

## LINE CONCENTRATOR NO. 1A

### TROUBLE ANALYSIS

#### 1. GENERAL

**1.01** This section is reissued for the following reasons:

- (a) To relocate Part 7 information of Section 067-105-502 (Analysis of Trouble Conditions) and revise associated table and Figs.
- (b) To revise trouble chart information (now Table C)
- (c) To make minor changes as required.

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

**Caution:** *Apparatus which is held operated by semipermanent or permanent magnetic properties is used in this system. When the apparatus is used in a test, precautions must be taken to ensure that the proper condition is restored.*

**1.02** Before analyzing a trouble condition, determine where the normal progress of the call has been stopped using the associated sequence chart as an aid. The normal release timing relay (TM1) should not be blocked in the course of trouble location procedures because holding a trouble condition may discharge the remote unit battery in excess of acceptable limits. Therefore, repeated tests should be made and at the same time observe relay operations to determine where circuit operation stops. For sequence chart reference(s), the associated CDs are as follows.

- SD-96536-01, Line Concentrator No. 1A, Control Circuit, 100 line Capacity
- SD-96537-01, Line Concentrator No. 1A, Remote Circuit, 100 Line Capacity
- SD-95957-01, Line Concentrator No. 1A, Remote Circuit, 50 Line Capacity

**1.03** To facilitate trouble analysis, a disconnect call initiation may be required by operation(s) of the DP- relay until the Z2A relay operates. The disconnect call initiation is necessary because three or four trunks are held in cut-through condition by the concentrator trunk load feature. A line with a trouble condition remains connected to a trunk until another call is initiated, or until all lines connected to trunks with higher preference have released. Operation(s) of the DP- relay is required only if the call using the line in trouble has progressed far enough to operate the hold magnets.

**1.04** For a trouble condition, determine:

- Associated group (0 or 1)
- Type of call
- Line(s) associated with trouble condition
- Trunk(s) associated with trouble condition
- Progress of the call
- Cause of the RL1 relay operation.

(a) **To determine the associated group and type of call**, observe which preference relay is operated.

- Operated DP- relay indicates disconnect call
- Operated SRP- relay indicates a service request call
- Operated TP- relay indicates a terminating call
- 0 to 1 after relay designation indicates group 0 or 1 respectively.

(b) **Line(s) associated with the trouble condition** can be determined by observing the SL-, A-, and B- relays.

**SECTION 067-105-301**

- SL- relay operates for terminating call or disconnect call
- A- and B- relays operate for service request call.

(c) **Trunk(s) associated with the trouble condition** can be determined by observing HS-, TB- or TBA- relay.

- HS- or TB- relay operates when a call fails before hold magnet operation
- TBA- relay or hold magnet operates when a call fails after hold magnet operation.

(d) **Progress of call** can be determined by observing the condition of the RK2, CCK, W- and Z relays at the time when normal circuit operation stops and before concentrator release.

- Nonoperated RK2 relay indicates the remote circuit has failed to complete a function (group and class, A- or B- information, or complete a connection).
- Nonoperated CCK relay indicates that the control circuit failed to obtain a check for some function that the control circuit completed.
- Nonoperated W- and/or Z- relay(s) indicate a failure of the control and remote circuits to exchange circuit operation sequence advancing information.

(e) **The cause of RL1 relay premature operation** must be found by determining the reason for normally operated TM1 relay (Timer) release. RL1 relay operation releases the remote circuit. Premature operation of RL1 relay releases the call before full soak of the hold magnet occurs or before operation of the CO- relay occurs.

**1.05** If the trouble condition has not caused a transmission error of signaling information, the line number associated with service request calls (operated A- and B- relays) may be determined by use of Table A.

**1.06** The operated control circuit A- and B- relays and operated remote circuit LA- and LB- relays that should be associated with a specific line number may not agree (Table A). The disagreement may be the result from

- Trouble condition
- Faulty signaling information
- Crossed wiring.

Thus, a customer originated service request call may seize the wrong central office line equipment for dial tone.

