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COMMON SYSTEMS
LOCAL TEST CABINET NO. 3
TELEPHONE AND TEST CIRCUIT
FOR TESTING SUBSCRIBER LINES

CHANGES

B. Changes in Apparatus

B.1 Added

W4CJ Cord Assembly - Fig. 14

B12

Removed	Replaced By
W4BK Cord Assembly, Fig. 12, YH Option	W4BR Cord Assembly, Fig. 12, YJ Option

D. Description of Changes

D.1 Connecting information on FS 1 is englarged so that this circuit may function with MF outpulsing from a test trunk with key access. Option YK is designated and Option YL is added.

D.2 App. Fig. 14 is added for use at protector frame with 303 type connector for in and out test.

D.3 In App. Fig. 12, Cord Assembly W4BK is desinated Option YH and rated manufacture discontinued - replaced by W4BR Cord Assembly - Option YJ.

D.4 Circuit note 113 is added to indicate that connection to positive coin voltage is required whenever option ZP for testing touch tone dials is equipped.

D.5 Changes supporting tne above are made in the sheet index, apparatus index, lead index, option index and circuit notes 102 and 104.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5225-LCB
WECO DEPT 5155-AAM-WEA

COMMON SYSTEMS
LOCAL TEST CABINET NO. 3
TELEPHONE AND TEST CIRCUIT
FOR TESTING SUBSCRIBER LINES

CHANGES

D. Description of Changes

D.1 In Section II paragraph 5.30 delete the words (Mfr. Disc.)

D.2 In Section II paragraph 5.36 change the first sentence to read "An initial deposit in a multi-slot coin set, such as 1C-type, should cause ground to be applied to the coin relay through the hopper trigger contacts."

D.3 In Section II paragraph 5.37 change the first sentence to read "In multi-slot coin stations, such as 200 type, arranged for dial tone first..."

D.4 In Section II paragraph 5.42 change the first sentence to read "In a 1C-type coin telephone arranged..."

D.5 In Section II paragraph 5.43 change the first sentence to read "The 1C-type coin sets arranged for dial tone first..."

D.6 No record changes are made to bring the drawing into agreement with WECo manufacturing information.

D.7 Wiring option YG is added to provide connection to a DC-toDC converter ~~on the Battery Supply Circuit.~~ The converter provides -72 volts in range-extended No. 2 ESS offices.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5225-LCB
WECo DEPT 5155-JEH-WEA

COMMON SYSTEMS
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CHANGES

A. Changed and Added Functions

A.1 A key (TTRK) and lamp are provided for switched access to test trunk kinds other than the test distributor. The connection can be held by operating the TTRK key to the HOLD position.

A.2 A TMS key and TMS jack are provided for transferring a line under test to an external transmission measuring set.

A.3 A %BK key and %BK jack are provided for transferring a line under test to an external percent break measuring set.

A.4 Various features in coin telephones arranged for dial tone first can be tested by use of the COIN+ and COIN- keys when option YD is provided. This option allows G key to apply resistance ground to the ring lead while coin potential is applied to the tip lead by COIN- key.

B. Changes in Apparatus

B.1 Added

Jack, TMS, App Fig. 1, Option ZZ

Jack, %BK, App Fig. 1, Option ZZ

479K Key, TMS and %BK, App Fig. 1, Option ZZ

18EY Resistor, DTF, App Fig. 1, Option YD

D. Description of Changes

D.1 Description of Operation

D.01 For description of operation see CD issue 10D.

D.2 In FS 7 the interconnections between COIN- and COIN+ keys have been changed so coin potential connects to tip lead only and resistance ground through G key now can be connected to the ring lead.

D.3 In FS 1 a block of leads has been added connecting externally to the test trunk circuit as option YB.

D.4 FS 2 has been made optional as option YA. The TC B and LINE jacks of App Fig. 3 are also made optional as option YA.

D.5 In FS 1 a key (%BK and TMS) and two jacks (%BK and TMS) have been added as option ZZ. These are added for testing pole mounted repeaters per J98619D and E. These items are also included in App Fig. 1.

D.6 The transmission test pad, FS 5, has had option YE added and use made of the negative options -ZE, -ZF, and -ZG. This is to make the options in FS 5 conform to standards.

D.7 Circuit Note 102 has been changed to clarify the use of options ZK and ZL.

D.8 In FS 3 the strap between B and R terminals in the dial has been moved from internal to external to agree with reality.

D.9 The dial in FS 3 has always been designated option X, but wiring needed when the dial was not furnished was not shown. That wiring is now shown as option -X as an alternate to capacitor F and resistor D which are now shown as option X. App Fig. 1 is changed to show the capacitor and resistor as option X.

D.10 In FS 6 the pairing of some internal leads to REX key has been changed on a no record basis per agreement with WECo.

D.11 In FS 9 a strap between 48V3 and 48V2 leads has been added as option YF. This is to permit full capability of the test cabinet that did not previously exist when it was portable.

D.12 Note 110 has been added to cover D.10.

D.13 Keys IN and RH may be mounted normal or reversed independently of the circuit schematic. Equipment Note 202 been added to explain this. References to Note 202 have been added at IN and RH key contacts in FS 1, 4, 7, and 8 and in App Fig. 1 for key and keytop.

D.14 Information Note 302 has been modified to account for unigauge loops.

D.15 Circuit Note 102 has been modified to reflect the above changes.

D.16 Circuit Note 107 has been modified to reflect change D.5. Circuit 108 has been added for this D.5 change.

D.17 Circuit Note 104 has been changed.

