TRANSMISSION MEASURING SYSTEM

WITH AUTOMATICALLY CONTROLLED SENDING ARRANGEMENTS

AS APPLIED TO EXCHANGE AREA CIRCUITS

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1. GENERAL

1.01 This section describes a transmission measuring system for 1000-cycle loss measurements of exchange area circuits. Measurements of transmission loss caused by the circuit under test are made by supplying the standard testing power of one milliwatt (1 MW) at 1000 cycles to one end of the circuit and measuring the received power at the other.

1.02 This issue replaces Issue 1 dated August, 1935. The principal changes are:

(1) Provision of information covering use of the 12A transmission measuring set.

(2) Removal of information covering use of modified 58A test set with the 9A transmission measuring set.

(3) Miscellaneous changes to clarify the text and bring the information up to date.

1.03 Sending channels from the 1 MW source are connected to test lines terminating in multiple jack circuits in switchboards or test boards or to connector multiple or final multiple terminals in dial offices. Testing power is automatically connected to the circuit under test when one end of the latter is connected to a test line. In the case of interoffice trunk testing, the incoming end of the trunk is routed to the test line by calling or dialing the test line number over the trunk from the outgoing office.

1.04 The sending power for this system is usually supplied by a 1000-cycle machine KS-5472 assembled on a 2A (J94002A) sending panel. For measuring the received power the 12A, 20A (J94020A) or 9A transmission measuring set is used. The 12A and 20A measuring sets are equipped with several jacks which provide means for connecting the measuring set to the circuit to be tested, and also to the test or traffic facilities which may be needed for establishing the connection to the testing power. The 9A transmission measuring set is equipped with two binding posts which provide the only means for making connection to the set.

1.05 The description of the manner of making transmission measurements of central office circuits given in this section assumes, unless otherwise stated, the use of either the 12A or 20A measuring set.

2. TEST LINE CIRCUITS

2.01 The connecting circuits by means of which the transmission testing power

is connected to the circuit under test are of two types. One type is called a cord test line circuit and the other a trunk test line circuit. The trunk test line circuit is shown in Fig. 1 of SD-96000-011, and the cord test line circuit in Fig. 2 of the same drawing.

2.02 The function of the cord test line circuit is to make the testing power available at switchboards, test boards and at the district selector test frame in link type panel offices for making transmission measurements of circuits on which it is not required to trip machine ringing. The cord test line circuit for the switchboard is cross-connected to an outgoing trunk multiple or subscriber multiple circuit. As shown on SD-96000-011 a cord test line circuit may be connected to two or more multiple jack circuits, having different sleeve conditions, in the same switchboard or in different switchboards in the same building. The tip and ring leads of these multiple circuits are connected together but the sleeve circuits are connected to different relays or to different windings of the same relay. However, if it is required to give a busy test at all other appearances of the cord test line when connection is established to one appearance as would be the case where two or more receiving sets might otherwise be connected to the testing power simultaneously, a separate cord test line circuit should be provided for each sleeve condition. When a test connection is established to the cord test line the 1000-cycle machine is started, the normal 600-ohm termination in the test line circuit is disconnected and the testing power is supplied to the cord circuit.

2.03 The trunk test line circuit is connected to a subscriber multiple jack circuit in a machine ringing manual switchboard, to a final terminal in a panel office or to a connector terminal in a step-by-step office and it is used primarily for testing machine ringing trunks. If more than one test line is required the test lines are arranged in a P.B.X. group. A common test line may be used for two or more offices in a building provided they have the same subscriber line circuit sleeve condition and the transmission requirements given on the circuit drawing for the 2A sending panel can be met. However, arrangements are provided for multipling a test line to terminals on the final frames in battery cutoff and ground cutoff relay panel offices in the same building. When a test call is routed over a trunk to the test line number the test line (1) trips machine ringing, (2) starts the 1000-cycle machine, (3) removes the normal 600-ohm termination and connects the testing power, and (4) disconnects the sending power and returns to normal when the trunk is disconnected from the test line. If a call from a message rate station is routed to the test line by a repairman or by a subscriber due to incorrect dialing the line message register will not be operated.