**1.07** When wrong central office line equipment is seized, the sleeve relay (SL-) associated with the customer line terminal and the line relay (L-) associated with central office line terminal are not in a cutoff condition. Thus, the customer

**TABLE A**

**OPERATED A-, B- AND LA-, LB- RELAYS TRANSLATION TO ASSOCIATED LINE NUMBER**

GROUP 0					GROUP 1				
OPERATED RELAYS				LINE NUMBER	OPERATED RELAYS				LINE NUMBER
CONTROL CIRCUIT		REMOTE CIRCUIT			CONTROL CIRCUIT		REMOTE CIRCUIT		
A-	B-	LA-	LB-		A-	B-	LA-	LB-	
0	0 thru 8	00	00 thru 08	00 thru 08	0	0 thru 8	06	09 thru 17	50 thru 58
1	0 thru 8	01	00 thru 08	09 thru 17	1	0 thru 8	07	09 thru 17	59 thru 67
2	0 thru 8	02	00 thru 08	18 thru 26	2	0 thru 8	08	09 thru 17	68 thru 76
3	0 thru 8	03	00 thru 08	27 thru 35	3	0 thru 8	09	09 thru 17	77 thru 85
4	0 thru 8	04	00 thru 08	36 thru 44	4	0 thru 8	10	09 thru 17	86 thru 94
5	0 thru 4	05	00 thru 04	45 thru 49	5	0 thru 4	11	09 thru 13	95 thru 99

originating the service request call may receive a terminating call, and the customer associated with the seized central office line equipment may cause a service request call. Either condition causes a double connection.

**1.08** *If required to remove a grounded concentrator trunk conductor* to prevent discharge of a remote unit battery before a trouble condition is cleared, the following procedure is recommended.

- Terminate a test call at the control unit to line 49 or 99 over the trunk with the trouble condition
- Block operated the TB- relay associated with the trunk at the control unit.

## 2. ANALYSIS OF TROUBLE CONDITIONS

**2.01** Table B lists typical effects which may result when calls do not satisfactorily complete. Fig. 1 through 8 show situations listed in Table B. Case 2 in Table B is used to explain table details.

**2.02** For Case 2, listed column headings with detailed information are as follows.

- (a) **Type of Call:** A service request (SR) call originated at the remote circuit (c).
- (b) **Condition(s):** The concentrator circuit condition(s) which leads to a trouble condition is that both the remote and control circuit line terminals were not connected for the previous call. Fig. 1 shows mismatched (noncorresponding) lines connected by a concentrator trunk as the trouble condition.
- (c) **Connected Line Terminals:** Line terminal crosspoints, associated with the line originating the call at the **remote circuit**, are closed; but the closed line terminal crosspoints at the **control circuit** are mismatched with the remote circuit line that originated the call. Lines B and C (Fig. 1) are assigned (working) lines, and have not had crosspoints previously closed, but dial tone is obtained.
- (d) **Connected Concentrator Trunk(s):** One trunk is associated with the trouble condition

(Fig. 1) and connected to mismatched line terminals of the remote and control circuits.

(e) **Result(s):** The immediate results of concentrator circuit condition(s) (b) is that the service request call completes. Thus, the subscriber does not experience service interruption for this specific call.

(f) **Action that Follows and Action Results:**  
The action that follows is directly associated with the action results and specifies the result for the particular call where more than one type of call could follow in an effort to correct a trouble condition.

(1) If a service request call is made from the line connected at the control circuit (Fig. 2), a double trunk connection at the control circuit develops. For Fig. 2, the subscriber associated with line C can originate a service request call since the cutoff relay associated with the remote circuit line terminal is normal. Thus, another trunk is selected and connected to the line terminal associated with line C at the control circuit. The call completes satisfactorily. Crosspoints associated with line C are closed at both remote and control circuits. Lines B and C are separately connected to their associated line terminals at the remote circuit, but line C is connected to two sets of crosspoints at the control circuit. The trouble condition is two concentrator trunks connected at the control circuit to the line terminal used at the control circuit.

(2) If a terminating call to line B is made after the original call, the call completes since the control circuit cutoff relay associated with line C remained normal for the original call. Thus, two trunks connect to the line terminal associated with line B at the remote circuit and one trunk connects separately to line terminals associated with lines B and C at the control circuit.

(3) If a disconnect call follows the original call, the line for disconnection is identified as line C. Thus, the remote circuit cutoff relay associated with line B remains in cutoff condition and further service from line B is denied.

## SECTION 067-105-301

**2.03** The *Action Result(s)* column provides the results of subsequent calls which may not agree with the observed results when a subscriber reports trouble. The following is an example.

(a) Two trunks may be connected to the remote circuit line terminal associated with line B when a terminating call followed the original call. But when the subscriber returned the telephone set handset to normal condition (on-hook), a disconnect is made. Now, if the trunk connecting remote circuit line B and control circuit line C is specified for disconnection first, the trunk disconnects. Since line identification is made at the control circuit, line C is identified and the associated cutoff relays in both remote and control circuits are returned to normal. Also since line C at the remote unit is idle, the associated cutoff relay is normal. Thus, when the disconnect call is made, the cutoff relay condition remains the same. The second trunk

associated with line B at both remote and control circuits, in turn, disconnects.