D.18 Circuit Note 109 has been added to reflect change D.1.

D.19 CAD 6 has been added.

D.20 CAD 5 has been changed to show the terminal strip as A. Previously it was not designated.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5822-KES-MAT

COMMON SYSTEMS
LOCAL TEST CABINET NO. 3
TELEPHONE AND TEST CIRCUIT
FOR TESTING SUBSCRIBER LINES

CHANGES

D. Description of Changes

D.1 This reissue was made to correct Table A. GRD 2 has been removed from the table in the third major section from the top under CONNECT LEADS. A similar correction has been made on CADs 54 and 55.

D.2 This change is made on an AC basis and is required only for those installations that were wired per the changed section of Table A.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5822-KES-MAT

COMMON SYSTEMS
LOCAL TEST CABINET NO. 3
TELEPHONE AND TEST CIRCUIT
FOR TESTING SUBSCRIBER LINES

TABLE OF CONTENTS

SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 This circuit is used for testing subscriber lines and trunks in manual, step-by-step, panel, crossbar, and ESS offices. It is arranged for portable use, it can be mounted permanently on a desk with or without an associated jack panel, or it can be mounted on a distributing frame or a wall. It contains a telephone circuit and, optionally, a rotary dial and/or connections to an MF keyset.

2. GENERAL DESCRIPTION OF OPERATION

2.01 This test cabinet provides means for making conventional volt-milliammeter tests on subscriber lines or trunks. In addition, it has provisions for receiver off-hook tone application, dial speed tests (including connections for a dial percent break test set), insulation breakdown tests, certain types of transmission testing, and various tests of coin telephones.

2.02 When the cabinet is used on a portable basis the test and supply jacks of FS1 and 9 (App Fig. 2 and 3) are used for setting up test connections and connecting the required power supply voltages. Frequently, a test cabinet will be installed on a distributing frame but will be equipped as if it were portable.

2.03 A permanently mounted test cabinet by itself has access to one trunk to the main distributing frame or to a toll testboard, one test trunk to a switchboard or one outgoing test trunk via an MF keyset circuit, one subscriber line connection to a local switching machine, one call circuit to a switchboard, and one key accessed trunk to a test distributor or to any incoming test trunk of the kind arranged to work with the No. 14 local test desk. If access to additional trunks is required for a desk mounted test cabinet an associated jack panel can be provided. Test connections are then made on the jack panel with patch cords.

SECTION II - DETAILED DESCRIPTION

1. TALKING

TALKING ON A TEST CONNECTION

1.01 Operation of the T key connects the telephone circuit to a line under test to permit talking on the line. Usually it is necessary also to supply talking battery and ground to the line. This is done by operating the RCCI key. Ground will then be applied to the tip lead through a winding of transformer A and battery will be applied to the ring lead through a winding of transformer A and the milliammeter (300-mA scale) in series.

TALKING OVER TRUNK TO LOCAL SUBSCRIBER LINE

1.02 When a test cabinet is permanently mounted and is not associated with a jack panel the ST and SR leads may be connected to a Subscriber Line Circuit of the local switching office. To talk over this path the TRK key is operated to the TALK position, bridging the telephone circuit across the path. In a manual office an operator responds and sets up the desired connection. In dial offices dial tone is received and the desired number can be reached by dialing it with the test cabinet rotary dial.

1.03 Incoming calls can be received over this path, in addition to making outgoing calls. An external bell provides a signal for the incoming calls. Ringing is tripped by operating the TRK key first to the HOLD position, then to TALK.

1.04 The TRK key can be operated to the HOLD position to hold a call and free the telephone for other use.

2. ESTABLISHING TEST CONNECTIONS

TEST TRUNK TO PANEL OR CROSSBAR OFFICES VIA B SWITCHBOARD (OPTION C OR K)

2.01 If the SS key is provided (option K) it must be operated first to provide the proper sleeve potential and resistance. If the DO key is operated, operation of the SS key is not required.

2.02 The T and RCCI keys are now operated. The battery (on ring lead) and ground which they apply to the trunk signal the B board operator. The operator completes the connection by keying. the desired telephone number into the switching machine and then drops off of the circuit. The machine automatically completes the connection.

2.03 To reach numbers in the extra number series in No. 1 Crossbar offices, the REV key is operated before the T and RCCI keys. This reversal of battery and ground on the trunk leads directs the incoming test trunk to prepare for connection to a number in the extra number series.

TEST TRUNK TO SWITCHBOARD

2.04 When the testman desires a connection to a line or trunk at the local switchboard, he operates the C CKT key (FS6). This connects his telephone circuit to the operator telephone circuit over the call circuit. He then orders up the desired connections.

TEST DISTRIBUTOR - STEP-BY-STEP OFFICE (FS2)

2.05 The test cabinet is either wired directly to a test distributor or is connected to one via the test distributor trunk at an associated jack panel. In either case

the test circuit is connected to the outgoing test leads (TT, TR, LT, and LR) by operating the TD key to the DIAL position. The test train (test distributors and test connectors) then completes the connection to the line whose number is dialed. The TT and TR leads are extended to the line under test directly and free of any bridges. This permits the normal voltmeter or other tests to be made on that line.

2.06 If the test connector is busy a tone will be heard in the telephone set.

2.07 After a test connection has been established the telephone circuit can be made free for other use and the test connection held by operating the TD key to the HOLD position. Also under this condition the line under test can be made available to the customer by operating the 3WO key after putting the TD key in the HOLD position. This holds the test connection but releases the cutoff relay in the line circuit under test. The test path is held by the 3WO and TD keys placing a 100-ohm ground on the LR lead to the test distributor.

