

5

CROSSBAR SYSTEMS
 NO. 3
 OUTGOING PLUG-ENDED TRUNK
 CIRCUIT
 REVERSE BATTERY SUPERVISION

TABLE OF CONTENTS	PAGE	<u>SECTION I - GENERAL DESCRIPTION</u>
<u>SECTION I - GENERAL DESCRIPTION</u>	1	<u>1. PURPOSE OF CIRCUIT</u>
<u>1. PURPOSE OF CIRCUIT</u>	1	1.01 This circuit is used to complete outgoing calls from a No. 3 crossbar customer to a distant office using MF or dial pulsing and reverse battery supervision.
<u>2. GENERAL DESCRIPTION OF OPERATION</u>	1	<u>2. GENERAL DESCRIPTION OF OPERATION</u>
SELECTION OF TRUNK	1	SELECTION OF TRUNK
SENDER FUNCTIONS	1	
CALLED CUSTOMER ANSWERS	1	2.01 When the marker receives an indication that an outgoing trunk is required, it selects an idle trunk switch and connector circuit, an idle trunk on the circuit associated with the desired route, and a sender. After the marker completes certain tests, the selected trunk is connected to the calling customer.
CALLED CUSTOMER DISCONNECTS FIRST	1	
CALLING CUSTOMER DISCONNECTS FIRST	1	
OVERFLOW	2	
ABANDONED CALLS	2	
<u>SECTION II - DETAILED DESCRIPTION</u>	2	<u>SENDER FUNCTIONS</u>
<u>1. TRUNK SELECTION AND SEIZURE BY THE MARKER</u>	2	2.02 The sender transmits the called number to the distant office and on an ANI call it also transmits the calling number to the distant office. The sender, after transmission is complete, disconnects from the trunk.
SETTING UP CONNECTION TO CALLING CUSTOMER AND SENDER FUNCTIONS	2	
CALLED CUSTOMER ANSWERS	3	<u>CALLED CUSTOMER ANSWERS</u>
CALLED CUSTOMER DISCONNECTS FIRST	3	2.03 When the called customer answers, the trunk prepares itself for subsequent disconnect. No other functions are performed at this time.
CALLING CUSTOMER DISCONNECTS FIRST	3	
<u>SECTION III - REFERENCE DATA</u>	3	<u>CALLED CUSTOMER DISCONNECTS FIRST</u>
<u>1. WORKING LIMITS</u>	3	2.04 After a timed interval, the holding bridge toward the called office is removed plus the channel through the switches is opened.
<u>2. FUNCTIONAL DESIGNATIONS</u>	3	
<u>3. FUNCTIONS</u>	4	<u>CALLING CUSTOMER DISCONNECTS FIRST</u>
<u>4. CONNECTING CIRCUITS</u>	4	2.05 Under this condition the holding bridge toward the called office is immediately removed and the channel through the switches is opened.
<u>5. MANUFACTURING TESTING REQUIREMENTS</u>	5	
<u>6. TAKING EQUIPMENT OUT OF SERVICE</u>	5	

OVERFLOW

2.06 If the sender cannot complete its functions, it removes the holding ground to the sleeve of the calling customers channel, this results in the calling customer being dropped to line lockout at which time 120-IPM tone is returned to the calling customer.

ABANDONED CALLS

2.07 The trunk is arranged to release if the originating customer abandons the call at any time after the marker disconnects. If the sender is still attached, the trunk cannot be selected for another call until the sender releases.

SECTION II - DETAILED DESCRIPTION

1. TRUNK SELECTION AND SEIZURE BY THE MARKER

1.01 There is one FT lead per trunk switch and connector circuit per route associated with the trunks arranged for originating outgoing calls. If there is at least one idle trunk on a particular trunk switch and connector circuit associated with the desired route, there will be a ground on the FT lead to the trunk switch and connector circuit. The marker determines which circuits have access to an idle sender and then selects one of these trunk switch and connector circuits which is ready to take a call. Ground is supplied to the TT lead to the trunks for this route on the selected circuit. The marker determines which of the trunks are idle by looking for this ground over the individual TG leads. The marker selects one of the idle trunks and then operates the F relay by applying battery to the TF lead. The F relay operates via battery on TF lead through normal contacts of relays CH and MRP as a guard against a false charge.

(a) The F relay operated:

- (1) Transfers the T, R, and S leads from this trunk to the marker for test via leads T1, R1, and SL, respectively.
- (2) Grounds the SW and JC leads to the trunk switch and connector circuit and the VG lead to the outsender link trunk identifier circuit.
- (3) Opens the loop to the distant office to prevent a false seizure prior to the operation of D relay.

