

**18B TESTBOARD LOWER UNIT
OPERATION
AND
TESTING METHODS IN NO. 3 OR NO. 11 (SLEEVE SUPERVISION)
SWITCHBOARD OFFICES**

CONTENTS	PAGE	CONTENTS	PAGE
1. GENERAL	2	<u>Chart</u> <u>Function</u>	
2. TESTING ARRANGEMENTS OF TRUNKS	3	4D Volt-milliammeter Tests	22
3. SECONDARY CORD, POSITION AND TELEPHONE CIRCUITS	5	(1) Measuring Test Battery Voltage	22
		(2) External Potentials on Tip and Ring	23
<u>Chart</u> <u>Function</u>		(3) Continuity and Insulation Resistance Tests across Tip and Ring	24
3A Busy Testing	9	(4) Bridged Capacitance across Tip and Ring	24
3B Monitoring	9	(5) Potentials on Tip or Ring	25
3C Talking, Ringing and Splitting	10	(6) Ground on Tip or Ring	26
3D Signal Receiving	10	(7) Crosses or Insulation Tests between Pairs	27
3E Positional Dialing	11	(8) Measurement of Currents on Telegraph Circuits	27
3F Key Pulsing	12	4E Connecting Cords C to the Wheatstone Bridge Circuit	28
3G Dial Cord Dialing	14	4F Microphonic Pickup of Telegraph Signals	28
3H Holding	15	4G Determining Approximate Resistance Values from Primary Test Cord Voltmeter Readings	29
3I Interconnections (Using Secondary Cord Circuits)	15	5. TRANSMISSION AND NOISE MEASURING ARRANGEMENTS	5
3J Talking and Signaling on Telephone Order Wires	15	(A) 4OB Transmission Measuring System	5
3K Monitoring, Talking or Signaling on Full Period Talking Circuits and Foreign Exchange Circuits	18	(B) Multi-frequency Transmission Measurements	6
3L Cord Circuit Supervisory Lamp Indications on Intertoll Dial Trunks	19	(C) Test Line Circuit for 1-Way Transmission Testing - Sending Only	7
4. PRIMARY CORD AND TEST CIRCUIT	5		
<u>Chart</u> <u>Function</u>			
4A Busy Testing	21		
4B Talking and Ringing	21		
4C Interconnections (Using Primary Test Cords)	22		

SECTION 664-600-500

CONTENTS	PAGE
(D) 43A Noise Measuring System	7
6. TELEGRAPH TESTING EQUIPMENT	8

1. GENERAL

1.01 This basic section with supplementary subsections covers the detailed operation of the various units of testing equipment in, or directly associated with, the lower unit only of the No. 18B toll testboard and methods of connecting this equipment to the circuits to be tested. Practices dealing with the operation of toll testboards have previously covered the upper unit jack field patching and testing arrangements as well as the lower units. The detailed treatment of the upper unit jack field arrangements in the individual toll testboard practices, the majority of which are applicable to several types of toll testboards, is repetitious and tends to complicate the problem of keeping the practices abreast of developments.

1.02 Jack field and supplementary designations are covered in Section 664-000-010.

1.03 This Issue 2 constitutes a complete revision of Issue 1 to incorporate the following changes:

- (1) The testboard lower unit only is covered in this revised section.
- (2) Provision has been made for issuing subsections covering the various options and adaptations of the testboard lower unit as discussed in Paragraphs 1.04 and 1.05.
- (3) The operating methods have been brought up to date and are presented in chart form to facilitate field use. These charts are arranged to show the schematic drawing number covering the circuits under discussion, typical key arrangements and the operating procedures for the various test circuits.

1.04 The No. 18B toll testboard was primarily designed to be associated with No. 3-type or No. 11-type switchboards which employ pad control, 48-volt battery for signaling and sleeve supervision. This basic section covers the general applications and testing methods for the No. 18B toll testboard lower unit with methods of operation when associated with the above-mentioned sleeve supervision type of switchboard.

1.05 The following subsections cover various applications and optional arrangements of the No. 18B toll testboard lower unit:

<u>Subsection</u>	<u>Title</u>
664-600-501	No. 18B Toll Testboard Lower Unit - Testing Methods for Intertoll Trunks in Nos. 1 and 2 Toll Switchboard Offices and Nos. 1D, 9C, 9D, 10, 11 (Bridged Supervision) and 12 Offices
664-600-502	No. 18B Toll Testboard Lower Unit - Testing Methods for Intertoll Trunks in Decentralized Toll or DSA Switchboards or Crossbar Tandem Offices

1.06 The circuit sketches, block diagrams and references to standard drawings given herein are for illustrative purposes only in connection with the operating and testing procedures. It is recommended that reference be made to local wiring list drawings to verify the actual circuit and testing features provided.

1.07 It is assumed that, upon the completion of any test, keys will be restored to normal positions or cords will be removed from jacks as required. No details covering these procedures are given in this section.

1.08 In operating the No. 18B toll testboard, cases will occur where two or more of the testing procedures given herein will follow in sequence. In order to avoid repetition, no information is given in this section for combining the procedures in such cases.

1.09 As the greater part of the tests involve the use of a toll testboard attendant's telephone set, no mention will be made in the detailed procedures of connecting the set to the telephone jacks.

Caution: The substitution of the new 52A head telephone set for the 528A receiver and 396A transmitter set is not recommended, as a decided impairment in transmission will result. If the substitution is made, the telephone set circuit at these installations should be adapted for the 52A head set. The necessary modifications may be determined by referring to the latest issue of telephone set circuit Drawing SD-55032-01.

1.10 When tests are made on intertoll trunks on which single frequency signaling is used, certain precautions are necessary to prevent false operation of the switching equipment,

cutoffs or wrong numbers. These precautions are outlined in B.S.P. 660-401-010, Testing and Operating Precautions for Toll Services.

2. TESTING ARRANGEMENTS OF TRUNKS

2.01 Examples of typical testing jack arrangements of intertoll trunks in No. 3 or No. 11 (sleeve supervision) switchboard offices are depicted in the following block diagrams:

Fig. 1 - Typical Primary Testing Jack Arrangement

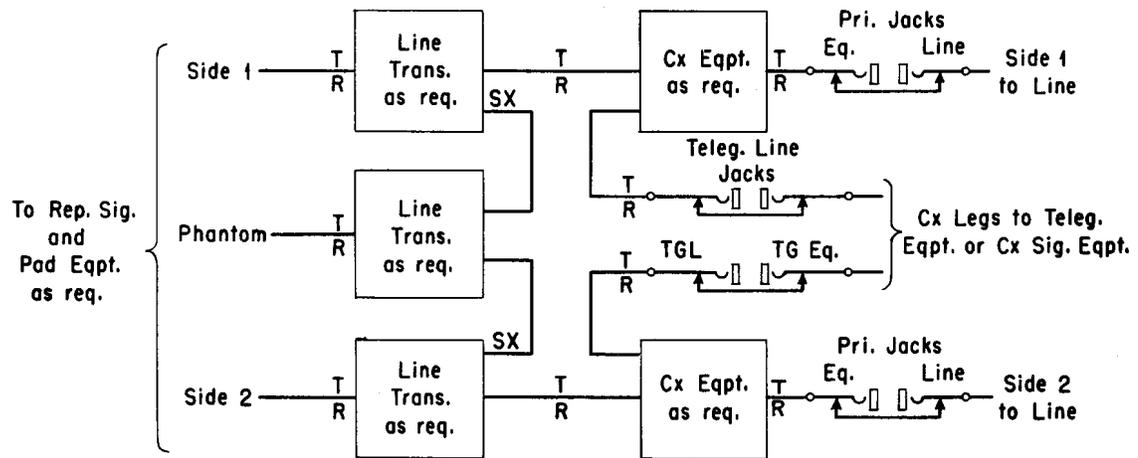


Fig. 1 - Typical Primary Testing Jack Arrangement

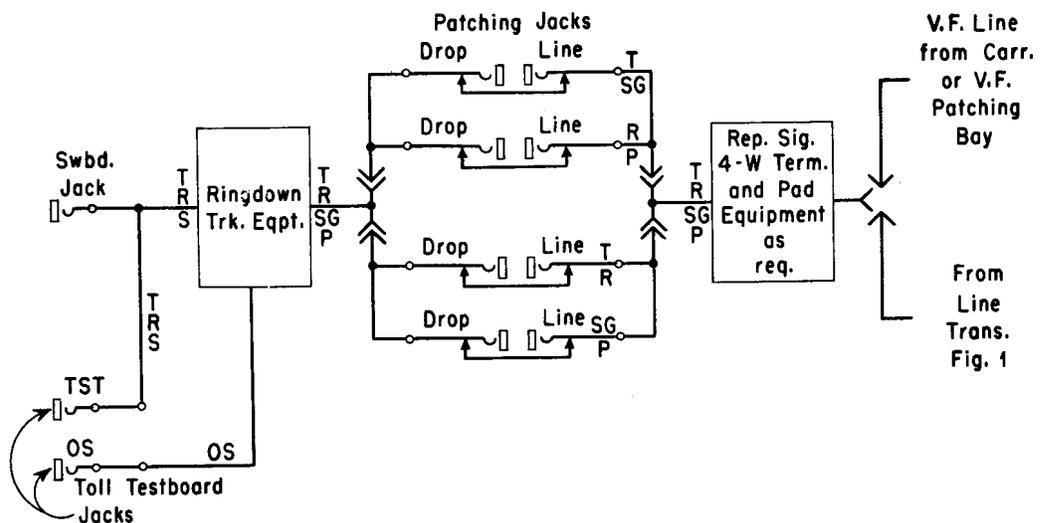


Fig. 2 - Typical Secondary Testing Jack Arrangement - Ringdown Intertoll Trunk - No. 3 or No. 11 (Sleeve Supervision) Toll Switchboard Office

Fig. 2 - Typical Secondary Testing Jack Arrangement - Ringdown Intertoll Trunk - No. 3 or No. 11 (Sleeve Supervision) Toll Switchboard Office

Fig. 3 - Typical Secondary Testing Jack Arrangement - Dial Intertoll Trunk - 2-Wire

Fig. 4 - Typical Secondary Testing Jack Arrangement - Dial Intertoll Trunk - 4-Wire

Fig. 5 - Typical Testing Jack Arrangement - Full Period Talking or Foreign Exchange Circuit

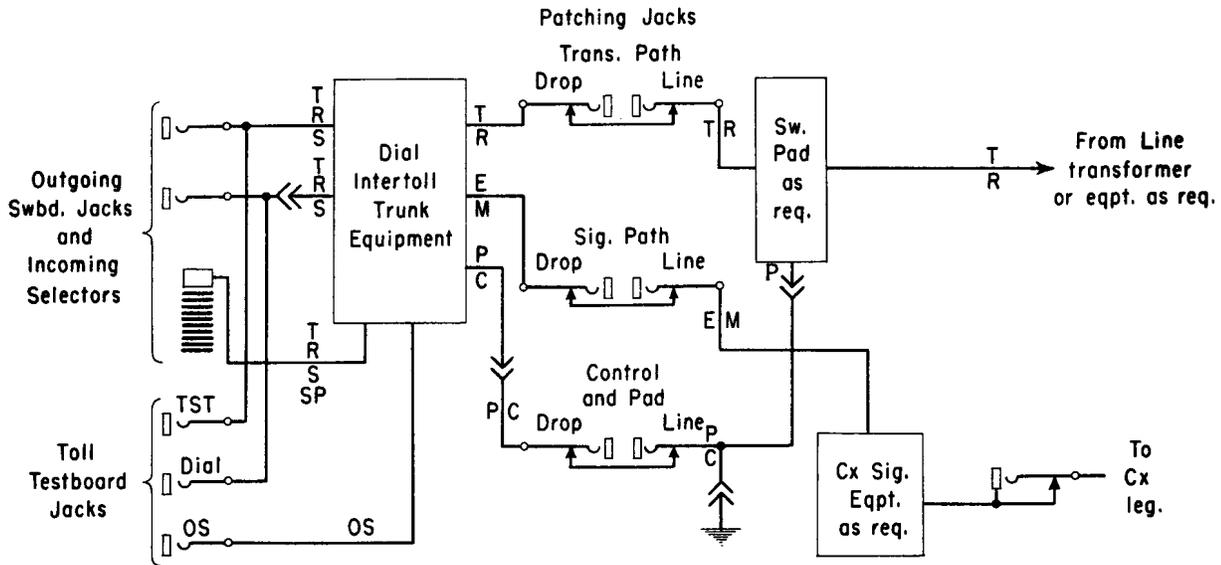


Fig. 3 - Typical Secondary Testing Jack Arrangement - Dial Intertoll Trunk - 2-Wire