TEST CONNECTOR - STEP-BY-STEP OFFICE (FS2)

2.08 When the cabinet is portable it can be connected to test connectors by patch cords using the TC B and LINE jacks. The test connector is then seized by operating the TD key to the DIAL position. Connection to the desired line is achieved by dialing the tens and units digits. The telephone circuit can be released for other use and the test connection held by operating the TD key to the HOLD position.

TEST TRUNKS USING DIAL PULSE SIGNALING (FS1, 3, 4)

2.09 Under this category we include trunks to test distributor control circuits in step-by-step offices, and incoming test trunks to panel, crossbar, and ESS offices. This circuit is first connected to the test trunk by patching in the patch panel or by operating the TTRK (test trunk) key, if provided.

2.10 If the SS key is provided (option K) it must be operated in order to connect the proper potential and resistance to the outgoing sleeve lead. If the DO key is operated, operation of the SS key is not necessary.

2.11 Seizure of the trunk is achieved next by operating the DIAL key. This switches the sleeve lead to low-resistance -48 volts and places a bridge across the TT and TR (or T1, R1) leads. The bridge includes the dial, 300-mA winding of the volt-milliammeter, and inductor B in series. The DIAL key contact sequence is designed to close the bridge before switching the sleeve to low-resistance -48 volts.

2.12 The distant trunk is ready for dialing when the meter reads some on-scale value of current. It may initially read off-scale low. The meter tries to follow the dial pulses during dialing. After dialing is completed the meter changes to off-scale low in all but step-by-step offices as a normal condition. If it reverses from a step-by-step office it indicates a connection to a busy line. During dialing (between digits) a continuous low tone is heard from the trunk except from step-by-step offices. The low tone is removed when the test connection is established or changed to interrupted tone if overflow or line busy is encountered. The DIAL key is released after the connection is completed or busy is encountered.

2.13 In Crossbar No. 1 offices having an extra number series a connection to an extra number is obtained by operating the VM REV key before operating the DIAL key. The VM REV key operated grounds the TR (or R1) lead through the meter to indicate to the crossbar test trunk that it should prepare for connection to an extra number.

TEST TRUNKS USING MF SIGNALING (FS1)

2.14 When the test cabinet is associated with test trunks using MF signaling this circuit will be wired to an MF keyset and from there to the jack panel. A patch cord is used to connect the test jack to the desired outgoing test trunk jack.

2.15 The KP key in the MF Keyset Circuit is operated to seize the trunk in the distant office. When the register in that office is ready to receive MF pulses it causes the S lamp in the MF Keyset Circuit to light. After pulsing the desired number the KP key is restored. The switching machine then attempts to set up the test connection. If the attempt fails an overflow tone or a line busy tone should be heard after restoring the KP key. If a no-test trunk is used it will complete the test connection even if the called line is busy.

Note: To determine whether the connection through a no-test trunk in a crossbar office was completed on regular or no-test basis operate the MON and 3WO keys. The presence of steady high tone indicates no-test basis; otherwise, it is regular.

2.16 To reach a number in the extra number series in a Crossbar No. 1 office, operate the VM REV key before operating the KP key. This grounds the TR lead to the MF keyset, which repeats the ground to the test trunk in the crossbar office, causing it to prepare for connection to an extra number. Proceed from here as in 2.15.

CONNECTION VIA MAIN DISTRIBUTING FRAME

A. IN and OUT Jacks (FS1)

2.17 Two-jack connections to lines at the MDF are made in three ways:

(a) By patching directly from MDF jacks in the test cabinet to the protector or jack springs of the line.

(b) By patching from jacks at the MDF (these jacks are wired to TS, TL, RS, and RL leads of this circuit) to the protector or jack springs of the line.

(c) By patching from the TST jack of the associated jack panel to the MDF IN or OUT jack in the panel which is wired to the jack boxes at the MDF. The connection is then completed by patching at the MDF as in (b). The MDF may be in a distant office.

2.18 When connection is made by method (a) or (b) the test circuit will be connected to the line and the line will be disconnected from the switching machine. Operation of the IN key switches the test circuit to look inward toward the office. For connection by method (c) the direction of testing is determined by plugging into the IN or OUT jack at the jack panel.

B. Single Jack (M Option, FS1, 4)

2.19 When single jack type MDF trunks are used the SS key (option K), if provided, must be operated. If the DO key is operated the SS key may be in any position. This is necessary in order to connect the required 48 volts through 3500 ohms to the outgoing TS lead.

2.20 With the test connection established with a patch cord at the jack panel (TST jack to MDF trunk jack) and the keys as discussed in 2.19, the line will be disconnected from the office equipment and the test circuit will be looking out on the line conductors.

2.21 If the 3WO key is operated the outgoing TS lead opens. This causes the MDF trunk circuit to connect the line to the office equipment and bridge the test circuit across the line conductors.

2.22 Operation of the IN key shifts the TS lead to low-resistance -48 volts, which causes the MDF trunk circuit to split the line and office conductors apart and connect the test circuit to the office path for testing inward.

3. MONITORING (FS1, 3)

3.01 For test connections not using the TD key, operation of the monitoring key connects the telephone circuit through capacitors to the line under test. The transmitter is disabled and the lack of dc bridge prevents interference with supervision.

3.02 For test connection through a test distributor (TD key operated) monitoring requires the operation of the T key after operation of the MCN key. The path established by the T key is open to dc because of capacitor D and operation of MON key opens the transmitter path.

