

CIRCUIT DESCRIPTION
SWITCHING SYSTEMS DEVELOPMENT DEPARTMENT

CD-31674-01
Issue 3-D
Appendix 4-D
Dwg. Issue 13-D

STEP BY STEP SYSTEMS
NO. 1, 350A, 355A, 360A, 370A OR 370B
2-WAY REPEATER CIRCUIT
OUTGOING-BATTERY AND GROUND PULSING
WITH LOOP SUPERVISION
INCOMING - ARRANGED FOR PULSE TRANSMISSION

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Cross-connection Fig. 56 is added in accordance with the 2" mounting plate program.

D.2 Cross-connection Fig. K is revised to show connecting information to Aux. Trk. Ckt. arranged to restrict service.

D.3 The table of working limits is revised.

4. CONNECTING CIRCUITS

When this circuit is listed on a key sheet, the connecting information thereon is to be followed. The following circuits are typical:

- 4.1 Local or Incoming Selector - SD-30200-01 or SD-31735-01
- 4.2 Sel. Bank Mult. Ckt. - SD-32123-01
- 4.3 Traffic Register Ckt. - SD-31109-01
- 4.4 Aux. Trk. Ckt. - SD-32032-01
- 4.5 Two-Way Repeater at Distant Office SD-31674-01
- 4.6 Misc. Alarm Circuit (Registers) SD-31976-01
- 4.7 Aux. Trk. Ckt. arranged to Restrict Service - SD-32187-01

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3030-VJA-RLL-N5

CIRCUIT DESCRIPTION
SWITCHING SYSTEMS DEVELOPMENT DEPARTMENT

CD-31674-01
Issue 3-D
Appendix 3-D
Dwg. Issue 12-D

STEP-BY-STEP SYSTEMS
NO. 1, 350A, 355A, 360A, 370A OR 370B
2-WAY REPEATER CIRCUIT
OUTGOING - BATTERY AND GROUND PULSING
WITH LOOP SUPERVISION
INCOMING - ARRANGED FOR PULSE TRANSMISSION

CHANGES

B. CHANGES IN APPARATUS

B.1 Superseded Superseded by
Relay 221BA 221BB

D.3 Cross-connection Figs. 52, 53, 54
and 55 are added.

D.4 The 221BA and 221BB relays are
added to note 104.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Cross-connection Figs. S and T are
rated A&M Only for No. 1, 350A and
360A offices.

D.5 The use of the 221BA relay is
superseded by the 221BB relay to
show realistic ratings for obsolescent
apparatus.

D.2 Cross-connection Fig. K is rated
A&M Only for No. 1 and 350A offices.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3360-BSA-CGM-R2

STEP-BY-STEP SYSTEMS
NO. 1, 350A, 355A, 360A, 370A, OR 370B
TWO WAY REPEATER CIRCUIT
OUTGOING BATTERY AND GROUND PULSING
WITH LOOP SUPERVISION
INCOMING ARRANGED FOR PULSE TRANSMISSION

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 Note 106 was standard.
- D.2 Note 107 is added.
- D.3 Note 204 is added.
- D.4 Under Fig. U the title read
"For Units Mounted on R. R.
Central Offices", and the connecting

information read "to frame fuse panel on
relay rack or miscellaneous fuse board".

D.5 The connecting information for
Fig. V was "to switch frame fuse
panel".

D.6 Under Fig. 51 the title formerly
read "for repeater mounted on re-
peater frame 20 repeater positions per
shelf", and the connecting information
read "to frame fuse panel or miscel-
laneous fuse panel".

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3310-RSN-RLL-XF

STEP-BY-STEP SYSTEMS
NO. 1, 350A, 355A, 360A, 370A, OR 370B
2 WAY REPEATER CIRCUIT
OUTGOING-BATTERY AND GROUND PULSING
WITH LOOP SUPERVISION
INCOMING ARRANGED FOR PULSE TRANSMISSION

CHANGES

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

C.1 The following current flow re-
quirements are added for use when
timing requirements are applied, to the
(C) 247C relay: Non-operate Test 13.3
ma. Readj. 14 ma.

C.2 The armature travel for the (H)
252^a relay is changed from 16 to
18.

