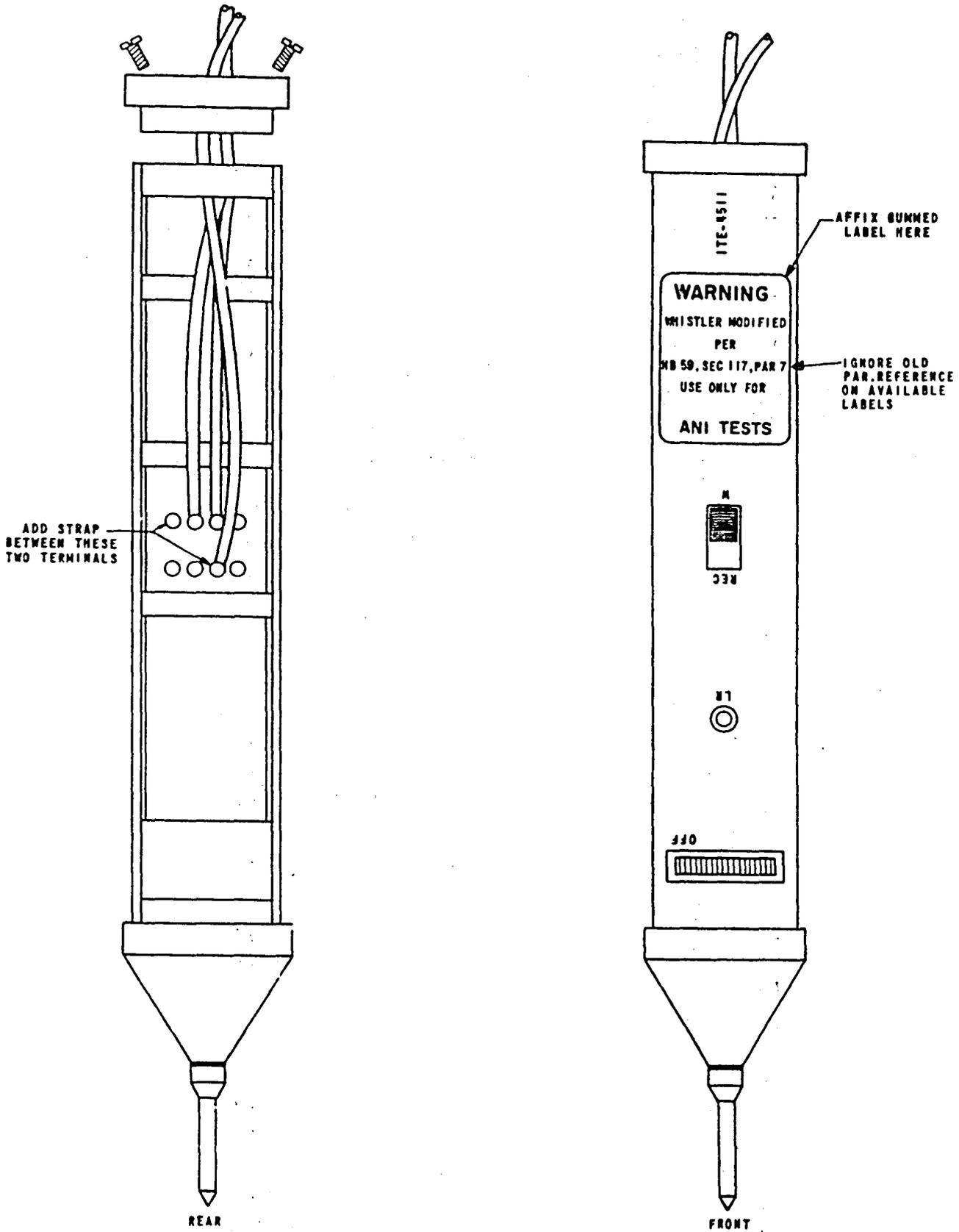


FIG. 2 MODIFICATION OF ITE-4511

4.4114 Whistler tests may be performed at either end of the bus connector cable termination. If test is performed at TP (-) relay contacts, carefully replace relay covers only after all bus connector leads have been tested.

