

6

STEP-BY-STEP SYSTEMS
NO. 1, 350A OR 355A
CONNECTOR CIRCUIT
LOCAL ROTARY HUNTING
SELECTIVE OR
ONE RING SEMI-SELECTIVE RINGING
WITH OR WITHOUT ARRANGEMENT
TO CANCEL REVERSE BATTERY SUPERVISION
ON SPECIFIED LEVELS

CHANGES

B. Changes in Apparatus

B.1 Added

B Network, 186A, ZZ Option Fig. 1

C Network, consisting of 2-542D Capacitor
and 1-KS13490 L2 Resistor, 150 Ohms,
YA Option, Fig. 1

T and R Capacitor, 580A, YC Option Fig. 1

A Capacitor, 542U, YC Option Fig. 1

C. Changes in Circuit Requirements Other Than Those
Caused by Changes in Apparatus

C.1 The spring layout BSP figure for the A relays (options T
and U) is changed from 11 to 726. The BSP figures are the
same except that 726 contains information on the newer silver/
palladium contact material.

D. Description of Changes

D.1 Figure 1 is revised to show the addition of pigtail contact
protection networks. The added networks are designated
options ZZ and YA and are rated Standard. The existing networks,
option Q, rated Standard are to be used only when option ZH is
required.

D.2 New T, R and A capacitors are added to Fig. 1. The previous
capacitors are designated option YB and are to be used only
when ZH option is required. The added capacitors are designated
YC option and are rated Standard.

D.3 Note 105 is revised and Notes 111, 112 and 113 are added to
explain options ZZ, YA, YB and YC.

D.4 Maintenance BSP information is added as part of the
Supporting Information.

F. Changes in CD Sections

F.1 Add the following as part of Section III - Reference Data

5. Manufacturing Testing Requirements

5.01 This circuit shall be capable of performing all the
functions or working limits specified in Section III -
Reference Data, and meeting all the requirements of the
Circuit Requirements Table.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5225-LCB
WECO DEPT 5152-RTO-WEA

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6. <u>BUSY TEST</u>	2	1. <u>PURPOSE OF CIRCUIT</u>	
7. <u>FIRST LINE OF GROUP IDLE</u>	2	1.01 This circuit is used as a local trunk hunting connector.	
8. <u>CUTTING THROUGH TO CALLED LINE</u>	2	<u>SECTION II - DETAILED DESCRIPTION</u>	
9. <u>RINGING THE CALLED STATION</u>	2	1. <u>SEIZURE</u>	
10. <u>RELEASE OF CONNECTOR WHEN THE CALLED PARTY IS LAST TO DISCONNECT</u>	3	1.01 When this switch is seized by a selector switch, relay A operates over the subscriber's loops which in turn operates relay B. Relay B operated returns ground to the sleeve lead S for holding the switches in the train in their operated condition, opens the release circuit for this switch, and prepares the circuit for the operation of the vertical magnet as well as preparing certain holding circuits which will be described later. It also grounds the MS lead to start the source of busy tone or ringing.	
11. <u>RELEASE OF CONNECTOR WHEN THE CALLING PARTY CONTROL ON DISCONNECT USED</u>	3	2. <u>VERTICAL STEPPING</u>	
JOINT CONTROL, BOTH CALLING PARTY AND CALLED PARTY, ON DISCONNECT USED	3	2.01 The first set of impulses sent out by the calling station, after the seizure of this switch, operates and releases relay A to step the shaft in a vertical direction and operates relay C in series with the vertical magnet. Relays B and C remain operated during this series of pulses since they are slow to release. As soon as the shaft moves one vertical step, the original circuit, through the vertical off-normal springs for operating the vertical magnet, is transferred from vertical off-normal spring 3 to vertical	
12. <u>AUTOMATIC DISCONNECT ON CALLING PARTY HOLDS - OPTIONS ZP AND ZN OR ZP, ZM AND ZL</u>	3		
13. <u>INDIVIDUAL LINES</u>	3		
14. <u>SUPERVISORY SIGNAL, ZO AND ZK OPTIONS</u>	3		
15. <u>SUPERVISORY SIGNAL, G, S, OR ZD OPTIONS</u>	3		
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off-normal spring 4 and the front contact of relay C which circuit is maintained, for all the additional pulses sent out by the dial, due to the slow-release action of relay C. As soon as this set of pulses ceases, relay C releases and prepares the circuit for sending pulses through the rotary magnet.