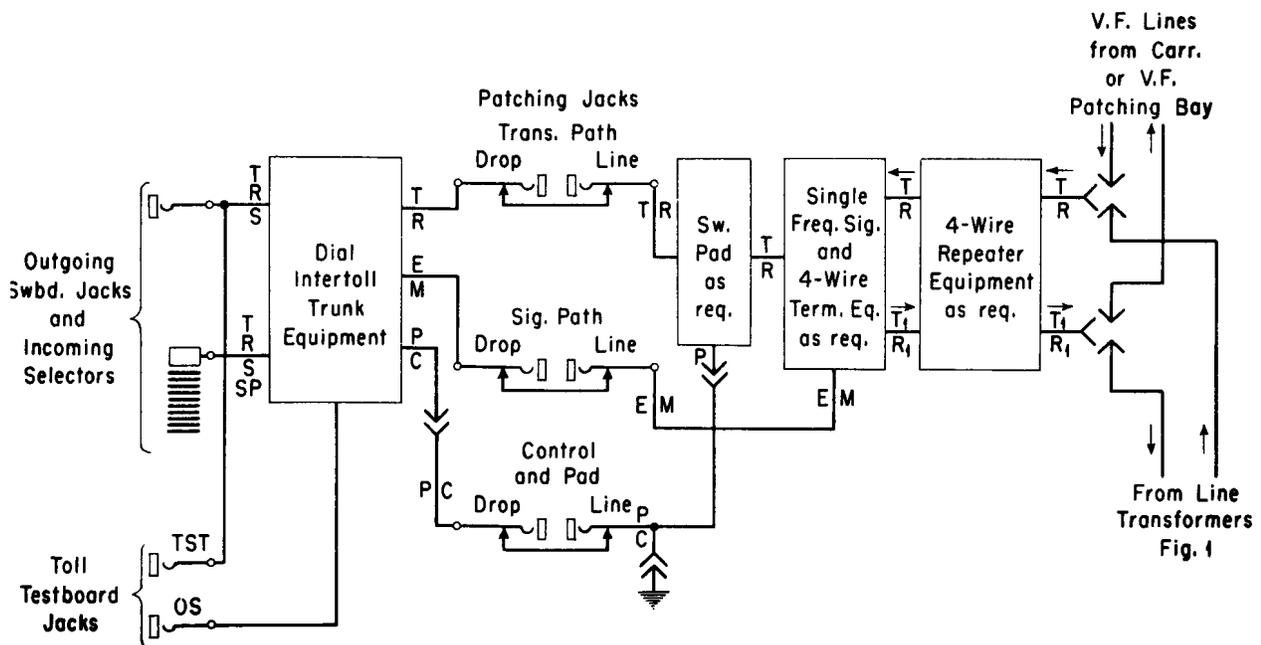


Fig. 4 - Typical Secondary Testing Jack Arrangement - Dial Intertoll Trunk - 4-Wire

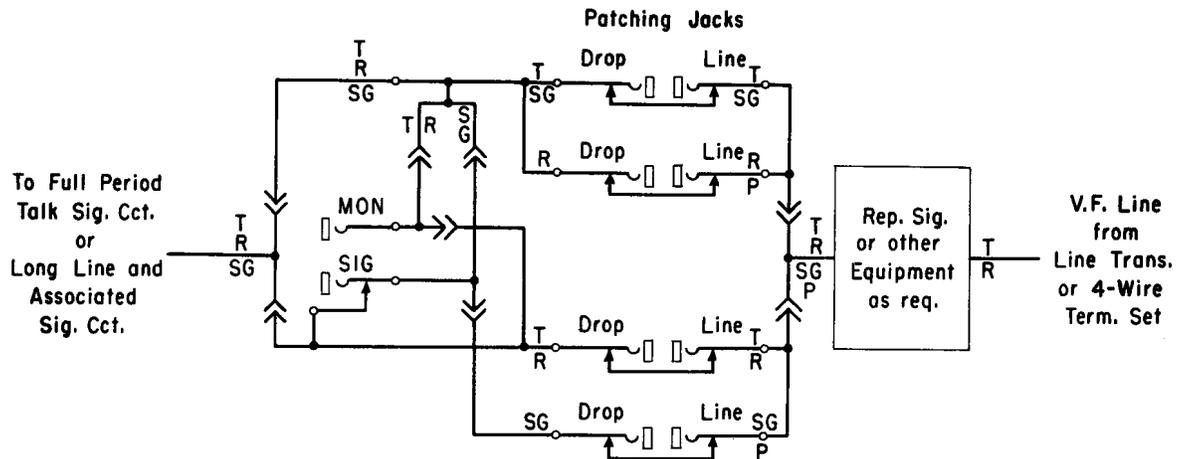


Fig. 5 - Typical Testing Jack Arrangement - Full Period Talking or Foreign Exchange Circuit

3. SECONDARY CORD, POSITION AND TELEPHONE CIRCUITS

3.01 These circuits are used for making over-all tests such as busy tests, monitoring, talking, ringing and dialing or key pulsing tests on intertoll trunks, master office trunks, full period talking circuits and foreign exchange circuits. The proper operation of the associated cord circuit keys enables either the front or rear cord to be used in making these tests. The secondary test cord circuits may also be used for holding trunks in a busy condition and for connecting trunks to test circuits such as transmission measuring circuits, etc.

4. PRIMARY CORD AND TEST CIRCUIT

4.01 This circuit is used for talking, ringing or making voltmeter tests on intertoll trunk line facilities at primary jacks. Provision is made for connecting one of the primary test cords to the position Wheatstone bridge circuit.

5. TRANSMISSION AND NOISE MEASURING ARRANGEMENTS

5.01 The basic principles involved in transmission and noise measuring tests, as well as the detailed operating instructions for the use of the various equipment arrangements at toll testboards for making these tests, are

covered in other Bell System Practices. It is recommended that reference be made to the practices applicable.

5.02 The following procedures cover briefly, for general information purposes, typical arrangements used at No. 18B toll testboards.

(A) 40B Transmission Measuring System

5.03 The transmission sending and receiving circuits associated with this equipment are arranged to send 1 MW at 1000 cycles and to measure received 1000-cycle or multi-frequency testing power from 15 db above 1 MW to 35 db below 1 MW.

Sending

5.04 To send 1 MW at 1000 cycles, connect the SEND 1 MW jacks to the trunk to be tested, using the front and rear cords of a secondary cord circuit with the keys normal or a 3-conductor patching cord (3P3A or equivalent). When the secondary cord circuit is used, and it is necessary to monitor while testing power is being applied, the CLOSE 3RD key of the cord circuit should be operated before the MON key is operated. This sequence is necessary to prevent interruption of the sleeve connection by the cord circuit.

Receiving

5.05 To receive incoming 1000-cycle or multi-frequency testing power, connect the REC B jack to the trunk, using the front and rear cords of a secondary cord circuit with the keys normal or a 3-conductor patching cord (3P3A or equivalent). The FLT REC B jack is used when 1000-cycle transmission measurements are made on intertoll trunks that, due to their physical make-up (such as open wire facilities), may have a relatively high level of low-frequency noise which may cause an error in the measurement. If it is necessary to monitor when using a secondary cord circuit the CLOSE 3RD key should be operated before operating the MON key. This sequence is necessary to prevent interruption of the sleeve connection by the cord circuit.

5.06 The received level will be indicated on the B scale of the meter associated with the test position. If the indication is off scale either on the low or high side, the proper sensitivity control keys of the 4OB transmission measuring system should be operated to obtain a meter indication within a suitable measuring range. The measured loss will be the sum of the meter reading and the figure associated with the operated sensitivity key. Where a switching pad is provided in the trunk being measured, the operation of the PO key will remove the pad.

Sectionalized Transmission Measurements at Circuit Patching Jacks

5.07 A trunk may be split between the line and drop sides at the trunk patching jacks for the purpose of making sectionalized transmission measurements by utilizing the position signal test circuit. The patches should be made from the LINE and DROP patching jacks to the LINE and DROP jacks, respectively, of the signal test jacks. Transmission measuring equipment may then be patched to either the LINE jack or DROP jack associated with the signal test circuit, and transmission tests be made as required.

Loop Tests

5.08 Loop tests may be made on two circuits connected together at the distant end if the total transmission loss does not exceed the range of the transmission measuring system (0 to -35 dbm). Testing power may be sent over one circuit and received over the other circuit as described under Paragraphs 5.04 to 5.07.

Zero Level Sensitivity Tests

5.09 The zero level sensitivity jacks are used to check the operation of echo suppressors associated with intertoll trunks. The trunk under test is connected to the ZLS B + 25 jack using the front and rear cords of a secondary cord circuit with the associated keys normal. The power supplied is gradually increased by advancing the ZLS TEST potentiometer from the maximum counterclockwise position until the echo suppressor operates. The reading of the meter on the B scale plus 25 at the time the echo suppressor operates gives the zero level sensitivity of the suppressor.

(B) Multi-frequency Transmission Measurements

5.10 Typical arrangements for multi-frequency transmission measurements at No. 18B toll testboards include the provision of sending and receiving trunks to the office multi-frequency test bay or an adjustable frequency oscillator located adjacent to or in the testboard bay with a jack appearance in the upper unit jack field of the testboard.

Multi-frequency Measurements of 2 or 4-Wire Trunks at Primary Line Jacks

Caution: When patches are made at the primary jacks, it should be borne in mind that any telephone and telegraph services which function in connection with trunks assigned to a pair will be interrupted. Appropriate steps should be taken to care for these services before such connections are made.

5.11 Trunks to the office multi-frequency test bay are used for making transmission measurements at the primary line jacks of 2 or 4-wire trunks and are usually designated SIDE 1 (SEND) and SIDE 2 (REC) at the testboard appearances. The required patches may be made to these jacks from the primary line jacks at the testboard using 2-conductor patching cords (2P13B cord or equivalent). The test bay jack appearances of the trunks are usually designated SIDE 1, SIDE 2 and PH. The PH jack is so arranged that, when a cord is inserted into it, the side circuits are individually shorted and SIDE 1 and SIDE 2 are connected to the PH tip and ring jacks, respectively. This trunk arrangement has been provided for the purpose of making impedance measurements on either side circuit or the phantom of the group.

Multi-frequency Measurements at Secondary Jacks

5.12 Trunks to the office multi-frequency test bay, provided for making transmission measurements at the secondary jacks, are usually designated TM1 and TM2 at the testboard

appearances. The required patches may be made to these jacks from the secondary jacks at the testboard using 3-conductor patching cords (3P3A cord or equivalent) or the front and rear cords of secondary cord circuits with the keys normal. When secondary cords are used, it is possible to monitor on the connected trunks if the CLOSE 3RD key is operated before the MON key is operated. This sequence must be followed in order to prevent interruption of the established sleeve connection. The test bay jack appearances of the trunks are usually designated TRK 1, MON 1, TRK 2 and MON 2. Where provided, the operation of the PO key associated with a trunk at the test bay will remove the switching pad of the trunk under test.

Multi-frequency Measurements at Secondary Jacks with an Adjustable Frequency Oscillator Associated with Testboard Positions

5.13 Normally the oscillator will be located in or adjacent to the test position with which it is associated, the oscillator output being wired to the tip and ring of a jack appearance designated OSC in the position jack field. The output power of the oscillator, at the desired frequency, should be adjusted with a 600-ohm termination at the oscillator output. At some installations the OSC jack will be equipped with normal springs wired to a 600-ohm resistor to provide a suitable termination when the jack is not in use. Otherwise it will be necessary to connect the OSC jack to a 600-ohm termination when adjusting the oscillator output. The trunk to be tested may be patched to the OSC jacks using a 3-conductor patch cord (3P3A or equivalent) or the front and rear cords of a secondary cord circuit with the keys normal. When secondary cords are used to monitor on the connected trunk the CLOSE 3RD key must be operated before the MON key is operated to prevent interrupting the sleeve connection. The procedure for calibrating the oscillator is covered in other sections of the E series of Bell System Practices.

(C) Test Line Circuit for 1-Way Transmission Testing - Sending Only

5.14 This test circuit which is connected to a common source of 1000-cycle power provides 1 MW of testing power terminated in a jack appearance designated SEND 1 MW. The trunk to be tested should be connected to the SEND 1 MW jack using the front and rear cords of a secondary cord circuit. A separate patching cord should not be used for making the connection because the design of the test circuit is such that a sleeve connection to battery is required for its operation. To monitor on the connection while testing power is being applied, the CLOSE 3RD key must be operated

before the MON key is operated. This sequence will prevent interrupting the connection between the sleeve and battery.

(D) 43A Noise Measuring System

Caution: The 43A noise measuring system was designed to measure noise and crosstalk using 114 LINE weighting only. When measurements are to be made using FLA weighting it will be necessary to modify the amplifier in accordance with Section E40.462, 43A Noise Measuring System.

5.15 The circuits associated with this system are arranged to measure noise and crosstalk volume at voice frequencies on either a 600-ohm or high impedance basis in the range between 10 db and 40 db above reference noise (-90 DBM). The range is adjustable in 5 db steps by means of keys at the testboard jack appearance of the equipment. Testboard jack arrangements provide for measurements on a terminating or bridging basis at the secondary jacks and for terminating and noise-to-ground measurements at primary jacks.

