

STEP-BY-STEP SYSTEMS  
NO. 1, 350A, 355A OR 35-E-97  
ROTARY OUT TRUNK  
SWITCH CIRCUIT  
3 OR 4 WIRE  
ARRANGED FOR PRESELECTION

Changes

D. Description of Changes

D.1 To decrease the possibility of ROTS following the dial pulses as a result of preceding selector interferences with ROTS seizures, the present circuit requirements of the SL relay are rated Mfr. Disc. and superseded by new requirements in the circuit Requirements Table.

D.2 A provision is also made to prevent premature return of the sleeve ground to this circuit upon the seizure of the succeeding circuit, if the ROTS should be used for access to certain trunk equipment such as X-Bar by-link incoming trunks. For this purpose, connecting information at the ROTS bank multiple leads in FS1 and in block diagram of item (A) of note 309 was changed and note 310 was added, which shows that sleeve repeating trunks of SD-31421-01 type along with the new SL relay adjustment should be provided in such ROTS application.

D.3 CAD 4 is changed to agree with the above.

F. Changes in CD Section III

F.1 Change 4.01, item (m) to read:

(m) Sleeve Repeating Trunk Circuit - SD-31421-01 (typical).

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STEP-BY-STEP SYSTEMS  
NO. 1, 350A, 355A, OR 35-E-9,  
ROTARY OUT TRUNK  
SWITCH CIRCUIT  
3 OR 4 WIRE  
ARRANGED FOR PRESELECTION

CHANGES

D. Description of Changes

- D.1 Notes 102, 105 and 304 were revised to clarify use of App. Figs. 4, 6 and 8 and options S, U and V, in various circuit applications.
- D.2 Note 308 was added and referred to in note 302 and in connecting information at T, R, S, A bank lead multiple, to show ROTS group and bank multiple arrangements when associated with combined outgoing trunks to TSPS.
- D.3 Note 309 was added to show block diagrams of the standard circuit applications.
- D.4 CADS 3 and 4 rerated "MFR DISC".
- D.5 CADS 7, 8 and 9 changed.
- D.6 CADS 13, 14, 15 and 16 added.

F. Changes in CD SECTION III

- F.1 Change 4.01, item (n), to read:
- (n) Auxiliary Trunk Circuit (To complete service code and CAMA or TSPS calls) - SD-32281-01.
- F.2 Add the following at end of 4.01:
- (s) Outgoing Trunk Circuit - By-link-DP-Coin & Non-coin-To TSPS - SD32542-01 (typical).
  - (t) Outgoing Trunk Circuit - By-Link-DP-Non-Coin -To-TSPS - SD-32543-01 (typical).

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STEP-BY-STEP SYSTEMS  
 NO. 1, 350A, 355A, OR 35-E-97  
 ROTARY OUT TRUNK  
 SWITCH CIRCUIT  
 3 OR 4 WIRE  
 ARRANGED FOR PRESELECTION

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ALARM RELAYS . . . . .		3	1.01 This circuit is used to distribute the traffic of small trunk groups from selectors over a large group of outgoing trunks.		
<u>6. RELEASE RELAYS</u> . . . . .		3	1.02 When this circuit is used with auxiliary trunks, its purpose is to concentrate traffic from the associated auxiliary trunks to a smaller number of outgoing trunks.		
<u>7. TESTING</u> . . . . .		4	<u>2. GENERAL DESCRIPTION OF OPERATION</u>		
FROM TEST JACK CONNECTED TO LOCAL SELECTOR BANKS OR AUXILIARY TRUNK CIRCUIT . . . . .		4	2.01 This rotary out trunk switch circuit is arranged for preselection of an idle trunk or repeater circuit. When a call is connected to a particular selector, its associated sleeve relay will operate and lock to the sleeve lead. All other selectors that may have been resting on the same outgoing trunk will be stepped off the terminal when the trunk relay operates. This stepping will continue until each selector arrives at another idle trunk circuit. Should all outgoing trunk circuits be busy, the selectors will step until the twenty-second terminal is reached and then stop. This is the all-trunk-busy condition, and no further action will take place until a trunk becomes idle, at which time the selectors will again step to the now idle trunk.		
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SECTION II - DETAILED DESCRIPTION

1. PRESELECTION OF OUTGOING TRUNK

1.01 When the trunk on which the selector is standing is made busy, ground over the sleeve lead makes this circuit busy at the selector banks and operates relay TK.

