

CIRCUIT DESCRIPTION

CD-31775-01  
ISSUE 8B  
APPENDIX 3B  
DWG ISSUE 20B

8

STEP BY STEP SYSTEMS  
NO. 1, 350A OR 355A  
2 WAY TRUNK CIRCUIT  
TO MANUAL OR TOLL OFFICE  
TYPE B T.B. SUPPLY  
COMPOSITE SIGNALING TYPE B

CHANGES

B. Changes in Apparatus

B.1 Added

C Network 186A - ZL Option - Fig. D

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

C.1 Information is added to disconnect the wire from the top of resistor G and connect battery when testing relay P furnished with ZM option.

D. Description of Changes

D.1 Circuit Note 103 is changed.

D.2 Option Used table is revised.

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DEPT 5643-CEH-MR

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STEP BY STEP SYSTEMS  
NO. 1, 350A, OR 355A  
2-WAY TRUNK CIRCUIT  
TO MANUAL OR TOLL OFFICE  
TYPE B T.B. SUPPLY  
COMPOSITE SIGNALING TYPE B

CHANGES

A. Changed and Added Functions

A.1 This circuit is changed to provide an off-hook signal of approximately 150 msec on initial seizure to establish trunk integrity when this trunk is associated with a No. 4A or 4M toll crossbar office arranged for trunk integrity check.

B. Changes in Apparatus

B.1 Added

Fig. 3

- 1-U165 D relay
- 1-446F D diode
- 1-D4 circuit pack

D. Description of Changes

- D.1 Fig. 1 is revised and Fig. 5 is added.
- D.2 Circuit Note 102 is changed to cover the application of Fig. 5.
- D.3 Fig. 59 and 60 are added, Fig. 51 is rated Mfr Disc., Fig. 52 to 58 are revised, and Note 204 is added to conform to the circuit changes.

F. Changes in Description of Operation

F.1 Under Part 3 add:

3.6 To provide a timed off-hook signal as a trunk integrity check when this trunk is associated with a No. 4A or 4M toll crossbar office.

F.2 Under SECTION II - DETAILED DESCRIPTION, under 2.1, add after the last paragraph:

Timed Off-Hook Signal - Fig. 5

When Fig. 5 is used, this circuit provides a timed off-hook signal on seizure to the incoming sender in a No. 4A or 4M toll crossbar office. This is used as an integrity check before connections are established. When this circuit is seized as described in 2.1 above, the operation of the N relay applies ground through diode D to terminal 3 of the circuit pack timer. The timer connects this ground through a resistor to terminal 1 for an interval of approximately 150 msec. This operates and releases the D1 relay which applies battery, then ground to the M lead, signaling the distant office.

F.3 Under 4. CONNECTING CIRCUITS add:

	<u>No. 1 or 350A</u>	<u>No. 355A</u>
Circuit Pack Schematic	SD-99355-01	SD-99355-01
Toll Switchboard No. 1, 3C, or 3CL - Trunk Circuit	SD-56525-01	SD-56525-01

F.4 Under 4. CONNECTING CIRCUITS revise Distributor Circuit to read:

	<u>No. 1 or 350A</u>	<u>No. 355A</u>
Distributor Circuit	SD-32007-01	SD-31851-01

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DEPT 5641-WCB-RMW

STEP BY STEP SYSTEMS  
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TO MANUAL OR TOLL OFFICE  
TYPE B T.B. SUPPLY  
COMPOSITE SIGNALING TYPE B

CHANGES

D. Description of Changes

- D.1 Connecting information for the test distributor is added in Fig. 1.
- D.2 Reference to E repeaters, when Q option is used, is added in Note 102.
- D.3 The circuit is rated A&M Only for 350A on this issue.
- D.4 Connecting information is revised on Fig. 51.

