

7

CROSSBAR SYSTEMS
NO. 3
OUTGOING PLUG-ENDED TRUNK
CIRCUIT
MF PULSING
AUTOMATIC NUMBER IDENTIFICATION
OPERATOR ASSISTANCE OR SPECIAL TOLL
HIGH-LOW SUPERVISION
NON-COIN

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<u>D. Disconnect</u>	2	<u>1. PURPOSE OF CIRCUIT</u>	
<u>SECTION II - DETAILED DESCRIPTION</u>	2	1.01 This circuit is used to complete dial	
<u>1. TRUNK SELECTION AND SEIZURE BY</u>		zero ANI and special toll ANI or NON-	
<u>THE MARKER WITH SENDER</u>	2	ANI calls from noncoin customer lines in	
SEIZURE SIGNAL TO THE TSP(S)	3	a No. 3 Crossbar Office to a Traffic Ser-	
<u>2. TRUNK SELECTION AND SEIZURE BY</u>		vice Position (TSP) or a Traffic Service	
<u>THE MARKER WITHOUT SENDER</u>	4	Position System (TSPS) for person-to-person	
TRUNK SELECTION	4	direct distance dialing. In this CD TSP(S)	
SEIZURE SIGNAL TO THE ASSISTANCE		refers to TSP or TSPS.	
OPERATOR AT THE TSP(S)	4	1.02 This circuit can be used as a temporary	
ASSISTANCE OPERATOR ANSWERS	5	operator assistance trunk with no	
<u>3. RECALLING THE CUSTOMER</u>	5	sender (NON-ANI). These calls may be com-	
RESTRICTED RINGBACK	5	pleted by a TSP(S) or a switchboard.	
UNRESTRICTED RINGBACK - OPTION Z	5	<u>2. GENERAL DESCRIPTION OF OPERATION</u>	
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		2.01 The circuit operation described here	
		is that required for a regular call,	

with sender, from seizure through the talking period until release without any variations.

A. Seizure for Completion of a Call

2.02 When the marker determines that a trunk of this type is required to complete a call, it selects an idle trunk of this type on an idle trunk switch and connector frame. The marker then operates the F relay of the selected trunk. The F relay operated, operates the trunk S1 relay.

2.03 The marker also selects an idle sender. Operation of the ON relay in the out-sender circuit operates the D relay in the selected trunk circuit. The S1 or D or both operated establishes the busy indication.

2.04 After determining that connections to the trunk are in order the marker releases (relay F then releases) and the customer line is connected to the tip and ring of this circuit.

2.05 The L operates over the customer loop and provides a holding path for S1. Then Ll operates from L operated. When the sender functions are completed ON releases in the sender circuit. The D then releases from ON released. When D releases the reversed signals of battery on the tip and ground on the ring operate CS. The CS operates CS1 which in turn operates TC. The call is now completed to the TSP(S).

B. Recalling the Customer

2.06 If the operator wishes to recall the customer the ringing key at the distant TSP(S) or a switchboard is operated. This gives an on-hook high current signal to the trunk circuit which operates RC. When RC operates, it removes the shunt on the R resistor to battery so that R operates. The RC operated also provides a holding path for CS1 to hold up the connection. The R operated connects ringing voltage to the customer line and holds L operated. When the ringing key is released, RC and R release thus disconnecting the ringing voltage from the line and restoring the talking battery.

C. Disconnect

2.07 When the customer disconnects first, at the end of the call, L and Ll release. The Ll released connects the high-resistance windings of RC and CS in series with the low-resistance windings and the

B resistor as a disconnect signal to the TSP(S). The TSP(S) then disconnects which releases CS and CS1. The CS1 released, releases S1 which in turn releases TC to restore the circuit to normal.

2.08 If TSP(S) disconnects first, CS and CS1 release. The CS1 released, releases S1. The S1 released, releases TC and the hold magnet of the calling customer. Release of the hold magnet releases L and Ll to restore the circuit to normal.