1.02 Relay TK operated:

- (a) Operates relay ST of this circuit and all other rotary switch circuits standing on bank terminals associated with the trunk made busy.
- (b) Removes TK resistor from its operate path.
- (c) Removes ground from common group relay C.

1.03 Relay ST operated:

- (a) Short circuits the primary winding of relay SL to guard against accidental operation of that relay.
- (b) Operates slow release relay MC of this circuit and all other rotary switch circuits standing on bank terminals associated with the trunk made busy.
- (c) Operates alarm relay F.
- (d) Operates stepping magnet S.

1.04 Relay MC operated:

- (a) Opens the tip and ring leads from the S switch brushes to prevent any impulse noise associated with these leads from interfering with busy trunks.
- (b) Grounds the sleeve toward the local selector brushes or auxiliary trunk circuit.
- (c) Holds operated during rotary stepping of switch S.

1.05 Stepping magnet S operated releases relay ST which in turn releases the stepping magnet. The switch then steps to the next terminal. If this terminal is also busy, the same action as described in 1.02 to 1.05 is repeated until an idle terminal is reached, or if all trunks are busy, until terminal 22 is reached.

1.06 Terminal 22 of arc 4 is normally grounded but this ground is removed when all trunks are busy. It is, therefore, evident that an idle selector always stands on or hunts for an idle trunk unless all trunks appearing on its banks are busy.

2. TRUNK SEIZURE VIA ROT SWITCH CIRCUIT

2.01 When all trunks that are directly connected to a selector are busy, the selector will reach the first idle contact to which a ROTS circuit is connected. Ground on the sleeve lead operates relay SL in series with relay TK. Relay SL operates and locks to the sleeve lead prior to the operation of relay TK.

2.02 Relay SL operated:

- (a) Opens the operate path of relay ST of this circuit to prevent hunting.
- (b) Short circuits its primary winding to reduce sleeve resistance.
- (c) Disconnects network E from the sleeve lead to prevent the network from interfering with this lead.

2.03 Same as described in 1.02 to 1.06 on all circuits of ROTS group not under seizure.

3. ALL TRUNKS BUSY

3.01 When an all-trunks-busy condition occurs, all TK relays of the same group will be operated and normally operated relay C will release.

3.02 Relay C released:

- (a) Removes ground from leads G and G1 to prevent idle switches from hunting unnecessarily and to prevent the activation of release relays.
- (b) Operates relay TB, when furnished, to provide an all-trunks-busy indication to associated auxiliary trunk circuits.

3.03 Where this circuit is used with a trunk incoming from a step-by-step office, App. Fig. 8 is provided where the number of outgoing trunks is great enough to require two groups of ROT switches. In this case, trunks of the two groups are connected to alternate selector bank terminals in the originating office. If all the outgoing trunks of one group are busy, the make-busy circuit connected to App. Fig. 8 will make busy the selector bank appearances of the trunks connected to that group of ROT switches, and the selectors will, therefore, pass over those trunks to select a trunk in another group.

4. DISCONNECT

PRESELECTION OF OUTGOING TRUNK

4.01 When the calling party disconnects, relay TK releases. The trunk on which the switch is standing becomes idle, and the switch remains in that position.

4.02 An exception to the above is when an all-trunks-busy condition is present. In this case all ROT switches standing on position 22 rotate to the trunk position made idle.

TRUNK SEIZURE VIA ROT SWITCH CIRCUIT

4.03 Same as described in 4.01 and 4.02 except relay SL also releases.

5. ALARM

ALARM RELAYS

5.01 During stepping of a ROT switch, relay ST operates relay MC which transfers the incoming ring and tip leads of the selector to battery through the ST relay winding and ground, respectively. If the tip and ring are short-circuited or if the ring is grounded, relays ST and MC remain operated, thus preventing further stepping of the switch. Relay ST operates the F relay causing an alarm to be brought in. Relay F operated lights alarm lamp A of the switch group. The operated MC relay grounds the incoming sleeve lead to make this circuit busy and to prevent the trouble condition from interfering with the trunk circuit beyond the selector. The circuit bringing in the alarm is then identified by the operated MC relay.

5.02 With App. Fig. 11 (A&M Only), the F relay is also operated (and the alarm activated) if relay SL accidentally locks up to the ground on 22nd bank sleeve terminal and a switch becomes stuck. In such case, relay A operates in series with relay SL and closes the operate path of relay F. The cause of the alarm is recognized by operated relay A. The stuck switch is freed and the alarm retired by operating key A. Its break contact opens the ground path to the 22nd bank sleeve terminal and releases relays SL and A.