4. RINGING (FS3)

4-PARTY SELECTIVE OR 8-PARTY SEMISELECTIVE RINGING

4.01 This type of ringing requires superimposed + or - ringing supply connections. Operation of the ± key or the ±- key connects positive superimposed ringing or negative superimposed ringing, respectively, to the ring side of the line. Operation of the REV key allows the ringing signal to be connected to the tip conductor (see 4.03).

2-PARTY SELECTIVE, 4-PARTY SEMISELECTIVE, OR 10-PARTY RINGING

4.02 These types of ringing require only a ringing supply connection to a superimposed negative source. Ringing signal is applied to the ring conductor by operating the ± or ±- key, and to the tip conductor by operating the REV key and then the ± or ±- key (see 4.03).

4.03 No provision for ringing trip is included in this circuit. There will be no indication while ringing that the call has been answered. However, see 4.04.

RINGING WITH TEST TRUNK RINGING CIRCUIT

4.04 When a test trunk ringing circuit is used the ringing procedure is the same as described above except that the test trunk ringing circuit must be activated by operating the MR key prior to ringing. Operation of the MR key connects +130 volts through high resistance to the outgoing sleeve (TS or S1) lead (LT lead when a test distributor is being used). Also the LR lead is grounded through 100 ohms when a test distributor is used. This sleeve condition (or LT,, LR condition) activates the test trunk ringing circuit so that it will detect the kind of ringing signals applied and repeat them onward toward the line under test. The test trunk ringing circuit includes an automatic ringing trip when the called station answers, but no indication is given of this at the test cabinet.

RINGING GROUND REMOVED

4.05 In testing party lines it may be desirable to open the ringing ground in the test circuit so that the bell rings even though the station is off-hook.

4.06 To ring with ground removed, first operate the LRP RG key. This opens the ringing supply ground path. Then operate the desired ringing key.

4.07 Ringing with ground removed cannot be done with a test trunk ringing circuit activated (MR key operated).

5. TESTING

TEST BATTERY VOLTAGE (FS7)

5.01 Since most resistance measurements are made with the volt-milliammeter in series with the test battery, variations in battery voltage can materially affect the test results.

5.02 To test the 100-volt battery operate the VM REV key (all other keys normal). This places the meter (120-volt, 100,000-ohm scale) in series with the 100-volt battery to ground.

5.03 To test the 20-volt battery operate the VM REV key and either the 1000 or 20,000 keys. In either case the meter is effectively placed across the 20-volt battery. With the 1000 key operated the battery is tested under maximum load, 1000 ohms, with full scale on the meter being 24 volts or 24 mA.

5.04 To measure the +STA and -STA voltages operate the +STA or -STA key and VM REV key. The voltages are read on the 100,000-ohm, 120-volt scale of the meter.

GROUNDED CONDUCTORS (FS7)

5.05 With all keys normal (except TD or TTRK which may have been operated to establish the test connection) the +100 volt test battery is connected through the 100,000-ohm, 120-volt winding of the meter to the ring side of the line under test. Any meter reading indicates a ground on the ring. Operation of the REV key shifts the test to the tip side of the line. The resistance to ground can be calculated from the relation

$$R = \frac{(V-M)\,Rm}{M}$$

where V = test battery voltage

M = meter reading

Rm = resistance of meter.

5.06 With no test keys operated the meter scale used is 120 volts at 100,000 ohms. Operation of the 20,000 key changes it to 24 volts at 20,000 ohms and operation of the 1000 key changes it to 24 volts (or 24 mA) at 1000 ohms.

5.07 The most accurate resistance measurements are obtained when the meter scale selected allows the reading to be about midscale (resistance to be measured is near the meter resistance).

SHORT CIRCUITS (FS7)

5.08 A short circuit (continuity) between tip and ring conductors can be detected by operating the G key. With no other test keys operated this setup applies the test battery through the meter to the ring lead and applies a ground to the tip lead. If resistance to ground exists this test may not be conclusive.

CROSSES TO OTHER LINES (FS7)

5.09 The usual indication of a cross to another line is the presence of a foreign EMF on the line under test. Such a potential could cause abnormal short and ground measurements. To read only the foreign EMF operate the FEMF key. This connects the meter between the ring lead and ground, removing the test battery from the circuit. If a reading off-scale low is obtained, also operate the VM REV key.

BALLISTIC CAPACITANCE TESTS (FS7)

5.10 The approximate capacitance from a conductor to ground or between conductors can be determined by noting the ballistic kick of the meter while charging or discharging the capacitance.

5.11 One method is to operate the G key, then alternately operate and restore the REV key, noting the kick resulting at each key change. The kick upon operating the REV key is roughly proportional to the capacitance from tip to ground or across tip and ring. The kick upon restoring the REV key is roughly proportional to the capacitance from ring to ground or across tip and ring.

5.12 In the method of 5.11 each operation or restoral of the REV key causes the tip or ring capacitance to ground, respectively, to charge through the meter to +100 volts. The ground from G key discharges the other lead's capacitance to ground. Capacitance across tip and ring is alternately charged to 100 volts in one direction, then discharged and recharged in the reverse direction. This makes for higher kicks from bridged capacitance than from grounded capacitance.

5.13 Another method involves the use of the RCCI key, with or without the G key operated. This method is more sensitive for grounded capacitance than the REV and G key method, but less sensitive than that method for bridged capacitance.

5.14 For grounded capacitance on the ring lead operate the RCCI key. This charges the ring lead to -48 volts. Then restore the RCCI key and note the kick. This discharges

the ring lead and recharges it to +100 volts. The kick is from an effective potential of 148 volts. To check the tip lead operate the REV key and repeat the test. This method is good for determining the degree of tip and ring balance to ground.