(b) However, if the trunk associated with line B at both remote and control circuits disconnects first, the remote circuit cutoff relay associated with line B returns to normal. Therefore a service request call originates, caused by the connection of the -48 volt central office battery through the remaining cutoff relay crosspoints and line B relay to -24 volt remote unit battery. The cycle continues as long as the trunk with line B connected at both remote and control circuits is disconnected first. Thus, for one disconnect sequence, the double trunk connection may be observed, while for the other sequence, a double trunk connection is not indicated.

**2.04** *Table C* shows trouble symptoms, their possible causes, and suggested remedies.

**TABLE B**  
**TYPICAL TROUBLE CASES**

CASE	TYPE OF CALL *	CONDITION(S)	CONNECTED LINE TERMINAL(S)		CONNECTED CONCENTRATOR TRUNK(S)		RESULT(S)	ACTION THAT FOLLOWS	ACTION RESULTS
			REMOTE CIRCUIT	CONTROL CIRCUIT	REMOTE	CONTROL			
1	SR	1. Control circuit line terminal not assigned, and 2. Both remote and control circuit line terminals not connected on previous call (Fig. 1).	Call originated	Mismatched	One trunk		1. Control circuit cycles until off-hook signal removed. 2. No trunk closure to corresponding line terminal in control circuit.	_____	_____
2	SR	1. Both remote and control circuit line terminals not connected for previous call (Fig. 1).	Call originated	Mismatched	One trunk		1. Call completes	1. If service request call from control circuit line terminal connected in control circuit (Fig. 2) —	Two concentrator trunks connected at control circuit to line terminal used at control circuit.
								2. If terminating call to line terminal that originated service request call (Fig. 3) —	Two trunks connected at remote circuit to line terminal that originated service request call.
								3. If disconnect call —	Originating service request call line terminal left in cutoff condition.
3	SR	1. Remote circuit line terminal not connected for previous call, but 2. Control circuit line terminal connected for previous call (Fig. 4).	Call originated	Mismatched	One trunk		1. Double trunk connection at control circuit line terminal.	1. If disconnect call made to trunk connected at remote circuit line terminal that originated call —	1. Originating call line terminal left in cutoff condition. 2. Service request call originated by other line terminal causes double trunk connection in both remote and control circuit.
								2. If disconnect call made to trunk used for previous call —	1. Both trunks disconnect. 2. Originating call line terminal left in cutoff condition.
								3. If terminating call to originating call line terminal (Fig. 5).	Two trunks connected to each line terminal (three trunks involved with one trunk shared).
4	SR	1. Trunk used for call not connected for previous call (Fig. 6).	Matched (but, not connected to same trunk as selected by control circuit.)	Call originated	Mismatched with trunk selected by control circuit	Trunk selected by control circuit	1. Both trunks held connected. 2. Trunk connected at remote circuit cannot be identified by control circuit for disconnection. 3. Trunk connected at control circuit held busy due to -48 volt central battery through TS-relay to remote unit -24 volt battery through remote circuit off-normal contact.	1. If terminating call originated using trunk connected at remote circuit —	Terminating call connects to different line terminal than one associated with trouble condition.
								2. If subscriber originates service request call at remote circuit using line terminal with connected trunk —	1. No dial tone. 2. Service request call completion not possible due to connected trunk.

