

STEP-BY-STEP SYSTEMS
NO. 1 OR 350A
TEST DISTRIBUTOR CONTROL CIRCUIT
FOR USE IN TESTING SUBSCRIBER LINES
FROM LOCAL TEST DESK NO. 14
ARRANGED FOR PERMANENT
SIGNAL TESTS

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Cross connection Figures 53, 54 and 57
are changed to show the pairing of
leads "TT" and "TR", "TTL" and "TRL" in a cable
separate from the other leads, the addition
of 19 gauge on these leads, and reference to
Note 202.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2325-RDN-EWO-FR

STEP BY STEP SYSTEMS
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CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 Connecting information is added to the "Line insulation test control circuit."
- D.2 CAD1, CAD2 and CAD3 are added.
- D.3 Cross connection Fig. 51 is changed to include reference to CAD1, 2 and 3, to remove reference "for ckts. 2 to 10" from "CH1" lead and to change the "EC" lead from punching 27 to 26.
- D.4 Cross connection Figs. 53 and 54 are changed to include connection to line insulation test control circuit.

4. CONNECTING CIRCUITS

When this circuit is listed on a key-sheet, the connecting information thereon is to be followed.

- 4.1 Test Trunk Circuit from Local Test Desk No. 14 - SD-90018-01.
- 4.2 Test Trunk Ringing Circuit - SD-31236-01*.
- 4.3 Test Distributor Circuit - SD-32007-01.
- 4.4 Permanent Signal Test Circuit - SD-31402-01.
- 4.5 Line Insulation Test Control Circuit - SD-32219-01.

*Typical

All other headings no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2353-VDM-EWO-NP

STEP-BY-STEP SYSTEMS
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CHANGES

B. CHANGES IN APPARATUS

B.1 Superseded Superseded By
 149CG relay 149AR relay
 "U" option B4 "P" option B1072
 relay (LS) relay (LS)

C. CHANGES IN CIRCUIT REQUIREMENTS
 OTHER THAN THOSE APPLYING TO ADDED
 OR REMOVED APPARATUS

C.1 Adjustment "A" is designated,
 rated "Mfr. Disc." and superseded
 by adjustment "B" for operation over
 maximum trunk loop of 1500 ohms.

C.2 Test note 1 is added on page 1
 and test note 3 is added on
 page 2.

2.2 Max. Ext. Ckt. Res.

	Earth Pot. ±15V	Earth Pot. 0 V	Earth Pot. ±27V
Adj. "A"			
Relay (D)	730 ohms	1220 ohms	
Relay (S)	4470 ohms	6915 ohms	
Relay (T)			1609 ohms
Relay (R)			711 ohms
Adj. "B"			
Relay (D)	1025 ohms	1800 ohms	
Relay (S)	5600 ohms	8450 ohms	
Relay (T)			2000 ohms
Relay (R)			711 ohms

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3310-DR-RLL-F1

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Working limits for adjustment "A"
 are designated and working limits
 for adjustment "B" are added.

D.2 "U" option is designated, rated
 "Mfr. Disc." and superseded by
 "P" option for operation over maximum
 trunk loop of 1500 ohms.

D.3 Notes 110 and 111 are added.

2. WORKING LIMITS

(D), (S), (T) and (R) relays.

2.1 Min. Ins. Res. 60,000 ohms.

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CHANGES

B. CHANGES IN APPARATUS

B.1 Superseded	Superseded By
Relays R1401	R1818
R1279	R488

D.2 Cross connection Fig. 52 is rated
"Mfg. Disc".

D.3 Cross connection Fig 51 is
modified.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Circuit note 109 is added.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3360 BSA-CGM-MP

STEP-BY-STEP SYSTEMS
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SIGNAL TESTS

CHANGES

B. CHANGES IN APPARATUS

B.1	Superseded	Superseded By	Removed
	1-149CG Rel. (DC), "W" Option	1-Y183 Rel. (DC), "V" Option	1-149 CG Rel. (DD), "T" Option
	1-R72 Rel. (CD), "W" Option	1-Y270 Rel. (CD), "V" Option	

C. CHANGES IN CIRCUIT REQUIREMENTS
OTHER THAN THOSE APPLYING TO ADDED
OR REMOVED APPARATUS

- C.1 "R" option is assigned to (SC) relay, R1075 and (SD) relay, R1075 and "Q" option is assigned to (SC) relay R990 and (SD) relay, R110.
- C.2 Test Note 1 is removed.

