

## 6

CROSSBAR SYSTEMS  
NO. 3  
INTRAOFFICE PLUG-ENDED TRUNK  
CIRCUIT

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<u>SECTION I - GENERAL DESCRIPTION</u>	
1. <u>PURPOSE OF CIRCUIT</u>	
1.01 This trunk provides the supervisory control for calls between any two customers on different lines in the same crossbar No. 3 office.	

2. GENERAL DESCRIPTION OF OPERATION

2.01 When a marker receives called and calling registrations which indicate that a call is an intraoffice call, but not a reverting call, it selects this type of trunk. The marker seizes this trunk and transfers the called end T, R, and S away from the trunk back through the trunk switch and connector to itself for continuity and other tests. The marker stores ringing code information in the trunk plus information on the calling party if they are a message register customer.

2.02 The marker sets the channel from the called customer to the trunk. If the call cannot be completed the marker will then connect the proper tone, announcement, or intercept trunk to called end appearance of the trunk. However it still retains control of the called T, R, and S. Next, the marker performs its call-back functions. To do this it transfers control of the calling end T, R, and S to itself and sets up the channel from the calling customer to the trunk. The marker having completed its functions turns control of the call over to the trunk.

2.03 As soon as the marker releases, the intraoffice trunk (IAO) applies ringing to the T and R to the called customer. Ringing will continue until either the called party answers or the calling party abandons the call. If the call is abandoned ringing is discontinued, the channels are released, and the trunk returns to normal ready for another marker seizure. The called party answering trips ringing which causes the trunk to remove the ringing and cut through the T and R talking path between customers.

2.04 Answer supervision starts a short, charge timing interval in the trunk at the end of which message register potential (MRP) is applied to the calling end sleeve to score a register if the customer is not flat rate or to set the auxiliary coin line circuit to the coin collect state. From this point on nothing further happens in the trunk until disconnect.

2.05 Either the calling or called party hanging-up constitutes disconnect. The trunk will release the channel to both customers and return to normal.

## SECTION II - DETAILED DESCRIPTION

### 1. ESTABLISHING CONNECTION - SC1

#### MARKER SEIZURE

1.01 There is one FT lead per trunk switch and connector circuit per route associated with IAO trunks. If there is at least one idle IAO trunk, there will be ground on the FT lead to the trunk switch and connector circuit. The marker selects one of the trunk switch and connector circuits which is ready to handle a call. Ground is applied, through the selected circuit, to the TT leads of all the IAO trunks associated with it. This ground is returned to the marker by each idle IAO trunk over their individual TG leads. The marker selects an idle trunk and operates its F relay by applying resistance battery to its TF lead. The F relay operated:

- (a) Locks to the TF lead through its 8 make-contact.
- (b) Transfers the called end T and R leads from the trunk to marker through the trunk switch and connector circuit over the T1 and R1 leads. The marker checks the tip and ring continuity over this path after the channel has been setup.
- (c) Cuts through to the marker the operate path of the CB, R2, R3, RC, TPC, and TPR relays.
- (d) Opens the operate path of the PU relay to prevent premature ringing of the called customer.
- (e) Operates the F1, MRP, and S1 relays.

1.02 The S1 relay 2 make-contact partially closes lock paths for the S1, CH1, MRP, RC, and TPC relays. Its 6 make- and 10 make-contacts partially close the ground to the called and calling end S sleeve leads, respectively and, the 4 make and 8 make contacts close the called and calling R leads to the CS and S supervisory relays. The F1 relay operated:

(a) Transfers the called end S sleeve lead from the trunk to the marker through the trunk switch and connector circuit over the S1 lead. The marker performs a trouble ground test on the sleeve and controls the channel over it.

(b) Transfers the RC relay lock path to the marker over the RA lead.

(c) Removes ground from the calling end sleeve through its 1 break-contact. This will release the channel to the previous calling customer if still off-hook when the marker seized this trunk for another call. The previous calling customer is returned to line lock-out.

(d) Grounds the JC and SW leads of the called end appearance at the trunk switch circuit.

1.03 The marker operates the RC ringing control relay. It checks that the RC has operated and that its lock path is intact by checking for the appearance of the locking ground on the RA lead. The path starts at ground on 2 fixed and make of the operated S1 relay, through 5 make RC, 6 break RT, and 4 make F1 to the RA lead. The marker stores ringing code information in the trunk by operating the proper combination of R2, R3, and TPR relays. These relays when operated lock to 4 make RC. If the calling party is a tip party message rate customer the TPC relay will be operated by the marker. It locks under control of 2 make of the S1. When the marker has set-up and checked the channel to the called party it operates the CB call-back relay over the CB lead. Ten make of the MRP is in the operate path of the CB relay but because it operates slowly serves only to prevent the CB from operating from ground on 6 make of the F at the beginning of the call. The CB relay operated:

(a) Transfers the calling end appearance T, R, and S from the trunk back to the trunk switch circuit for marker use similar to the called T, R, and S.

(b) Ten break opens the operate path of the F1 releasing that relay.