5.16 Noise level measurements should be read in the 5 to 15 range on the A scale of the meter. (An exception to this would be the measurement of a noise level too low to indicate in this range when the A + 10 key is operated.) If no indication or an indication in the 0 to 5 range on the A scale of the meter is obtained, the sensitivity control keys should be operated in proper succession to bring the deflection on the meter within a suitable measuring range. The amount of measured noise, expressed in db, will be equal to the meter reading on the A scale plus the amount indicated by the figures associated with the jack used or the operated sensitivity key.

5.17 When the noise measuring system is provided with more than one appearance of test jacks it will be necessary, before setting up connections at the testboard, to check that the equipment is not in use at some other point. A busy condition will be indicated by the illumination of the BSY or NMB lamp associated with the test jacks. If busy lamps are not provided, a busy test using a secondary cord may be made at the H IMP A + 25 jack or at the 600-ohm A + 25 jack, or, if a projection type meter is used, by observing if there is a projection on the screen.

5.18 Where a switching pad is provided in the trunk under test, the operation of the PO key associated with the noise measuring system will remove this pad.

Noise Measuring Tests at Secondary Jacks

5.19 When measuring the noise or the crosstalk volume on a trunk without removing it from service, operate the MON key associated with a secondary cord circuit, and use the cord circuit to make the connection between the trunk jack and the H IMP A + 25 jack. The high impedance arrangement of the H IMP A + 25 jack together with the open sleeve condition of the cord circuit, due to the operated MON key, prevents any interference with service on the trunk while making the measurements. At the same time, the cord circuit may be used to monitor on the trunk.

5.20 To measure the noise or the crosstalk volume on a trunk which has been removed from service, the 600-ohm input impedance arrangement of the noise measuring system should be used. This measurement is made by connecting the trunk jack to the 600-ohm A + 25 jack, using a secondary cord circuit for making the connection. To monitor on the trunk, the MON key associated with the cord circuit is operated.

5.21 When it is necessary to split a trunk circuit at the patching jacks between the line and drop sides for the purpose of making sectionalized measurements, the position signal test circuit may be used. Patches should be made from the LINE and DROP patching jacks to the LINE and DROP jacks, respectively, of the position signal test jacks. The 600-ohm A + 25 jack may then be connected to either the LINE jack or the DROP jack of the signal testing circuit, using a secondary cord circuit. The measurements may then be made in a manner similar to Paragraph 5.20.

Noise Measuring Tests at Primary Jacks

Caution: When connections are made to primary jacks, it should be borne in mind that any telephone and telegraph services which function in connection with circuits assigned to a pair will be interrupted. Appropriate steps should be taken to care for these services before such connections are made.

5.22 A metallic circuit noise or crosstalk volume measurement is made by patching the trunk to be tested to the 600-ohm A + 25 jack associated with the primary noise measuring jacks of the noise measuring system, using the A and B primary test cords with keys normal, or a 2-conductor twin plug patching cord (2Pl3B or equivalent).

5.23 Noise-to-ground measurements are made by patching the trunk to be tested to the N TO GRD jacks associated with the primary noise measuring jacks of the noise measuring system, using the A and B primary test cords with keys normal, or a 2-conductor twin plug patching cord (2Pl3B or equivalent).

5.24 The metallic-circuit-noise or noise-to-ground measurement may be monitored by using a secondary cord circuit, with the MON key operated, connected to the H IMP A + 25 jack associated with the secondary noise measuring jacks of the noise measuring system.

6. TELEGRAPH TESTING EQUIPMENT

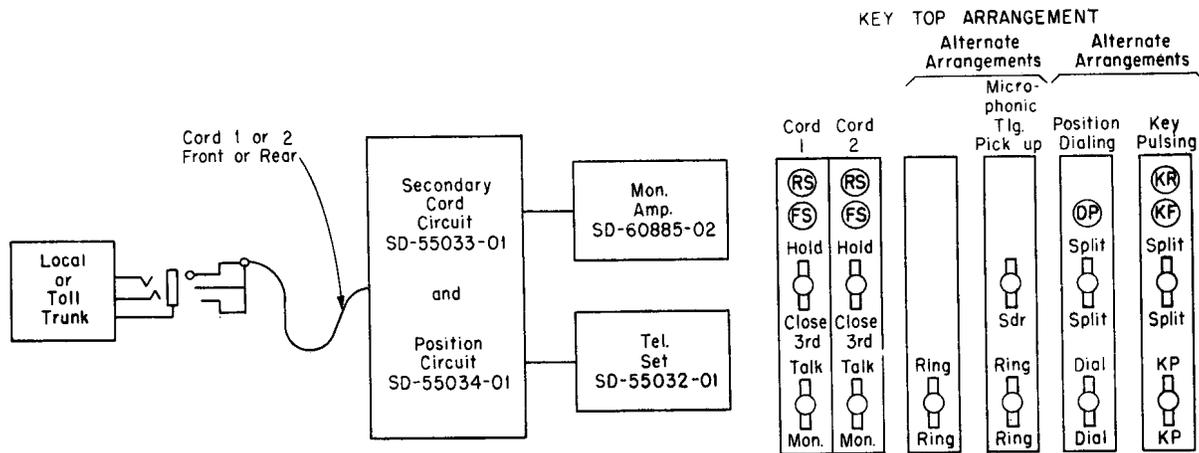
6.01 The following charts cover the operating procedures for telegraph testing equipment normally associated with the No. 18B toll testboard:

<u>Chart</u>	<u>Equipment</u>	<u>Page</u>
6A	No. 3 Telegraph Test Set	32
6B	No. 14 Teletype Monitor and Connecting Circuit	33

TESTBOARD NO. 18B - SECONDARY TEST CORD FUNCTIONS

CHART 3A: BUSY TEST

Tests for busy may be made with the front or rear cord of either secondary cord circuit.



STEP	PROCEDURE	REMARKS
1	Operate TALK key of cord circuit to be used.	
2	Touch the tip of the front or rear cord to the sleeve of the TEST jack of the trunk to be tested.	A click heard in the receiver indicates a busy trunk.

CHART 3B: MONITORING (Refer to Block Diagram CHART 3A)

Monitoring tests may be made with the front or rear cord of either secondary cord circuit. The cord circuit is arranged so that the sleeve circuit is normally open while monitoring. This makes it possible to monitor on a trunk without making it appear busy or causing other interference. However, if it is desired to make the trunk appear busy to outgoing traffic while monitoring, this may be done by operating the CLOSE 3RD key in addition to the MON key. Under this condition, incoming signals on the trunk will be indicated by the flashing of the supervisory lamp in the cord circuit. While using one cord of a pair for monitoring, the other cord cannot be used for any other purpose.

STEP	PROCEDURE	REMARKS
1	Operate the MON key of the cord circuit to be used.	If one cord is used for monitoring, other cord of pair cannot be used for any other purpose.
2	Connect the front or rear cord to the TEST or MON jack of the circuit on which it is desired to monitor.	If it is desired to make the trunk appear busy to outgoing traffic or to receive supervisory signals while monitoring, operate the CLOSE 3RD key.

TESTBOARD NO. 18B - SECONDARY TEST CORD FUNCTIONS

CHART 3C: TALKING, RINGING AND SPLITTING (Refer to Block Diagram CHART 3A)

Either front or rear cords may be used for talking or ringing on trunks. When talking on either front or rear cords or on both, a potential is applied on the tip and ring of the associated trunks for the purpose of controlling the switching pads in the trunks. The supervisory lamps associated with the front and rear cords will respond to signals from the trunks as determined by the high or low resistance of the sleeves. The split key permits disconnecting the front cord from the rear cord.

STEP	PROCEDURE	REMARKS
1	Make busy test as outlined in Chart 3A, Steps 1 and 2.	
2	Insert either the front or rear cord in the TST jack of the trunk.	<p>TALKING ON TWO CORD CIRCUITS: If, while monitoring on one cord, the TALK key of another cord circuit is operated, the MON key of the first cord becomes ineffective. However, the circuit is arranged so that if the CLOSE 3RD key of the first cord is operated, the position telephone circuit becomes connected to both cords. Under this condition, a potential to control the pads in the connected trunks of the front and rear cords of both cord circuits is placed across the tip and ring. The RING, SPLIT and DIAL or KP keys are effective only on the cord having the TALK key operated. The supervisory lamps of all four cords remain effective.</p> <p>LOCKOUT FEATURE: In order to prevent dialing, key pulsing or ringing on two cords at one time, the TALK keys of different cords are wired in a series arrangement so that, if two of these keys are operated, the first key operated opens the dialing, key pulsing and ringing circuits to the second cord.</p>
3	RINGING: Operate the RING key in the direction corresponding to the cord used for the trunk.	
4A	SPLITTING: Operate the SPLIT key to the front position (TALK key operated) to isolate the front cord.	Under this condition the functions of talking, signaling, dialing or key pulsing may be performed with the <u>front</u> cord. Any trunk connected to the rear cord will be disconnected from the talking and position circuit and terminated with 600 ohms.
4B	Operate the SPLIT key to the rear position (TALK key operated) to isolate the <u>rear</u> cord.	The application will be the same as the remarks under Step 4A above with the functions of the <u>front</u> and <u>rear</u> cords interchanged.

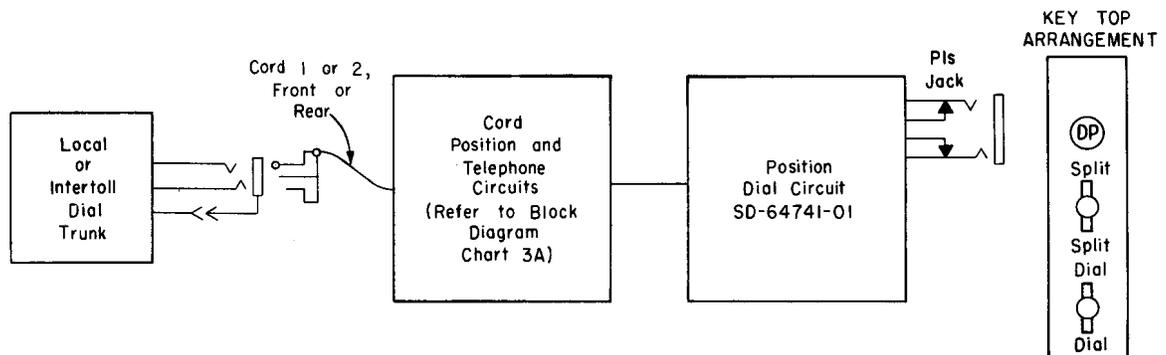
CHART 3D: SIGNAL RECEIVING (Refer to Block Diagram CHART 3A)

STEP	PROCEDURE	REMARKS
1	With the TALK key operated, test for busy on the trunk, using the front or rear cord in accordance with CHART 3A.	
2	If the trunk is idle, connect the cord to the jack of the trunk.	
3	With the TALK key operated, ring on the trunk in accordance with CHART 3C.	
4	Request the distant terminal to signal on the trunk circuit.	The supervisory lamp associated with the cord circuit being used should light for the duration of the incoming ring.

TESTBOARD NO. 18B - SECONDARY TEST CORD FUNCTIONS

CHART 3E: POSITIONAL DIALING

The position dial circuit may be used for dial pulsing on local trunks or intertoll dial trunks. The DP lamp provides the start dial indication when the position dial circuit is connected to the intertoll dial trunk. When dialing on intertoll dial trunks, the DP lamp will give the necessary stop-start dialing indication. The circuit is so arranged that the position DIAL key may be restored while the position dial is returning to normal on the final digit of a number without interrupting the pulses.