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 The (DC) relay, 149CG, and the (CD) relay, R72, are designated "W" option and rated "Mfr. Disc." They are superseded by the Y183 and Y270 relays respectively which are designated "V" options.
- D.2 The (DD) relay, 149CG, is designated "T" option and is rated "Mfr. Disc." It is superseded by "S" option.

- D.3 Notes 106, 107 and 108 and the Options Used Table are added.

- D.4 "R" option is assigned to (SC) relay, R1075 and (SD) relay, R1075 and "Q" option is assigned to (SC) relay R990 and (SD) Relay, R110 and notes 104 and 105 are changed accordingly.

- D.5 Cross connection Figs. K, L, M & N are rated "Mfr. Disc." and Figs. 51, 52, 53 & 54 and note 203 are added.

4. CONNECTING CIRCUITS

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

- 4.1 Test Trunk Circuit from Local Test Desk No. 14 - SD-90018-01.
- 4.2 Test Trunk Ringing Circuit - SD-31236-01*.
- 4.3 Test Distributor Circuit - SD-32007-01.
- 4.4 Permanent Signal Test Circuit - SD-31402-01.

*Typical

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3310-LAH-RLI-KK

CIRCUIT DESCRIPTION
SYSTEMS DEVELOPMENT DEPARTMENT

CD-31401-G1
Issue 2-D
Appendix 2-D
Dwg. Issue 5-D

STEP BY STEP SYSTEMS
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CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Equipment Note 202 is added.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3310-VJA-RLL-WN

STEP-BY-STEP SYSTEMS
NO. 1 OR 350A
TEST DISTRIBUTOR CONTROL CIRCUIT
FOR USE IN TESTING SUBSCRIBER LINES
FROM LOCAL TEST DESK NO. 14
ARRANGED FOR PERMANENT
SIGNAL TESTS

CHANGES

C. CHANGES IN CIRCUIT REQUIREMENTS OTHER THAN THOSE APPLYING TO
ADDED OR REMOVED APPARATUS

- C.1 On pages 1 and 2 in the remarks column the word "option" was formerly "wiring".
- C.2 The armature travels and current flow values were formerly in inches and amperes, respectively.

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 In notes 102 and 103 the word "option" was formerly "wiring"
- D.2 The first line of the title was formerly step-by-step system.
- D.3 The drawing was redrawn on account of poor condition of the tracing.
- D.4 In cross-connection Figs. M and N, Terminals 1 and 2 of lower Terminal strip were strapped to Terminals 3 and 4, respectively, on this issue and the second 19 gauge pair was terminated on terminals 3 and 4 instead of 1 and 2.
- D.5 Leads "B" and "EC" were added from the last (CH) relay for connection to the SW. TALK LINE & FERM SIG RIS. CKT. Corresponding additions were made in cross-connections Figs. K, L, M & N.

All other headings, No Change.

BELL TELEPHONE LABORATORIES, INC.

DEPT 3350

DOW)C
RSW)

STEP BY STEP SYSTEM
NO. 1 or 350A
TEST DISTRIBUTOR CONTROL CIRCUIT
FOR USE IN TESTING SUBSCRIBER LINES
FROM LOCAL TEST DESK NO. 14
ARRANGED FOR PERMANENT
SIGNAL TESTS

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 The cross connections have been changed.
- D.2 "No. 1 or 350A" has been added as the second line of the title.
- D.3 The circuit is designated Fig. 1.

All other headings under "Changes", no change.

1. PURPOSE OF CIRCUIT

- 1.1 This circuit is used as a control circuit for connecting a test line circuit at the local test desk with the test distributor circuit for the purpose of testing subscriber lines from the local test desk No. 14.

2. WORKING LIMITS

- 2.1 (D) Relay
 - 2.11 The maximum external circuit resistance is 730 ohms with ± 15 volts earth potential.
 - 2.12 The maximum external circuit resistance is 1220 ohms without earth potential.
 - 2.13 The minimum line insulation resistance is 60,000 ohms.
- 2.3 (S) Relay
 - 2.21 The maximum external circuit resistance is 4470 ohms with ± 15 volts earth potential.
 - 2.22 The maximum external circuit resistance is 6915 ohms without earth potential.