4.412 Tip Bus Leads (All N.N. Frames)

4.4121 Tip bus leads may be checked for crosses with all TP(-) relays normal. Using the ITE-4511 Whistler Test Set, set (REC-W) switch at (W) and turn on set by rotating knurled control disc away from (OFF) position. Connect alligator clip lead to ground and touch probe to the first tip bus connector lead, either at the N.N. frames or at the TP (-) relay contact. See Tables 1 and 2 for appearance of these leads at the relays. Adjust frequency control on ITE-4511 for optimum response.

4.4122 Touch test probe of ITE-4511 to all remaining tip bus leads. The tone should be similar for leads with some allowance made for the difference in cable length between the first and last N.N. frame connections. This test will check the 200 tip bus connector leads for crosses.

4.4123 After completing tip bus lead tests, carefully replace covers on all TP (-) relays and verify that no relay springs are disturbed or out of position after covers are replaced.

4.5 One set of primary number networks, secondary number networks, and TP (0-19) relays are provided per office of 10,000 lines capacity. If more than one office is equipped, additional sets of secondary number networks and TP (-) relays will be provided at each identifier frame. Perform continuity and cross tests as outlined above for each office cabled to the identifier frame.

4.6 Where two or more identifiers are equipped and several offices are provided, each office is assigned to ONE basic appearance on a particular identifier frame. Only the leads for the basic appearance can be checked. The multiple carrying an office appearance to a second identifier frame (digit N (-) and P (-) leads) is not suitable for simple continuity and cross testing and must be checked operationally.

5. SLEEVE LEAD TESTS

5.1 Sleeve leads from the distributing frame to the N.N. frames must be checked for opens and crosses before being tied down at the distributing frame. Since the cable lead will be connected at the number network end, a large capacitance-resistance path to ground is present on each lead. To use the ITE-4511 Whistler Test Set for checking these leads, a small modification is required in this set.

5.2 Modification of Whistler Test Set

5.21 Remove casing of the probe by loosening the screws on the top of the probe. See sketch in Figure 2.

5.22 Connect a short strap between the two terminals shown in the rear view of Figure 1. Extreme care must be taken not to apply too much heat to the terminals when soldering the strap. Excessive heat may damage the semiconductor devices used in this set.

5.23 **IMPORTANT:** When modification has been made, replace casing of the ITE-4511. Remove one of the adhesive labels fastened to this section, if provided, and press onto the casing of the ITE-4511. Refer to Figure 2. The paragraph reference on the labels refers to a previous issue of Section 117 and may be ignored. If labels have not been salvaged from the previous issue, prepare an equivalent warning on a small piece of paper and fasten to the casing with adhesive cellophane tape.

5.3 Cross and Open Tests

5.31 Using the modified ITE-4511, perform a whistle test on all sleeve leads from the distributing frame to the number network frame. This test is performed most conveniently at the sleeve terminal multiple connections at the rear of the primary N.N. frame.

5.32 Open leads or open capacitors in the number network will result in a high pitched change of tone or no tone at all. Crossed leads will result in a lower pitch of tone.

5.33 Where primary number network cross connections are installed, the whistle tests can be performed, but the difference in pitch between a single network and crossed networks is not as great as with uncross-connected networks. A preliminary test should be made with two circuits deliberately crossed temporarily, to determine the change in pitch.

5.34 If leads have been skinned at the distributing frame, verify that skimmers are separated and are not grounded.

5.4 **IMPORTANT:** When whistle tests of the sleeve leads have been completed, cut and remove strap from the ITE-4511 which was added as outlined in Paragraph 5.2. Then remove the adhesive warning label from the whistler casing. This must be done so that the ITE-4511 can function properly on standard whistle tests.

5.5 The sleeve lead tests are intended primarily to check installer's cabling between N.N. and MDF locations. However, the tests will disclose also the small percentage of capacitors that become open-circuited during shipment. Although these components are thoroughly shop tested, the fragile nature of the internal connections does result in some failures on a typical job.