2.04 The trunk test line circuit is also used for testing machine ringing "A" cords in manual switchboards. In No. 1C switchboards in which the subscriber cords are arranged for machine ringing with no means for canceling the machine ringing, the trunk test line circuit is connected to a multiple jack circuit in the "A" board. In machine ringing No. 11 switchboards in which a key is provided in the "A" positions for canceling the machine ringing of the "A" cord circuits either the trunk test line or the cord test line may be terminated in the "A" board. If one test line circuit is sufficient from the standpoint of handling the testing traffic, the trunk test line circuit may be multipled from the "B" switchboard to the "A" switchboard. The trunk test line circuit may also be used for testing manual ringing "A" cords if the ringing key is momentarily operated at the start of each test.

2.05 The trunk test line circuit is suitable for use as a "B" board test line in an office having manual ringing incoming trunks. It will retire the ringing guard signal in manual ringing "B" positions. The simpler cord test line circuit may be used for this purpose if the retiring of the ringing guard signal can be waived.

2.06 Transmission testing power for testing P.B.X. trunks and cord circuits and for testing subscriber lines may be supplied through either the cord test line circuit or the trunk test line circuit depending upon the type of office and in some instances, on the operating practice employed. Both circuits are arranged so as not to give supervision. Therefore, the line message register will not be operated on a test call from a message rate subscriber line or P.B.X. trunk.

3. TEST ARRANGEMENTS

3.01 The general scheme of making transmission measurements using these facilities is, as shown in Fig. 1, based on connecting one end of the circuit to be measured to the milliwatt power supply test line and the other end to the measuring set. The transmission loss through the circuit (or circuits) thus connected is read on the db meter of the measuring set.

3.02 When a particular sleeve condition is required for the cord connected to the measuring set this requirement is arranged for by carrying the sleeve through from the MEAS jacks to the DIAL jacks and to the SM and SD binding posts. A suitable condition may be connected to either the jacks or binding posts.

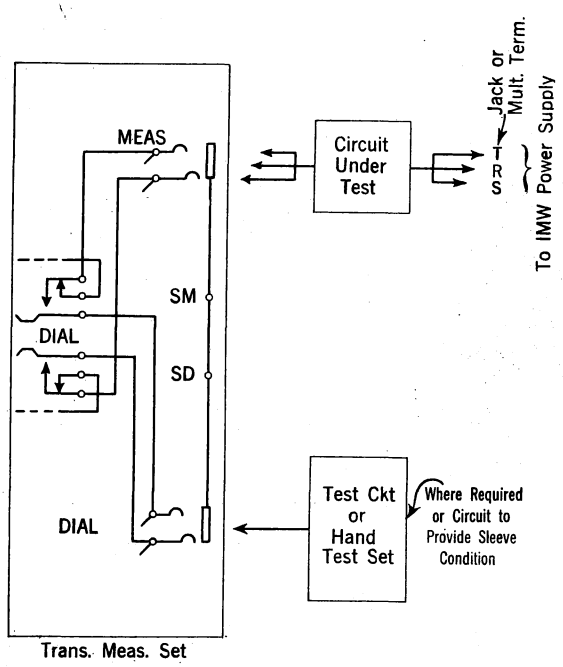


Fig. 1 - Typical Test Arrangements For Making Transmission Measurements.

(A) Trunk Circuits

Outgoing Trunks from Switchboards

3.03 For testing trunk circuits outgoing from switchboards, the measuring set is connected to the trunk by means of a cord circuit and the regular traffic facilities are used for establishing the test connection. If the trunk terminates in a local office, the connection is completed to the test line in the same manner as is a service call to a subscriber line. If the trunk terminates in a tandem selector or trunk hunting switch from which several offices may be reached, the test call is routed to the test line in a local office in the building. If the trunk terminates in a manual tandem or a toll position, the connection is completed to the test line jack in the outgoing trunk multiple.