3. ROTARY STEPPING

3.01 A set of impulses now sent out by the calling dial will operate the rotary magnet and step the shaft in a rotary direction due to the pulses sent out from relay A as before. Relay B will also remain operated as during vertical stepping on account of its slow-release feature. On the first step, the RON spring operates to open the original operate path of the E relay which operated in series with the rotary magnet and closed a circuit for testing the called line.

4. TESTING THE CALLED LINE

4.01 If the first terminal in the group called is busy, ground is found on the S and H leads, since the circuit arrangement is such that the S and H leads are strapped together on all lines of the group except the last line of the group, and the guarding potential placed on the S lead will also be placed on the H lead. The guarding potential on the S lead will operate relay H which will lock up through its front contact upon the release of relay E, which operated in series with the rotary magnet at the end on the pulses sent out by the dial. With relay H operated, a path is provided upon the release of relay E for operating relay G over the H lead which is grounded as described above.

5. ROTARY HUNTING

5.01 The conditions just described have closed a circuit for operating the rotary magnet which will open its contacts as it moves the wipers, S and H, from the terminal found busy and allowed relay G to release, whereupon the rotary magnet will release; and if the S and H wipers still find a busy terminal, relay H will remain operated and relay G will again operate to step the switch to another terminal. This operation will continue until either an idle line is found, or until the last line of the group is reached where the terminals for the S and H wipers are not strapped together. In this case, if the line is busy, the S lead will be grounded and relay H will remain operated, but the G relay will not again operate due to the fact that there is no ground on the H wiper. During the hunting operation just described, relay J did not operate due to the fact that it must operate in series with relay G, and the ground on the H lead, which operated relay G shunted out relay J. As soon as the last terminal of the group is reached, relay J will operate, since there is now no ground on the H lead, and it will lock

to a lead which is grounded by the B relay. Relay H is also held locked to this lead by the operation of relay J. Relay J gives busy indication as described in 6., and together with relay H keeps the S and H wiper leads open toward the switch. If the switch in rotating finds an idle line, relay H will release and the switch will cut through to the called line as described below.

6. BUSY TEST

6.01 With option 2A or 2Q, busy tone is connected through contacts of the J relay to the ring of the line connected to the calling party.

6.02 With option 2B, busy tone is connected through contacts of the J relay to the ring of the line connected to the calling party or operator and the busy flash is connected through other contacts of the J relay to the F lead to preceding selectors toward the calling operator.

7. FIRST LINE OF GROUP IDLE

7.01 If the first line of the group dialed, as described above, is idle, relays H and G will not operate, there will be no further rotary motion of the switch, and the switch will be in a position to cut through to the called line.

8. CUTTING THROUGH TO CALLED LINE

8.01 As soon as the called line is seized, relay K will operate through its P winding from battery in the called line circuit to ground on the front contact of relay B. This ground acts as a guarding potential on the S lead until relay K operates and puts ground on the S lead. The circuit through the P winding of relay K serves only to operate contacts 1B and 2B of the relay which closes a local circuit through its S winding and fully operates the relay. This circuit is maintained until the switch releases. The operation of relay K also closes the tip and ring wipers through to the ringing leads on relay F for automatically ringing the called station.

9. RINGING THE CALLED STATION

9.01 Ringing current is now impressed on the called line through the back contacts of relay F. This ringing will continue until the called station answers, whereupon relay F will operate to close contacts 1 and 2 due to the current in its P winding. The S winding being energized fully operates the relay, and it remains operated until the switch releases. The operation of this relay connects the talking leads through to the D relay which supplies talking battery to the called station. It also removes ground from the MS lead to stop the supply of ringing.

The called and the calling stations are now connected for talking purposes through the 2-mF condensers connected to the tip and ring leads. Under this condition, relay D operates. When X wiring is used or when Y wiring is used and the normal post springs are not operated on the particular level to which the switch has been stepped, the operation of relay D reverses battery and ground through the A relay windings toward the calling end as a change condition. If the normal post springs are operated, this reversal does not take place.