6. LINE NUMBER VERIFICATION

6.1 Test Setup

6.11 This test is made using the ITE-4570, ANI test set. In this test, a tone is sent out by the test set over the line sleeve, through the number

network circuits, and is identified in the Identifier circuit. Test connections are made from the test set to the Identifier circuit to record and display the office index number and line directory number on numerical indicating glow tubes in the test set.

6.12 Connect -48 Volt battery and ground to the 48 Volt battery and ground terminals of the test set using 20 gauge minimum cords or conductors. The supply should be fused for 3 amperes minimum.

6.13 Connect the Jones socket of an ITE-9962 cord to the A connector of the test set. Connect the 10 sockets at the other end of the cord, equipped with ITE-4085 push-on clips to terminals of the "C" terminal strip associated with the first identifier as shown on Table 3.

TABLE 3

Lead	Identifier T.S. "C"	Jones Conn.	Cord End
TH0	00	A1	0
TH1	10	A2	1
TH2	20	A3	2
TH4	30	A4	3
TH7	40	A5	4
H0	01	A6	5
H1	11	A7	6
H2	21	A8	7
H4	31	A9	8
H7	41	A10	9

6.14 Connect the Jones sockets of 4 more ITE-9962 cords to sockets B, C, D and E of the test set. Connect the other ends of these cords to the "C" terminal strip of the same identifier as shown on Table 4.

6.15 Observe that all keys are normal, and that only lamp NS is lighted. If other lamps are lighted, operate key RN to extinguish these lamps.

6.16 Operate keys SN and GCO.

6.17 Connect the alligator clip of an ITE-9536 cord to the S binding post of the test set.

6.2 Multiparty Test

6.21 Extend the test cord connecting to the S terminal of the test set so that the test prod can reach the front or rear of each number network frame.

6.22 Touch the test probe of ITE-9536 to the multiparty bus located between the tip and ring buses at the bottom of the first N.N. frame at the TH(0)U(0) location.

6.23 Observe that lamp PTY lights on ITE-4570.

6.24 Repeat the test for each of the remaining PY (0-9) leads. One PY (-) lead is provided for each half of a full number network frame (1 per 1,000 lines). These operational tests are required to check the PY (-) cable leads which are permanently connected to a low resistance ground.

TABLE 4

Lead	Ident. "C" T.S.	Jones Socket	Cord End
T0	02	B 1	0
T1	12	" 2	1
T2	22	" 3	2
T4	32	" 4	3
T7	42	" 5	4
U0	03	" 6	5
U1	13	" 7	6
U2	23	" 8	7
U4	33	" 9	8
U7	43	B10	9
PTY	04	C 1	0
SO	14	" 2	1
OPKO	05	" 3	2
OPK1	15	" 4	3
OPK2	25	" 5	4
OPK3	35	" 6	5
OPK4	45	" 7	6
OPK5	55	" 8	7
OPG	06	" 9	8
	-	C10	9
LT	-	D 1	-
ST	17	" 2	1
RP	27	" 3	2
TP	37	" 4	3
THK	47	" 5	4
HK	08	" 6	5
TK	18	" 7	6
UK	28	" 8	7
WC	38	" 9	8
	48	D10	9
OF0	09	E 1	0
OF1	19	" 2	1
OF2	29	" 3	2
OF3	39	" 4	3
OF4	49	" 5	4
OF5	59	" 6	5
FA	MISC. 04	" 7	6
OSC	G48	" 8	7

6.3 Line Number Test Setup

6.31 Line verification tests are performed with maximum effectiveness by extending the (S) test terminal of ITE-4570 to the line sleeve appearances at the office distributing frame. The tests can be performed with the same effort by connecting to the sleeve at the N.N. frame but the sleeve lead cabling is not used.

6.32 To extend the (S) test terminal to the distributing frame, use the spare (B) jack multiple, if provided, or any spare cable lead that runs between the two locations. Do NOT use a spare lead in the cable containing the line sleeve conductors. This arrangement has been known to cause unwanted induction of identification tone into other line sleeve leads.