Outgoing Trunks from Selector Multiple or District or Office Multiple in Dial Offices

3.04 Where dial office circuits not having a switchboard jack appearance are involved it will usually be necessary to use auxiliary means such as a test circuit or a dial hand test set to direct the connection to the power supply. As shown in Fig. 1, these additional test facilities are connected to one of the DIAL jacks of the measuring set and one of the MEAS jacks of the measuring set is connected to the test jack of a selector which has access to the trunk to be tested, or to the test jack of the trunk itself. When the DIAL key of the measuring set is operated, the test equipment is connected directly through the measuring set to the test jack of the trunk or of the selector used for selecting the trunk. When the connection is established, the DIAL key is restored. This disconnects the tip and ring of the trunk from the test equipment and connects these leads to the measuring set in which a retard coil is bridged across the circuit for holding the circuit in talking condition. The sleeve circuit is connected directly through the measuring set to the sleeve of the test jack. In connection with this testing arrangement it should be noted that the retard coil bridge in the measuring set is dry and therefore those circuits not arranged to provide a battery and ground supply for use in conjunction with the bridge must be held in talking position by other means in order to obtain the transmission measurement.

Outgoing Trunks from Selector Multiple in Step-by-Step Offices

3.05 For testing trunks outgoing from repeaters the hand test set is connected to one of the DIAL jacks of the measuring set and one of the MEAS jacks of the measuring set is connected to the repeater test jack. The dial of the hand test set is used to route the call to the trunk test line in the terminating office. If the trunk terminates in a tandem selector, the call is routed to the trunk test line in an office in the building in which the trunk terminates.

3.06 For testing recording-completing trunks not equipped with test jacks the hand test set is connected to one of the DIAL jacks of the measuring set and one of the MEAS jacks is connected to the test jack of a service code selector. Recording-completing trunks equipped with test jacks may be tested either by the above method or by employing the trunk test set, in which case the latter is connected to one of the DIAL jacks of the measuring set and one of the MEAS jacks is connected to the trunk test jacks. The hand test set should not be used in place of the trunk test set in this manner since there will be no busy indication and a service call might be interfered with. In either case, the call is routed to the toll board and the toll operator establishes the connection to the cord test line jack appearing in the switchboard.

3.07 For testing message rate trunks the line finder test set is employed. The test set is connected in the same manner as for making routine tests except that instead of connecting the A jack directly to the A jack of the line finder test line when testing an individual message rate trunk or to the A jack of a 2-party message rate trunk at the relay rack, this connection is made through the DIAL and MEAS jacks of the measuring set. The test connection to the trunk test line is established by using the dial in the line finder test set.

3.08 For testing coin box trunks the trunk test set is used. The test set is connected through the DIAL and MEAS jacks of the measuring set to the trunk test jack at the relay rack. The dial in the test set is used to establish connection to the trunk test line.

Outgoing Trunks from District or Office Multiple in Panel Offices

3.09 Tests of outgoing trunks, except local three-wire incoming trunks, in panel offices are made at the outgoing trunk test board by connecting the trunk test cord to one of the DIAL jacks of the measuring set and one of the MEAS jacks to the test jack of the trunk. The test call is routed to the trunk test line number in the office in which the trunk terminates. If the trunk terminates in a two-wire office selector or tandem district selector, the call is routed to the trunk test line in an office in the building in which the trunk is terminated.

3.10 Three-wire incoming selector circuits are tested at the incoming frame by connecting the selector test set (wagon type) to one of the DIAL jacks of the measuring set and one of the MEAS jacks to the incoming selector test jack. The test call is routed by the selector test set to the trunk test line number.

Test of Trunk Circuits by Loop Method

3.11 Tests of trunk circuits can be made by the loop method from a point at which a test line terminates. There are two conditions under which this method may be employed to advantage. The loop method may be employed where the terminating end of the circuit cannot be connected to a test line but it can be looped to another trunk by a convenient means; for example, trunks to information desk looped by connecting the terminating jacks with a patching cord or by operating keys to the talking positions in desks not equipped with trunk multiple jacks. In this case the test line is connected to one trunk through a switchboard cord circuit, and the other trunk is connected to the measuring set through a cord circuit for holding, if necessary.