2.23 The minimum line insulation resistance is 60,000 ohms.

2.3 (T) Relay

2.31 The maximum external circuit resistance is 1609 ohms with 27 volts earth potential.

2.32 The minimum insulation resistance is 60,000 ohms.

2.4 (R) Relay

2.41 The maximum external circuit resistance is 711 ohms with 27 volts earth potential.

2.42 The minimum insulation resistance is 60,000 ohms.

3. FUNCTIONS

3.1 The operation of the (SB) relay from the test distributor provides for closing the sleeve lead to the test desk.

3.2 Holds a bridge across the line (T) and line (R) during the testing of the subscriber's line.

3.3 Arranged to close through the test tip and test ring leads to the line when the dial key at the test desk is restored to normal after the desired number has been dialed.

3.4 Arranged to connect a ground to the line tip and line ring to release the cut-off relay in the subscriber's line circuit when the (3WO) key at the test desk is operated.

3.5 Arranged to advance the test connector by rotary stepping without releasing the connecting chain of circuits.

3.6 Arranged to connect to a permanent signal test circuit in order to release the selector which is connected to the line.

3.7 Arranged to restore to normal when the test cord is removed from the test line jack and the disconnect key in the test line circuit is operated.

3.8 The (IS) relay requires that the plug be in the jack in order to operate relay (SB) which permits varying the test distributor without blocking relay (SB).

4. CONNECTING CIRCUITS

4.1 Test Trunk Circuit from Local Test Desk No. 14.

4.2 Test Trunk Ringing Circuit.

4.3 Test Distributor Circuit.

4.4 Permanent Signal Test Circuit.

DESCRIPTION OF OPERATION

5. CIRCUIT OPERATION

5.1 Originating a Test

When the plug of a test cord is inserted in the jack of a test line and the dial key is operated, a bridge is placed across the tip and ring in series with compensating resistances (C) and (D) (when furnished) or through "Z" wiring, completing a circuit over the line tip and line ring to operate the (A) and (G) relays in the test distributor circuit in series with relay (IS) of the control circuit. The operation of these relays connects a ground to the line sleeve which operates the (SB) relay through contacts of relay (IS). The operation of relay (SB) locks itself to the line sleeve, closes a circuit for the operation of relay (KD) and at the same time closes the sleeve relays (S) and (D) to the sleeve of the cord at the test desk. Since the dial key is operated at the test desk a low battery condition exists on the sleeve so that the marginal relay (D) as well as relay (S) will be operated. A race condition exists between the operation of the (D) relay and the (KD) relay. The operation of relay (D) will shunt relay (KD) which may or may not have operated but in either case relay (KD) will remain non-operated while relay (D) is operated. In addition the operation of relay (SB) closes a circuit to operate relay (DC) which in turn operates relays (DD) and (CD). The (CT) relay released short circuits the 100 ohm (B) resistance so as to eliminate this from the dialing circuit. The tester will dial the desired number to actuate the test distributor and the test connector to connect to the line to be tested.

Relay (IS) is provided so that the test distributor may be tested without blocking the (SB) relay. As no plug is in the jack relay (IS) will not be energized hence relay (SB) cannot be energized and the test is not interfered with.

5.2 Closing Through the Line for Testing

After the desired line to be tested has been selected by the test connector, the dial key in the test circuit is restored to normal. This opens the sleeve momentarily and releases the (S) and (D) relays. High resistance battery is then connected to the "S" lead which reoperates the (S) relay but the (D) relay being marginal does not operate on this condition. The (D) relay released, removes the shunting ground from the (KD) relay which now operates and causes

the operation of the (CT) and (SC) relays. The operation of relay (KD) releases relays (DC), (DD) and (CD). With the (CT) relay operated and the (CD) relay released, the test tip and test ring leads, free from any bridge, battery or ground, are cut through to the subscriber's line for testing. The (DC), (DD) and (CD) relays are slow in releasing in order to delay closing the test leads until the bridge across the test cord is removed by restoring the dial key to normal in order to reduce the possibility of prematurely tripping in case the line is being called at this time. Relays (KD) and (SC) each closes a bridge circuit across the line tip and ring in series with the 100 ohm (B) resistance to hold the test distributor.