WITHOUT A SENDER

A. Seizure for Completion of a Call

2.09 When the marker determines that a trunk of this type is required to complete a call, it selects an idle trunk of this type on an idle trunk switch and connector frame. The marker then operates the F relay of the selected trunk which in turn operates S1. Relay S1 operated establishes the busy indication. After determining that connections to the trunk are in order the marker releases. Relay F then releases and the customer line is connected to the tip and ring of this circuit.

2.10 The L operates over the customer loop and provides a holding path for S1. The Ll operates from L operated. The Ll operated connects a low bridge through the primary windings of CS and RC to TSP(S).

B. Operator Answers

2.11 When the operator answers at the distant TSP(S) office battery on the tip and ground on the ring is extended to the trunk circuit to operate CS which then operates CS1. The CS1 operated operates TC and the call is now completed to the operator and conversation can proceed.

C. Recalling the Customer

2.12 Recalling the customer under Z option is the same as described in 2.06 of SECTION I.

D. Disconnect

2.13 Disconnecting is the same as described in 2.07 of SECTION I.

SECTION II - DETAILED DESCRIPTION

1. TRUNK SELECTION AND SEIZURE BY THE MARKER WITH SENDER

1.01 When the marker determines that a trunk of this type is required to

complete the call, it finds and selects an idle trunk in the following manner. The marker first locates an idle trunk switch and connector frame that has at least one idle trunk of the desired route before establishing a connection to the frame through its connector. Ground on the FT lead from the trunk indicates to the marker that at least one trunk in the group on the associated frame is idle. Then the marker connects to the idle frame and selects and seizes one of the idle trunks of the desired route. The marker connects resistance battery through a marker relay coil to the TF lead to operate the trunk F relay which self locks to the TF lead.

1.02 The operation of F:

- (a) Grounds leads JC and SW to the trunk switch and connector circuit operating associated trunk connector relays JC and SW, respectively.
- (b) Locks directly to lead TF.
- (c) Operates relay SL.
- (d) Connects sleeve lead S to lead SL to allow the marker to operate the hold magnet in the trunk switch and connector circuit.
- (e) Transfers the T and R leads from this trunk to the marker for continuity, ground, etc, tests.
- (f) Opens MB lead to test circuit.
- (g) Connects SS lead to SSB lead to operate select magnet in outgoing sender link and grounds the VG lead enabling the hold magnet to be operated in the outsender link circuit.

1.03 The marker also selects an idle outsender. Operation of the ON relay in the outsender circuit provides a ground to operate relay D in the trunk circuit.

1.04 The operation of D:

- (a) Prepares for connecting sleeve lead S to lead SL to the outsender so that when relay F releases the outsender will share control of the sleeve lead with the trunk while the outsender is connected.
- (b) Opens relay TC operate path.

1.05 The operation of S1:

- (a) Opens the FT lead to indicate that this circuit is busy.

- (b) Prepares a ground to the S lead to the trunk switch and connector circuit for holding the switch connections after the F relay releases.
- (c) Opens the operate path for F.
- (d) Provides a locking path for itself through CS1 operated or through L operated and TC released.
- (e) Prepares a holding path for TC.
- (f) Breaks connection between marker trunk test leads TT and TG.
- (g) Opens the MB lead in another place.

SEIZURE SIGNAL TO THE TSP(S)

1.06 A short time after the operation of S1 the marker disconnects from the trunk releasing F. The release of F releases the trunk connector relay and connects the T, R, and S leads to the trunk through the links with the T and R leads extended to the customer line. The customer supervisory relay L then operates over the customer loop.

1.07 The operation of L:

- (a) Provides a holding path for S1 through TC normal. The S1 being slow to release holds from the time the marker disconnects until L operates. The S1 will also hold if the customer dials extra pulses in error after cut through.
- (b) Operates Ll.

1.08 The operation of Ll:

- (a) Provides a ground path for operating R when RC operates.
- (b) Closes the talking path through the T and R capacitors.
- (c) Short circuits the high-resistance windings of RC and CS through TC released. The sender performs its functions after receiving reverse battery and ground from the TSP(S) office. This information is sent over the T and R lead through the outsender link circuit and trunk circuit to TSP(S). When the sender functions have been completed ON releases in the outsender circuit. With ON released ground is removed from the D lead and D releases.