3.12 The loop method may also be employed to advantage for testing trunks between a large office and a small manual office not equipped with testing power and where it is desirable, from an administration point of view, to make the test from the large office. For example, in testing trunks from a step-by-step office to a magneto office in which the testing power is not available, the measuring set may be connected in the same manner as it would be if the sending power were available in the magneto office. When the test call is made to the magneto office, the operator is requested to call the trunk test line over an outgoing trunk and the two trunks are looped together with a switchboard cord.

(B) District Selector Circuits in Panel Offices

3.13 In link type panel offices the district selector circuits are tested from the district selector test frame. A separate cord test line circuit terminates at this frame in a jack designated (OS). The test frame is equipped with two jacks designated (S) and (R), and when the district selector is routed to the test line terminal for testing district selectors the (S) jack connects to the tip and ring of the subscriber side of the district circuit, and the (R) jack connects to the trunk side of the district circuit. The measuring set is connected to the (S) jack, and the (R) jack is patched to the (OS) jack which also furnishes the required ground to the sleeve of the test line.

3.14 In sender selector type offices the portable district selector test set is connected to the measuring set, and the test call is routed to the trunk test line. In line switch offices the test is made from the district frame. In this case the measuring set is connected to the test jack of the district selector circuit to be tested. In line finder sender selector offices the test is made from the line finder frame. The measuring set is connected to the (0) test line jack. By inserting a make-busy plug or cord in the make-busy jack of the circuit to be tested, the associated line finder is caused to select the (0) test line. On the receipt of dial tone the test line number is dialed. In each case the connection from the measuring set includes an incoming selector circuit for which an allowance must be made in determining the transmission loss.

(C) Connector Circuits in Step-by-Step Offices

3.15 In testing connector circuits in step-by-step offices, the hand test set is connected to one of the DIAL jacks of the measuring set and one of the MEAS jacks is connected to the connector test jack. The dial of the hand test set is used to route the connector to the trunk test line terminal. The trunk test line circuit must be connected to a terminal in the particular hundred group in which the connector appears. In the case of level hunting connectors, special procedures will be required to cause the connector to pick the test line terminal. In order to test ten-party terminal per line connectors by using the trunk test line special procedures must be employed for starting and tripping the ringing.

3.16 The method of making the trunk test line available for testing connectors other than those of the hundred group in which the test line is permanently connected is as follows: Where the tip and ring leads of the connector test line circuit are not connected to bridged or series apparatus, the connector terminal to which

the trunk test line for transmission testing is connected should be cross-connected temporarily to one of the connector test line terminals 99 (or 90 in the case of rotary hunting connectors). This terminal is multipled through several connector groups. By placing a make-busy plug in the (4) jack, the connector test line is disconnected from the intercepting trunk. All connectors having access to this connector test line can be connected to the testing power by dialing the test line number 99. The testing power is made available to other groups of connectors by temporarily cross-connecting the associated connector test line terminal to the trunk test line terminal in a similar manner. In offices where the tip and ring leads of the connector test line circuit are permanently connected to apparatus which would cause a transmission loss, the above method may be employed provided an allowance is made for the transmission loss introduced by the connector test line. Otherwise, it will be necessary to temporarily cross-connect the trunk test line circuit to a spare terminal of each hundred group.

(D) Toll Transmission Selectors in Step-by-Step Offices

3.17 Where the toll transmission selector is not preceded by an incoming selector, the transmission selector is tested in connection with the test of the trunk from the toll board. However, where the transmission selector is preceded by an incoming selector a particular toll transmission selector cannot be picked at the toll board. It may be tested by connecting a hand test set to the measuring set and the measuring set to the test jack at the transmission selector. Where the transmission selector has access to only 1000 terminals in the office, it will be necessary in testing the 1000 groups other than the one in which the transmission test line number appears, to connect the test line terminal temporarily to a terminal in the particular 1000 group under test.