6.321 If the spare jack multiple is provided, use an ITE-9639 or ITE-9606 cord and connect the tip lead to the (S) binding post of ITE-4570. Connect the 310 plug at the other end of the cord to the spare B jack of an adjacent frame.

6.322 At the distributing frame, insert the 310 plug of a similar cord to the appearance of the same spare jack. Using the ITE-9536 cord provided with ITE-4570, connect the alligator clip of this cord to the tip conductor of the cord connected to the B jack. Insulate this connection by wrapping it with adhesive insulating tape.

6.323 If the spare jack appearance is not available, run a separate lead or pick up a spare cable lead to obtain a similar circuit.

6.324 Set up a talking line between the ITE-4570 and the distributing frame. If the frame line multiple is working, use ITE-9650, Telephone Set, plugged into the frame line jacks, or an ITE-2580B, Combination Talking Set plugged into the talking line of a Step-by-Step office.

6.4 Line Number Tests

6.41 Cross connections should be installed on the number network frames prior to the start of the line number test.

6.42 Certain precautions should be observed before starting line verification tests. If working lines or lines assigned to intercept are involved, arrangements should be made with the local telephone company for connection of the sleeve leads at the distribution frame and for application of the line number test to cover the following conditions:

(a) No. 1 Crossbar: Sleeve leads may be connected completely at the distributing frame after tests of Paragraph 5 have been completed. Line verification test can be made using the ITE-4570 or the maintenance test circuit on all working lines. On unassigned or intercepted lines, or any other condition in which the sleeve lead at the distributing frame is not connected to a single line relay, it will be necessary to operate key ST on ITE-4570 in order to identify the line number.

(b) Battery Cut-Off Panel: Sleeve leads may be connected at the distributing frame after completing tests of Paragraph 5. All working lines may be connected. Where lines are assigned to intercept and intercept straps are not connected, sleeve lead may be connected and test performed before intercept strap are applied. If line is strapped to intercept, and intercept assignments are interspersed among working lines, identification test may be made on the unconnected sleeve lead, if there is very little likelihood of error in connecting the sleeve. If both the cable lead and intercept strap have been connected, one end of the sleeve intercept strap must be disconnected temporarily, the identification test performed, and the strap reconnected after the test.

(c) Ground Cut-Off Panel: The same conditions apply as outlined for the Battery Cut-Off office except that key GCO is operated in the test set. A special condition applies when a line switch ground cut-off panel office is adapted for ANI.

For this condition, the GCO key in the test set is not operated. On connection to the sleeve lead, a busy condition will light lamp LB properly in the test set. An idle line will appear as an open sleeve connection and it is necessary to operate key ST of the test set to start the test of each line.

(d) Step-by-Step: The same conditions apply as outlined for the battery cut-off panel office. If a large number of lines are assigned to intercept, and the lines are grouped together, the test can be performed on the unconnected sleeve leads, but there is some hazard in introducing error in connecting the sleeve leads after test. If all leads have been tied down, it will be necessary to disconnect one end of the sleeve intercept strap, or remove the snap-on intercept fixture, perform the identification test, and reconnect or replace the intercept assignment. If a very large number of lines are involved in this condition, arrangements may be made with the operating company either to cover the additional effort or to waive the tests of intercepted lines, whichever is considered more acceptable to them.

6.43 Unassigned Lines: Where cross connections are installed by the shop, unassigned lines will have ring party straps and may be tested using the ST key of ITE-4570. Where cross connections are job installed, some strap assignment is required to test unassigned lines. Most operating companies have agreed to permit blanket ring party assignments for unassigned lines to permit testing with ITE test equipment and maintenance test equipment. Where such agreements are not available, temporary jumpers or temporary straps may be used to connect the unassigned number network to one of the bus arrangements.

6.44 If there are no tip party assignments in the telephone company lists, assign at least one unused line as a tip party so that the TP (-) relays will be used operationally during the tests.