5.15 To check bridged capacitance operate the G and RCCI keys. This charges the capacitance across tip and ring to 48 volts with ring side negative. Then restore the RCCI key and note the kick. This recharges the tip to ring capacitance to 100 volts with ring side positive.

TUBE TYPE SUBSCRIBER SETS (FS7)

5.16 Operation of the -STA or +STA key connects negative or positive coin potential, or its equivalent, through the 120-volt, 100,000-ohm meter terminals to the ring conductor. The meter will have 8000 ohms bridged across it. The voltage is hign enough to ionize any negative or positive station gas tubes and causes an appreciable meter deflection. Sets on the tip side of the line may be checked in the same manner after operating the REV key. A knowledge of line conditions permits the tester to estimate the number of tubes ionized in each test.

BREAKDOWN TEST (FS7)

5.17 A test of line insulation for breakdown at 200 volts is made as follows. Operate the BT key. This connects +200 volts through the 120-volt (100,000 ohms) terminals of the meter to the ring side of the line. The high resistance of the meter allows the line to charge without tapping any ringer bell.

5.18 Next, the 1000 key is operated to change the meter to 24 mA (1000 ohms) by shunting it with the A resistor. A current reading now indicates an insulation breakdown. The 1000 key should be released first at the end of the test to avoid bell tapping.

5.19 The tip side of the line is tested in the same manner after operating the REV key.

THIRD WIRE TESTS (FS1, 2, 4, 7)

5.20 With the 3WT key operated, voltmeter tests can be made on the sleeve lead (S1 or TS), also known as the third wire, or on the sleeve of jack TC B. Operation of the 3WT key disconnects the normal sleeve terminations and transfers the negative side of the meter from the ring conductor to the sleeve leads. The normal tests for ground, etc, can then be made as previously described.

SUBSCRIBER LINE CIRCUIT TESTS (FS1, 2, 3, 4)

5.21 Testing of a Subscriber Line Circuit can be done over an outgoing trunk circuit to the incoming test trunk or test distributor to any telephone switching system except the crossbar types. For the crossbar type systems, as well as any other system, the test can be made with a test connection at the MDF.

5.22 If the test connection is established at the MDF, the IN jack should be used in 2-jack arrangements, or the IN key should be operated in single-jack arrangements. The IN key operated puts low-resistance negative battery on the MDF trunk, causing the MDF trunk circuit to make the test connection look inward toward the office.

5.23 For test connections through the outgoing test trunk other than to a test distributor, the 3WO key is operated. This opens the outgoing sleeve lead, TS or S1, to cause the incoming test trunk circuit to repeat the required signal to release the cutoff relay in the Subscriber Line Circuit.

5.24 For test connections established through a test distributor the TD key is now moved from the previously operated DIAL position to the HOLD position. This puts a short across the LT and LR leads to hold the connection and frees the telephone circuit for later line relay tests. Next, the 3WO key is operated. This opens the LT lead and grounds the LR lead through 100 ohms. The resistance ground holds the connection and the open LT lead releases the G relay in the test distributor which eventually results in the release of the cutoff relay in the Subscriber Line Circuit.

5.25 For test connections established by a portable test cabinet through a test connector the procedure is the same as in 5.24 except that the release of the cutoff relay results from the operation of the 3WO key opening the sleeve lead of the TC B jack.

5.26 After the release of the cutoff relay according to the procedure in 5.23, 5.24, or 5.25, the voltmeter circuit can be used to test for battery and ground on the tip and ring conductors.

5.27 To test for operation of the line relay operate the T key. The T key operated bridges the telephone circuit across the tip and ring conductors and the 3WO key operated replaces the D capacitor in this circuit with a resistor (T, U, V, W) to make it a dc bridge with a predetermined value of resistance. Operation of the relay is indicated by an operator answering or by receipt of dial tone. This applies to line circuits arranged for bridge start.

5.28 For line circuits arranged for ground start, the LRP RG key also must be operated. This places 100-ohm start ground on the tip conductors. For line circuits

TABLE A

Test Result	Line Identification	
	No. 1 Crossbar	No. 5 Crossbar
-48V on Ring	Ring party, individual line or last line of hunting group	Ring party or individual line (non-unigauge)
-24V on Ring		Ring party or individual line (unigauge)
-48V on Tip	Tip party	Tip party (non-unigauge)
-24V on Tip		Tip party (unigauge)
Direct Ground on Ring	PBX hunting line	PBX hunting line including last line of hunting group (nonunigauge)
1000-Ohm Ground on Ring		PBX hunting line including last line of hunting group (unigauge)

requiring ground start on the ring lead also operate the REV key.

5.29 When a test connection is made to a line in a crossbar type office, except at the MDF, the line relay cannot be tested. However, operation of the 3WO key does permit some line identification information to be obtained. Operate key 3WO and test the tip and ring leads for battery and ground as previously described. For interpretation of the results use Table A.

COIN STATION TESTS (FS7, OPTION YC)

5.30 Coin telephone stations arranged for coin first operation can be checked for proper coin return and collect operation when option YC (Mfr Disc.) is provided.

5.31 When the COIN+ key is operated, positive coin control potential is applied through the volt-milliammeter (300-mA scale) to the tip and ring conductors, which are connected together by this key operation. This is usually the coin collect polarity and should cause a deposited coin to be collected. Similarly, operation of the COIN- key applies negative coin control potential which is usually the return polarity. A deposited coin should be returned.