STEP	PROCEDURE	REMARKS
1	After testing for busy, connect a front or rear secondary test cord with associated TALK key operated to the TST jack of the trunk and operate the position DIAL key to the front or rear depending on the test cord used.	(1) START DIAL SUPERVISION: In general, the dial circuit DP lamp and the cord circuit FS or RS supervisory lamps will light steadily when the connected trunk is ready to receive dial pulses. Refer to TABLE I, CHART 3L of this section which covers in detail the various "delay dial" and "start dial" supervisory indications received when testing intertoll dial trunks.
2	When the DP and FS or RS lamps light, dial the desired number. (When dialing on local dial trunks no indications will be received on the DP or cord circuit supervisory lamps and dialing may be started as soon as the DIAL key is operated.)	<p>(1) STOP-START DIALING SUPERVISION: On an intertoll dial trunk arranged for stop-start dialing supervision, the DP lamp will serve to indicate the progress of the call during dialing. Thus when it is extinguished it will inform the operator to stop dialing. When the DP lamp relights it will be an indication to resume dialing.</p> <p>(2) TROUBLE RELEASE: If an error is made during dialing, the DIAL key should be restored and the test cord removed to release the connection. Then proceed as for a new call.</p> <p>(3) FLASHING SUPERVISORY INDICATIONS: If, during dialing on intertoll trunks, flashing supervision is received on the DP and cord circuit supervisory lamps, a BUSY, OVERFLOW or REORDER condition exists. Refer to TABLE II, CHART 3L of this section which covers the identification of these conditions and the action to be taken.</p>

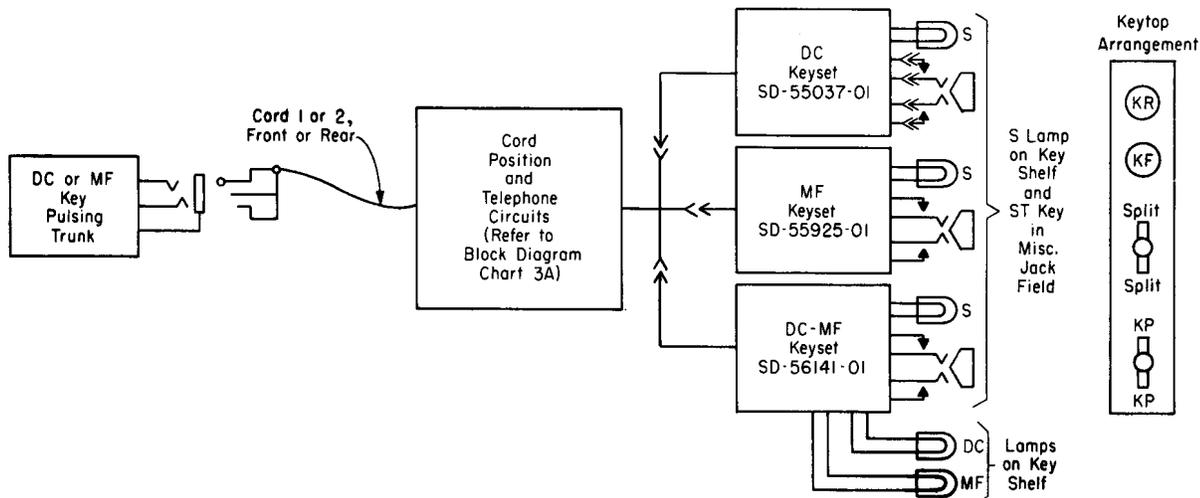
TESTBOARD NO. 18B - SECONDARY TEST CORD FUNCTIONS

CHART 3E: POSITIONAL DIALING (Contd.)

STEP	PROCEDURE	REMARKS
3	<p>When all of the digits have been dialed and, on intertoll trunks, if the DP and supervisory lamps do not flash, restore the DIAL key and wait for the distant end to answer.</p> <p>Note: Continuous pulses are specified in the course of some maintenance tests on dial intertoll trunks. These pulses may be applied by proceeding in accordance with STEPS 1 through 3 except that the DIAL key should not be restored to normal after dialing. A patch may then be made from the LP OUT jack of the pulsing test set to the PLS jack of the position dial circuit. The connection to the PLS jack of the position dial circuit should be made last to avoid releasing the trunk connection.</p>	<p>(1) DISASSOCIATION OF POSITION DIAL CIRCUIT: When the DIAL key is restored to normal, the position dial circuit will be disconnected from the cord circuit.</p> <p>(2) CALLED NUMBER ANSWERS: When the called number answers on intertoll trunks, an "off-hook" signal will be received from the distant end and the cord circuit supervisory lamp will go out.</p> <p>(3) RECALL: Some classes of intertoll trunks provide for reringing the distant point after a call has been answered. Recall signals may be sent by momentarily operating the RING key associated with the test cord used.</p> <p>(4) MOMENTARY ON-HOOK SIGNAL TOWARD THE DISTANT END: When performing some of the signaling and supervision tests on intertoll dial trunks, a momentary "on-hook" signal is required after reaching the 103 test line at the distant end. On trunks arranged for reringing, this "on-hook" signal may be sent by momentarily operating the RING key associated with the cord used.</p> <p>(5) RELEASE OF CONNECTION: The circuit will be under control of the originating end and will be held until released by restoring the TALK key and removing the test cord used.</p>

CHART 3F: KEY PULSING

Three types of position keyset circuits are available for No. 18B toll testboards: DC pulsing only, MF pulsing only or combined DC-MF pulsing. The DC-MF keyset circuit arranges itself automatically for the type of pulsing required on a trunk by checking the ring conductor of the connected trunk. The operating procedures and supervisory indications of the keyset circuits are similar in that the keyset may be associated with a secondary test cord circuit by momentarily operating the KP key associated with the keyset. The KR or KF lamps associated with the keyset will indicate when the keyset has been connected to a front or a rear cord. The cord circuit supervisory lamp indicates when the connected trunk is ready to receive pulses and the keyset S lamp indicates when the circuit is ready for keying. Minor variations will be covered under remarks in the operating procedure.



TESTBOARD NO. 18B - SECONDARY TEST CORD FUNCTIONS		
CHART 3F: KEY PULSING (Contd.)		
STEP	PROCEDURE	REMARKS
1	<p>After testing for busy, connect a front or rear secondary test cord with associated TALK key operated to the test jack of the trunk and momentarily operate the position KP key to the front or rear depending on the test cord used.</p> <p><u>Note:</u> When the D-C keyset or combined D-C-MF keyset are provided, any registration on the keyset after the operation of the KP key but before the lighting of the S lamp, will result in a flashing S lamp to indicate premature keying. The circuit can be restored to normal by momentarily operating the KP key.</p>	<p>(1) KEYSET ASSOCIATION: The position KF or KR lamp will light when the keyset has been connected to the cord circuit and on positions equipped with the combined D-C-MF keyset the D-C or MF lamp associated with the keyset will light to indicate the type of pulsing automatically selected.</p> <p>(2) START KEYING SUPERVISION: In general, the cord circuit FS or RS supervisory lamp will light steadily when the connected trunk is ready to receive pulses and the keyset S lamp will light when the position keyset circuit is ready for registration. When testing on MF keypulsing trunks, the lighting of the keyset S lamp also indicates that a "KP" tone signal has been sent to the distant sender to prepare it for registration. Refer to TABLE I, CHART 3 of this section which covers in detail the various "delay dial" and "start dial" indications received on the cord circuit supervisory lamp when testing on intertoll dial trunks.</p>
2	<p>When the cord circuit supervisory and the keyset S lamps light to indicate that the connected trunk and position keyset circuit are ready for pulsing proceed with the registration of the desired number.</p>	<p>(1) STOP-START DIALING SUPERVISION: When keying through crossbar tandem to intertoll dial trunks arranged for stop-start dialing supervision, keying must be stopped when the S Lamp is extinguished after the directing code has been keyed. When the distant sender is ready for pulsing the S lamp will relight as an indication that keying may be resumed.</p> <p>(2) TROUBLE RELEASE: If an error is made during keying, the test cord should be removed to release the connection. Then proceed as for a new call.</p> <p>(3) FLASHING SUPERVISORY INDICATIONS: If, during pulsing, flashing supervision is received on the cord circuit supervisory lamp, a BUSY, OVERFLOW or REORDER condition exists. Refer to TABLE II, CHART 3 of this section which covers the identification of these conditions and action to be taken.</p>
3	<p>When the digits of the number have been registered, operate the ST key associated with the keyset when required. (Refer to Paragraph (1) and (2) under REMARKS in Step 3) and wait for the distant end to answer.</p>	<p>(1) MANUAL RELEASE OF DISTANT SENDER: All MF key pulsing trunks and the majority of D-C key pulsing trunks require that a final pulse be registered to release the sender at the distant end of the circuit. This is accomplished by operating the ST key associated with the keyset. The operation of this key also releases the keyset from the test cord and position circuits and the KP, S and D-C or MF lamps on combined keysets will go out.</p> <p>(2) AUTOMATIC RELEASE OF KEYSET: Some types of D-C key pulsing trunks will release the keyset automatically after the required number of digits have been registered making it unnecessary to operate the ST key.</p> <p>(3) CALLED NUMBER ANSWERS: When the called number answers, an "off-hook" signal will be received from the distant end and the cord circuit supervisory lamp will go out.</p>

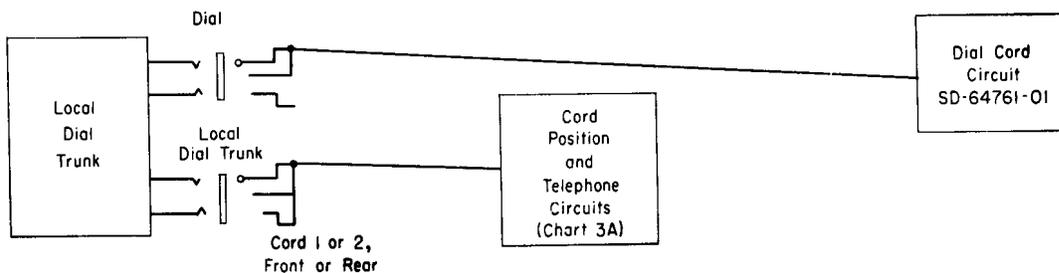
TESTBOARD NO. 18B - SECONDARY TEST CORD FUNCTIONS

CHART 3F: KEY PULSING (Contd.)

STEP	PROCEDURE	REMARKS
3	Contd.	<p>(4) RECALL: Some classes of trunks provide for recalling or reringing the distant point after a call has been answered initially. On such trunks this signal may be sent by momentarily operating the RING key associated with the test cord used.</p> <p>(5) MOMENTARY ON-HOOK SIGNAL TOWARD THE DISTANT END: When performing some of the signaling and supervision tests on intertoll dial trunks, a momentary "on-hook" signal is required after reaching the 103 test number at the distant end. On trunks arranged for reringing, the signal may be sent by momentarily operating the RING key associated with the test cord used.</p> <p>(6) RELEASE OF CONNECTION: The circuit will be under control of the originating end and will be held until released by restoring the TALK key and removing the test cord used.</p>

CHART 3G: DIAL CORD DIALING

When a testboard position is equipped for key pulsing and provisions for dialing on local trunks are also required, an additional jack designated DIAL will be provided for each appearance of the multiple jacks of the dialing trunk. These jacks are normally located just above the multiple jacks. A dial with the pulsing contacts wired to a dialing cord will be provided.



STEP	PROCEDURE	REMARKS
1	With the TALK key operated, test for busy on the trunk using either a front or rear cord in accordance with CHART 3A.	
2	If the trunk is idle connect the cord to the multiple jack of the trunk.	Dial tone will be heard in the receiver if the trunk is ready for dial pulses.
3	Connect the DIAL cord to the DIAL jack associated with the trunk.	
4	Dial the desired number and remove the DIAL cord from the DIAL jack.	No supervision will be obtained on the FS or RS cord circuit supervisory lamps with this type of connection.

TESTBOARD NO. 18B - SECONDARY TEST CORD FUNCTIONS

CHART 3H: HOLDING (Refer to Block Diagram CHART 3A)

Holding circuits are provided with each cord for use when it is desired to hold intertoll trunks busy and in condition to receive incoming visual and audible signals. The tip and ring of trunks so held are terminated in 600-ohm networks. The front and rear cords may be used independently for this purpose. When it is desired to use one cord of a pair for holding while the other cord is being used for talking, ringing, dialing or key pulsing it is recommended that the SPLIT key be used as discussed in CHART 3C. When so doing, it should be remembered that the TALK key must be kept operated to maintain the hold condition and that monitoring tests cannot be made on either cord.

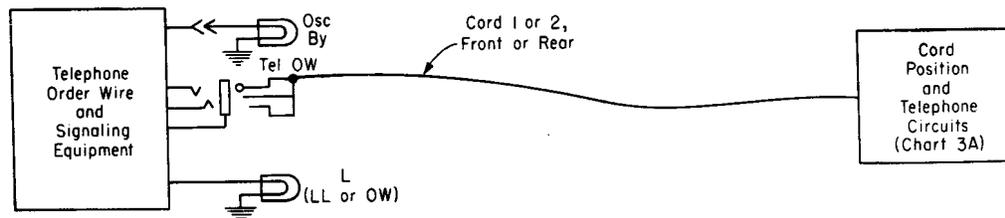
STEP	PROCEDURE	REMARKS
1	Connect the front or rear cord to the TEST jack of the trunk to be held. In the case of an established connection, omit this step and proceed with STEP 2.	
2A	Operate the HOLD key associated with the cord circuit used.	The supervisory lamp associated with the cord will light for the duration of an incoming ring.
2B	If it is desired to have an audible signal on an incoming ring, operate the position NA key.	

CHART 3I: INTERCONNECTIONS (Refer to Block Diagram CHART 3A)

When a front or rear secondary test cord is connected to an intertoll trunk, the associated cord of the pair may be used as a connecting cord to patch the intertoll trunk to the jack of a transmission measuring circuit or other circuits normally used with the No. 18B toll testboard.