1.09 The release of D:

- (a) Provides a path for the battery on the tip and ground on the ring from the TSP(S) to operate CS through its low-resistance winding. The CS operated, operates CS1.

1.10 The operation of CS1:

- (a) Provides a second locking path for S1.
- (b) Provides a second path through L1 operated to short out the high-resistance windings of CS and RC.
- (c) Operates TC.

1.11 The operation of TC:

- (a) Breaks the first locking path for S1 and gives complete control of the connection to the TSP(S).
- (b) Locks to S1 operated.
- (c) Breaks one shorting path of the high-resistance winding of CS and RC, and puts the low bridge under control of L1 and CS1 operated.

The call has now reached the assistance operator at the TSP(S) office and conversation can proceed.

2. TRUNK SELECTION AND SEIZURE BY THE MARKER WITHOUT SENDER

TRUNK SELECTION

2.01 When the marker determines that a trunk of this type is required to complete the call it finds and selects an idle trunk in the following manner. The marker first locates an idle trunk switch and connector frame that has at least one idle trunk of the desired route before establishing a connection to the frame through its connector. Ground on the FT lead from the trunk indicates to the marker that at least one trunk in the group on the trunk switch and connector frame is idle. Then the marker connects to the idle frame and selects and seizes one of the trunks of the desired route. The marker connects resistance battery through the marker XF relay winding to the trunk TF lead and operates F relay which locks to TF lead through its own contacts.

2.02 The operation of F:

- (a) Grounds leads JC and SW to the trunk switch and connector circuit operating associated trunk connector relays.

(b) Operates relay S1.

- (c) Connects the S lead to the SL lead so the marker can operate the trunk switch circuit hold magnets.

- (d) Transfers the T, R, and S leads from the trunk and connects them to the marker for continuity, ground, etc, tests.

2.03 The operation of S1:

- (a) Connects ground through normal D relay contacts to the S lead to the trunk switch and connector circuit for holding the switch connections.
- (b) Opens the operate path of F.
- (c) Provides a locking path for itself through CS1 operated, or through L operated and TC released.
- (d) Provides a locking path for TC.
- (e) Opens the FT lead to indicate that this circuit is busy.

SEIZURE SIGNAL TO THE ASSISTANCE OPERATOR AT THE TSP(S)

2.04 A short time after the operation of S1 the marker disconnects from the trunk releasing F. The release of F releases the trunk connector relays and connects the T, R, and S leads of the trunk through the links with the T and R leads extended to the customer line. The customer supervisory relay L then operates over the customer loop.

2.05 The operation of L:

- (a) Provides a holding path for S1 through TC released. The S1 being slow to release holds from the time the marker disconnects until L operates. The S1 will also hold if the customer dials extra digits.

- (b) Operates L1.

2.06 The operation of L1:

- (a) Provides a ground path for operating R when RC operates.
- (b) Closes the talking path through the T and R capacitors.
- (c) Short circuits the high-resistance windings of RC and CS through TC released to give off-hook supervision after the operator answers.

ASSISTANCE OPERATOR ANSWERS

2.07 When the assistance operator at the TSP(S) answers, battery and ground are put on the tip and ring leads, respectively, which operates CS. The CS operated, operates CS1.

2.08 The operation of CS1:

- (a) Provides a second holding path for S1 through a contact of S1.
- (b) Provides a second path through L1 operated to short out the high-resistance windings of CS and RC.
- (c) Operates TC.

2.09 The operation of TC:

- (a) Breaks the first locking path for S1 and gives complete control of the connection to the TSP(S).
- (b) Breaks one shorting path of the high-resistance windings of CS and RC, and puts the low bridge under control of L1 and CS1 operated.