5.3 Releasing Cut-Off Relay

When it is desired to release the cut-off relay without releasing the connecting chain of circuits, the sleeve of the test cord is opened at the test desk by the operation of the (3WO) key at the test desk. This releases the (S) relay which in turn releases the (SD) relay. With the (SD) relay released, ground from the back contact of the (CD) relay through a contact of relay (CT) is connected to the line tip for the purpose of shunting and releasing the (G) relay in the test distributor circuit. This same ground through the (B) resistance is connected to the line ring to hold the (A) relay in the test distributor circuit. The release of the (G) relay opens the sleeve lead to the cut-off relay releasing it. The (SD) relay is slow releasing to prevent the above operation when the (S) relay releases momentarily.

5.4 Permanent Signal Test

In case there is a permanent signal on the line to which the test connector is connected, the tester will operate a permanent signal test key at the test desk in order to release the associated selector. This is desirable in order to free the line of the battery and ground feed so as to permit further testing and the application of the howler if desired. Relay (P) is operated since the line called will indicate busy. The operation of the key at the test desk will connect the tip and ring to battery and open the sleeve. Opening the sleeve will cause relays (S) and (SD) to release. The release of relay (SD) will close a circuit through a make contact of relay (B) to operate and lock relay (DB). Relay (DB) operated will open the circuit of the shunting ground from the line tip and will close a ground to operate relay (PT) and will close a circuit to operate relay (R) as soon as relay (PT) operates. Relay (PT) also closes the tip through relay (T) to a ground on the make contact of relay (B). Since both tip and ring will have battery connected at the test desk both the (T)

and (R) relays will operate. Assuming the permanent signal test circuit is idle the operation of relays (T) and (R) will close the "G" lead to operate the chain relay (CH) which will operate and lock. The operation of relay (CH) will close a circuit to operate relay (PS) which in operating will transfer the test tip and ring to the permanent signal test circuit. Relay (PS) also switches the connection of the relay (T) to lead "FL" to provide a flashing signal to the tester while the test leads are connected to the permanent signal test circuit. Relay (PS) closes ground to lead "ST" and ground from relay (B) to lead "BC". The permanent signal test circuit will attempt to release the selector associated with the line. Following the test, relay (EC) will be operated from ground on lead "EC". This will cause relays (CH), (PS) and (R) to release. If the selector is released during the test, relay (B) will be released but relay (DB) will remain locked operated. When relay (PS) releases it will transfer the tip from the "FL" lead to the contact of relay (B) and a signal will be given to the test desk. Ground over the tip will indicate that the permanent signal test circuit for some reason failed to release the selector whereas an open tip will indicate that the switch was released and the line is clear. Restoring the permanent signal test key at the test desk will close the sleeve circuit to reoperate relay (S). This will operate relay (SD) which opens the locking circuit for relay (DB) which releases and in turn releases relay (PT). This again closes through the test leads to the test desk for further tests. The purpose of the chain circuit through the (CH) relays of different control circuits is to permit only one control circuit to be connected to the common permanent signal test circuit at a time.

5.5 Advance of Test Connector

When the dial key in the test desk is reoperated, a bridge is connected across the "T" and "R" leads and a low resistance battery is connected to the "S" lead, causing the (D) relay to operate. The (D) relay operated, shunts down the (KD) relay thru the (A) resistance. The (KD) relay released, releases the (CT) and (SC) relays and operates the (DC) relay in turn operating the (DD) and (CD) relays. The (CD) relay operated opens the test tip and test ring leads. With the (CT), (KD) and (SC) relays released, the 100 ohm (B) resistance is short circuited and the test distributor is held by the bridge in the test desk. The connector may then be advanced by means of the dial to other lines in the same level or it may be released by means of the connector release key in the test desk and advanced to a different level by means of the dial. Restoring the dial key at the test desk will again switch the tip and ring to the test leads as previously described.

5.6 Disconnection

When the plug is withdrawn from the test trunk jack and the disconnect key of the test line circuit is operated the "T" and "R" leads are opened and a low resistance battery is connected to the "S" lead, causing the (D) relay to operate. The (D) relay operated, shunts down the (KD) relay thru (A) resistance. The (KD) relay released, releases the (CT) and (SC) relays which opens the bridge across the line tip and ring leads causing the test distributor and test connector to release. When the test distributor is normal, ground is removed from the line sleeve lead releasing the (SB) relay in turn releasing the (DC), (DD) and (CD) relays, opening the operating circuit of the (KD) relay. The (SB) relay releasing opens the sleeve of the test line releasing the (D) and (S) relays in turn releasing the (SD) relay and the circuit is normal.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3340

EBS) PP
FJS)