CHART 3J: TALKING AND SIGNALING ON TELEPHONE ORDER WIRES

Either front or rear secondary cords may be used for talking or signaling on telephone order wires. The three most common methods of signaling employed on order wires appearing at the No. 18B toll testboard will for the purpose of this section be classified as: (1) THE D-C SELECTIVE SIGNALING TYPE in which the selectors at the various connected offices are advanced by the opening and closing of what is essentially a telegraph circuit interconnecting the offices; at the No. 18B testboard the signaling equipment is so arranged that the operation and release of the RING key associated with a secondary cord circuit connected to the order wire will advance all selectors; (2) THE 600-1500-CYCLE SELECTIVE SIGNALING TYPE in which the selectors at the various offices are advanced by alternate dial controlled pulses of 600-cycle and 1500-cycle current sent over the talking path of the order wire; (3) THE 1000-CYCLE RINGDOWN TYPE which does not provide selective signaling. Order wire and order wire signaling arrangements are discussed in other Bell System Practices. It is recommended that applicable sections of the practices be consulted for detailed information. Only the operating procedures for talking and signaling on order wires are covered in this chart.



TESTBOARD NO. 18B - SECONDARY TEST CORD FUNCTIONS		
CHART 3J: TALKING AND SIGNALING ON TELEPHONE ORDER WIRES (Contd.)		
(1) ANSWERING INCOMING CALLS		
STEP	PROCEDURE	REMARKS
1	Operate the TALK key of a secondary cord circuit and connect a front or rear cord to the TEL OW jacks.	(1) Observe that the answering lamp is extinguished and the audible signals, if any, are silenced. (2) If a second signal is received on a selective signaling order wire it may be retired by removing and reinserting the cord in the TEL OW jack. On a ringdown order wire a rering signal does not lock in. (3) No cord circuit supervision will be obtained on these trunks.
(2) ORIGINATING CALLS ON 600-1500-CYCLE SELECTIVE SIGNALING ORDER WIRES		
STEP	PROCEDURE	REMARKS
1	Observe that the OSC BSY lamp, if provided, is not lighted.	
2	Operate the MON key of a secondary cord circuit and connect an associated front or rear cord to the TEL OW jack.	
3	If no voices or tone are heard, operate the TALK key of the connected cord circuit and challenge on the circuit.	
4	Operate the position DIAL key and dial the desired code, then restore the DIAL key.	
(3) ORIGINATING CALLS ON D-C SELECTIVE SIGNALING ORDER WIRES		
STEP	PROCEDURE	REMARKS
1	Operate the MON key of a secondary cord circuit and connect an associated front or rear cord to the TEL OW jacks.	
2	If no voices are heard, operate the TALK key and challenge on the circuit.	
3	Alternately operate and release the RING key of the connected cord circuit in accordance with the first digit of the code for the office being called.	(1) The LL lamp will light each time the RING key is released indicating that the selector circuit is functioning properly. (2) After a pause, the LL lamp will flicker indicating that the selector circuit is ready for the second digit to be sent. Note: If the LL starts to flicker before the completion of the first digit, it is an indication that the RING key was operated too slowly. In this case clear the circuit by operating and releasing the RING key once. Then repeat the selection of the first digit.
4	Repeat the operation described in STEP 3 for the second digit.	The LL lamp will again light each time the RING key is operated. After a pause, the LL lamp will flicker for a brief period and then go out, indicating that the desired station has been signaled and that the selector circuit has returned to normal.

TESTBOARD NO. 18B - SECONDARY TEST CORD FUNCTIONS		
CHART 3J: TALKING AND SIGNALING ON TELEPHONE ORDER WIRES (Contd.)		
(3) ORIGINATING CALLS ON D-C SELECTIVE SIGNALING ORDER WIRES (Contd.)		
STEP	PROCEDURE	REMARKS
5	To clear the circuit following an incompleted call or a momentary open circuit condition, operate and release the RING key once. If necessary, due to the position of the selector, repeat this operation a second time.	(1) Failure to signal a station when conditions appear to be normal at the sending station may be due to the called station selector being off normal. In this case, a clearing signal should be given by operating and releasing the RING key once. This will cause all selectors to be returned to normal. Steps 3 and 4 above may then be repeated to signal the desired station. (2) The persistent flickering of the LL lamp at any time, which can not be stopped by a clearing signal, is an indication of trouble. This trouble, which is most commonly due to an open telegraph leg, should be remedied through the usual maintenance channels.
(4) ORIGINATING CALLS ON 1000-CYCLE RINGDOWN ORDER WIRES		
STEP	PROCEDURE	REMARKS
1	Operate the MON key of a secondary cord circuit and connect an associated front or rear cord to the TEL OW jack.	
2	If no voices or tone are heard operate the TALK key of the connected cord circuit and challenge on the circuit.	
3	Operate RING key of the connected cord circuit. All stations on the order wire will receive a signal.	

SECTION 664-600-500

TESTBOARD NO. 18B - SECONDARY TEST CORD FUNCTIONS		
CHART 3K: MONITORING, TALKING OR SIGNALING ON FULL PERIOD TALKING CIRCUITS AND FOREIGN EXCHANGE CIRCUITS		
(1) MONITORING		
STEP	PROCEDURE	REMARKS
1	Operate the MON key of one of the secondary cord circuits. Connect either the front or the rear cord to the MON jack of the circuit to be tested.	The MON jack provides access to the tip and ring of the circuit and monitoring is done on a bridging basis.
(2) TALKING		
STEP	PROCEDURE	REMARKS
1	Operate the TALK key of one of the secondary cord circuits. Connect either the front or the rear cord to the MON jack of the circuit to be tested.	The MON jack provides access to the tip and ring of the circuit and with the cord circuit TALK key operated, the telephone set is connected to the circuit on a bridged basis.
(3) SIGNALING		
STEP	PROCEDURE - <u>SENDING</u>	REMARKS
1	Use the front and rear cords of a secondary cord circuit, with the keys normal, to patch from the SIG jack of the circuit to be tested to the SIG jack of the position signal test circuit. Operate the RING LINE key or the RING DROP key to signal in the direction necessary on the circuit.	Operation of either the RING LINE key or the RING DROP key will apply battery toward the signaling equipment as designated by the key operated.
STEP	PROCEDURE - <u>RECEIVING</u>	REMARKS
1	Connect the SIG jack of the circuit to be tested to the position signal test circuit jack SIG with the front and rear cords of a secondary cord circuit. Operate the SIG REC key associated with the signal test circuit.	Signals received from the line side or drop side of the patching jack will light the LINE or DROP lamps, respectively, of the signal testing circuit.

TESTBOARD NO. 18B - SECONDARY TEST CORD FUNCTIONS

CHART 3L: CORD CIRCUIT SUPERVISORY LAMP INDICATIONS ON INTERTOLL DIAL TRUNKS

TABLE I

SEQUENCE OF SUPERVISORY LAMP INDICATIONS

<u>TRUNK CONDITION</u>	<u>ORIGINATING END</u>		<u>CALLED END Signal Returned</u>
	<u>Cord Ckt. Supv. Lamp (See Note 1)</u>	<u>Signal Sent</u>	
1. IDLE	Lamp Dark	Disconnect (On-hook)	On-hook
2. SEIZURE	Lamp Lights Momentarily	Connect (Off-hook)	On-hook
3. DELAY DIAL (See Note 2)	Lamp Dark	Connect (Off-hook)	Off-hook
4. START DIAL (See Note 2)	Lamp Lights Steadily	Connect (Off-hook)	On-hook
5. PULSING NUMBER	Lamp Remains Lighted	-	On-hook
6. AWAITING ANSWER	Lamp Remains Lighted	Connect (Off-hook)	On-hook
7A FLASHING SIGNALS (See TABLE II)	Lamp Flashes	Connect (Off-hook)	Alternate Off-hook and On-hook
or			
7B CALLED NUMBER ANSWERS	Lamp Dark	Connect (Off-hook)	Off-hook
8. CALLED NUMBER HANGS UP	Lamp Lights	Connect (Off-hook)	On-hook
9. DISCONNECT AND RETURN TO IDLE	Lamp Dark	Disconnect (On-hook)	On-hook

Note 1(a): When pulsing from testboard position dial circuits, the associated DP lamp will operate in unison with the cord circuit supervisory lamp until the position DIAL key is restored.

Note 1(b): When pulsing through dialing and supervisory circuits or pulsing and supervisory circuits, supervision will be obtained via the supervisory lamp in these circuits and the cord circuit supervisory lamp will remain dark.

Note 2(a): DELAY DIAL and START DIAL indications are used when the pulses are sent to crossbar or link type step-by-step offices. Such offices register the pulses in common equipment which may not be immediately available. For other types of receiving offices these steps are omitted and condition 5 follows condition 2.

Note 2(b): Some types of trunks incoming to crossbar tandem equipment employ the "wink" type of start pulsing signal. With this type of trunk conditions 2 through 4 will be replaced by the following:

<u>TRUNK CONDITION</u>	<u>ORIGINATING END Cord Ckt. Lamp</u>	<u>CALLED END Signal Returned</u>
2. TRUNK SEIZED	Lamp Lights	On-hook
3. START DIAL (WINK - .150 Sec.)	Lamp flashes off then on	Off-hook followed by On-hook
4. Omit and resume with 5		

TESTBOARD NO. 18B - SECONDARY TEST CORD FUNCTIONS

CHART 3L: CORD CIRCUIT SUPERVISORY LAMP INDICATIONS ON INTERTOLL DIAL TRUNKS (Contd.)

TABLE II

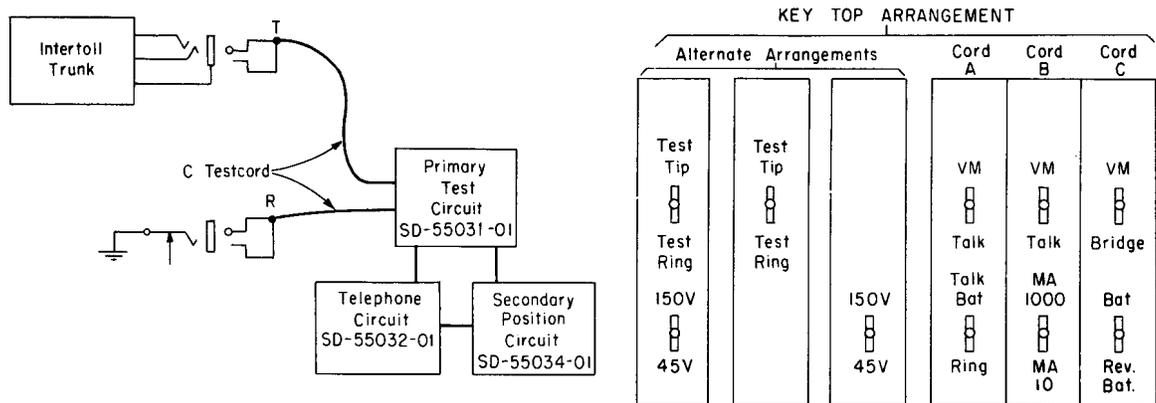
SUMMARY OF FLASHING SIGNALS

<u>ORIGINATING END</u> <u>Cord Ckt. Supv. Lamp</u>	<u>TRUNK</u> <u>CONDITION</u>	<u>ACTION</u> <u>TAKEN</u>
60 IPM Flashing and tone	LINE BUSY (Called number busy)	Disconnect and after an interval, initiate a new call.
Irregular 60 IPM Flashing and tone	MASTER BUSY (All circuits busy or all overflow trunks busy)	Disconnect and after an interval, initiate a new call.
120 IPM Flashing and tone	PATHS BUSY-REORDER (Includes cases where excessive time is taken in pulsing)	Disconnect and initiate a new call immediately.
30 IPM Flashing and tone	OVERFLOW (All circuits busy, but overflow trunks available)	Wait until flashing changes to 120 IPM to indicate that trunk is available. Then disconnect and initiate a new call immediately.

TESTBOARD NO. 18B - PRIMARY TEST CORD FUNCTIONS

CHART 4A: BUSY TEST

A busy test of an intertoll trunk is ordinarily performed with a secondary cord, the tip of the cord being touched momentarily to the sleeve of the TEST jack of the trunk as described under secondary test cord functions, CHART 3A. However, the voltmeter in the primary test circuit may also be used for this purpose.