2.10 The call has now reached the assistance operator at the TSP(S) office and conversation can proceed.

3. RECALLING THE CUSTOMER

RESTRICTED RINGBACK

3.01 With restricted ringback relay R operated only with L1 operated, that is, in an off-hook condition. This feature is usually used in connection with a PBX line after the extension has hung up, but while the cord is still connected which presents an off-hook indication.

UNRESTRICTED RINGBACK - OPTION Z

3.02 With unrestricted ringback any customer or PBX line connected to this trunk can be recalled at any time. In this case an operating path is provided for relay R regardless of the switchhook position. Unrestricted ringback is usually used only if no party lines are served by this trunk.

CIRCUIT OPERATION ON RECALL

3.03 When the ringing key is operated at the distant TSP(S) office an on-hook current signal is sent to the trunk circuit which operates RC.

3.04 The operation of RC:

- (a) Provides a holding path for CS1 to hold up the connection.
- (b) Removes the shunt on the R relay allowing R to operate.

3.05 The operation of R:

- (a) Provides a holding path for L through L1 operated.
- (b) Disconnects talking battery and ground and connects 20-Hz ringing voltage and ringing ground to the customers line.

3.06 When the ringing key is released the RC and R relays release thus reconnecting talking battery to the customers line.

3.07 Resistor L1 in parallel with relay L1 coil guards against L releasing L1 relay, should L release momentarily during contact stagger of relay R contacts when R operates and releases.

4. SIGNALING THE ASSISTANCE OPERATOR

4.01 If the calling customer wishes to signal the assistance operator after the operator has answered, the switchhook is depressed and released. The L follows the operation of switchhook and L1 follows the operation of L. The operation and release of L1 closes and opens the short circuit on the high-resistance winding of RC and CS causing the TSP(S) supervisory lamp to flash as a recall signal.

5. HOLD AND DISCONNECT

5.01 The connection is held under complete control of the TSP(S) once the distant office has answered. When the calling customer disconnects, L releases which in turn releases L1.

5.02 The release of L1:

- (a) Connects the high-resistance winding of RC and CS in series with the low-resistance windings and the B resistor as a disconnect signal of TSP(S). When the TSP(S) disconnects CS releases which in turn releases CS1. The CS1 released, releases S1.

5.03 The release of S1:

- (a) Removes ground from the S lead to the trunk switch and connector circuit thus releasing the connections through the link frames.
- (b) Releases TC.

5.04 The release of TC:

- (a) Grounds lead FT of the trunk switch and connector circuit indicating there is an idle trunk on this frame.
- (b) Completes continuity through TF lead to F relay to indicate that this circuit is idle.

The circuit is now restored to normal.

5.05 If the TSP(S) disconnects first, CS releases which releases CS1. The CS1 released releases S1 and also gives a high bridge condition which will remain throughout the completion of the disconnect.

5.06 The release of S1:

- (a) Removes ground from the S lead to the trunk switch and connector circuit thus releasing the connections through the switch frames.
- (b) Releases L which in turn releases L1.
- (c) Releases the hold magnet on the line switch frame.

5.07 The release of relay L1:

- (a) Releases TC.

5.08 The release of TC:

- (a) Grounds lead FT of the trunk switch and connector circuit indicating there is an idle trunk on the frame.
- (b) Completes path through TF lead to F relay to indicate that this circuit is idle. The circuit is now restored to normal.

6. TESTING

6.01 Routine tests are made on this trunk by setting up a test connection to this trunk from the test circuit to distant office incoming trunk test line. The test circuit is used to control a marker which selects this trunk in the same general manner as for a regular call with the exception that if the trunk has already been made busy, the marker can be directed to temporarily remove ground from lead MB of the trunk circuit, via the trunk switch and connector circuit, thus permitting this trunk to be selected by the marker. Routine operations are performed from the test circuit to the distant TSP(S) in the same manner that a call is completed from a customer to the TSP(S).

6.02 If tests are to be performed on tip and ring cable conductors to TSP(S) office, access can be obtained at the CDM.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 See the No. 3 Crossbar Keysheet for customer line supervision limits.