F. Changes in CD Sections

- F.1 Under SECTION III, 4. CONNECTING CIRCUITS, add:  

Distributor Circuit	No. 1	No. 350A or 355A
	SD-32007-01	SD-31851-01*

\*Typical Circuit

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DEPT 2341-WCB-RMW

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STEP BY STEP SYSTEMS  
NO. 1, 350A OR 355A  
2 WAY TRUNK CIRCUIT  
TO MANUAL OR TOLL OFFICE  
TYPE B T.B. SUPPLY  
COMPOSITE SIGNALING TYPE B

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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

This circuit is for use at a No. 1, 350A, or 355A office to provide 2-way service to a manual or toll office. It is arranged to give class-of-service indication to the operator when desired and also is arranged for tandem calls to other manual or toll offices over similar trunks.

SECTION II - DETAILED DESCRIPTION

1. OUTWARD CALLS

1.1 Seizure and Signaling

When this circuit is seized the A relay operates over the subscriber loop. Relay A operates relay G and closes part of the operating circuit for relay D. Relay G grounds the sleeve for the purpose of holding the preceding selector, places battery on the "M" lead to the Composite Signaling Circuit which signals the distant operator and operates relays B and D. Relay B closes the "MS" lead for the purpose of starting the ringing machine, connects ground to the sleeve lead and removes ground from the all-trunks-busy register. Relay D operates relay J, transfers the tip and ring of the selector multiple to the outside terminals of the associated repeating coil and transfers the windings of relay A to the inside terminals of the repeating coil. Relay J operated, transfers the loop over the "E" and "F" leads from the incoming selector to relay K, closes a circuit which locks relay D to the sleeve and closes the audible ringing circuit through condenser A to the ring side of the talking circuit, thus providing ringing tone to the calling subscriber.

1.2 Distant Operator Answers

When the distant operator answers, the loop over the "E" and "F" leads is closed in the Composite Signaling Circuit, or when Fig. 3 or Fig. 4 is used, the "E" lead is

grounded, operating relay PR, which operates relay K and connects ground to lead "A" of the Miscellaneous Alarm Circuit and to the "E" lead to the intercepting trunk and subscriber line circuit with rotary line switch. When ZF option is used ground on the "E" lead grounds the "G" lead to the coin control trunk. The operation of relay K removes the audible ringing tone from the ring side of the trunk, closes a circuit for holding relay B and removes ground from the motor start lead "MS". Relay K also reverses the tip and ring leads but this does not serve any useful function except on tandem calls. The circuit is now in a talking condition and local grade battery is supplied to the calling subscriber through the A relay and the repeating coil.

### 1.3 Class-of-Service Tones

This circuit is arranged to provide either one or two class-of-service tones to the operator office operator to indicate calls originated by postpay coin lines or other lines entitled to special treatment. When only one class-of-service tone is desired X wiring is provided and on calls requiring class tone direct ground will be found on lead "A" from the banks of the local selectors or Subscribers Line Circuit with Rotary Line Switch or from coin control trunk at the time of seizure of this trunk. This ground will operate relay H which in turn will ground lead "MS" to the Power Ringing Circuit when S wiring is used or lead "IS" to the Tone Interrupter Circuit when T wiring is used. When S wiring is used for a single class-of-service tone M wiring will also be used and steady low tone on lead "IT2" from the Miscellaneous Alarm Circuit will be connected through the B condenser to the contacts of relay K. When T wiring is used for a single class-of-service tone, L wiring will also be used and interrupted low tone on lead "IT" from the Miscellaneous Alarm Circuit will be connected through the B condenser to the contacts of relay K. When the operator answers and relay K operates the tone either steady or interrupted will be connected to the trunk and relay H will be released. Relay H however is slow in releasing and the operator hears the tone during its releasing time. Should the operator wish to verify the tone she may disconnect and reconnect thus releasing the K relay and allowing H to reoperate. When she reconnects the K relay reoperates and H is again released thus repeating the tone.