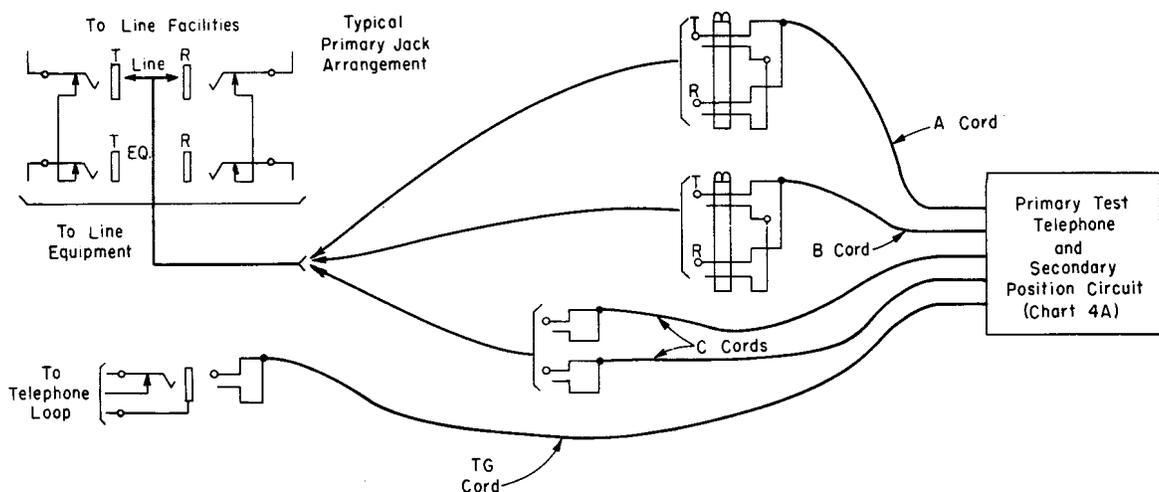


STEP	PROCEDURE	REMARKS
1	Insert the ring plug of Cord C into a grounded jack.	
2	Operate the VM key associated with the C cords.	
3	Touch the tip of the tip plug of Cord C to the sleeve of the TEST jack of the trunk.	A deflection on the position voltmeter indicates a busy condition.

CHART 4B: TALKING AND RINGING

Either the A or B (twin-plug ended) cords and the TG (single-plug ended) cord, which is in parallel with the B cord, may be connected to the position telephone set.

Caution: When connections are made to primary line jacks, it should be understood that the telephone or telegraph service which normally functions in connection with trunks assigned to the pair will be interrupted. Approved methods and procedures for taking care of this service should, therefore, be followed before such connections are made.



SECTION 664-600-500

TESTBOARD NO. 18B - PRIMARY TEST CORD FUNCTIONS		
CHART 4B: TALKING AND RINGING (Contd.)		
STEP	PROCEDURE	REMARKS
1A	TWIN-PLUG ENDED CORDS - Connect test cord A or B to the LINE or EQ jacks of the primary line jacks.	
1B	SINGLE-PLUG ENDED CORD - Connect test cord TG to the desired loop.	
2	TALKING - Operate the TALK key associated with A or B and TG primary test cords.	When it is desired to furnish talking battery to the distant end, operate the TALK BAT key.
3	RINGING - To send a 20-cycle outward ring, operate the associated RING key.	<u>Caution: When using primary test cords it should be remembered that the RING key is common to the A or B and TG cords when the associated TALK keys are operated.</u>

CHART 4C: INTERCONNECTIONS WITH PRIMARY TEST CORDS (Refer to Block Diagram CHART 4B)

Test cords A and B are arranged so that when the VM and TALK keys associated with the cords are normal, the tips and rings of the two cords are connected together, thus making it possible to use these cords for making temporary connections.

STEP	PROCEDURE	REMARKS
1	To temporarily interconnect two circuits plug the A test cord into one circuit and the B test cord into the other circuit.	<p>TALKING ON BOTH CIRCUITS - To talk on both interconnected trunks, operate the TALK keys of both cord circuits simultaneously to avoid breaking the connection.</p> <p>TALKING ON ONE CIRCUIT - To split two interconnected trunks and talk on either one individually, operate the appropriate TALK key.</p> <p>Note: The use of this feature is not recommended where the interconnected trunks require a termination as the operation of the TALK key of either cord circuit individually will leave the other cord circuit unterminated.</p>

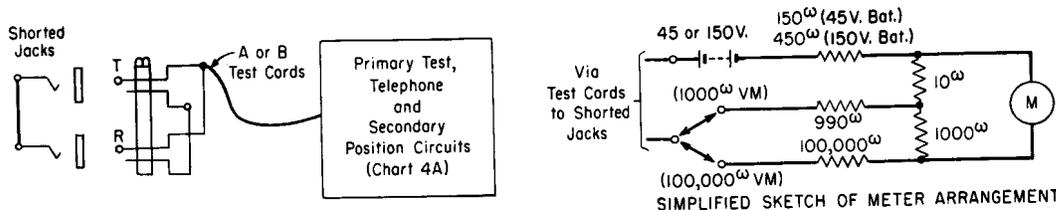
CHART 4D: VOLT-MILLIAMMETER TESTS

The position voltmeter circuit provides connections from all cords for volt-milliammeter tests. Up to 150 volts of either polarity may be measured. Up to 150 milliamperes may be measured. By operation of the position keys, the meter may be arranged as a 100,000-ohm or 1000-ohm voltmeter or as a milliammeter with a resistance of 1000 ohms or 10 ohms.

The various testing arrangements of the volt-milliammeter circuit are covered in the following typical examples.

Note: When making tests involving the measurement of external potentials or of ground on the tip side only or ring side only of a line, it is advisable in many cases to open both the tip and ring sides of the trunk at both ends by means of dummy plugs inserted in the line jacks other than the jacks to which the test cords are connected. This will avoid misleading measurements due to battery or ground from connected equipment at either end.

(1) MEASURING THE TEST BATTERY VOLTAGE

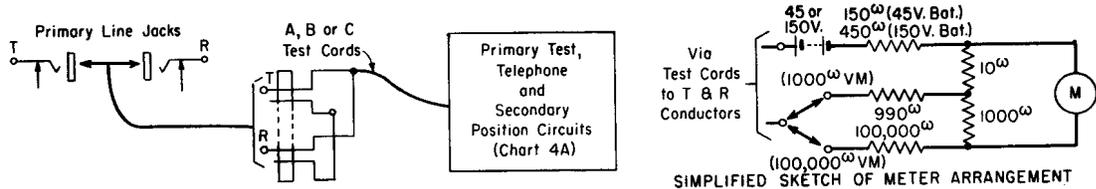


TESTBOARD NO. 18B - PRIMARY TEST CORD FUNCTIONS		
CHART 4D: VOLT-MILLIAMMETER TESTS (Contd.)		
(1) MEASURING THE TEST BATTERY VOLTAGE (Contd.)		
STEP	PROCEDURE	REMARKS
1	Connect Cord A or B to a pair of short-circuited jacks.	
2	Operate the VM key associated with the cord circuit used.	
3A	ON POSITIONS NOT PROVIDED WITH 150V-45V KEY operate the BAT key.	The full no-load voltage of the test battery will be indicated on the meter arranged as a 100,000-ohm voltmeter connected to the battery through a protective 450-ohm resistance which will not materially effect the reading of the 100,000-ohm-meter.
3B	ON POSITIONS PROVIDED WITH 150V-45V KEY operate the 150V-45V key to the appropriate position for the voltage to be observed.	<p>The no-load voltage of the 150-volt or 45-volt sections of the test battery, depending upon the way the key is operated, will be indicated on the meter arranged as a 100,000-ohm voltmeter connected to the battery through a 450-ohm protective resistance when the 150-volt battery is being checked or 150-ohm resistance when the 45-volt battery is being checked. These resistances, which are small compared to that of the voltmeter, will not materially effect the reading.</p> <p><u>Note:</u> If it is desired to observe the voltage of the battery under a load, the operation of the MA 1000 key will cause the resistance of voltmeter to be decreased to 1000 ohms. It should be borne in mind that the protective resistances (450 ohms for the 150-volt battery and 150 ohms for the 45-volt section of the battery) will have a marked effect on the meter reading under this condition and should be taken into account if accurate quantitative results are desired.</p>
(2) MEASUREMENT OF EXTERNAL POTENTIALS ON TIP AND RING		
<p>The diagram illustrates the setup for measuring external potentials. On the left, 'Primary Line Jacks' T and R are connected to 'A, B or C Test Cords' which lead to a 'Primary Test, Telephone and Secondary Position Circuits (Chart 4A)'. On the right, a 'SIMPLIFIED SKETCH OF METER ARRANGEMENT' shows a meter 'M' connected to a circuit with a 100,000Ω VM, a 990Ω resistor, a 100,000Ω resistor, and a 10Ω resistor. The connection is labeled 'Via Test Cords to T & R Conductors'.</p>		
STEP	PROCEDURE	REMARKS
1	Connect Cord A, B or C to the primary line jacks T and R of the line which it is desired to test.	
2	Operate the VM key corresponding to the cord used.	The potential may be read on the meter which will be connected as a 100,000-ohm voltmeter.
3	To arrange the meter as a 1000-ohm voltmeter, operate the MA 1000 key.	

TESTBOARD NO. 18B - PRIMARY TEST CORD FUNCTIONS

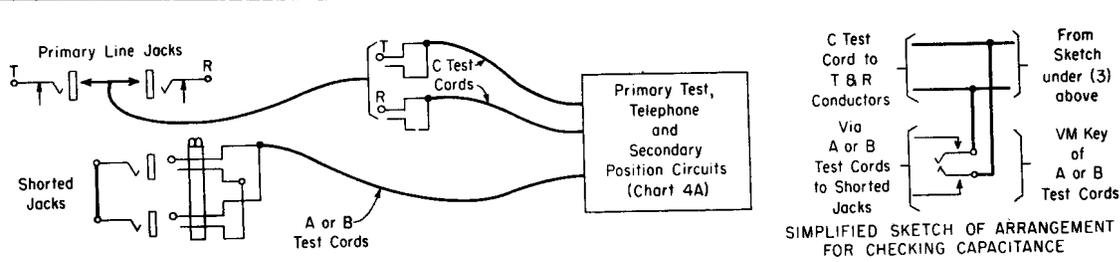
CHART 4D: VOLT-MILLIAMMETER TESTS (Contd.)

(3) CONTINUITY AND INSULATION RESISTANCE TESTS ACROSS TIP AND RING may be made by using the meter arranged as a voltmeter in series with the test battery across the tip and ring of a test cord. The readings observed on the meter arranged as a 100,000-ohm or 1000-voltmeter with the 150-volt testing battery may be applied to TABLES I or II, CHART 4G to determine the approximate resistance connected to the test cords.



STEP	PROCEDURE	REMARKS
1	Connect Cord A, B or C to the primary line jacks T and R of the line which it is desired to test.	
2	Operate the VM key associated with the cord used.	
3A	ON POSITIONS NOT PROVIDED WITH A 150V-45V KEY operate the BAT key.	The steady deflection on the meter, which will be connected as a 100,000-ohm voltmeter, will indicate the voltage of the 150-volt test battery less the voltage drop due to the resistance in the connected circuit. If the circuit is open, a momentary kick of the meter pointer due to capacitance effects may be observed with a subsequent low or zero reading.
3B	ON POSITIONS PROVIDED WITH 150V-45V KEY operate that key to the test battery voltage desired.	The steady deflection on the meter, which will be connected as a 100,000-ohm voltmeter, will indicate the voltage of the 150-volt or 45-volt test battery less the voltage drop due to the resistance in the connected circuit.
4	To arrange the meter as 1000-ohm voltmeter, operate the MA 1000 key.	

(4) BRIDGED CAPACITANCE ACROSS THE TIP AND RING of an open circuit may be checked, since the momentary deflection on the meter caused by a charging current is proportional to the capacitance. Such deflections serve as an indication of the capacitance between the conductors.



STEP	PROCEDURE	REMARKS
1	Proceed as described in STEPS 1 to 3 under (3) CONTINUITY AND INSULATION TESTS ACROSS TIP AND RING above using Cords C only.	

TESTBOARD NO. 18B - PRIMARY TEST CORD FUNCTIONS		
CHART 4D: VOLT-MILLIAMMETER TESTS (Contd.)		
(4) BRIDGED CAPACITANCE ACROSS THE TIP AND RING (Contd.)		
STEP	PROCEDURE	REMARKS
2	Connect the A or B cord to short-circuiting jacks and momentarily operate the associated VM key.	<p>The operation of the VM key will connect the shorted cords across the circuit being tested, discharging the capacitance on the line. When the VM key is released, the momentary deflection observed on the meter will be approximately proportional to the capacity between the line conductors connected to Cord C.</p> <p>Successive deflections in opposite directions on the meter (without the use of Cord A or B) may be secured by operating in turn the BAT and REV BAT keys (positions not provided with the 150V-45V key) or the 150V or 45V keys and REV BAT keys. The momentary readings observed on the meter will be higher in this case due to the charging and discharging of the line capacitance in opposite directions.</p>
(5) MEASUREMENT OF POTENTIALS ON TIP OR RING		
<p>A- POSITIONS NOT PROVIDED WITH TEST TIP-TEST RING KEY</p> <p>Via C Test Cords to Conductor under Test and Ground</p> <p>Simplified sketch of Meter arrangement</p>		
<p>B- POSITIONS PROVIDED WITH TEST TIP-TEST RING KEY</p> <p>Via Test Cords to T&R Conductors</p> <p>Simplified sketch of Meter arrangement</p>		
STEP	PROCEDURE	REMARKS
1A	ON POSITIONS NOT PROVIDED WITH TEST TIP-TEST RING KEY insert the tip plug of Cord C into the T jack or R jack of the primary line jacks of the line to be tested.	
2A	ON POSITIONS NOT PROVIDED WITH TEST TIP-TEST RING KEY insert the ring plug of Cord C into a ground jack.	
1B	ON POSITIONS PROVIDED WITH TEST TIP-TEST RING KEY insert the A, B or C cord into the T and R jacks of the primary line jacks of the line to be tested.	If desired, the T or R plugs of cord circuit C may be used individually.
2B	ON POSITIONS PROVIDED WITH TEST TIP-TEST RING KEY operate that key to the TEST TIP or TEST RING position as appropriate.	The operation of the TEST TIP key opens up the lead from the voltmeter to the ring conductor normal contacts of the VM keys associated with the cord circuits and places ground on that lead toward the voltmeter. Similarly, when the TEST RING key is operated the tip lead is opened and grounded toward the voltmeter.
3	Operate the VM key associated with the cord circuit used.	The potential may be read on the meter which will be connected as a 100,000-ohm voltmeter.