6.45 With all keys normal on the test set lamp NS should be lighted. If the line to be tested is a tip party line, operate key TP on ITE-4570. For individual or ring party lines, leave TP key normal. In ground cut-off panel offices, operate GCO key where line finders are provided, and leave GCO key normal where line switches are provided.

NOTE: In Step-by-Step offices arranged for two-party message rate service, it should be kept in mind that tip party line assignments are cross connected as ring parties at the ANI Number Network frame. For two-party flat rate service, tip parties are connected to the tip party bus at the ANI Number Network frame.

6.451 Touch the test probe to the first line number terminal of the distributing frame. Be sure that the probe is held firmly against the terminal.

6.452 If the line tested is a working line, the office designation and associated line number should be displayed on the test set. If the line becomes busy before the number is identified, lamp LB will light on the test set, also if the line is busy when the probe is applied to the terminal, lamp LB will light and identification will be impossible until the line is idle.

6.453 If the sleeve lead at the distributing frame is not connected to a line relay, it will be necessary to operate key ST on ITE-4570 in order to identify the line number.

6.454 Continue test in this manner, referring to the telephone company assignment sheets for the tip, ring, party or PBX indications.

6.455 On PBX lines, the billing number of the PBX group will be displayed on the test set. This will be indicated on the assignment sheets.

6.46 Repeat the line verification test for all line numbers in all offices. It is advisable to arrange the tests so that the office under test should be checked from the identifier which is connected by means of the short jumper cable between identifier frames. For example: If Identifiers 0 and 1 are equipped, and Offices 0-5 are equipped, the basic appearance of Offices 0-2 would be on Identifier 0 and their multiple appearance would be on Identifier 1. Similarly, the basic appearance of Offices 3-5 would be on Identifier 1 and the multiple appearance would be on Identifier 0. A good test setup, therefore, would be to test lines in Offices 0-2 with the test set connected to Identifier 1 and to test lines in Offices 3-5 with the test set connected to Identifier 0. Although this would involve one change in test setup, a more thorough test is obtained and a cable is checked operationally where it could not be buzzed or whistled.

6.47 For aid in locating troubles during line verification tests, refer to the procedure of Paragraph 8.

7. MISCELLANEOUS CIRCUIT TESTS

7.1 Frame Test Battery Supply

7.11 Check 48V test battery terminal for presence of 48 volts.

7.12 Check the G test terminal for direct ground.

7.13 Check the HRG test terminal for high resistance ground (12,000 Ω).

7.2 Spare B Jack

7.21 Make a continuity test of the B jack to the preceding number network frame or to the Identifier frame.

7.3 Frame Line Jacks

7.31 Panel and No. 1 Crossbar Offices

7.311 Make a continuity and cross test of the tip and sleeve leads of the TEL (A and B) jacks to all

associated TEL jack appearances and to the Frame Line Circuit. Check transmission between appearances of the TEL jacks.

7.32 SXS Offices

7.321 Make a continuity and cross test of the tip and ring leads of the SWMN jack to other ANI frames and to the SWMN talking line circuit. Also check transmission between appearances.

8. TROUBLE LOCATING INFORMATION

8.1 It is rare that line verification tests proceed without any trouble stoppages. In a multioffice installation, some troubles must be expected and some time must be spent in tracing and clearing these conditions. Troubles can arise from the following sources:

- (a) Test set malfunction;
- (b) Defective primary network;
- (c) Defective secondary network;
- (d) Identifier steering failure;
- (e) Amplifier-Detector failure;
- (f) Error or open in cabling.

8.2 Test Set Troubles

8.21 The ITE-4570, ANI Test Set, performs relatively few switching functions and can be blocked mechanically at any phase of its operational sequence. The oscillator supply can be checked with an AC voltmeter, and the ANI tone can be heard at the (S) binding post with a high resistance test receiver.

8.22 After the initial busy test, the test set applies the identification tone until an indication is received from the identifier that digit information has come through. It is possible to block the test set to keep the tone applied if the signal path has to be traced.