The F1 relay released:

(c) Transfers the called end appearance and control of the S sleeve lead into the trunk.

- (d) Provides an operate path through its 2 break contact to keep the CB relay operated when ground is removed from the CB lead.
- (e) Completes paths from ground to the calling end appearances of the JC and SW leads.

The marker sets-up the channel from the calling customer to the trunk, performs its tests on the T, R, and S and prepares to release by releasing the trunk F relay. The F relay releasing releases the CB relay which transfers the calling channel T, R, and S into and under control of the trunk. The marker checks for ground on the calling sleeve lead and releases. From this point on until the calling or called party hangs-up the markers will not be able to seize the trunk. The trunk will appear busy because contacts 9 and 5 break on the operated S1, open up the TT and FT leads.

#### ABANDONED CALL

1.04 When the CB relay released it cut through the T and R leads from the trunk S supervisory relay to the calling customers loop. The S relay provides talking battery and ground to the calling customer and operates over that loop. The S operated closes a lock path for the slow-release S1 relay through 2 make S1, 8 make S, and 6 break CH1. If the calling customer hangs up during ringing which commences when the marker releases, the S relay releases. This causes the slow-release MRP and S1 relays to release. The S1 relay releases the RC and TPC relays. The RC relay releases the PU pick up relay and any of the R2, R3, or TPR ringing combination relays which are operated. The normal S1 relay reestablishes continuity in the FT lead to ground and in the TG to TT leads. The released MRP re-establishes continuity in the TF lead to the F relay. In this state the trunk is idle and ready to handle another call.

#### RINGING

1.05 The marker released the trunk F relay when it prepared to release. Twelve break of the F completed a path from the PU pick-up relay coil to either ground or to the PU lead from the PRTD circuit. The combination of transfer contacts 11 on R2 and 2 on R3 and the options Y and Z provide that, if code 1 ringing is to be applied to the

tip or ring, the operate path of the PU relay will be grounded and it will operate immediately. If on the other hand any other code of ringing is to be applied, the operate path will be brought out to the PU lead. A 250-millisecond pulse of ground appears on the PU lead near the end of the 6-second ringing cycle and when the PU relay is operated from it, it assures that ringing codes 2, 3, and 4 are applied at the beginning of their sequences. In any event the PU relay operates and locks through its 8 make-contact to 4 make of the RC. Ringing potential is applied through its 12 make-contact through the RT ringing trip relay to either the tip or ring of the called customer. The following chart specifies the ringing combinations sent to the called customer for the various combinations of operated R2, R3, and TPR relays.

Ringling Combinations

Called Party	Relays Oper	Ringling		Ringling Applied to
		Superimp	Coded	
1	-	Code 1-	Code 1	Ring
2	TPR	Code 1-	Code 1	Tip
3	R2	Code 1+	Code 2	Ring
4	R2,TPR	Code 1+	Code 2	Tip
5	R3	Code 2-	Code 3	Ring
6	R3,TPR	Code 2-	Code 3	Tip
7	R2,R3	Code 2+	Code 4	Ring
8	R2,R3 TPR	Code 2+	Code 4	Tip

#### ANSWER

1.06 Ringling potential is applied to the ring through 2 make RC or to the tip through 3 make RC. Ground originating at 2 fixed TPR is applied to the side of line opposite that of where the ringling potential is applied. Some of the ringling potential is feedback as audible tone to the calling customer through the R1 or T1 capacitors. When the called customer answers the impedance of the loop is reduced sufficiently that the increased current flow operates the RT ringling trip relay. Six break of the operated RT opens the lock path of the RC ringling control relay causing it to release. The RC released:

- (a) The 2 and 3 transfer contacts remove ringing from the called line and cut-on the called supervision CS relay which supplies talking battery and ground to the called party; operating the CS relay.
- (b) Release the ringing combination relays R2, R3, and TPR.
- (c) Opens the locking and operating paths of the PU relay releasing it.

#### CHARGE TIMING

1.07 The operated CS relay removes ground from the I lead to the TM time delay control circuit which begins a 685- to 800-millisecond charge timing interval. Upon time out the CH relay operates operating relay CH1. The CH1 operated:

- (a) Locks operated to 2 make S1 relay.
- (b) Transfers the I lead to the TM time delay control circuit to ground through 2 make CS, 8 make S, and 2 make S1. This causes relay CH to release.
- (c) Transfers the lock path of the S1 relay to control of 3 break CH relay.
- (d) Through its 2 make-contact applies message register potential (either ring party or tip party potential according to the setting of the TPC relay) to the calling party sleeve. This potential is used to score a message register for a MR customer or to set the auxiliary coin line circuit to the coin collect state.
- (e) Eleven make grounds the A lead to the trunk switch and connector circuit, which will start a message register timing circuit.
- (f) Further opens the TF lead.
- (g) Transfers the operate path of the MRP relay to the B lead to the trunk switch and connector circuit. Ground on the B lead from the MR timer will operate the MRP relay to cause additional scoring of the customers message register.

