

CROSSBAR SYSTEMS  
NO. 3  
FREE NUMBER AUXILIARY  
LINE PLUG-ENDED  
CIRCUIT

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(a) If the calling party disconnects first, the circuit reverts to the idle state and the line is placed on line lock out at the line, line switch, and connector circuit.

(b) If the called customer (the free number) hangs up first, the auxiliary line circuit starts a timed release timing interval. If the calling customer hangs up during the interval, the circuit reverts to the idle state. However, if the calling customer is still off-hook at the end of the timed interval, the line circuit takes action to cause the calling party to be disconnected so that the free number line cannot be indefinitely held out of service by a calling customer. The circuit does this by winking an answer signal to the connected trunk circuit. The wink causes the trunk to start its timed release timing cycle which when completed will disconnect the calling customer. The auxiliary line circuit then returns to the idle state and the free number line is again available for service.

#### INCOMING TEST CALL

2.03 A seizure by an incoming test trunk causes the auxiliary line circuit to check for the presence of ringing. The circuit times for the length of the maximum silent interval of a ringing cycle. When no ringing is detected during the timing interval due to the fact that no ringing is applied to the line from the incoming test trunk, the auxiliary line circuit will at the end of the interval cut through a clear tip and ring to the free number line and set itself into the test trunk call state. The circuit will remain in that state until testing is completed and the line is released at which time it will revert to the idle state.

#### SECTION II - DETAILED DESCRIPTION

##### 1. DIAL TONE CALL - SC1

1.01 When a customer on a line to which a free number auxiliary line circuit is connected, goes off-hook, this signal is sent through the line, line switch, and connector circuit to the marker circuit as a request for an idle originating register. When seized by the marker, the originating register returns ground over the sleeve lead to operate the SL relay.

##### 1.02 The operation of relay SL:

- (a) Closes the customer loop thereby operating the S relay.
- (b) Removes a control ground from the TM timer.
- (c) Partially closes the operate path of the DT and FC relays.
- (d) Partially closes the operate path of the RD relay through the ringing detector network.

##### 1.03 The operation of relay S:

- (a) Operates the DT relay.
- (b) Partially opens the ANS relay operate path.

##### 1.04 The operation of relay DT:

- (a) Operates the CT relay when 9 break opens the RC discharge path.

##### 1.05 The operation of relay CT:

- (a) Transfers the T and R leads from this circuit to the line, line switch, and connector circuit and releases the S relay.
- (b) Opens the ringing detector circuit.

A channel is now established through this circuit and dial pulse signals from the calling customer are sent to the originating register for completion of the call.

1.06 When the calling customer disconnects first, the S and SL relays in the trunk circuit release which release the SL relay.

##### 1.07 The release of relay SL:

- (a) Releases the DT relay
- (b) Transfers a control ground to the TM timer and releases the CT relay.

1.08 The release of relay CT returns this circuit to its normal idle state and is now available for another call.

1.09 When the called customer disconnects first the CS and SL relays in the trunk circuit release which drops the free line to line lock out and releases the SL relay.

1.10 The release of relay SL releases the CT and DT relays making this circuit idle.

## 2. FREE CALL - SC2

2.01 This circuit receives a ground signal over the sleeve lead when a marker has connected a free call from a trunk to the free line. The ground on the sleeve operates the SL relay.

2.02 The operation of relay SL:

- (a) Removes a control ground from the TM timer and starts timing.
- (b) Partially closes the FC and DT relay operate paths.
- (c) Partially establishes a channel on the T and R leads from the trunk circuit to the customers line.
- (d) Partially closes the operate path of the RD relay through the ringing detector circuit.

2.03 The marker stores the called party ringing information in the trunk and checks for an abandoned call. If the call is not abandoned ringing is applied by the trunk which is detected by the ringing detector circuit and operates the RD relay.

2.04 The operation of relay RD:

- (a) Operates the ANS relay.
- (b) Establishes a path for the T lead from the trunk to the customer line which cuts through ringing to the customer.
- (c) Opens the path for the R lead to the trunk and grounds the R lead to the customers line.

2.05 The operation of relay ANS:

- (a) Transfers control ground to the TM time delay circuit I3 lead to stop timing.
- (b) Provides its own locking path.

(c) Partially applies a 300-ohm bridge circuit across the T and R leads. When the called party answers the bridge will remain for an interval sufficiently long to trip ringing in the trunk. The polarity of the D1 diode insures that the supervisory relay in the trunk does not operate and charge the calling customer.

2.06 When the customer answers during the ringing interval the trunk functions to remove the ringing potential and causes the RD relay to release. The release of relay RD closes the customer loop and operates the S relay.

2.07 The operation of relay S:

- (a) Operates the FC relay.
- (b) Partially opens the ANS relay lock path.

2.08 The operation of relay FC:

- (a) Releases the slow-release ANS relay, thereby removing the 300-ohm bridge from the T and R leads.
- (b) Removes the ringing detector circuit from the tip lead.
- (c) Provides its own lock path.
- (d) Transfers ground to the TM timer.

2.09 This circuit is now in the state in which conversation can take place between the calling and called customers. It will remain in this state with the SL, FC, and S relays operated until disconnect.

2.10 When the customer answers during the silent interval, that is with RD released, the loop through the customers line is closed, operating the S relay.

2.11 The operation of relay S:

- (a) Operates the FC relay.
- (b) Partially opens the ANS relay lock path.

