

STEP-BY-STEP SYSTEMS
NO. 1, 350A OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
DIVIDED RINGING
ARRANGED FOR REVERTING CALLS
AND FOR CALLING PARTY CONTROL

CHANGES

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

C.1 Test Note 9 on Page 3, referred to at
relay (L) is clarified to specify
connecting to 8T (N) relay instead of 8 (N)
relay with "H" Option.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2325-FHP-EWO-LN

STEP-BY-STEP SYSTEMS
NO. 1, 350A OR 355A
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CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Note 111 is changed to remove reference to the intercepting trunks for tripping ringing with momentary ground, cold cathode tube or momentary battery. Note 111 formerly read: "Provide "M" option where intercepting circuits trip ringing only with momentary grd. on one side of the circuit and where 10-party lines are equipped with high impedance ringers. Provide "K" option if any 10-party line is equipped with tube type sublets or where the intercepting circuits trip either with a cold cathode

tube or by a momentary battery on one side of the circuit."

D.2 Note 301 is added to clarify the situation in regard to the arrangement necessary in intercepting trunks for tripping ringing when the connectors are provided with "K" or "M" options.

D.3 Reference to Note 301 is added to Note 106 at the entry for Issue 10-D.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2353-VDM-EWO-SL

STEP-BY-STEP SYSTEMS
NO.1, 350A OR 355A
COMBINATION CONNECTOR CIRCUIT
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CHANGES

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

C.1 "P/S" is removed from the "TEST WDG."
column for relay (E) since the windings
are internally connected.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 2353-MBB-EWO-PS

STEP BY STEP SYSTEMS
NO. 1, 350A, OR 355A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
10 PARTY TERMINAL PER STATION
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AND FOR CALLING PARTY CONTROL

CHANGES

A. CHANGED OR ADDED FUNCTIONS

A.1 "H" option is added to provide busy flash on calls to operators in offices without a toll train where this circuit has been provided.

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

C.1 Test Note 9, page 3 is added to replace test clip data for relay L.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 To provide the feature per A.1 above, "H" option is added to replace "J" option, formerly part of Fig. 1.

D.2 "G" option is added to replace "Q" and "V" options in case buzzing of

the (A) and (D) relays should occur on disconnect, when the (D) relay adjustment is weakened for 1500 ohm loops.

D.3 Notes 105, 106 and 107 are revised to refer to options G, H and J.

D.4 Note 109 formerly read "'Q' option is for use with 'V' option when improvement in balance against inductive disturbance is req."

D.5 The "F" lead designated "H" option is added in Fig. 51 and the "C" lead is designated "J" option.

D.6 Information is added at the multiple strap on the busy tone lead to care for cases where the connecting circuit is arranged to prevent conferences over the busy tone lead, and the multiple is shown thereon.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3030-OCH-RLI-R2

STEP-BY-STEP SYSTEMS
NO. 1, 350-A OR 355-A
COMBINATION CONNECTOR CIRCUIT
5 CODE FOR
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CHANGES

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

C.1 For Relay (F), adjustments "E" and "F" are added to supersede adjustments C and D for the primary winding. The secondary current flow requirements were formerly:

	Test	Readjust
O	30	27
NO	23	25.5

C.2 Three test notes have been added referring to adjustments E and F, and reference to the note concerning superseding of adjustments has been added opposite adjustments C and D.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 In the tripping range table, "ADJS. "E" & "F" was formerly ADJS. "C" & "D".

D.2 The Description of Operation applies to Drawing Issue 18-D, issued concurrently.

All other headings under Changes, no change.

1. PURPOSE OF CIRCUIT

1.1 This circuit is used for extending a call from a toll or local selector to a subscriber's line in a 10 party terminal per station connector group.