6. RELEASE RELAYS

6.01 As mentioned in 5.02, if an SL relay should lock to the sleeve while a switch is standing on the twenty-second terminal, the switch would not step off. When App. Fig. 7 or 13 is used, however, relay A will operate in series with the 1375-ohm winding of relay SL.

6.02 With App. Fig. 7, relay A closes the operate path of relay R either directly to ground (option E), or to ground via

lead G1 and a make contact of relay C (option B).

Relay R operated (with option B, relay R operates and the further functions take place only when the all trunks busy condition does not exist, or after it ceases and relay C operates):

- (a) Locks to ground under control of the R1 relay.
- (b) Opens the path from sleeve to ground through the low resistance winding of relay A which releases.
- (c) Closes the path from battery through resistor R1 to the R1 relay.

The high resistance winding of R1 is now effectively connected in series with the parallel combination of the 1375-ohm winding of the SL and battery through a make of the R. The R1 operated releases the R and ~~keeps~~ keeps the operate path of the A open. The R released removes the battery which is in parallel with the 1375-ohm winding of the SL. The high resistance winding of R1 in series with the SL winding through an SL make contact causes the SL to release. The SL is slow to release; when it does release the R1 also releases and the circuit is restored to normal.

6.03 With App. Fig. 13, relay A closes the operate path of relay R to ground via lead G1 and a make contact of relay C. As with App. Fig. 7 and option B, relay R will operate only when the all trunks busy condition does not exist, or after it ceases and relay C operates. If this is the case, the operated R will operate relay R1 from battery through resistor R and winding R1 to ground. When relay R1 operates, it transfers the sleeve lead path from a low resistance ground through the A relay winding to a high resistance ground through resistor R1 and the R1 winding. Relay A will release, in turn releasing relay R. Relay R1, however, will stay operated and maintain the high resistance in series with SL relay winding, until the SL relay releases and the circuit is restored to normal.

6.04 The R relay is slow to operate. With App. Fig. 7 and option E, this is to prevent its operation on momentary operations of relay A which may occur during the all trunks busy condition, when the preceding selectors are hunting over the sleeve leads associated with the idle ROT switches resting in 22nd position. With App. Fig. 13 or App. Fig. 7 and option B, the slow operate characteristic of relay R assures that all idle ROT switches which may have been resting on 22nd step

will step off, before the R relay can operate at the end of the all trunks busy condition.

7. TESTING

FROM TEST JACK CONNECTED TO LOCAL SELECTOR BANKS OR AUXILIARY TRUNK CIRCUIT

7.01 The test jack per U option provides for making this trunk appear busy to incoming calls and routine tests of this circuit. When a plug is inserted into the jack, ground appears on the S lead to make this trunk appear busy.

FROM TEST JACK CONNECTED TO AUXILIARY TRUNK CIRCUIT (ARRANGED TO COMPLETE SPECIAL TOLL AND OPERATOR ASSISTANCE TRAFFIC)

7.02 The test jack per V option provides for making routine tests of this circuit. When a plug is inserted into the jack, ground appears on lead B and lead S is opened to the Auxiliary Trunk. Ground on lead B alerts the Auxiliary Trunk that the ROT switch it is associated with is out of service. The Auxiliary Trunk will then block all calls to the ROT switch.

TEST CIRCUIT FOR 4-WIRE SWITCHES

7.03 When testing 4-wire switches, jack OUT is patched to jack TST and the test set is patched to jack IN. The incoming A lead terminal at the unit terminal strip is connected to jack A. If the A lead is continuous through the ROT switch to the associated trunk circuit, relay AT will operate closing the ring and the test will then proceed as for 3-wire switches. If, however, the A lead is open on any trunk tested the ring lead will be open at AT and the switch will not step off the defective trunk. When it is desired to test 4-wire switches and omit the test of the A lead, they are tested the same as 3-wire switches.

8. TRUNK CIRCUIT

8.01 Provision is made for connecting some of the trunks directly to the local selector banks. The purpose of this is to reduce the number of ROT switches required for handling a given amount of traffic.

8.02 Provision is also made for multiplying any trunk into two groups of switches. When less than 21 trunks are required for a group of switches, the remaining terminals are multiplied to trunks in another group in case there is more than one group of switches. In case there is only one group, then the available trunks are multiplied over the 21 terminals of the switches in that group.