1.02 Trunk supervision RC - S-530

Max Ext Ckt, Loop Res (-45 volt min to +130 volt min) - 3900 ohms
Min Ins Res - 30,000 ohms.

1.03 Trunk supervision CS - 280 AE

Max Ext Ckt, Loop Res (to -45 volt min) 7600 ohms
Min Ins Res - 30,000 ohms

2. FUNCTIONAL DESIGNATIONS

2.01 Relays

<u>Designation</u>	<u>Meaning</u>
CS	Called-End Supervision
CS1	Auxiliary to CS
D	Disconnect
F	Frame
L	Calling Customer Supervision
L1	Auxiliary to L
R	Ring
RC	Ring Control
TC	Trunk Control
S1	Sleeve

3. FUNCTIONS

3.01 When the circuit is available for seizure, provides a ground on lead FT of trunk switch and connector circuit to indicate to the markers that there is an idle trunk on the frame.

3.02 Provides an F relay associated with lead F which is operated by the marker when seizing this trunk and which operates an associated trunk connector relay in the trunk switch and connector circuit and transfers T, R, and sleeve lead connection to the marker for making line tip and ring continuity and S lead false ground tests during the build-up of the connection.

- 3.03 Provides for the removal of ground from lead FT and the opening of leads TT and TG during the operation of this circuit to present a busy indication to the markers.
- 3.04 When a marker seizes this trunk and operates relay F a ground through F contacts operates relay S1 to hold the connection following the disconnection of the marker until the customer line supervisory circuit takes control.
- 3.05 Provides for holding the connection over extra dial pulses.
- 3.06 Provides for signaling the operator when the customers supervisory circuit is completed.
- 3.07 Permits the customer to abandon the call and release the connection before the TSP(S) has answered.
- 3.08 Provides means for TSP(S) to hold or release the connection independent of the customer.
- 3.09 Provides for recalling a customer or PBX against either an on-hook or off-hook condition.
- 3.10 Provides for a guaranteed high-bridge signal to TSP(S) once the TSP(S) disconnects while this circuit is releasing, independent of the customer.
- 3.11 Provides switchhook supervision to the operator.
- 3.12 Provides connection to an associated make-busy (MB) jack on the test circuit to make the trunk busy without interfering with an established connection.
- 3.13 Provides means for overriding a make-busy condition on test calls. The marker may set up test connection by causing the removal of ground from lead MB long enough to permit selection of the trunk.
- 3.14 Provides for connection to the traffic usage recorder circuit.
- 3.15 Provides for making this circuit busy from the distant office over the tip and ring leads.

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4. CONNECTING CIRCUITS

4.01 When this circuit is listed on a key-sheet, the information thereon shall be followed.

- (a) Trunk Switch and Connector Circuit - SD-26383-01.
- (b) Test Circuit - SD-26411-01.
- (c) Power, Ringing, and Tone Distributing Circuit - SD-26414-01.
- (d) Traffic Usage Recorder Circuit - SD-96494-01.
- (e) Outgoing Sender Link Circuit - SD-26395-01.

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 Tables.

6. TAKING EQUIPMENT OUT OF SERVICE

6.01 If it is desired to remove this trunk from service for trouble or other reasons, a short-circuit plug is inserted into the make-busy jack MB on the test circuit. This connects ground to the MB lead in this circuit causing the D relay to operate. The operation of D opens the circuit for the winding of relay F, disconnects lead TT from TG thereby indicating that this circuit is busy, disconnects ground from lead FT which indicates this frame is busy insofar as this circuit is concerned.

6.02 When remote make-busy facilities are provided, the MB lead to the trunk can be grounded by the operation of an associated latching relay located in the remote make-busy and restore translator circuit via the jack at the test circuit.

6.03 If it is desired to make this trunk busy from the distant office, battery on the tip and ground on the ring leads operate relay CS. The CS operated, operates CS1. The CS1 operated, operates TC which opens leads FT and TF and disconnects lead TT from lead TG thus indicating the trunk is busy. The operation of TC also opens the operate path of the D relay via the MB lead to the test circuit.