8.23 After digit information has been received, control relays in the set connect ground to the digit input leads of the "NIXIE" glow tubes on the top panel of the set. If any tube does not light, it can be checked by manually operating the relay providing ground. See the associated FS (-) figures in the ITD-4570 drawings.

8.3 Primary Network Troubles

8.31 Primary networks are thoroughly tested by the shop prior to shipment. However, component leads have been known to open up as a result of shocks during shipment. Open networks can be found by connecting a temporary jumper across the input capacitor and one of the output leads. Since the network supplies two outputs (vertical and horizontal bus leads), the resistor feeding each leg can be checked by determining which bus is carrying the signal.

8.32 The audible level of the tone is such that it can be heard with a high resistance test receiver at the input and at the output of the primary network. For ring party leads, the contacts at the identifier TP (-) relay must be opened to remove the low resistance ground.

8.4 Secondary Network Troubles

8.41 Secondary networks are shop tested and should cause little difficulty. In some cases the (G) inductor becomes shorted and shunts the signal to ground. This trouble is difficult to track down and may be located only by disconnecting one end of the inductor.

8.42 If the (G) inductor becomes open, the signal will remain at too high a level and may spill over into adjacent leads. This may be determined by connecting a temporary jumper to an unused (G) inductor and verifying that the signal is reduced to the proper level, as indicated by the removal of over-registration symptoms.

8.43 From the (G) inductor the signal passes into the digit connector relays. These are dry reed relays and cannot be opened mechanically.

8.5 Identifier Steering Troubles

8.51 If the identification signal reaches the steering relays in the identifier, the pulsing control can be blocked by removing the PG relay from its socket. Steering can be controlled manually by operating and releasing the P relay in the identifier to advance the steering train. The schematic layout of the lower part of FS5 on SD-95814-01-B4 shows the contact sequence required to operate the TH (-), H (-), T (-) and U (-) dry reed connector relays, one set at a time.

8.52 Operation of the digit connector relays can be verified by testing for ground with a voltmeter at pin 1 of the relay. Four relays (A, B, C, D) are operated simultaneously for each digit.

No arrows are shown due to extensive changes.

8.6 Amplifier-Detector Troubles

8.61 Amplifier-detectors are in working condition when the identifier frame leaves the shop. Job failures can result from broken wires, tube failures or shielded wiring interference.

8.62 The signal level at the input to the amplifier-detector is too low to measure and is difficult to find. However, after the first two stages of amplification, the AC signal can be measured at the plate of the LA2 tube with a sensitive VTVM. The signal level in the higher stages of amplification is easily measured with the AC scale of the VTVM.

8.63 If the troubles are confined to a particular digit, one amplifier-detector may be suspected. If the troubles vary over all digits, a common condition may be suspected on all amplifier-detectors.

8.64 If the amplifier-detectors operate erratically, the shielded wiring should be checked, particularly at the PA2 jack and at the grid (pin 7) of the LA4 tube. In some cases, the ground wire under the braided shield must be soldered to the shield to improve stability. Also, some units require that the terminal used to ground the bare wire of the shield must be strapped directly to the unit ground feed (terminal 2, top terminal strip B).

8.7 Cabling Troubles

8.71 After performing the cabling checks of Paragraphs 4 and 5, there should be no question of cabling errors. However, if leads must be checked, the association of individual circuit leads between the identifier frame and the primary number network frames is laid out in entirely on SD-95814-01, sheets B2 and B3. The association of office multiple leads between identifier frames is shown in CAD 4 of SD-95810-01-G1, and CAD 5 of SD-95814-01-G1.

8.72 The association of sleeve leads from the distributing frame to the number network frames is determined almost completely by local job conditions and the cable lead assignments will be prepared on an individual job basis. After being tied down to the working sleeve terminal, the only practicable means of checking the leads is by matching color code at each end.

Superintendent, Installation Engineering

Reason for Reissue:
Primary and Secondary Number Network tests removed. Trouble locating information added.

Replaces Section 117 dated 11-16-61.