(4) Operates the TP relay when tip party charging is required (W option provided).

(5) Operates S1 relay.

(b) The S1 relay operated:

(1) Opens the path from TT lead to the TG lead which prevents any subsequent marker seizure while the call is in progress.

(2) Opens the FT lead which makes this trunk appear busy to the trunk switch and connector circuit.

(3) Operates the MRP relay (W option provided).

(4) Locks the TP relay operated when tip party charging is required (W option provided).

(5) Opens MB lead to test frame circuit to prevent this trunk from being seized by the test frame while a call is in progress.

(6) Removes CAMA make-busy relay P, B resistor, and C diode from the tip and ring (App Fig. 2 provided).

SETTING UP CONNECTION TO CALLING CUSTOMER AND SENDER FUNCTIONS

1.02 At the same time that the above operation is taking place, the marker selects an idle sender available to this trunk and operates the select magnet of the outsender link switch for the level on which the trunk appears. A select magnet operated provides a path over which the marker operates the hold magnet of the outsender link switch associated with the desired sender. The hold magnet is held under control of the sender which then operates the D relay. The D relay operated:

(a) Removes the tip and ring of the outgoing trunk circuit from the trunk pair so the sender can signal the distant office as required to set up the connection in that office, also the CS relay bridge is removed from the tip and ring.

(b) Grounds lead AB to the outsender link circuit.

(c) Prepares a holding ground path for the hold magnets of the channel through the trunk switch and connector circuit, over lead SL.

1.03 When the marker has completed its functions with this trunk and the attached sender, it releases the F relay. The F relay released, causes the customer line to be connected to the S relay causing it to operate unless the customer has abandoned the call. The S1 relay is slow to release so as to hold over from the time the marker removes ground from the F relay until the S relay operates over the customer loop.

1.04 When the sender has completed its functions with the other office, it releases the D relay and removes the bridge from across the tip and ring.

1.05 If the customer abandons the call before the sender has completed its functions, the S and, in turn, the S1 relays release. The S1 relay released removes ground from the AB lead to the sender indicating to it that the call is abandoned. It also removes ground from the S lead to the trunk switch circuit to release the channel to the calling line. The trunk is still held busy by the D relay operated which holds the TT, TG, and FT leads of this trunk open. When the sender releases the D relay, the circuit is normal and ready for a new call.

CALLED CUSTOMER ANSWERS

1.06 When the called customer answers (goes off-hook) reverse battery is received over the trunk. The CS relay operates. The CS relay operated removes ground from the TM timer which starts timing.

1.07 When ground is removed from the charging network of the TM timer, the voltage at the C lead becomes approximately -96 volts which reverse biases diode CR1 in the timer. The A capacitor then discharges into the timer through the I lead, through the Q1 transistor from base to emitter, out of the timer on B lead to battery, and from ground through A resistor back to the other side of the A capacitor. When the A capacitor is discharged, the Q1 transistor turns off which turns on the Q2 transistor, which operates the CH relay. The time constant of the A capacitor and the A resistor determines the time (0.685 to 0.800 seconds) until Q1 transistor turns off. The CH relay operated:

- (a) Locks under control of the S1 relay by opening the charge path of the A capacitor.

- (b) Prepares an operate path for RL relay.

- (c) Opens the operate path to the MRP relay during the 225 to 830 millisecond slow-release interval of the MRP relay the customers message register is pegged (W option) by application of message register potential to the sleeve lead.

CALLED CUSTOMER DISCONNECTS FIRST

1.08 When the called customer goes on-hook before the calling customer, the CS relay releases which energizes thermal relay RL, through 8 make CH and 3 break D relays.

1.09 Thermal relay RL operates after a minimum of 13 seconds and operates the D relay. The D relay in operating removes the holding ground to the sleeve of the calling customers channel hold magnets releasing the crosspoints of the channel. The channel released removes the customer loop from across the tip and ring causing the S relay to release which releases the S1 relay and the circuit returns to idle, by releasing the CH and D relays.