When two class-of-service tones are desired relay M is provided and direct ground on lead "A" indicates one class-of-service while ground through 3000-ohm resistance indicates the other class-of-service. On direct ground relay M fully operates operating in turn relay H which functions as above with T wiring. On resistance ground relay M closes contacts 1 and 2 but does not break its back contacts 3 and 4. Thus relay M through its partial or full operation

chooses the kind of tone to be sent to the master office. If M, N, and T wiring are used partial operation of relay M will connect interrupted tone to the trunk and full operation of relay M will connect steady tone to the trunk. If K, L, and T wiring are used the reverse of this will occur.

With ZF option the class-of-service lead is connected to the coin control trunk through lead K and tone is applied to the line in the coin control trunk.

### 1.4 Flashing Supervision and Disconnection

If the calling subscriber should flash his switchhook the A and G relays will follow flashing. When the G relay releases, it replaces battery with ground on the "M" lead to the Composite Signaling Circuit which signals the distant operator. The G released also places ground on the "N" lead when ZF option is used. With the A and G relays released, relay B and the connection is held by relay K which is held operated over the "E" and "F" leads to the Composite Signaling Circuit or by the PR relay which is in turn held operated by the signaling circuit. When the calling subscriber hangs up first, relays A and G release which supplies the disconnect signal to the operator as just described. When the operator removes the plug the loop over the "E" and "F" leads opens in the Composite Signaling Circuit, or ground is removed from the "E" lead, releasing relay PR, causing the release of relay K and, with ZF option, the removal of ground from the "G" lead. The release of relay K allows relays B, D, and J to release. The circuit is then restored to normal.

### 1.5 Distant Operator Sends "Wink" for Coin Control or Rering (ZF Option)

When the operator desires to return or collect coins to rering, the operator sends approximately a one-tenth second wink over the "E" lead. This wink momentarily removes ground from the "E" lead causing the K relay to release and momentarily removes ground from the "G" lead. The wink forwarded on the "G" lead performs a function in the coin control trunk. The release and reoperate of the K performs no useful function.

## 2. INWARD CALLS

### 2.1 Seizure

When this trunk is seized by an operator at the distant office, the loop over the "E" and "F" leads is closed in the Composite Signaling Circuit. This closes the loop to the A relay of the associated Incoming Selector Circuit in series with relay N in parallel with relay P which causes the operation of the line relay in the Incoming Selector Circuit. The operation of relay N places a ground on the "S" lead which is later supplemented by a ground supplied by the incoming selector and operates relay R. Relay R locks

to the sleeve, prepares a circuit for the operation of relay C, opens a circuit to prevent the operation of relay B when the called party answers and removes ground from the all-trunks-busy register.

When Fig. 3 is used, a ground is furnished on the "E" lead by the signaling circuit, instead of a closure of the "E" and "F" leads. This ground operates the PR relay, which provides the "E" and "F" lead closure.

## 2.2 Pulsing

A relay in the Composite Signaling Circuit follows the dial pulses which opens and closes the loop over the "E" and "F" leads. On the first open of this loop relay C is operated from a back contact of relay N which follows the dial pulses. C remains operated during pulsing of a digit. The operation of relay C short-circuits both windings of the repeating coil and places a 500-ohm resistance in series with the 2-uf and 4-uf condensers. The 4-uf condenser is normally connected across the inside terminals of the repeating coil.

## 2.3 Line or Trunks Busy and Ringing

With Fig. C

When all trunks or the called line are busy the operator will receive an audible busy signal supplied by the selector or connector. The operator also receives an audible ringing tone supplied by the connector when an idle line is seized.

With Fig. D

When all trunks or the called line are busy the operator will receive an audible busy and a busy flash signal supplied by the selector or connector. The busy flash signal is supplied to this circuit over lead "F" through the break contacts of relay C. This causes the G relay to respond and transmit the busy flash signal to the operator by removing ground and placing battery on the "M" lead to the Composite Signaling Circuit. The operator also receives an audible ringing tone supplied by the connector when an idle line is seized.