SECTION 664-600-500

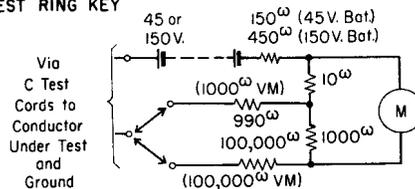
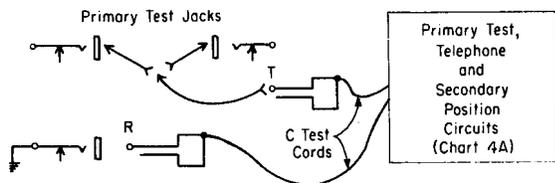
TESTBOARD NO. 18B - PRIMARY TEST CORD FUNCTIONS

CHART 4D: VOLT-MILLIAMMETER TESTS (Contd.)

(6) MEASUREMENT OF GROUND ON TIP OR RING

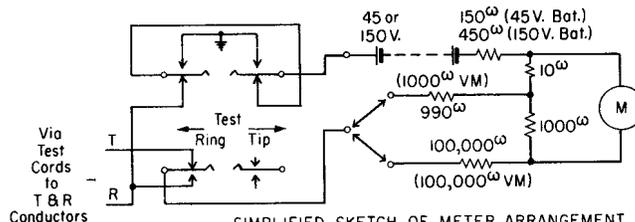
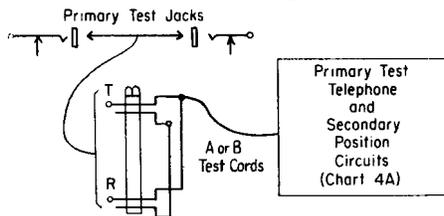
The readings observed on the meter arranged as a 100,000-ohm or 1000-ohm voltmeter with the 150-volt testing battery may be applied to TABLES I or II, CHART 4G to determine the approximate resistance connected to the test cords.

A. POSITIONS NOT PROVIDED WITH TEST TIP-TEST RING KEY



SIMPLIFIED SKETCH OF METER ARRANGEMENT

B. POSITIONS PROVIDED WITH TEST TIP-TEST RING KEY



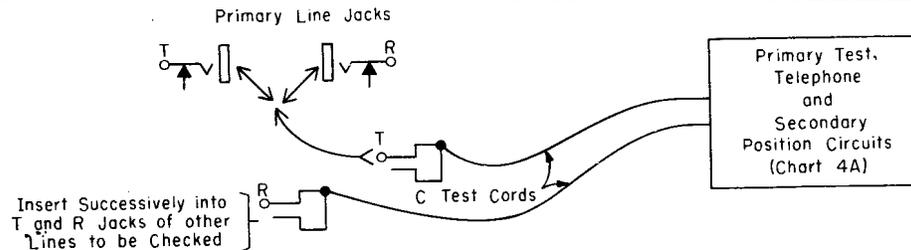
SIMPLIFIED SKETCH OF METER ARRANGEMENT

STEP	PROCEDURE	REMARKS
1	Proceed as described in STEPS 1 to 3 under (5) MEASUREMENT OF POTENTIALS ON TIP OR RING.	
2A	ON POSITIONS NOT PROVIDED WITH 150V-45V KEY operate the BAT key.	<p>The steady deflection on the meter, which will be connected as 100,000-ohm voltmeter, will indicate the voltage of the test battery less the voltage drop due to the resistance through the connected conductor to ground. (The momentary maximum deflection of the pointer due to the capacitance of the conductor to ground should be disregarded.)</p> <p>If it is desired to apply the voltmeter readings to TABLES I or II, CHART 4G to determine the approximate resistance, the meter reading should be noted, then the REV BAT key operated and meter reading again noted. To compensate for possible errors due to earth currents, the average of the two readings should be used.</p>
2B	ON POSITIONS PROVIDED WITH 150V-45V KEY operate that key to the test battery voltage desired.	Refer to the REMARKS under Step 2A.
3	To arrange the meter as a 1000-ohm voltmeter, operate the MA 1000 key.	

TESTBOARD NO. 18B - PRIMARY TEST CORD FUNCTIONS

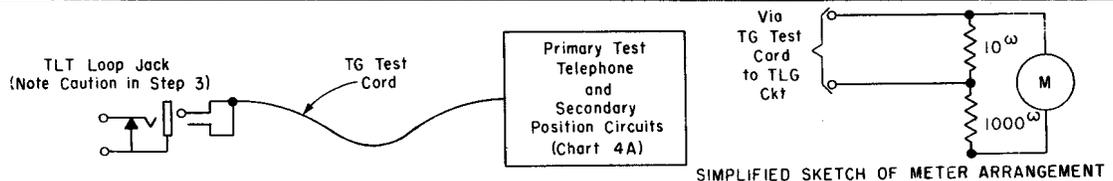
CHART 4D: VOLT-MILLIAMMETER TESTS (Contd.)

(7) CROSSES OR INSULATION TESTS BETWEEN PAIRS. The readings observed on the meter arranged as a 100,000-ohm or 1000-ohm voltmeter with the 150-volt testing battery may be applied to TABLES I or II, CHART 4G to determine the approximate resistance connected to the test cords.



STEP	PROCEDURE	REMARKS
1	Insert the tip plug of Cord C into the T or R jack of the primary line jacks of the line that is to be tested.	
2	Operate the VM key associated with the C cord.	
3A	ON POSITIONS NOT PROVIDED WITH A 150V-45V KEY operate the BAT key.	
3B	ON POSITIONS PROVIDED WITH A 150V-45V KEY operate that key to the test battery voltage desired.	
4	Insert the ring plug of Cord C successively into the T and R jacks of the primary line jacks of all other lines to be tested.	A steady meter indication at any time will indicate a cross between the lines connected to the tip and ring plugs of Cord C.
5	To arrange the meter as a 1000-ohm voltmeter, operate the MA-1000 key.	

(8) MEASUREMENT OF CURRENTS ON TELEGRAPH CIRCUITS USING SINGLE-PLUG ENDED TG CORD

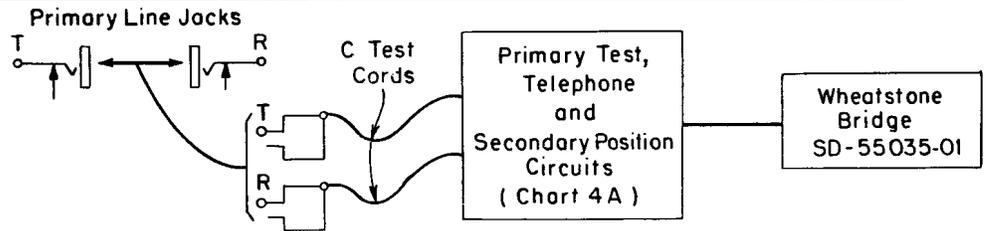


STEP	PROCEDURE	REMARKS
1	Operate the MA 10 key.	
2	Operate the VM key associated with test cords B and TG. (The T and R of the single-ended TG cord are wired in parallel with the T and R of the B cord.)	
3	Connect the TG cord to a LOOP jack in the telegraph loop terminal circuit (TLT) of the telegraph circuit which it is desired to test. <u>Caution: Some variation may be found in the wiring of TLT's. Therefore, in the interest of avoiding possible service interruptions, care should be exercised to assure that the TLT jack selected will connect the TG cord in series with the line of the telegraph circuit being tested.</u>	The meter which will be connected as a milliammeter of 10 ohms resistance in series with the line being tested will indicate up to 150 ma. line current.

TESTBOARD NO. 18B - PRIMARY TEST CORD FUNCTIONS

CHART 4E: CONNECTING CORDS C TO THE WHEATSTONE BRIDGE CIRCUIT

The primary test cords C (T and R) may be connected to the position Wheatstone bridge circuit for making fault location tests. The detailed methods of making the various Wheatstone bridge tests are covered in the E20 and E30 series of the Bell System Practices.



STEP	PROCEDURE	REMARKS
1A	ON POSITIONS NOT PROVIDED WITH 150V-45V KEY operate the BRIDGE key and BAT or REV BAT key.	The operation of the BRIDGE key connects the C cords to the Wheatstone bridge circuit, connects ground to the bridge circuit for energizing the field coil and lighting the galvanometer lamp, and when the BAT or BAT REV key is operated connects 150-volt test battery to the bridge circuit where initially it is reduced to six volts by means of a potentiometer arrangement in the bridge circuit. Note: The operation of the BAT or REV BAT key normally connects test battery in series with the position volt-milliammeter. However, the BRIDGE key, when operated, isolates the test battery from the meter circuit, thus permitting current or voltage measurements with the A or B cords while the C cord is connected to the Wheatstone bridge.
1B	ON POSITIONS PROVIDED WITH 150V-45V KEY, operate the BRIDGE key.	The operation of the BRIDGE key performs the same functions described in the remarks under STEP 1A. The voltage applied to the bridge will be either 150 volts or 45 volts as indicated by the position to which the key is operated. Note: The operation of the BRIDGE key, also isolates the test battery from the meter circuit as described in the Note under STEP 1A remarks above.

CHART 4F: MICROPHONIC PICKUP OF TELEGRAPH SIGNALS (Refer to sketch associated with CHART 4D(8), Measurement of Currents on Telegraph Circuits)

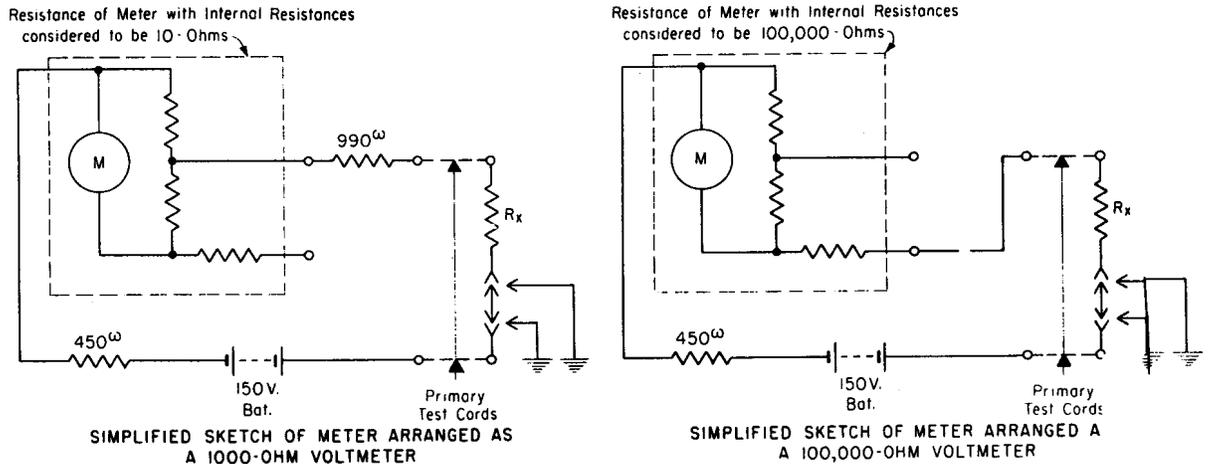
Some testboards are provided with arrangements to permit reception of telegraph signals through the receiver associated with the position telephone circuit.

STEP	PROCEDURE	REMARKS
1	Operate the SDR key.	The operation of the SDR key transfers the tip and ring of the TG cord of the primary test circuit from the B cord to a relay in the telegraph signal pickup circuit, which follows telegraph signals received on the TG cord and repeats them to a sounder in the signal pickup circuit. A transmitter mounted on the sounder microphonically picks up the telegraph signals and transmits them through a coupling transformer to the receiver leads of the position telephone circuit. Note: Telegraph signals may be received as described above while using a secondary cord circuit with its associated TALK key operated to converse on a connected trunk. The telegraph signals will be heard in the position telephone set receiver but will not be introduced into the secondary cord circuit as the operation of the SDR key effects a rearrangement of the telephone and secondary position circuits whereby the monitoring amplifier is connected into the receiver circuit as a blocking amplifier.
2	Connect the TG cord to a LOOP jack in the TLT circuit of the telegraph circuit on which it is desired to monitor.	