1.2 This circuit is arranged for reverting call service on local calls.

1.3 It provides for the use of tube type subsets on 10 Party Lines.

2. WORKING LIMITS

2.1 For Pulsing and Supervisory Limits, see drawing.

2.2 This circuit can be used for reverting call service only where there is

a direct local circuit from the sleeve of the line circuit to the connector multiple bank sleeve terminal.

2.3 This circuit shall not be used for local calls over incoming repeaters or trunks which place a holding ground forward on the sleeve at the time when the connector is releasing.

3. FUNCTIONS

3.1 To differentiate between local and toll calls.

3.2 To select a line as determined by the pulses received by the connector.

3.3 To test busy to toll train when held by the local train.

3.4 To test busy to the local trains while held by the toll train.

3.5 To return audible ringing tone to the calling end.

3.6 To signal the called party with code ringing and to trip machine ringing when the called party answers.

3.7 To start the ringing machine or interrupter and alarm circuit.

3.8 The following functions apply when used as a local connector:

3.801 To return busy tone to the calling subscriber when the line selected is busy.

3.802 To start machine ringing as soon as the line selected is seized.

3.803 To reverse battery to the calling line when the called subscriber answers.

- 3.804 To provide a supervisory signal if one subscriber disconnects before the other.
- 3.805 To supply the calling and called ends with transmission battery.
- 3.806 To make a test, on the release from a busy line, to determine whether the call is for a party on the calling line.
- 3.807 To release after the reverting call test if the sleeve of the called terminal is not connected thru the switch train to the incoming connector sleeve.
- 3.808 To ring both the called and the calling station bells on a reverting call.
- 3.809 To release the line finder and selectors on reverting calls.
- 3.810 To release when the calling party disconnects.
- 3.811 To allow the calling party to release the train of switches.

- 3.812 With "H" option to return busy flash on calls from operators.
- 3.9 The following functions apply when used as a toll connector:
- 3.91 To cause the operator to receive the line busy flash if the line dialed is busy.
- 3.92 To extend the trunk free of transmission obstructions to the line seized.
- 3.93 To cause the operator to be signalled when the line has been seized.
- 3.94 To start machine ringing under control of the toll operator.

4. CONNECTING CIRCUITS

Where this circuit is shown on a key-sheet the connecting information thereon is to be followed.

Circuit	<u>No. 1 or 350A</u>	<u>No. 355</u>
4.1 Local Selectors	SD-30200-01*	SD-31735-01*
4.2 Toll Intermediate Selector	SD-31179-01	SD-31744-01
4.3 Toll Transmission Selector	SD-31745-01	
4.4 AB Toll Transmission Selector	SD-31723-01*	
4.5 Selector Bank Multiple Circuit	SD-32123-01	
4.6 Switch Trouble Alarm Circuit or Misc. Alarm Circuit - Connector Shelves	SD-32045-01	
4.7 Connector Bank Multiple Circuit	SD-32128-01	
4.8 Ringing Interrupter and Alarm Circuit	SD-31298-01	
4.9 Power Ringing Circuit	-	SD-80780-01*
4.10 Interrupter Relay Circuit	SD-32135-01	SD-31868-01
4.11 Subscriber Line Circuit	SD-32133-01*	SD-31777-01
4.12 Intercepting Trunk Circuit	SD-31337-01	

* Typical Circuit

DESCRIPTION OF OPERATION

5. SEIZURE

5.1 Local

When this connector is seized by a local selector a loop is extended across the incoming local tip and ring leads which causes relay (A) to operate. (A) operated, operates (G) which places ground upon both the local and toll sleeves for a busy condition and to hold operated the preceding switches and also prepares the vertical stepping circuit. (G) operated, also prepares certain circuits which will be described later.