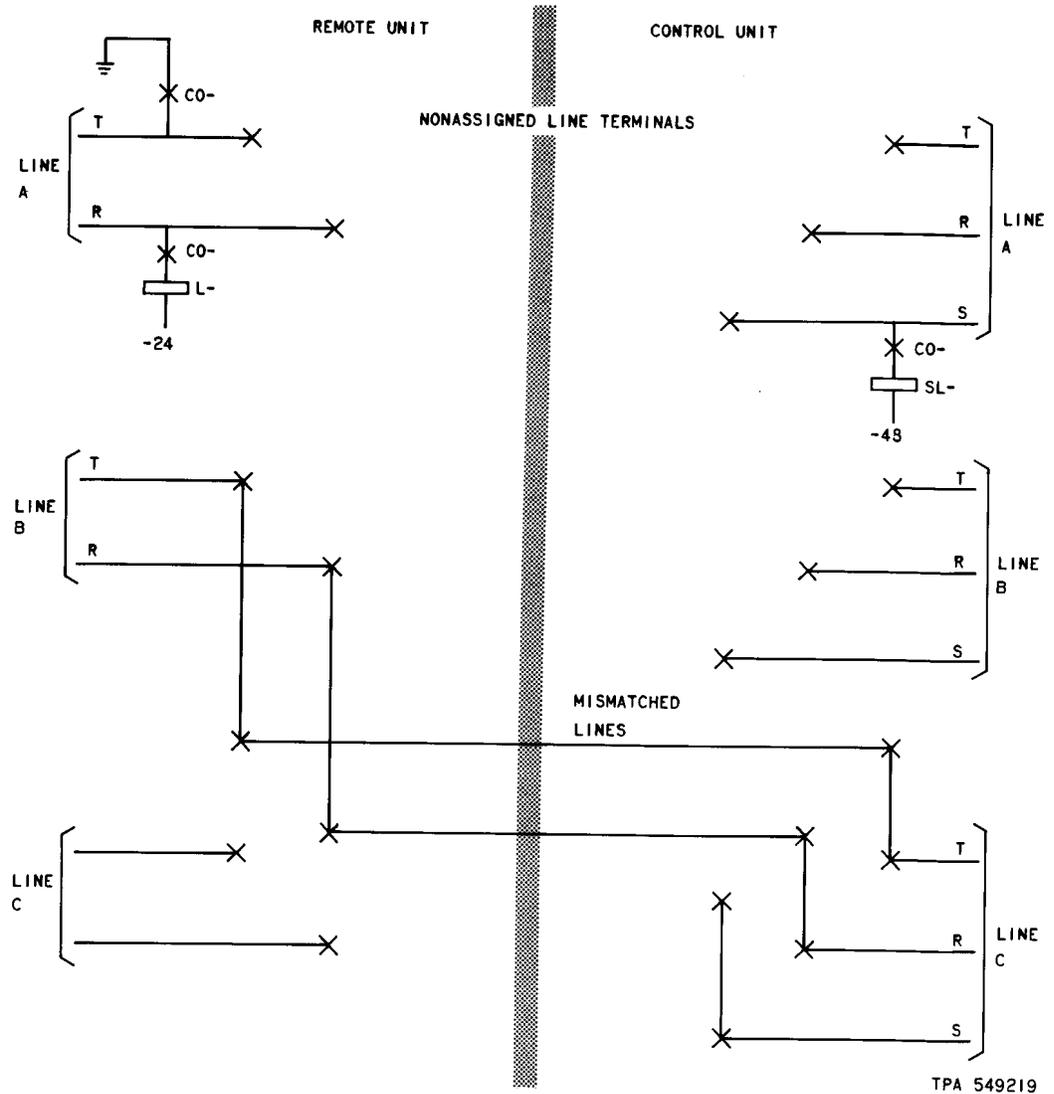
TABLE B (Cont)  
TYPICAL TROUBLE CASES

CASE	TYPE OF CALL *	CONDITION(S)	CONNECTED LINE TERMINAL(S)		CONNECTED CONCENTRATOR TRUNK(S)		RESULT(S)	ACTION THAT FOLLOWS	ACTION RESULTS
			REMOTE CIRCUIT	CONTROL CIRCUIT	REMOTE	CONTROL			
5	SR	Connection at remote circuit to a trunk not selected for use by control circuit.	Matched (but, already connected to trunk)	Call originated	Mismatched with trunk selected by control circuit	Trunk selected by control circuit	<ol style="list-style-type: none"> <li>No dial tone.</li> <li>Trunk selected by control circuit remains busy (Case 4).</li> <li>Control circuit line terminal cutoff but no line closure at remote circuit.</li> </ol>	_____	_____
6	TC	Control and remote circuit line terminals not used on previous call (Fig. 1).	Mismatched	Call originated	One trunk		<ol style="list-style-type: none"> <li>Subscriber reached does not correspond to number dialed.</li> </ol>	1. If service request call from originating call line terminal (Fig. 2) —	Double line connection at control circuit.
								2. If terminating call to remote circuit line terminal (Fig. 3) —	Double line connection at remote circuit.
								3. If disconnect call —	Remote circuit line terminal left cutoff.
7	TC	Line terminal to trunk connection exists (in normal use) at remote circuit when another call is made to remote circuit line terminal in use (Fig. 7).	Matched	Call originated	One trunk		<ol style="list-style-type: none"> <li>Subscriber reached does not correspond to number dialed.</li> <li>Double line connection at remote circuit.</li> </ol>	1. If disconnect call on trunk connected to control line terminal that originated call —	Both trunks disconnect.
								2. If disconnect call on trunk used for previous call —	When remote circuit line terminal released, service request call originates due to central office battery through other trunks; cycle continues.
								3. If service request call originates from originating call line terminal (Fig. 8) —	Two trunks connected to each line terminal (three trunks involved with one trunk shared).
8	TC	Trunk used for call not connected for previous call (Fig. 6).	Matched	Call originated	Mismatched (second trunk connected)	First trunk selected by control circuit	<ol style="list-style-type: none"> <li>Called subscriber not reached.</li> <li>Audible ringing may or may not be tripped.</li> <li>Trunk connected to remote circuit can not be identified by control circuit for disconnection.</li> <li>Trunk connected to control circuit remains busy due to —48 volt central office battery through TS- relay to remote unit —24 volt battery through remote circuit off-normal contact.</li> </ol>	Same as for case 4.	