5.32 When either the COIN+ or COIN- key is operated the current can be adjusted by also operating the RH key and adjusting the rheostat. This permits operate and nonoperate tests and adjustments of the coin relay to be made.

COIN STATION TESTS (FS7, OPTION YD)

5.33 When option YD is provided, the tests described in 5.30 through 5.32 can be made and some additional tests can be made on stations arranged for dial tone first.

A. Coin Collect and Return

5.34 Operation of the COIN+ key applies positive coin control potential through the volt-milliammeter to the tip conductor. The coin relay should operate and collect the coin. Similarly, operation of the COIN- key applies negative coin control potential to return coins.

5.35 The current can be measured and adjusted by operating the T, RCCI, and RH keys and adjusting the rheostat.

B. Coin Relay Ground Closure

5.36 An initial deposit in 200-type coin sets or any deposit in 1A-type coin sets should cause ground to be applied to the coin magnet through the hopper trigger contacts. The presence of that ground can be verified by the normal voltmeter test applied to the tip lead. The 1000 or 20,000 key can be used, if desired, for resistance measurement.

C. Chute Magnet

5.37 In 200-type coin stations arranged for dial tone first and an initial deposit of more than a nickel, a single nickel deposit should be trapped in the coin chute. A diode across the coin chute magnet shunts it out for normal loop current with negative battery

applied to the ring lead. To verify proper operation have a single nickel deposited. There should be no coin relay ground closure. With T and RCCI keys operated the coin should be held, but upon subsequent operation of the REV key the current reversal in the loop should operate the chute magnet to release the coin. Ground should then be found on the coin relay (see 5.36).

D. Ground Removal

5.38 Coin telephones arranged for dial tone first may have a coin relay ground removal feature. A relay operates from loop current in the ring lead to remove the ground during normal talking. To test this feature ask the attendant at the coin station to deposit a dime or two nickels after waiting a few seconds. The T and RCCI keys are of course operated while this request is made.

5.39 During the few seconds waiting period, operate the COIN- and G keys. This applies coin return potential to the tip lead and grounds the ring lead through 1800 ohms. The meter should indicate some value of current greater than 20 mA. This should operate the ground removal relay to open the coin relay path.

5.40 When the coin(s) is deposited the hopper trigger will close in the ground path. If the ground removal feature works there will be no change in the meter reading. If it fails the meter reading will increase by at least 25 mA. Usually the coin will then be returned with the current subsequently returning to the initial value. In some long loop cases the coin may be held and the meter reading will stay high.

5.41 After the coin deposit and no change in current is seen the presence of the coin in the hopper should be verified by verifying ground closure per 5.36.

E. Totalizer Shunt Diode

5.42 In a 1A-type coin telephone arranged for dial tone first and an initial deposit of more than a nickel, a diode shunts the totalizer to prevent a nickel readout while normal -48 volt talking battery is applied to the ring lead. A nickel deposit should be made while the T and RCCI keys are operated. No readout should be heard. Then operate the REV key to reverse the current in the loop. The shunting diode should cease conducting and the nickel readout should be heard.

F. SCR and Diode Shunts in Coin Relay Path

5.43 The 1A-type coin sets modified for dial tone first have an SCR-DIODE circuit in parallel with the totalizer contacts in the coin relay control path. This circuit permits the collection or return of coins even though the totalizer contacts are open.

5.44 After a single nickel deposit has been made there should be a ground on the coin relay as long as no appreciable current is in the ring lead, and the totalizer contacts will be open. Test for this ground on the tip lead as described in 5.05. The diodes across the totalizer contacts are poled to conduct when the positive test battery is applied. A ground indication shows that one or both diodes do conduct with positive potential on the tip.

5.45 For negative voltages under about 60V on the tip the SCR should appear open. To test this operate the REV and RCCI keys. This puts -48V talking battery through the meter (300-mA scale) onto the tip lead. With this voltage the SCR should not conduct and there should be no meter reading above normal leakage.

5.46 Next operate the COIN- key. The meter should kick upwards momentarily while the coin is being returned, indicating the SCR did conduct when the high negative voltage was applied.

TRANSMISSION TESTS

5.47 Two types of transmission testing can be done. One is a talking test with the attendant at a subscriber station while an attenuator is switched into the path. The testman's judgment is required to evaluate the results. The other method involves an external transmission measuring set that is patched into this circuit to measure the level of a test signal from the distant end of the circuit under test.

A. Voice and Attenuator Type Test (FS5, 6)

5.48 This type of transmission test is made with the RCCI and TMT keys operated. The TMT key operated connects the telephone circuit to the line under test via the transmission test pad (FS5) and transformer A. The RCCI key completes the connection to the line and supplies talking battery and ground to the line through the transformer windings on the line side.

5.49 The transmission test pad introduces 21-dB loss in the talking path with DO key normal or 12 dB with DO key operated. The testman judges the talking capability of the line and station with this attenuation present. The RCCI key operation places the meter (300-mA scale) in series with the ring lead so line current can be measured during the test.

B. Transmission Measurement (FS1, Option ZZ)

5.50 When option ZZ is provided a transmission measuring set (TMS) can be connected to the line under test by patching the TMS to the TMS jack in this circuit and operating the TMS key. The TMS key operated transfers the line from the test circuit to the TMS jack. During this time battery and ground are not supplied to the line so this arrangement cannot be used to measure speech volumes

from the subscriber station (see note under 5.56).

DIAL TESTS

5.51 Two kinds of dial testing can be done. One is a measurement of the customer's dial speed. The other uses an external percent break test set to measure the percent break time of a specially generated pulse train generated by a type of pole mounted repeater.