The transfer of the MRP relay operate path by the CH1 relay causes it to release. The MRP is a slow-release relay which insures, that when it has released and removed the MR potential from the sleeve, that the potential has been applied for sufficient time to perform its task. Eight break of the MRP places solid ground on the calling end sleeve through 9 break CB and 1 break F1. The trunk is now in the conversation mode and remains in this state until either the called party or the calling party disconnect.

#### 2. CALLED CUSTOMER DISCONNECTS FIRST - SC2

2.01 When the called customer disconnects, the loop through which the CS relay operates is opened and the CS releases. Two make removes ground from the I lead of the TM time delay control circuit which starts a 685- to 800- millisecond timing interval. The TM timer times out and operates the CH relay. Three break of the CH opens the lock path of slow-release relay S1, which when released:

- (a) Grounds the I lead to the TM timer causing it to release the CH relay.
- (b) Releases the TPC (if operated) and CH1 relays.
- (c) Opens the R lead to the S relay so that current is removed from the crossbar switch contacts when they open.
- (d) Opens the called and calling end sleeves which releases both channels.
- (e) Closes ground to the FT lead, and continuity between the TG and TT leads. These lead closures make the trunk appear idle and available for marker seizure.

#### 3. CALLING CUSTOMER DISCONNECTS FIRST - SC3

3.01 The action of the trunk when the calling customer disconnects first is the same as described in 2.01 except it is the S relay instead of the CS which releases.



SECTION III - REFERENCE DATA1. WORKING LIMITS

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

2. FUNCTIONAL DESIGNATIONS2.01 Relays

<u>Designation</u>	<u>Meaning</u>
BSY	(Made) Busy
CB	Call Back
CH	Charge
CH1	Charge Auxiliary
CS	Called (End) Supervision
F	Traditional
F1	F Auxiliary
MRP	Message Register Potential
PU	Pick Up
R2	Ringing (Combination)
R3	Ringing (Combination)
RC	Ringing Control
RT	Ringing Trip
S	(Calling End) Supervision
TPC	Tip Party Charge
TPR	Tip Party Ringing

3. FUNCTIONS

3.01 Indicates to the marker that there are idle trunks of this type on a selected trunk switch and connector circuit.

3.02 Indicates to the marker which of these trunks associated with a particular trunk switch and connector circuit are idle.

3.03 Connects the idle selected trunk to the marker.

3.04 Checks that the CH1 and MRP relay are released.

3.05 Operates the S1 and MRP relays to make the trunk busy.

3.06 Transfers first the called and then the calling T, R, and S to the trunk switch and connector circuit for connection to the marker for tests and control of the channel.

3.07 Grounds the JC and SW leads first of the called end appearance and then of the calling end appearance to the trunk switch and connector circuit which cuts-through various leads from the trunk to the marker.

3.08 Establishes the connection between the called and calling customers when the marker releases.

3.09 Operates the PU pick-up relay immediately on calls using code 1 ringing, to avoid delay in starting ringing.

3.10 Delays the start of ringing to the beginning of the first full cycle, for other than code 1 ringing.

3.11 Connects machine ringing to the called line.

3.12 During ring holds connection under control of the calling customer.

3.13 When called customer answers to trip ringing, to release ringing control, ringing combination, and pick-up relays.

3.14 Furnish talking battery and ground to the called and calling customers.

3.15 Indicate, by placing MR potential on the calling end appearance sleeve, that the called customer has answered.

3.16 When either customer disconnects to release both lines and to appear idle to the marker.

3.17 To be made busy for test without interfering with an established call.

4. CONNECTING CIRCUITS

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

- (a) Trunk Switch and Connector Circuit - SD-26383-01.
- (b) Power, Ringing and Tone Distribution Circuit - SD-26414-01.
- (c) Test Circuit - SD-26411-01.
- (d) Message Register Power Supply Circuit - SD-26408-01.
- (e) Traffic Usage Recorder - (Typical) SD-96494-01.
- (f) Auxiliary Coin Circuit - SD-26409-01.

#### 5. MANUFACTURING TEST REQUIREMENTS

5.01 This circuit shall be capable of performing all of the functions listed in this Circuit Description and of 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 circuit for making these trunks busy. When a sleeve-ring shorting plug is inserted, ground through a normal contact of relay TST in the test circuit is passed over lead MB to operate the trunk BSY relay. The BSY operated:

- (a) Removes ground from the FT lead.
- (b) Breaks continuity between leads TG and TT.

- (c) Opens the F relay operate path from lead TF.

If the trunk is in use relay BSY will operate but will not interfere with the call. When either party disconnects releasing relay S1, the ground on the MB lead will maintain BSY operated and as a result the trunk will not appear idle to a marker.

#### SECTION IV - REASONS FOR REISSUE

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

C.1 Changes are made in the test clip data and test set prep. for the CH timing tests.

##### D. Description of Changes

- D.1 The S and CS relay contacts have been removed from the calling and called end S leads, respectively.
- D.2 The S1 contacts have been added to the calling and called end R leads.
- D.3 The coil of the BSY lead is connected directly to the MB lead.
- D.4 The S1 contacts have been added to the FT and TT leads.

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