9. MISCELLANEOUS

LAST SWITCH BUSY REGISTER

9.01 Provision is made to connect the R1 lead of the SL relay to a traffic register when traffic observation is required. This register is connected when used only on the switch serving the last terminal of a selector level.

ALL TRUNKS BUSY REGISTER

9.02 Provision is made to connect the OF lead of the C relay to a traffic register to indicate the number of times all trunks accessible through a group of switches are busy simultaneously.

DIODES

A. V Diode

9.03 The V diode shunts the SL relay to prevent its operation on reverse current over lead S when the ROT switch is resting on a busy trunk.

B. MC Diode

9.04 The MC diode electrically isolates the MC relay from stepping magnet S during release. This prevents the MC relay from releasing prematurely.

NETWORKS

A. C Network

9.05 The C network is furnished to make the R1 relay slow to release, thereby allowing the R1 to hold until the SL relay has released completely.

B. E Network

9.06 The E network is furnished to aid in preventing premature operation of the SL relay on the switch seizure.

OPERATION IN A NO. 35E97 OFFICE

9.07 Operation in a No. 35E97 office is restricted to use with nonbattery searching selectors. Circuit operation is the same as described in the preceding paragraphs.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 Battery Voltages: -45 to -50 volts

1.02 Maximum sleeve resistance from this circuit to the selector bank multiple

and to the outgoing repeater or trunk circuit is 10 ohms.

2. FUNCTIONAL DESIGNATIONS

None

3. FUNCTIONS

- 3.01 To preselect an idle outgoing circuit.
- 3.02 To make the outgoing circuit busy to all other selectors and connecting circuits as soon as this circuit is seized.
- 3.03 To stop hunting when all outgoing trunks in its group become busy.
- 3.04 To stop any selector having an excessive leak from ring to ground, or having a short-circuited tip and ring on the twenty-second terminal, and to bring in an alarm.
- 3.05 To bring in an alarm if any selector trunk hunts continuously for a predetermined length of time.
- 3.06 To bring in an alarm if any SL relay operates while a switch is standing on the twenty-second terminal.
- 3.07 To operate a traffic register when all trunks on the banks of the switch become busy.
- 3.08 To operate a last-trunk-busy register when required.
- 3.09 To give an indication to outgoing repeaters in distant offices when all trunks on the banks of this switch are busy.
- 3.10 To automatically release any SL relay that operates while a switch is standing idle on the twenty-second terminal.
- 3.11 To open the incoming tip and ring leads during preselection.

4. CONNECTING CIRCUITS

- 4.01 When this circuit is listed on a key-sheet the connecting information thereon is to be followed.
  - (a) Selector Bank Multiple Circuit - SD-32123-01.
  - (b) Local Selector - SD-30200-01 (typical), SD-30976-01 (typical).
  - (c) Auxiliary Trunk - SD-30865-01 (typical).
  - (d) Outgoing Repeater - SD-31779-01 (typical).

- (e) Outgoing Trunk Circuit - SD-31795-01 (typical), SD-32136-01 (typical).
- (f) Traffic Register Circuit - SD-30896-01.
- (g) Switch Trouble Alarm Circuit - SD-31518-01.
- (h) Miscellaneous Alarm Circuit, Alarm Control - SD-31980-01.
- (i) Miscellaneous Alarm Circuit (Aisle Pilots) - SD-31970-01.
- (j) Make-Busy Trunk Circuit in Distant Office - SD-31225-01.
- (k) Trunk Test Set - SD-90469-02.
- (l) Miscellaneous Alarm Circuit - (registers) - SD-31976-01.
- (m) Incoming Tandem Trunk Circuit - SD-68480-01 and SD-27014-01.
- (n) Auxiliary Trunk Circuit (To Complete Service Code and CAMA Calls) - SD-32281-01.
- (o) Auxiliary Trunk Circuit (To Complete Special Toll and Operator Assistance Traffic) - SD-32341-01.
- (p) Outgoing Trunk Circuit - SD-32342-01.
- (q) Outgoing Coin Trunk Circuit - SD-32344-01.
- (r) Pulse Correcting Repeater Circuit - SD-32346-01.

5. MANUFACTURING TESTING REQUIREMENTS

- 5.01 This Rotary Out Trunk Switch Circuit shall be capable of performing all the functions and working limits specified in Section III - Reference data and meeting all the requirements of the Circuit Requirements Table, battery voltage and other limits specified in SD-30868-02.