5.2 Toll ("J" Option)

When this connector is seized by a toll selector a loop is extended across the toll tip and ring and ground is connected to the toll sleeve lead. The loop across the tip and ring causes relays (M) and (A) to operate in series. The ground on the toll sleeve is closed thru a back contact of (K) to the toll control lead. (M) operates and locks to ground on the toll sleeve and (a) opens the supervisory No. 1 circuit, (b) operates (L), (c) operates (F) to ground on the "C" lead and (d) closes the locking circuit of (F) to the "C" lead. (L) operated (a) partially closes a circuit to (K), (b) transfers the busy test circuit from tone to 60 or 120 I.P.M. and (c) partially closes the operate circuit for (B). The operation of (A) is the same as Paragraph 5.1.

6. VERTICAL STEPPING

As the dial returns to normal on the first digit, (A) responds to the pulses, closing the circuit through (C) and the vertical magnet in series. (C) and the vertical magnet both operate. (G) and the (C) are slow to release and do not restore on dial pulses. When the pulses cease (C) releases and prepares the circuit for rotary stepping.

7. ROTARY STEPPING

The next set of impulses operate the rotary magnet which steps the shaft in a rotary direction in accordance with the pulses from (A). (G) remains operated during the rotary stepping on account of its slow release feature. (E) operates in multiple with the rotary magnet and due to its slow release feature remains operated during the rotary stepping. (E) closes a circuit for operating (B) which on this operation prepares a part of the circuit for making the busy test of the called terminal.

The toll and local sleeves are normally connected together through the rotary off-normal springs 1 and 3. This reduces the unguarded interval to either multiple bank when the switch is seized from the other one, and insures that both sleeves will test busy when the switch is made busy in any of the usual ways. When the R.O.N. springs operate this connection is opened to prevent interference with the release of relay (P) on release from a reverting call. The lead to 1B (P) is normally open until the R.O.N. springs operate to prevent the (P) relay remaining operated in case it is manually operated while the switch is normal.

8. BUSY TEST OF CALLED TERMINAL

8.1 Local Call

When the impulses of the last digit cease, (E) releases and opens the circuit to the winding of (B) and also closes a circuit for making the busy test of the called terminal. If the called terminal is busy, ground is found on the bank contacts for the "S" wiper and this operates (N) during the releasing time of (B) which releases slowly. (N) locks to the "S" lead thru its own contacts and closes a circuit for the transmission of the busy tone to the calling station. ("J" option) When "H" option is provided, the path thru (P) and (N) operates (L) which connects busy tone to the ring, and busy flash to lead "F" which on calls from an operator, causes the associated trunk circuit to return busy flashes to the operator.

8.2 Toll Call ("J" option)

If the called line is busy (N) will operate upon release of (E) as described for the local call. With (N) operated a circuit is closed to operate (K) which (a) closes 60 or 120 I.P.M. to the toll selector ring lead, (b) removes ground from the toll "C" lead and (c) closes a local holding circuit for (A) and (G). The removal of ground from the "C" lead and closure of the 60 or 120 I.P.M. circuit will provide a busy signal to the toll operator.

8.3 Called Line Idle

If the called line is idle, (N) does not operate and upon release of (E) and (B) the sleeve is closed through for operating (P).

9. CUTTING THRU TO CALLED LINES

When the called line is seized (P) operates thru its 125 ohm winding from battery in the called line circuit to ground at the front contact of (G). This ground

acts as a guarding potential on the "S" wiper until (P) operates and grounds the "S" wiper directly. The circuit to the 125 ohm winding of (P) serves only to operate spring 1 which closes a local circuit to its locking winding to fully operate the relay. The locking circuit is maintained for the duration of the call. The operation of (P) also closes the tip and ring wipers thru for ringing the called station and talking as hereinafter described.

The battery to the secondary winding of (P) is supplied through the rotary magnet to prevent the operation of the relay if a pulse is transmitted to the rotary magnet by an irregular operation at the calling station after springs 1B and 2B have made and before springs 3B and 4B have broken. If (P) were permitted to operate under conditions described in the foregoing it might result in the calling party cutting in on a busy connection.