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The codes of the plugs and jacks
shown in Fig. 1 are added to
the schematic.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3330-VJA-AJB-AL

STEP-BY-STEP SYSTEMS
NO. 1, 350A, 355A, 360A, 370A OR 370B
2-WAY REPEATER CIRCUIT
OUTGOING - BATTERY AND GROUND PULSING
WITH LOOP SUPERVISION
INCOMING ARRANGED FOR PULSE TRANSMISSION

CHANGES

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

- C.1 In the "Soak" column, Full Soak is now specified for all relays.
- C.2 (H)NO is added in the Block or Insulate column, for the 221-FAC (A) relay and reference is made to Test Note 10.
- C.3 In the "Remarks" column for the 221-FAC (A) relay, the following has been added "For Use When Pulse Rep. Req. Are Applied".
- C.4 Test Note 10 has been added on Page 1.
- C.5 Timing Requirements are added and "2(B)" is removed from the "Block or Insulate" column for relay(F).
- C.6 Test Note 4, p.1 formerly read "Prior to iss. 4-D Armature Travel for Rel. (F) was 11".

D. DESCRIPTION OF CIRCUIT CHANGES

- D.1 The cross-connection figures are revised to provide for the use of this circuit in No. 355A offices.
- D.2 The references at Figures K and V formerly read, respectively, "For Central Offices and 350A Dial Offices" and "For Units Mounted on Sw. Frame for Central Offices". In Figure T, reference was previously made to M.D.F. only.
- D.3 Note 103 has been revised, note 101 rated "MFR. DISC." and note 106 added.
- D.4 The Working Limits have been changed.
- D.5 In the rating box, the 370A and 370B PRX's have been rated "A & M Only".
- D.6 The following replacement note has been added "Replacing SD-31754-01 except for additions to existing shelves".
- D.7 Previous to this issue the title did not include the 355A, 370A and 370B PRX's.

All other headings under "Changes", no change.

1. PURPOSE OF CIRCUIT

- 1.1 This trunk circuit is for use at each end of a two-way trunk between step-by-step offices.

2. WORKING LIMITS

	(A) Relay	
	Pulsing	Supv.
Max. Ext. Ckt. Loop Res.	1000 ω	2340 ω
Min. Ins. Res.	15000 ω	30000 ω

2.2 Trunk Supervision
(H) Relay
W Wiring Z Wiring Fig. 5

Max. Ext. Cct. Loop Res.	2060 ω	2560 ω	1560 ω
Max. Ext. Cct. Loop 42-56 V.	1885 ω	2385 ω	1385 ω

(G) Relay

Max. Ext. Cct. Loop Res.	2390 ω
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Min. conductor loop res. and max. earth potential - See tables in circuit note 103 on use of Fig. 4 and Fig. 5.

3. FUNCTIONS

- 3.1 When seized by a selector to hold the preceding selectors and to make this trunk busy to other selectors.
- 3.2 To repeat the pulses received.
- 3.3 To transfer from a polarized relay bridge to battery and ground during the pulsing of each digit.
- 3.4 To repeat the reverse battery supervision received to the calling subscriber.
- 3.5 To restore to normal when the calling party disconnects.
- 3.6 When the incoming selector is seized to ground the outgoing selector bank sleeve to make this circuit test busy.

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- 3.7 To restore to normal when the calling subscriber at the distant end of the trunk disconnects.
- 3.8 To prevent operation of the (A) relays of the associated incoming selectors at each end of the trunk on ground potential while the circuit is idle.

4. CONNECTING CIRCUITS

When this circuit is listed on a key sheet, the connecting information thereon is to be followed. The following circuits are typical:

- 4.1 Local or Incoming Selector - SD-30200-01 or SD-31735-01
- 4.2 Sel. Bank Mult. Ckt. - SD-32123-01
- 4.3 Traffic Register Ckt. - SD-31109-01
- 4.4 Aux. Trk. Ckt. - SD-32032-01
- 4.5 Two-Way Repeater at Distant Office SD-31674-01
- 4.6 Misc. Alarm Circuit (Registers) SD-31976-01

DESCRIPTION OF OPERATION

5. OUTGOING CALL

5.1 Seizure

When this circuit is seized by a selector, the (A) relay operates over the subscriber's loop and the (E) relay operates from ground on the sleeve lead from the selector. The rear winding of relay (H) is also energized in multiple with the (E) relay but the (H) relay does not operate. The (A) relay operated operates the (B) relay which grounds the sleeve lead and operates the (F) relay. The (F) relay operated also connects ground to the sleeve lead and removes ground from the "BR" lead to the traffic register circuit so that when all the trunks in a group are busy this lead is no longer grounded. With the (A) and (E) relays operated a dry bridge including the front winding of the (H) relay and Res. C is connected across the tip and ring of the trunk and the incoming selector tip and ring is out off. Relay (H) does not operate since its front and rear windings are opposing.