## 2.4 Called Subscriber Answers

When the called subscriber answers, battery is reversed over the tip and ring which causes the operation of the polarized relay P. The operation of relay P operated relay G. The operation of relay G removes the ground and places battery on the "M" lead to the Composite Signaling Circuit which signals the distant operator. The operation of relay G also places the polarized relay P across the "E" and "F" leads. This, however, does not perform any useful function except on tandem calls.

## 2.5 Supervision and Disconnect (ZN Option)

The connection is held under control of the calling operator by holding the loop over the "E" and "F" leads closed. The subscriber may flash the operator. Relays P and G follow the switchhook flashing which signals the operator by placing ground and battery alternately on the "M" lead to the Composite Signaling Circuit. When the operator disconnects, the loop over the "E" and "F" leads is opened, allowing the connector and relay N to release. Relay N releasing operator relay C which connects the 500-ohm resistance in series with the 2-uf and 4-uf condensers across the inside terminals of the repeating coil. This reduces the 4-uf condenser to 1.33-uf and prevents a possible lockup of the connecting circuits during disconnect. If the called station has not disconnected, relays P and G remain operated until the incoming selector has released. With ZF option, the G operated removes ground from the sleeve to the incoming selector. When the incoming selector restores to normal the battery over the loop is restored to normal and ground is removed from the "S" lead allowing relays R, P, and G to release.

## 2.6 Supervision and Disconnect (ZM Option)

The connection is held under control of the calling operator by holding the loop over the "E" and "F" leads closed. The subscriber may flash the operator as described in 2.5. When the operator disconnects, the loop over the "E" and "F" leads is opened, allowing relays N and P to release. Relay N in releasing, causes the same sequence of operation as described in 2.5. Relay P releases, releasing G which removes ground from the sleeve permitting the termination connection to release.

## 3. TANDEM CALLS (A & M Only)

### 3.1 Outgoing Calls

On calls from a distant office to this trunk by way of a tandem selector the circuit functions as described for outward calls under 1. When the called operator answers the battery over the loop is reversed for the purpose of supervision to the calling operator and for holding the connection if the calling operator disconnects first.

### 3.2 Incoming Calls (ZN option)

Incoming calls which are routed to trunks to other offices proceed as described under 2.1, 2.2, 2.3, and 2.4. When the called operator answers battery over loop is reversed which operates the polarized relay P. The operation of relay P operates relay G. Relay G places battery on the "M" lead to the Composite Signaling Circuit for the purpose of giving an answer signal to the calling operator and also places a high

resistance bridge consisting of the winding of relay P and resistance G across the "E" and "F" leads for the purpose of holding relay G if the calling operator disconnects first. This high resistance bridge will allow the line relay of the outgoing trunk circuit to release and give a disconnect signal to the called operator. The connection is held by the P and G relays until the called operator disconnects. The connection is under joint control of the calling and called operators. When the called operator disconnects the battery over the loop is restored to normal allowing relays P and G to release. The release of relay G removes ground from the sleeve allowing the connection to release.

4. TESTING

Test jack A is provided for convenience in making routine tests of the trunk circuit. When Fig. B is used the "BR" lead is opened when a plug is inserted into the jack. This is to prevent spinning the rotary line or trunk switches if the circuit made busy at the A jack is the last idle one in the group.

5. EXTENSION OF ALARMS TO THE OPERATOR OFFICE

Facilities are provided for extending alarms in this office to the operator office over the T2 and R2 leads of an idle trunk.

6. FUSE FAILURE ON TRUNK

When the fuse of the trunk operates, the trunk is immediately made busy by relay MB in Fig. 2. This relay is normally operated and the operation of the trunk fuse will cause the relay to release and ground the sleeve to make the trunk test busy to selectors and the alarm circuit. When W wiring is provided, an operated fuse will also remove ground from the "BR" lead to the register circuit.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

	Tandem Trunk Supv A Relay	Subscriber Supv A Relay
Maximum external loop resistance	2340 ohms	1500 ohms
Minimum insulation resistance	30,000 ohms	15,000 ohms

2. FUNCTIONAL DESIGNATIONS

None.