(E) Switchboard Cord Circuits

3.18 Tests of double ended cord circuits in switchboards are made by connecting one cord of the pair to one of the MEAS jacks of the measuring set and the other cord to the test line appearing in the switchboard. Where cord circuits have marginal sleeve conditions, under the control of which the transmission circuit of the cord is changed, two cord test lines appear in the switchboard, one equipped with the high resistance sleeve condition, and the other with the low resistance sleeve condition. Thus, either transmission condition of the cord circuit may be obtained by connecting it to the proper test line. The sleeve condition of the cord circuit connected to the measuring set may also be controlled by connecting one of the DIAL jacks by means of a P3F (J99213A-L13) cord to a switchboard jack having the desired sleeve condition. This arrangement is shown in Fig. 2. In connection with this test a check for continuity and condition of the cord plug and key contacts may be made.

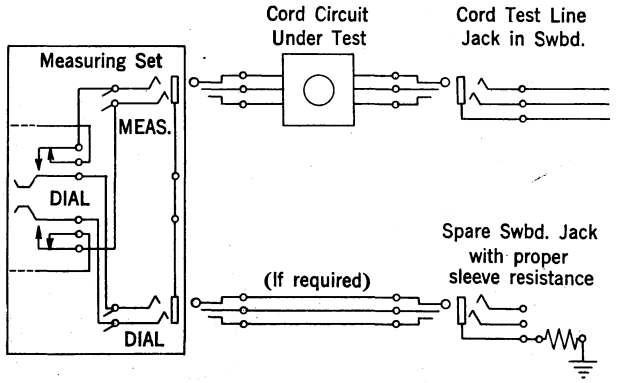


Fig. 2 - Switchboard Cord Circuit Test.

(F) P.B.X. Trunk and Cord Circuits

Using 12A Transmission Measuring Set

3.19 The 12A measuring set has a feature not incorporated in the 20A set for facilitating the testing of P.B.X. cord circuits. This feature makes it possible to test P.B.X. cord circuits for the extension to extension transmission condition as well as the trunk to extension transmission condition. It also permits changing cords without releasing the central office connection to the testing power and measuring the loss of the trunk alone.

3.20 The jack designated X is used for connecting the measuring set to the trunk over which the testing power is supplied from the central office. The trunk cord of the pair to be tested is connected to one of the DIAL jacks, the extension cord is connected to one of the MEAS jacks and ground is connected to the SM binding post. Then the following circuit combinations are set up by means of the DIAL-SLV key:

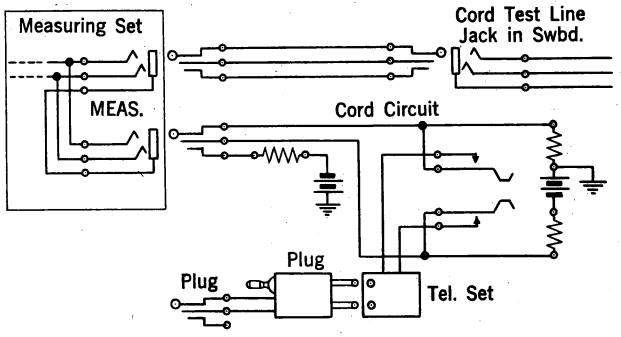
(1) When the DIAL key is operated the trunk is connected directly to the meter circuit of the test set. This provides for measuring the transmission loss in the trunk and for holding the central office connection while changing cords.

(2) With the key in the normal position the sleeve of the trunk cord is connected directly to the trunk jack sleeve and the transmission condition in the cord is that which exists when an extension is connected to a P.B.X. trunk. The testing power passes from the trunk through the cord circuit to the meter circuit and the test set retard coil provides for holding the central office connection.