CALLING CUSTOMER DISCONNECTS FIRST

1.10 When the calling customer disconnects the S relay releases releasing S1 relay which releases the channel hold magnets. The release of S1 relay causes the CS relay to be released and also opens the tip and ring to the terminating office as an indication that the calling customer has disconnected. This circuit is now returned to normal.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 Trunk Supervision

Minimum Insulation Resistance - 30,000 ohms

Maximum External Circuit Loop -
 8000 Ohms to 45-50 Volts
 7110 Ohms to 40-56 Volts
 3415 Ohms to 20-28 Volts
 3575 Ohms to 21-26 Volts

2. FUNCTIONAL DESIGNATIONS

2.01 Relays

<u>Designations</u>	<u>Meaning</u>
CH	Charge
CS	Supervisory (Called Customer)

<u>Designations</u>	<u>Meaning</u>
D	Disconnect
F	Frame
MRP	Message Register Pulse
P	Polar Make-Busy
RL	Timed Release
S	Supervisory (Calling Customer)
SL	Sleeve
TP	Tip Party

3. FUNCTIONS

- 3.01 In combination with other trunks of a group, indicate that one or more trunks for a particular route on a trunk switch and connector circuit are idle.
- 3.02 Give an individual indication that it is idle.
- 3.03 Permit the marker to connect to this trunk when selected.
- 3.04 Permit a test call to be made even though the trunk is made busy, unless the trunk is occupied by a call established before the trunk was made busy.
- 3.05 Complete the transmission and reverse battery supervision circuits after the sender completes its functions.
- 3.06 Cause the tip and ring of the calling channel to be connected to the marker for continuity tests and the sleeve for trouble ground test.
- 3.07 Connect to an idle sender through the sender link under control of the marker.
- 3.08 Provide for operating relay S1 making the trunk busy, to other traffic.
- 3.09 Control the connection to the calling line when the marker disconnects.
- 3.10 To serve two party message rate or coin line traffic (W option provided).
- 3.11 To provide tip party charging when required on message rate traffic (W option provided).

- 3.12 To provide a signal to an auxiliary circuit to collect or return coins on a call originated by a local coin station (W option provided).
- 3.13 To provide for pegging a customer message register for calls originated by message rate lines (W option provided).
- 3.14 Indicate to the sender an abandoned call if the calling customer disconnects before the sender has completed its function and release the trunk and the calling line.
- 3.15 Record that the called customer has answered after 0.685 to 0.800 seconds.
- 3.16 Indicate that the trunk is idle and release the connection when the calling party disconnects.
- 3.17 Disconnect the trunk and calling line if the calling party fails to hang up within 13 to 32 seconds after the called party hangs up.
- 3.18 Provide for making this circuit busy at the test frame without interfering with an established call.
- 3.20 When normal, to present a high-resistance relay bridge across the tip and ring of the trunk. (App Fig. 2 provided.)
- 3.21 When seized by the marker to remove the bridge across the tip and ring.
- 3.22 When the incoming CAMA trunk is made busy, to make this trunk busy. (App Fig. 2 provided.)

4. CONNECTING CIRCUITS

- 4.01 When this circuit is shown on a key-sheet, the connecting information thereon is to be followed.
 - (a) Trunk Switch and Connector Circuit - SD-26383-01.
 - (b) Outgoing Sender Link and Trunk Identifier - SD-26395-01.
 - (c) Message Register Power Supply Circuit - SD-26408-01.
 - (d) Test Circuit - SD-26411-01.
 - (e) Power Ringing and Tone Distributing Circuit - SD-26414-01.

- (f) Incoming Trunk Circuit (Typical) - SD-26070-01.
- (g) Traffic Usage Recorder Circuit (Typical) - SD-96494-01.
- (h) 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 the Circuit Description and meeting the requirements listed in the Circuit Requirements Tables.

6. TAKING EQUIPMENT OUT OF SERVICE

6.01 A jack per trunk is provided at the test frame for making the trunk busy. When a sleeve-ring shorting plug is inserted, ground through a normal contact of relay TST- in the test frame is passed over lead

MB to the trunk. If the trunk is not in use relay D will operate to open leads TT, TG, and FT to the marker. If trunk is busy with a call relay D will not operate until that call ends. Insertion of the plug does not interfere with a call that is in progress.

6.02 When testing this trunk, the test frame will remove ground from MB leads of any trunks that are made busy and associated with that trunk switch and connector circuit. The trunk is then seized normally by the marker as directed by test frame setup.

6.03 Apparatus Fig. 2 provided - CAMA make-busy, this option provides for making this circuit busy from the CAMA office incoming trunk. This is accomplished at the distant office by applying battery to the tip and ground to the ring causing the P relay to operate in this circuit. Relay P operated closes ground operating the D relay and making this circuit busy.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5245-LCB

WE DEPT 355-JLS-KLF-MH