5.2 Pulsing

On the first open of the dial, relay (A) releases opening the tip and ring of the trunk and operating relay (C). Relay (C) opens the (H) relay bridge and substitutes battery through resistance (B) and ground through resistance (A). Relay (B) being slow to release remains operated during the train of pulses. When relay (A) re-operates on the closure of the dial, the battery and ground prepared by the (C) relay is connected to the trunk in a direction to aid the ground and battery on the pulsing relay at the distant office. Relay (C) being slow to release holds during the pulses. At the end of the digit relay (C) releases to remove battery and ground from the trunk and reclose the talking circuit and (H) relay bridge.

5.3 Supervision

When the called subscriber answers, the line current is reversed over the trunk so that the front winding of the (H) relay is aiding to the rear winding and the relay operates to reverse the line current to the calling subscriber. Relay (H) also opens the circuit to relay (C) so that if the calling subscriber momentarily depresses the switchhook the switches at the distant office will not be released. If the (C) relay were allowed to operate the battery and ground introduced by it would be opposing the battery and ground at the distant office after answer and the delay introduced by the slow release of the (C) relay might release the switch train. When the called subscriber hangs up, the line current is restored to normal and the current in the front winding of the (H) relay again opposes the current in the rear winding and the relay releases and restores the line current to normal toward the calling subscriber.

5.4 Disconnection

When the calling subscriber disconnects relay (A) releases releasing relay (B). Relay (B) released releases relay (F) which in turn removes ground from the sleeve lead to release the preceding selectors, releases the (E) relay and if operated the (H) relay and restores ground to the "BR" lead to the traffic register circuit. Relay (F) is slow to release in order to delay closure of the incoming selector or Fig. 4 to the trunk until the selector or connector at the distant office has restored to normal.

6. INCOMING CALLS

6.1 With Fig. 3

When a loop is closed to this circuit at the distant office, the (A) and (B) relays of the associated incoming selector operate and ground the incoming selector sleeve to operate relay (F) in this circuit. Relay (F) opens the (E) and (H) relays from the outgoing selector sleeve and grounds the outgoing selector sleeve to busy the trunk to outgoing calls. Relay (F) also opens ground from the "BR" lead to the traffic register circuit. Upon disconnection, ground is removed from the incoming selector sleeve releasing relay (F) and restoring the circuit to normal.

6.2 With Fig. 4

When a loop is closed to this circuit at the distant office, relay (G) operates over the loop and grounds the outgoing selector sleeve to busy the trunk. Relay (G) also opens relay (E) and closes a bridge to the incoming selector. When the (A) and (B) relays of the selector operate and ground the sleeve, relays (F) and (D) operate. Relay (D) transfers the incoming selector tip and ring to the trunk and releases relay (G). Relay (F) grounds the outgoing selector sleeve in place of relay (G) and opens the "BR" lead to the traffic register circuit.

The purpose of the relays in Fig. 4 is to provide for immediately grounding the sleeve when the circuit is seized and relay (G) operates, rather than waiting for the (F) relay and the selector (A) and (B) relays to operate

as when Fig. 3 is used. Therefore, the probability of double seizure which is inherent in two-way operation is reduced. With larger trunk groups this probability increases and Fig. 4 should be provided when there are more than 6 trunks in a group. It should be noted that if double seizures do occur, one subscriber's line may be reversed. Upon disconnection, there is also a probability of seizure depending upon the relative release times of the various slow relays in both ends before the circuit has fully restored to normal.

7. Precautions against false operation on ground potential:

7.1 With Fig. 3

With short loops and high earth potential the (A) relays of the incoming selectors at both ends of the circuit may operate on ground potential while the circuit is idle. To prevent this, Fig. 5 is used as described in Note 103, to increase the trunk resistance.

7.2 With Fig. 4

The (G) relays of Fig. 4 are connected at each end of the trunk, when idle, in place of the (A) relays of the incoming selectors. These (G) relays have higher resistance than the (A) relays, and also, on short trunks, are given a stiffer adjustment, hence will not operate falsely on ground potential.

8. Test jack (T) is provided to give access to this circuit for routine or other tests.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 3350-MLR-FJS