10. RINGING THE CALLED STATION

10.1 Local Call

On a local call ringing the called station is not started until (J) operates from ground on the pick-up lead to insure the right number of rings being sent out over the line. (J) locks to its own contacts in series with contacts on (F) to ground at contacts on (G) and closes the ringing interrupter leads and the ringing supply circuit. (G) operated grounds the "MS or INT. ST" lead under control of (D) for the purpose of starting the ringing or interrupter circuit. (N) is operated from the ground pulses on the ringing interrupter leads connected to wiper "A" which may be code ground 1, 2, 3, 4 or 5 thus transmitting ringing current over the called line in code as determined by the lead connected to wiper "A". The "A" condenser transmits ringing tone to the calling subscriber during the ringing period. This ringing continues until the called station answers whereupon (F) operates to close contacts with springs 1 and 2 due to the current thru its operate winding. The 1300 ohm winding then being energized fully operates the relay. The operation of this relay connects the talking leads thru to (D) which supplies talking battery to the called station and causes (J) to release. The called and the calling stations are now connected for talking purposes thru the 2 MF condensers in the tip and ring leads. (D) operates and reverses the battery to the calling station for the purpose of supervision or metered service and other functions hereinafter described.

10.2 Toll Call ("J" option)

On a toll call the operation of (F) upon seizure of the line causes (K) relay

to operate. (K) extends the called subscriber's line to the transmission selector, free from all transmission obstructions, and also removes ground from the toll "C" lead which is a signal to the toll operator or the A-B Toll Transmission Selector to ring. (K) also opens the operating circuit to the (F) relay secondary winding, and holds operated the (A) relay. (F) is held operated thru its locking contacts to ground on the "C" lead. When the toll operator rings ground is removed from the "C" lead and the (F) relay releases. The (J) and (N) relays then operate as for a local call. When the called party answers (F) operates over its primary winding and locks on its secondary winding to the "C" lead. This arrangement provides a means for reringing from the toll board when required. (F) connects the called line thru contacts of (K) relay operated to the transmission selector. Talking battery and supervision on the called line are provided by the transmission selector.

11. REVERTING CALLS

On local calls when a station calls another station on the same line the busy test of the called terminal and the busy tone to the calling station are the same as described under paragraph 8. When the calling station hangs up (A) releases, operating (E) and allowing (G) to release. On the release of (G), (E) is locked to a ground thru the back contacts of (G) and grounds the sleeve wiper "S" which is now connected to the sleeve of the calling line. When (G) releases the shunt is removed from the primary winding of (H), which operates from the (E) relay ground connected to the sleeve wiper and calling line sleeve sufficiently to close contacts 1 and 2. On a reverting call the sleeve of the calling line is the same as the called line. Thus the ground from the back contact of (M) thru (E) connected to the called line sleeve is also closed thru the line and selector ckts. to the operate winding of (H), operating the latter, which then fully operates over its secondary winding. The operation of (H) operates (C) in series with resistance (A) and the vertical magnet. The operation of (C) opens the holding circuit for (E) and removes the ground from the sleeve which allows all the switches in the local train except the connector to release. When the ground is removed from the sleeve, (N) releases but the circuit for the release magnet of the connector is opened by contacts on (C). The release of (N) operates (G) which grounds the toll sleeve for the purpose of guarding the circuit from being seized by toll selectors. (E) released closes ground to the local selector banks to guard against reseizure. The local selector sleeve circuit is ungrounded during the release of (E) to insure release of the line and preceding selector circuits. The release of (E)