6. ALARM INFORMATION

- 6.01 This circuit is arranged to bring in a minor alarm after a predetermined period of time, under any of the following condition:
  - (a) The switch is stepping continuously.
  - (b) The switch fails to step with its ST relay operated due to a short from the incoming Ring to the incoming Tip lead, or from the incoming Ring lead to ground.

- (c) The switch sticks on 22nd step with its SL relay operated (A&M only).

7. TAKING EQUIPMENT OUT OF SERVICE

7.01 The test jack is arranged for blocking the ROTS against incoming calls when it is to be taken out of service for any reasons. A plug is to be inserted into the jack for this purpose.

SECTION IV - REASONS FOR REISSUE

B. Changes in Apparatus (Components).

<u>B.1 Superseded</u>	<u>Superseded By</u>
ST - Resistor 18 EF - FS1, App. Fig. 1, Option G	ST- Resistor KS-20289,L1C, 2500 - FS1, App. Fig. 1, Option F
A - Network 177H - FS1, App. Fig. 1, Option G	A - Resistor KS-13490,L2, 150 and A - Capacitor 542K - FS1, App. Fig. 1, Option F
E - Network 177D 177D - FS1, App. Fig. 1, Option G	E - Resistor KS-13490,L2, 560 and E - Capacitor 542D - FS1, App. Fig. 1, Option F
Apparatus Figure 2	Apparatus Figure 12
Apparatus Figure 7	Apparatus Figure 13

D. Description of Changes

- D.1 Wiring option H was designated and rated Standard to provide for R1 lead to the Traffic Register Circuit in 4-wire application of the ROTS circuit.
- D.2 Connecting information for leads from ROTS banks in FS1 are modified and note 302 is changed to provide for correct and straightforward information on multiplying arrangements of the outgoing trunks over ROTS banks, and on the use of relays TK. Note 302 now specifies the use of one TK relay per outgoing trunk per ROTS group when two ROTS groups share an outgoing trunk circuit.

Note 302 previously read:

3.02 All 21 terminals shall be connected to trunk circuits. If fewer than 21 trunk circuits are available they shall be assigned to terminals, then multiplied at the distributing frame to unassigned trunks from bank terminals of another Rotary Out Trunk Switch group when available or of the same Rotary Out Trunk Switch group. One (TK) relay shall be connected to each trunk circuit. If a trunk circuit has two or more appearances in the multiple, the (TK) relays in excess of one shall be removed from the circuit by omitting the Q option straps at the TKA and TKB terminal strips.

D.3 New release relays arrangement is added and shown in Standard FS11 and App. Fig. 13. It also requires addition of lead G1 in FS4. New FS11 and App. Fig. 13 replace release relays of FS6 and App. Fig. 7 which are now rated Mfr. Disc.

This change:

- (a) Improves performance of the ROTS circuit since the new release relays cannot be activated to place a high resistance ground on 22nd bank sleeve terminal when all trunks busy condition exists and the idle ROT switches are resting in 22nd position.
  - (b) Improves the maintenance of the circuit since two flat spring type relays are replaced by wire spring relays.
  - (c) Reduces the cost of the equipment.
- D.4 The provision is made for field modification of the existing equipment to achieve the improved ROTS performance described in D.3 (a). For this purpose, Mfr. Disc. wiring B was added in FS6, which is intended to replace newly designated wiring E rated Mfr. Disc.

D.5 To reduce the cost of the equipment and to improve its physical design the following changes are made:

- (a) Present ST resistor, and A and E networks in FS1 and App. Fig. 1 are designated option G rated Mfr. Disc. Option G is replaced by standard option F which includes the pigtail resistor and capacitor components assembled on 278 type terminal strip.

(b) App. Fig. 2 (trunk relay) is rated Mfr. Disc. and replaced by new App. Fig. 12 which includes all 21 TK relays and resistors TK and TKA needed for a group of ROT switches. All resistors in App. Fig. 12 are pigtail type components of which 21 resistors (TK) are assembled on 278 terminal strips.

(c) FS3 is revised to reflect replacement of App. Fig. 2 by App. Fig. 12.

D.6 Circuit notes 102 and 104 are updated and notes 109 and 110 are added to keep the record of changes made on this drawing issue.

D.7 Circuit note 107 is deleted as it did not provide usefull and valid information.  
It previously read:

107. Prior to issue 5D, option K was not shown. Option K is added to exchange contacts 2 and 11 with contacts 4 and 9 of the (MC) relay, to correct an unguarded sleeve condition.

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