3. FUNCTIONS

3.1 Outward Calls

3.101 To hold the preceding circuits when this trunk is seized.

- 3.102 To signal the distant operator.
- 3.103 To start the ringing machine.
- 3.104 To provide an audible ringing signal to the calling subscriber.
- 3.105 To cutoff the audible ringing signal when the operator answers.
- 3.106 If the call requires a class-of-service indication to give the operator a spurt of steady or interrupted tone when she answers the call.
- 3.107 To provide switchhook flashing.
- 3.108 To hold until both ends have disconnected.
- 3.109 To provide for extending alarms to the master office when used as an alarm trunk.
- 3.110 To supply local grade transmission.
- 3.111 To provide access by an intercepting trunk.
- 3.112 To provide access by a subscriber line circuit with a rotary line switch.
- 3.113 To function with the coin control trunk using ac signaling methods.

3.2 Inward Calls

- 3.201 To seize the associated incoming selector and to make the trunk busy to other selectors when the distant operator originates a call.
- 3.202 To provide a pulsing circuit.
- 3.203 To repeat a busy indication to the distant operator when all trunks are busy or when the called subscriber line is busy.
- 3.204 To signal the distant operator when the called subscriber answers.
- 3.205 To provide switchhook flashing.
- 3.206 To release when the operator disconnects on calls to local subscriber.
- 3.207 To hold until both operators disconnect on tandem calls.
- 3.3 To provide means for making trunk tests.
- 3.4 To provide means for making the trunk busy if the circuit fuse operates.
- 3.5 To provide means for opening the lead to the register circuit when the circuit is made busy at the test jack.

4. CONNECTING CIRCUITS

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

	<u>No. 1 or 350A</u>	<u>No. 355A</u>
Selector Bank Multiple Circuit	SD-32123-01	SD-32123-01
Composite Signaling Circuit	SD-95028-02*	SD-95028-02*
Composite Set and Repeating Coil Circuit	SD-95015-01*	SD-95015-01*
Miscellaneous Alarm Circuit (Alarm Sender)	SD-32193-01*	SD-32193-01*
Miscellaneous Alarm Circuit (Keys)		SD-31974-01
Miscellaneous Alarm Circuit (Registers)		SD-31976-01
Miscellaneous Tone and Tone Alarm Circuits	SD-31521-01	
Traffic Register Circuit	SD-30896-01*	
Tone Interrupter Circuit	SD-31825-01	SD-31825-01
Power Ringing Circuit	SD-80884-01* (350A only)	SD-80780-01*
Outgoing Tandem Trunk Rotary Selector		SD-31990-01
Rotary Out Trunk Switch	SD-32253-01	SD-32253-01
Intercepting Trunk Circuit	SD-31771-01	SD-31771-01
Subscribers Line Circuit with Rotary Line Switch	SD-31259-01	SD-31259-01
Signaling Circuit	SD-56202-01	SD-56202-01
Auxiliary Trunk Circuit	SD-32025-01 (350A only)	SD-32025-01
Coin Control Trunk Circuit	SD-32288-01	SD-32288-01
4-Wire Terminating Circuits	SD-96463-01	SD-96463-01
Incoming Selector Circuit	SD-30200-01*	SD-30200-01*

\*Typical Circuits

SECTION IV - REASONS FOR REISSUE

- A. CHANGED AND ADDED FUNCTIONS
  - A.1 To provide joint or operator control on inward calls on an option basis.
- C. CHANGES IN CIRCUIT REQUIREMENTS OTHER THAN THOSE CAUSED BY CHANGES IN APPARATUS
  - C.1 Test Clip Data for relay B on Issue 16D read connect ground 4T (G).

D. DESCRIPTION OF CHANGES

- D.1 Option ZM was added to the drawing. This option provides operator control on inward calls.
- D.2 Tandem circuit operation was standard prior to Issue 17B.
- D.3 Provide ZM option to make this circuit compatible with combination connectors.
- D.4 Added Note 108, revised Notes 102 and 103 to reflect changes.

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