also closes a circuit from ground thru the primary winding of (P) in series with the cut-off relay of the line circuit to battery. This operates the cut-off relay and also (P) sufficiently to close contacts 1 and 2 and P then fully operates over its locking winding and remains energized until the connection is released. The release of (E) also allows (C) to release and opens the circuit to the winding of (G). Relay (G) is slow in releasing and holds during the operating time of (P). (P) closes a circuit for holding (C). The operation of (P) also closes the tip and ring wipers thru to (F), prepares circuits to prevent the operation of the release and the rotary magnets, prevents the locking of (N), grounds the sleeve and closes a circuit for operating (J) over the pickup lead. The operation of (J) starts the ringing in the same manner as already described under paragraph 10.1. Ground over the RR lead operates (B) momentarily and transmits a short ring on the opposite side of the line to that of the code ringing of the called station. The purpose of this is to provide a signal to the calling station when the calling station's ringer is on the opposite side of the line from that of the called station, so that the calling party will know when the called party answers. When the called station answers, (F) is operated the same as already described in paragraph 10.1 and talking battery is supplied to both stations thru the windings of relay (D). On the operation of (F), ground is removed from the winding of (G), but (G) is slow in releasing and therefore does not release during the operating time of (D) which re-established the holding circuit for (G) which is held operated from the ground at contacts of (D) until the connection is released. If the called party does not answer, the calling party must remove the receiver from the hook and trip the ringing to release the connection. This circuit should not be used for calls incoming over repeaters or trunks that place a holding ground forward on the sleeve at the time when the connector is in process of releasing because this may cause a false reverting call test if after finding the called terminal busy the terminal becomes idle before the connection is released and if on the release (G) releases just enough before the forward ground is removed from the sleeve to operate (H) and the ground is removed a sufficient length of time before the release of (E) to allow the re-operation of (G).

12. RELEASE OF CONNECTOR

12.1 Local Nonreverting Call

If the called line disconnects first (D) releases and closes a circuit to the

SUPV 1 lead to operate an alarm if the calling party fails to disconnect.

When the calling party disconnects (A) releases in turn releasing (G). With (A) relay normal a circuit is closed to momentarily operate (E). The operation of (E) at this time has no effect. (G) in releasing (a) removes ground from the toll and local selector sleeves and (b) releases (P) on a completed call or releases (N) on a line busy condition. With (G), (N), and (P) normal the release magnet is energized thru the vertical off normal contacts returning the circuit to normal and allowing (F) to release. (H) does not operate because the connector sleeve terminal is not associated with the calling line and therefore the ground is removed from the sleeve when (G) releases.

12.2 Local Reverting Call

On a reverting call (D) remains operated until both the calling and the called station disconnect - thus holding the (G) thru (H) operated. (G) holds the circuit off normal as on a nonreverting call. When (D) releases upon disconnect of both parties (G) releases. (P) releases closing the release magnet circuit. When the switch restores to normal the vertical off normal contacts open and release (F) and (H).

12.3 Toll Call ("J" option)

The connector does not release until the toll selector removes ground from the toll sleeve terminal. The removal of sleeve ground releases the (A), (K), (L), (P), and (M) relays. (M) is slow to release to allow the toll train to release before reclosing a guarding sleeve ground as well as to prevent reclosing ground to the locking winding of (P). (A) releases (G) which in turn operates the release magnet and restores the switch to normal.

12.4 Toll or Local Call (Nonreverting) Line Busy

When the toll train disconnects on a busy condition the release of (A) operates (E) which remains locked through the operated (N) relay to ground on a back contact of (G). (N) however releases upon release of (G) thereby releasing (E) which performs no function at this time. (N) normal also closes a circuit to the release magnet restoring the switch.

13. SUPERVISORY #1

If the called station disconnects before the calling station a circuit is closed thru a back contact of relay (D) and a front contact of relay (F) for operating a signal designed SUPV. #1.

14. TEST JACK

A test jack is provided for making routine tests on this switch.

15. CONTACT PROTECTION

The (C) contact protection unit is provided for protecting the contacts

which make and break the circuit to the stepping magnet. The (B) contact protection unit is provided for protecting the contacts of relay (F) which break the ringing current when the ringing is tripped.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3030-OCH-RL-TC