A. Dial Speed (FS8, Option V)

5.52 To prepare for testing the customer's dial speed operate the RCCI and RH keys. The RCCI key operated removes the +100 volt test battery from the meter. The RH key operated puts the rheostat into the meter circuit and partly closes a path to operate the C relay in the dial testing circuit.

5.53 Next operate the DT key to the SET position. This transfers the line to the dial test circuit, connects the meter circuit to the dial test circuit, and operates relay C in the dial test circuit. Resistor DT and the rheostat form a voltage divider between battery and ground from the dial test circuit. The meter (24-volt scale) is connected from the divider midpoint through 25,650 ohms (resistor CA) to ground. (Relay C is operated.) The rheostat is now adjusted until the meter reads 10 on the 24-volt scale. This completes the calibration.

5.54 To test the dial speed the DT key is now operated to the DIAL position and the attendant at the subscriber set dials 0. Operation of the DT key to DIAL opens the 24-volt lead from the meter, connects the 1.2-mA lead of the meter to a capacitor charging path in the dial test circuit, releases relay C in the dial test circuit, and closes a path to supply dial tone to the line. Receipt of dial tone is the signal for the attendant to dial 0 (zero).

5.55 Relay P1 in the dial test circuit follows the dial pulses. Its operations alternately discharge capacitor C and charge it through the meter. The meter deflection is proportional to the pulse speed and has been calibrated to read pulses per second directly on the 24-volt scale. The reading should be taken near the end of the pulse train.

B. Percent Break Test (FS1, Option ZZ)

5.56 When option ZZ is provided an external percent break test set may be patched into this circuit via the %BK jack. Connection of the line under test is completed by operating the %BK key. The test set is operated according to its instructions to read the percent break of the received test pulse train. This circuit does not supply battery or ground to the line during this test; it only provides a path to connect the line to the test set.

Note: At the time this feature (and the transmission measuring feature) was added to this circuit it was intended to be used in testing J98619D and E pole mounted rural repeaters. Application of COIN+ potential to the line for over 20 seconds is the start signal to the repeater. Thereafter the repeater will transmit a 1000-Hz signal for 20 seconds followed by a simulated dial pulse train for 20 seconds.

"TOUCH-TONE" STATION TEST (FS4)

5.57 Before making a TOUCH-TONE station test the test connection is made to the station and the test procedure explained to the attendant.

5.58 Next the TT key is operated. This transfers the outgoing sleeve (TS or S1) to positive coin control potential through 4000 ohms (resistor TT). This causes the outgoing test trunk to repeat this action on its outgoing sleeve lead. The resultant high positive current on the sleeve causes the associated TOUCH-TONE Frequency Test Applique Circuit, or its equivalent in ESS-type offices, to be activated. Upon hearing dial tone from the test circuit the attendant keys in sequence the digits from 1 to 0 within 15 seconds. The tester at this circuit can monitor the test through a one-way bridging amplifier at the test applique or in the ESS office.

5.59 Two zips of tone at the end of the sequence indicate the test was good; one zip of tone at the end of 15 seconds indicates a failed test. After the test ends the TT key is restored, which causes the talking path to the subscriber to be restored and the test setup to be released.

UNIGAUGE SUBSCRIBER LINES

5.60 Connections to unigauge extended range subscriber lines are made in the same manner as other lines. All tests are performed in the normal manner, except that it is desirable to operate the REX key while talking.

5.61 Operation of the REX key:

(a) In offices equipped for local testing only (option ZU), raises the talking battery to -72 volts.

(b) In offices equipped for local and distant office testing (option ZV), raises the talking battery to 96 volts (-48 volts on ring, +48 volts) and connects a 5-dB switched gain repeater into the telephone circuit.

5.62 The provision of unigauge testing options requires the use of resistors R1 and R2 along with either resistance lamp A or B in order to limit current to safe values for meter protection and yet keep the loop current up to required minimum values on long loops.

5.63 The testman can determine from line record cards or from line identification tests per 5.29 when operation of the REX key is required. This operation is considered to be necessary for unigauge lines over 15,000 feet long.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 This circuit has no working limits. It does, however, incorporate a compromise compensation of sorts with regard to testing subscriber line relays with various test trunk resistances. (See Note 302.)

2. FUNCTIONAL DESIGNATIONS

2.01 Keys

Designation	Meaning
BT	Breakdown Test
C CKT	Call Circuit
COIN+	Coin Battery Positive
COIN-	Coin Battery Negative
DIAL	Dial
DO	Distant Office
DT	Dial Test
FEMF	Foreign Electromotive Force
G	Ground
IN	In
LRP RG	Line Relay Prepay - Remove Ground
MON	Monitor
MR	Master Ring
RCCI	Repeat Coil Cut-In
REV	Reverse
REX	Range Extension
RH	Rheostat
SS	Sleeve Switching
+STA	Positive Station
-STA	Negative Station
T	Talk
TD	Test Distributor
TMS	Transmission Measuring Set
TMT	Transmission Test
TRK	Trunk
TT	TOUCH-TONE
TTRK	Test Trunk
VM REV	Voltmeter Reverse
3WO	Third Wire Open
3WT	Third Wire Test
1000	1000 Ohms
20,000	20,000 Ohms
±+	Ringing Positive Superimposed
±-	Ringing Negative Superimposed
%BK	Percent Break

2.02 Jacks

Designation	Meaning
CT	Coin Test Supply
LINE	Line
TC B	Test Connector, Busy
MDF (T,R)	Main Distributing Frame (Tip and Ring)
R+	Ringing, Positive Superimposed
R or R-	Ringing, Negative Superimposed
T BAT	Test Battery (20, 100, or 200 Volts)
TEL	Telephone
TMS	Transmission Measuring Set
TST	Test
24V	-24 Volt Supply
48V	-48 Volt Supply
72V	-72 Volt Supply
%BK	Percent Break

3. FUNCTIONS

3.01 Provides for talking over the test circuit tip and ring leads by operating the T key.

3.02 Provides talking battery and ground to the test circuit tip and ring leads upon operating the RCCI key and either the T or TMT key.