2.12 The operation of relay FC:

- (a) Releases the slow-release ANS relay which in turn removes the 300-ohm bridge from the T and R leads.
- (b) Provides its own lock path.
- (c) Removes the ringing detector circuit from the tip lead causing the ringing control relay in the trunk to function and remove the ringing potential.
- (d) Transfers ground to the TM timer.

2.13 The circuit is now in the state in which conversation can take place as mentioned in 2.09. In both instances the trunk sees a high dc impedance on the T and R leads imposed by the T and R capacitors which prevents a charging condition from being set in the trunk.

3. CALLING CUSTOMER DISCONNECTS FIRST FROM FREE CALL - SC3

3.01 The calling customer disconnecting first causes the trunk circuit to release the channel, thereby removing ground from the SL lead releasing the SL relay and dropping the free line to line lock out.

3.02 The release of relay SL:

- (a) Opens the customer loop which causes the S relay to release.
- (b) Releases the FC relay.
- (c) Opens the operate path of the RD relay through the ringing detector circuit.

3.03 The release of relay FC returns this circuit to its idle state and is now available for another call.

4. CALLED CUSTOMER DISCONNECTS FIRST FROM FREE CALL - SC4.

4.01 When the called customer disconnects first the S relay releases. The S relay released, operates the DT relay which removes ground from I3 lead to the TM timer starting it.

4.02 If the calling customer disconnects before time-out occurs the SL relay is released by the trunk.

4.03 The release of relay SL:

- (a) Opens the operate path of the RD relay through the ringing detector circuit.
- (b) Releases the DT relay.
- (c) Releases the FC relay, returning this circuit to its idle state and is now available for another call.

4.04 If the calling customer does not disconnect before time-out, the operation of relay DT changes the operate time of relay CT by the TM time delay circuit from 4.8 seconds through 5.7 seconds to 24 second through 28 seconds.

4.05 The operation of relay CT:

- (a) Operates the ANS relay.
- (b) Partially opens the ringing detector circuit.

4.06 The operation of relay ANS:

- (a) Transfers a control ground to the timer, releasing the CT relay.
- (b) Applies 300-ohm bridge circuit across the T and R leads creating a charge condition in the trunk.
- (c) Provides its own lock path.

4.07 The release of relay CT:

- (a) Partially closes the operate path of the RD relay through the ringing detector circuit.
- (b) Releases the DT relay.

4.08 The release of relay DT:

- (a) Removes a control ground from the TM timer.

(b) Changes the operate time of relay CT by the TM time delay circuit from 24 seconds through 28 seconds to 4.8 seconds through 5.7 seconds.

4.09 The operation of relay CT:

- (a) Releases the ANS relay.
- (b) Opens the ringing detector circuit.

4.10 The release of relay ANS:

(a) Transfers a control around to the TM time delay circuit, releasing the CT relay. With relay CT released, relay DT operates.

(b) Removes the 300-ohm bridge from the T and R leads causing the trunk to function and after a timed interval to remove the ground on lead S1 releasing the SL relay.

4.11 The release of relay SL:

- (a) Partially opens the RD relay operate path through the ringing detector circuit.
- (b) Releases the DT relay.
- (c) Transfers a control ground to the TM timer.
- (d) Releases the FC relay.

4.12 The release of the FC relay returns this circuit to its idle state and is now available for another call.

5. INCOMING TEST TRUNK CALL - SC5

5.01 When this circuit is seized by a trunk for an incoming test call, the trunk applies ground to the S1 lead, operating the SL relay.

5.02 The operation of relay SL:

(a) Transfers control ground from the TM time delay circuit starting a timing interval of 4.8 seconds through 5.7 seconds.

(b) Closes the operate path of the RD relay through the ringing detector circuit.

5.03 No ringing is applied to the line by the incoming test trunk. Therefore the RD and ANS relays do not operate, as in an incoming call, to stop the TM timer. At

the end of the 4.8- to 5.7-second timing interval, CT operates to remove the ringing detector and cut through a clear T and R to the customer line.

5.04 When the test call is completed the trunk functions to remove the ground from the S1 lead, releasing the SL relay.

5.05 The release of relay SL, transfers a control ground to the TM time delay circuit, releasing the CT relay and returning this circuit to its idle state and is now available for another call.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 The customer working limits for this circuit will be found in the No. 3 crossbar keysheet.

2. FUNCTIONAL DESIGNATIONS

2.01 Relays

<u>Designation</u>	<u>Meaning</u>
ANS	Answer
CT	Cut Through
DT	Dial Tone
FC	Frec Call
RD	Ringing Detector
S	Supervisory
SL	Sleeve

3. FUNCTIONS

3.01 See SECTION I and II for functions of this circuit.

4. CONNECTING CIRCUITS

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

(a) Line, Line Switch and Connector Circuit - SD-26382-01.

(b) Time Delay Control Circuit - SD-94820-01.

5. MANUFACTURING TESTING REQUIREMENTS

5.01 This circuit shall be capable of performing all the functions listed in this Circuit Description and meeting the requirements listed in the Circuit Requirements Table.

6. TAKING EQUIPMENT OUT OF SERVICE

6.01 To take this circuit out of service, the cross connection for the directory number in the line number translator should be changed to trouble intercept to prevent incoming seizures and the associated line relays should be blocked nonoperated to prevent originating attempts.

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