10. RELEASE OF CONNECTOR WHEN THE CALLING PARTY IS LAST TO DISCONNECT

10.01 If the called station disconnects previous to the disconnect of the calling station, relay D is released, and when the calling station disconnects, relays A and B will release and ground will be removed from the sleeve lead S allowing the switches back of this switch to return to normal. Relays F and K which were held operated from a contact of relay B will also release, and the release magnet of this switch will be energized to return the shaft to its normal position.

11. RELEASE OF CONNECTOR WHEN THE CALLED PARTY IS LAST TO DISCONNECT

CALLING PARTY CONTROL ON DISCONNECT USED

11.01 When the calling party disconnects, the A and B relays release, releasing the F and K relays and opening ground from the sleeve to release the preceding switches. Relay D releases when the K relay releases and with the A, B, D, and K relays released, the release magnet operates and releases the connector.

JOINT CONTROL, BOTH CALLING PARTY AND CALLED PARTY, ON DISCONNECT USED

11.02 When the calling party disconnects, the A and B relays release and ground will be removed from the sleeve lead S allowing the preceding switches to return to normal. When the called station disconnects, relay D releases. Relays F and K, which were held operated from a contact of relay D, will also release and the release magnet of this switch will be energized to return the shaft to its normal position.

12. AUTOMATIC DISCONNECT ON CALLING PARTY HOLDS - OPTIONS ZP AND ZN OR ZP, ZM AND ZL

12.01 If the calling party fails to replace his receiver on-hook after called party disconnects, releasing the D relay, the connector is released after a predetermined interval. If options ZM and ZL are provided with ZP option, ground over lead ICT, through R resistor, make on F, the heater of thermal

unit on relay J, break on D, VON springs, and RLS magnet to battery starts the thermal unit to heat. If ZN option is provided with ZP option, direct ground in this circuit over the above path starts the thermal unit to heat. After 25 to 37 seconds, the bimetallic springs of the thermal unit close and shunt the 470-ohm heater. This causes the RLS magnet to operate on its first step to release relay B. B released permits the preceding switches to restore and open the loop to release relay A. B also releases K and F. The release of A fully operates the RLS magnet, returning the connector to normal.

12.02 When the connector hundreds group is provided with trunks arranged to trip ringing without charging, the disconnect timing is under control of these trunks. When any of these trunks are busy, ground is removed from lead ICT, thus disabling the timing circuit.

13. INDIVIDUAL LINES

13.01 It is possible to use the lines connected to this switch as individual lines by leaving the strap open between the bank contacts of the S and H leads which will cause the switch to function the same as on the last line of a PBX group.

14. SUPERVISORY SIGNAL, ZO AND ZK OPTIONS

14.01 If the called station disconnects before the calling station, a path is closed through a back contact of relay D and a front contact of relay F for operating a supervisory signal (SUPV 1), ZO and ZK options.

15. SUPERVISORY SIGNAL G, S, OR ZD OPTIONS

15.01 If the calling station disconnects before the called station, a path is closed through a back contact of relay A, a back contact of relay B, and a front contact of relay D for operating a supervisory signal (SUPV 2).

16. TEST JACKS

16.01 Test jack springs 3 and 4 may be used to make this switch busy to incoming calls when it is out of order. The test jack may be used for making local tests on this switch to cause it to function in the same manner as described for an originating call. The make-busy feature of the test jack is also duplicated by the removal of the switch from its jacks, since the jacks are arranged to place ground on the sleeve lead S upon the removal of the switch from its position.

TABLE A

Type of Dial or Adj	45-Volt Minimum					48-Volt Minimum				
	Pulsing from Sub			Called Sta Supv		Pulsing from Sub			Called Sta Supv	
	2,4, or 5	6	7	Adj A	Adj B	2,4, or 5	6	7	Adj A	Adj B
ohms										
Max Ext Ckt Loop ¹	750	1200	1100	1000	1400	850	1500	1400	1115	1500
Max Ext Ckt Loop ²	850	1400	1300	1000	1400	1000	1500	1500	1115	1500
Max Ext Ckt Loop ³	1000	1400	1400	1000	1400	1115	1500	1500	1115	1500
Min Ins Res	15000			15000		15000			15000	

¹When using 1000W loop, leak B in pulsing test set.