3.03 Provides for talking and holding on a Subscriber Line Circuit of a switching system upon operation of a TRK key.

3.04 Provides for connection to and talking over a Call Circuit to a switchboard under control of a C CKT key.

3.05 A talking type transmission test is provided under control of TMT and RCCI keys.

3.06 Ringing on lines under test is done by operating ±+ or ±- key as required. Ringing signal is directly under manual key control.

3.07 Ringing ground can be removed by operating the LRP RG key.

3.08 A test trunk ringing circuit can be activated by operating the MR key.

3.09 Monitoring a line under test can be done by operating the MON key, or by operating the MON key followed by the T key when the test connection is via a test distributor.

3.10 Patch cords and built-in jacks are available when the cabinet is to be portable. For nonportable use terminals for direct wiring and connection to an auxiliary jack panel are provided.

3.11 The TD key is provided for seizing and holding a test distributor. The TD key provides the connection of the test circuit to the test distributor.

3.12 A key (TTRK) and lamp are provided for switched access to test trunk kinds other than the test distributor. The connection can be held by operating the TTRK to the HOLD position.

3.13 An IN key is provided to control the in and out features of the MDF test trunk circuits. The bridging feature is controlled by the 3WO key.

3.14 A TMS key and TMS jack are provided for transferring a line under test to an external transmission measuring set.

3.15 A %BK key and %BK jack are provided for transferring a line under test to an external percent break measuring set.

3.16 Some compensation for test trunks to distant offices is provided under control of the DO key.

3.17 A Dial Testing Circuit may be connected for measuring customer dial speed. The connection and calibration are under control of the DT key.

3.18 A rotary dial and circuitry are provided for dialing on line circuits of local switching machines and for dialing into test trunks for establishing connection to lines and trunks for testing.

3.19 The test circuit outgoing sleeve termination in this circuit can be varied to match the requirements of various outgoing trunks. An SS key is provided to switch the sleeve lead to the terminations required for trunks designed to work with the No. 14 local test desk type test circuits.

3.20 A TT key is provided for activating a TOUCH-TONE frequency test applique circuit, or equivalent, used in making signaling tests of customer's TOUCH-TONE sets.

3.21 A REX key is provided for increasing the talking battery voltage, and with ZV option for switching into the talking path a 5-dB repeater, when talking to extended range unigauge customers.

3.22 Voltmeter tests on outgoing sleeve leads may be made after operating the 3WT key.

3.23 Outgoing sleeve leads may be opened by operating the 3WO key. This results in release of the cutoff relay in a Subscriber Line Circuit of a line under test or in establishing a bridging test connection when using the MDF trunk circuit.

3.24 A volt-milliammeter is provided with the following scales and resistances: 120 volts at 100,000 ohms, 24 volts at 20,000 ohms, 300 mA at 3 ohms, and 1.2 mA at 200 ohms. Operation of the 1000 key connects an external shunt to make another scale of 24 mA at 1000 ohms.

3.25 Various voltmeter tests, such as tests for grounds, crosses, ballistic capacitance kicks, and foreign EMF, are provided under control of RH, 1000, 20,000, FEMF, VM REV, REV, and G keys.

3.26 An insulation breakdown test with 200 volts can be made under control of the BT key.

3.27 Continuity tests of lines with tube type subsets can be made under control of the +STA and -STA keys.

3.28 Coin collect and return potentials can be applied to coin stations and the current may be adjusted using COIN+, COIN-, and RH keys. Current is indicated by the milliammeter.

3.29 Various features in coin telephones arranged for dial tone first can be tested by use of the keys in 3.25 when option YD is

provided. This option allows the G key to apply resistance ground to the ring lead while coin potential is applied to tip lead by the COIN- key.

4. CONNECTING CIRCUITS

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

(a) Subscriber Line Circuit - SD-25553-01, SD-21712-01, SD-21712-01, SD-21715-01, SD-26030-01 (typical).

(b) Call Circuit - SD-96185-01.

(c) Test Distributor Circuit - SD-32007-01.

(d) Test Distributor Control Circuit - SD-39349-01, SD-39401-01.

(e) Toll Testboard Test Trunk Circuit - SD-61172-01.

(f) Switchboard Test Trunk Circuit - SD-15033-01.

(g) Outgoing or Incoming Test Trunk Circuit - SD-96229-01.

(h) Test Trunk Circuit to Test Distributor - SD-96225-01.

(i) Universal Line or Trunk Circuit - SD-99434-01.

(j) Test Jack Circuit - SD-96182-01.

(k) Supply Circuit - SD-96205-01.

(l) Dial Testing Circuit - SD-96335-01.

(m) Power Supply, No. 1 ESS - SD-1A230-01.

(n) Receiver Off-Hook Tone Connector Circuit - SD-96322-01.

(o) MF Keyset Circuit - SD-95703-01.

(p) Voice Operated Switched Gain Repeater - SD-99488-01.

SECTION IV - REASONS FOR REISSUE

D.1 This reissue of the circuit was made to convert the schematic to detached contact form.

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