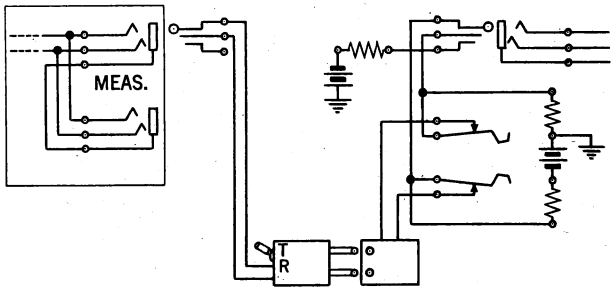
(3) When the SLV key is operated the sleeve circuit of the trunk cord is disconnected from the trunk and the sleeve circuits of both cords are connected to ground supplied at the SM binding post. This sets up the extension to extension transmission condition in the cord circuit. The central office connection is held by ground on the tip of the cord circuit, the tip being connected to the ring of the trunk due to the reversal of the tip and ring leads between the X and DIAL jacks. At any P.B.X. where the trunk circuits require the operation of a relay in the sleeve of the trunk to cut it through to the central office it will be necessary to supply the proper sleeve condition to the trunk.

(G) "A" Operator Telephone Circuits

3.21 The arrangement for testing the "A" operator telephone circuit is shown in Fig. 3.



A - Arrangement for Bridged Loss of Operator Telephone Set



B - Arrangement for Transmitting Loss of Operator Telephone Set

Fig. 3 - "A" Operator Telephone Circuit Test.

3.22 With the arrangement shown in Fig. 3A, a measurement is first made with the keys of the cord circuit and the 220 plug normal. A second measurement is made with the listening or monitoring key operated to obtain the bridged loss of the operator telephone set circuit. The arrangement in Fig. 3B is then set up, in which the P3F (J99213A-L13) cord is removed, the switchboard cord is placed in the test line jack, the cord connected to the 220 plug is inserted in the proper MEAS jack of the measuring set, and the key of the 220 plug is operated to the "T" position. A measurement is then made with the cord circuit listening key operated to obtain the transmitting loss of the operator set. The Receiving Monitoring loss is determined with the monitoring key operated and the key of the 220 plug operated to R.

(H) Miscellaneous Circuits

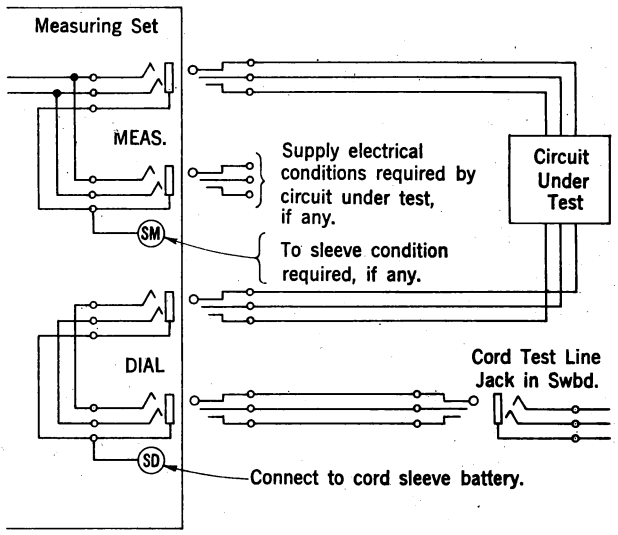


Fig. 4 - Tests on Miscellaneous Circuits.

3.23 Fig. 4 shows how the cord test line and the measuring set may be used for testing miscellaneous circuits. The binding post SD provides means for connecting battery through the sleeve of the DIAL jacks for operating the sleeve relay of the test line, which closes the circuit to the source of testing power. Tip, ring and sleeve conditions may be applied through the MEAS jack. The binding post SM permits connecting a sleeve condition to the circuit under test.

(I) Subscriber Lines from Stations

Using 9A or 12A Transmission Measuring Set

3.24 A subscriber line may be tested by means of a 9A or 12A transmission measuring set at the subscriber station. The trunk test line number is called or dialed, or the "A" or special service operator is requested to make connection to the test line circuit in the switchboard, the particular method employed depending upon the type of office and the traffic operating practice adopted. When the testing power is connected, the measuring set is connected across the line terminals and then the receiver is placed on the switchhook.