TESTBOARD NO. 18B - PRIMARY TEST CORD FUNCTIONS

CHART 4G: DETERMINING APPROXIMATE RESISTANCE VALUES FROM PRIMARY TEST CORD VOLTMETER READINGS

In the course of making CONTINUITY AND INSULATION TESTS ACROSS THE TIP AND RING (CHART 4D(3)), tests for GROUND ON TIP OR RING (CHART 4D(6)) or CROSSES OR INSULATION TESTS BETWEEN PAIRS (CHART 4D(7)) it is occasionally desired to determine the approximate resistance in the circuit connected to the primary test cords. These values may be calculated as discussed below:



Legend for the Above Sketches and Formula Developed Below

R_m = Total Resistance in the meter circuit (1450 ohms for the 1000-ohm voltmeter and 100,450 ohms for the 100,000-ohm voltmeter).

R_x = Unknown resistance connected to the test cords.

D = Deflection of the meter observed with $R_x = 0$ (Shorted test cords)

d = Deflection of the meter observed with R_x connected to the test cords.

Referring to the sketches above:

$$\frac{D}{d} = \frac{R_x + R_m}{R_m}$$

Solving for R_x ;

$$R_x = R_m \left(\frac{D}{d} - 1 \right)$$

The 1000-ohm voltmeter arrangement should be used in determining approximate resistances up to 60,000 ohms. The 100,000-ohm voltmeter arrangement should be used for determining approximate resistances between 60,000 ohms and 6,000,000 ohms.

Charts I and II which follow are based on the above formula. In the majority of cases, sufficiently accurate resistance values may be determined by applying the observed meter readings to the appropriate table with interpolations.

TESTBOARD NO. 18B - PRIMARY TEST CORD FUNCTIONS

CHART 4G: DETERMINING APPROXIMATE RESISTANCE VALUES FROM PRIMARY TEST CORD READINGS (Contd.)

TABLE I

APPROXIMATE VALUES OF RESISTANCE

UP TO 6,000,000 OHMS

100,000-Ohm Voltmeter	150-Volt Testing Battery		
	<u>Voltmeter Reading</u> Scale Reading or Volts	<u>Resistance</u>	
		<u>Test Battery Voltage</u>	
		<u>146</u>	<u>150</u>
150	-	-	
145	1,005	3,014	
140	4,018	7,032	
135	8,036	11,050	
130	12,054	15,068	
125	17,077	20,090	
120	22,099	25,113	
115	27,122	30,135	
110	33,149	36,162	
105	39,176	43,194	
100	46,207	50,225	
95	54,243	58,261	
90	62,279	67,302	
85	72,324	76,342	
80	83,374	88,396	
75	95,428	100,450	
70	109,491	114,513	
65	125,563	131,590	
60	143,644	150,675	
55	165,743	173,779	
50	192,864	200,900	
45	225,008	234,049	
40	266,193	276,238	
35	318,427	330,481	
30	388,742	401,800	
25	486,178	502,250	
20	632,835	652,925	
15	876,929	904,050	
10	1,366,120	1,406,300	
5	2,832,690	2,913,050	
2.5	5,765,830	5,926,550	

TESTBOARD NO. 18B - PRIMARY TEST CORD FUNCTIONS

CHART 4G: DETERMINING APPROXIMATE RESISTANCE VALUES FROM PRIMARY TEST CORD VOLTMETER READINGS

TABLE II

APPROXIMATE VALUES OF RESISTANCE

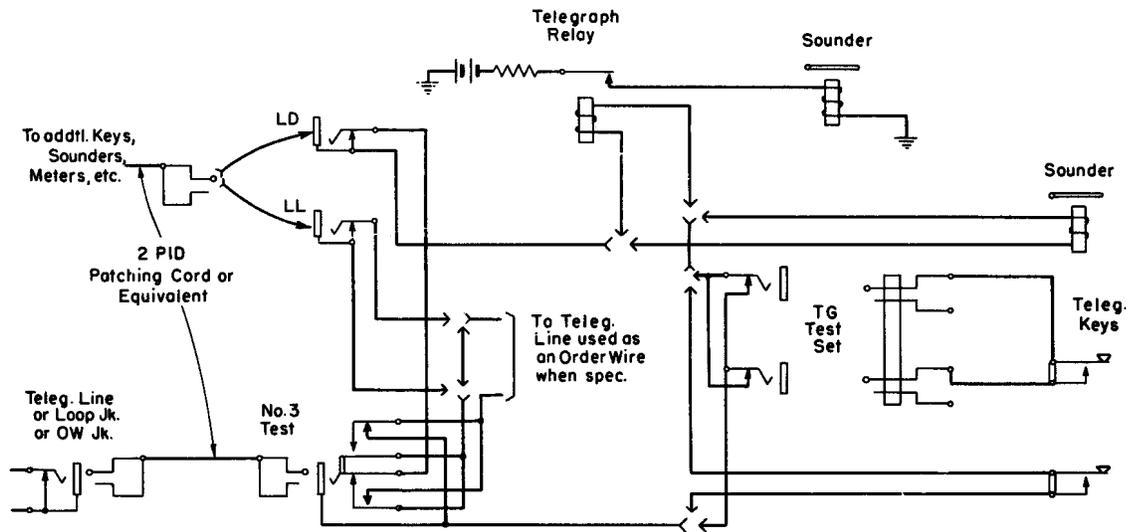
UP TO 60,000 OHMS

1000-Ohm Voltmeter <u>Voltmeter Reading</u> Scale Reading or <u>Volts</u>	150-Volt Testing Battery	
	<u>Resistance</u>	
	Test Battery Voltage	
	<u>146</u>	<u>150</u>
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
100	15	44
95	87	116
90	174	203
85	276	305
80	377	421
75	508	537
70	638	682
65	798	841
60	986	1,044
55	1,218	1,262
50	1,479	1,537
45	1,798	1,871
40	2,219	2,291
35	2,741	2,813
30	3,437	3,524
25	4,408	4,524
20	5,873	6,018
15	8,309	8,512
10	13,195	13,485
5	27,840	28,420
2.5	57,130	58,290

TESTBOARD NO. 18B - ASSOCIATED TELEGRAPH TESTING EQUIPMENT

CHART 6A: NO. 3 TELEGRAPH TEST SET

The No. 3 telegraph test set consists essentially of a telegraph key and sounder or relay key and sounder with connecting circuit and associated jacks arranged to permit connection by means of patching cords to telegraph order wires or telegraph circuits for the purpose of monitoring or communication. Jacks are provided for the introduction of additional equipment such as keys, sounders, relays or meters for current measurements into the test circuit. The test set may also be permanently associated with one telegraph order wire.



TYPICAL ARRANGEMENT NO. 3 TELEGRAPH TEST SET (REFER SD-63677-01)

(1) CONNECTING THE TEST SET WITH A SEPARATELY WIRED ORDER WIRE OR WITH A TLT CIRCUIT

STEP	PROCEDURE	REMARKS
1	Patch from the NO. 3 TEST jack to the OW jack or to the LINE or LOOP jack of the desired TLT with a 2-conductor patching cord. The patching cord should be inserted into the NO. 3 TEST jack <u>first</u> to prevent interrupting the telegraph circuit.	The inserting of the patch cord in the NO. 3 TEST jack will disconnect from the test set any order wire permanently associated with the test set.

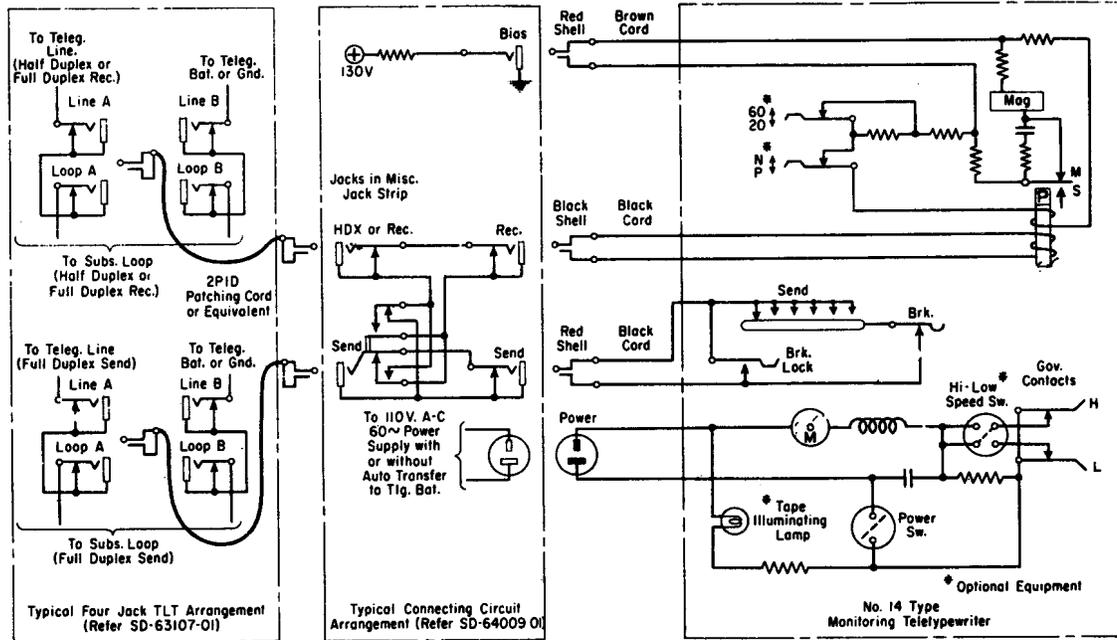
(2) CONNECTING ADDITIONAL EQUIPMENT SUCH AS KEYS, RELAYS, SOUNDERS OR METERS TO THE TEST SET

STEP	PROCEDURE	REMARKS
1	Patch from the desired equipment to the LD or LL jack of the test set with a 2-conductor patching cord. The patching cord should be inserted into the LD or LL jack <u>last</u> to prevent an interruption of any telegraph circuit to which the telegraph test set is connected.	

TESTBOARD NO. 18B - ASSOCIATED TELEGRAPH TESTING EQUIPMENT

CHART 6B: NO. 14 TELETYPE MONITOR AND CONNECTING CIRCUIT

A typical arrangement for monitoring or communication on teletypewriter circuits at No. 18B toll testboards consists of a connecting circuit with associated jacks to which the keyboard, typing unit and power cords of a fixed or portable No. 14 teletypewriter may be connected. The jack arrangement of the connecting circuit permits the connection by means of patching cords to teletypewriter circuits employing either half duplex or full duplex signaling. Depending upon the operating features provided in the teletypewriter monitor, polar or neutral, either one of two word speeds and .020 ampere or .0625 ampere type circuits may be accommodated. The operating procedures below assume that the teletypewriter and power supply cords are connected and that the power switch is operated to the ON position.



(1) CONNECTING THE TELETYPEWRITER MONITOR TO HALF DUPLEX CIRCUITS

STEP	PROCEDURE	REMARKS
1	<p>Patch from the HDX or REC jack to the LINE A or LOOP B jack of the desired circuit using a 2-conductor patching cord (2P1D or equivalent). The patching cord should be connected to the HDX or REC jack first to avoid the interruption of a working circuit.</p>	<p>(1) If a HI-LOW SPEED SW is provided, it should be operated to the HI or to the LOW position when monitoring in accordance with the word speed of the loop being monitored.</p> <p>(2) If a 60-20 key is provided, it should be operated to the 60 or to the 20 position when monitoring on .0625 ampere or .020 ampere circuits, respectively.</p> <p>(3) If an N-P key is provided, it should be operated to the N or the P position when monitoring on circuits employing neutral or polar signals, respectively. It will not be possible to type from the monitoring teletypewriter when connected to circuits employing polar signals.</p>

SECTION 664-600-500

TESTBOARD NO. 18B - ASSOCIATED TELEGRAPH TESTING EQUIPMENT		
CHART 6B: NO. 14 TELETYPE MONITOR AND CONNECTING CIRCUIT (Contd.)		
(2) CONNECTING THE TELETYPEWRITER MONITOR TO FULL DUPLEX CIRCUITS		
STEP	PROCEDURE	REMARKS
1	Patch from the HDX or REC jack to the <u>receiving leg</u> LINE A or LOOP B jack of the desired circuit using a 2-conductor patching cord (2P1D or equivalent). The patching cord should be connected to the HDX or REC jack <u>first</u> to avoid the interruption of a working circuit.	
2	Patch from the SEND jack to the <u>send- ing leg</u> LINE A or LOOP B jack of the <u>desired</u> circuit using a 2-conductor patching cord. The patching cord should be connected to the SEND jack <u>first</u> to avoid the interruption of a <u>working</u> circuit.	(1) Refer to Remarks (1) through (3) under STEP 1, CONNECTING THE TELETYPEWRITER MONITOR TO HALF DUPLEX CIRCUITS, above. (2) This operation is necessary only when it is desired to send on a circuit from the monitor keyboard.