²When using 1200W loop, leak A in pulsing test set.

³When using 1400W loop, leak A in pulsing test set.

17. CONTACT PROTECTION

17.01 The resistor and capacitor unit B is provided to reduce sparking at springs of relay F when this relay operates. The C and C1 units reduce sparking at the contacts which open the stepping magnet circuits.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 Limits are for single office areas. For multioffice areas and for operator pulsing, see keysheets (see Table A).

1.02 Tripping Ranges: See Table B.

2. FUNCTIONAL DESIGNATIONS

None.

3. FUNCTIONS

3.01 To return ground on the sleeve lead for holding the switches back of the connector in their operated position.

3.02 To return busy flashon operator originated calls if the line tested is busy.

3.03 To step the shaft in a vertical and rotary direction in response to pulses out by the dial at the calling station.

3.04 To connect the talking wires through to the called line and remove the line relay from called line.

3.05 To prevent intrusion on the called line and on the calling line.

3.06 To ring the called party and trip the ringing when the called party answers.

3.07 To test a busy line and rotate to the first idle line or to stop at last line of a group if all the lines are busy.

3.08 To release under the control of the calling station or under the control of both the calling and called parties.

3.09 To allow the calling or called party to release the train of switches preceding the connector.

3.10 To furnish talking battery to the called and its calling parties.

3.11 To reverse battery and ground toward the calling end when the call subscriber answers when X wiring is used and also when Y wiring is used and the normal post springs are not operated.

3.12 To furnish a busy tone to the calling party if the called line is busy.

3.13 To give the calling party ringing induction if the called line is idle.

3.14 To start and stop the source of ringing supply.

3.15 To automatically release the connector and switch train within a predetermined time when the called party disconnects but the calling party fails to disconnect.

TABLE B

Type of Ringing and District	Ringing Interval Voltage	Silent Interval Voltage	Code of Relay	Option	Rating	Max Ext Ckt Loop for Tripping			
						Adj A	Adj B	Adj C	Adj E
AC-DC	80-90 ac ^{1 2}	45-52	222T	D,ZG	Std ²	1030		1400	
	45-52 dc	48-52	222T	D,ZG	Std ²	1115		1500	
Sup Tube ±5V EP	80-90 ac ¹	45-52	222T	D&ZG	Std			1400	1400
	45-52 dc	48-52	222T	or ZH	Std			1500	1500
	65-90 ac	45-52	222T	D,ZG	Std	1030		1400	
	65-90 ac		48-52	222T	D,ZG	Std	1115		1500
	37-40 dc		60-75	222T	D,ZG	MD		1500	
				222DP	E,ZG	A&M		1500	
Sup Inverted 42A and Tube	65-90 ac 37-40 dc	60-75	222DP	E,ZG	A&M	1040			
Sup 42A, Inverted 42A and Tube	65-90 ac 37-40 dc	60-75	222DP	E,ZG	A&M	900			

¹ 75-90 during power failure.

² 75-110 ac is A&M.

4. CONNECTING CIRCUITS

(h) Power Ringing Circuit - SD-80885-01.

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

- (a) Selector Circuits - SD-31735-01 (typical).
- (b) Incoming Selector Circuit - SD-30972-01.
- (c) Selector Bank Multiple Circuit - SD-32123-01.
- (d) Connector Bank Multiple Circuit - SD-32128-01.
- (e) Miscellaneous Alarm Circuit or Switch Trouble Alarm Circuit - SD-32045-01.
- (f) Subscribers Line Circuit - SD-32133-01 (typical).
- (g) Intercepting Trunk Circuits - SD-31337-01 (typical).

SECTION IV - REASONS FOR REISSUE

A. Changed and Added Functions

A.1 Provision is made to change the J position relay to put into effect a cost reduction.

B. Changes in Apparatus

B.1 <u>Superseded</u>	<u>Superseded By</u>
Relay J, 307C, ZQ option	Relay J, 307B, ZZ option

D. Description of Changes

D.1 The 307C relay, option ZQ, is rated Mfr Disc. and is replaced by the 307B relay, ZZ option.