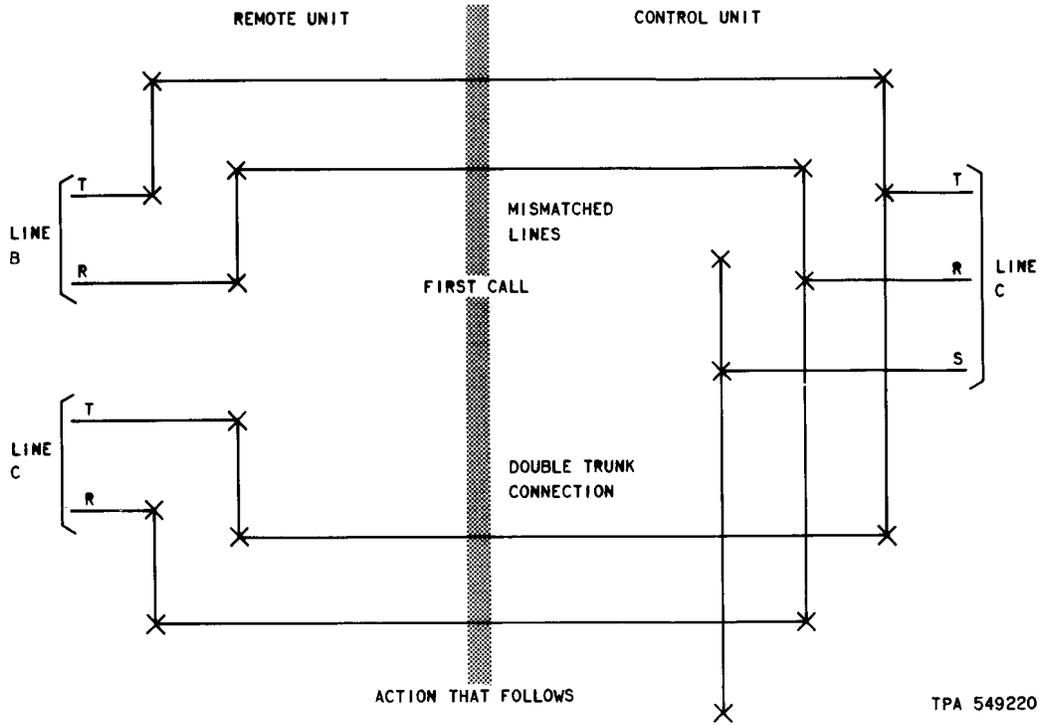
**TABLE B (Cont)**  
**TYPICAL TROUBLE CASES**

CASE	TYPE OF CALL *	CONDITION(S)	CONNECTED LINE TERMINAL(S)		CONNECTED CONCENTRATOR TRUNK(S)		RESULT(S)	ACTION THAT FOLLOWS	ACTION RESULTS
			REMOTE CIRCUIT	CONTROL CIRCUIT	REMOTE	CONTROL			
9	TC	Connection to trunk at remote circuit.	Matched	Call originated	Mismatched with trunk selected by control circuit	Trunk selected by control circuit	<ol style="list-style-type: none"> <li>1. Called subscriber not reached.</li> <li>2. Audible ringing may or may not be tripped.</li> <li>3. Trunk selected by control circuit remains busy (Case 8).</li> <li>4. Control circuit line terminal cutoff but no line closure at remote circuit.</li> </ol>	_____	_____
10	SR or TC	No trunk connection to remote or control line terminals used for call.	To line terminals not associated with line used to originate service request or terminating call.		Trunk selected by control circuit		<ol style="list-style-type: none"> <li>1. Any trunk can connect to line terminal not associated with call.</li> <li>2. Trunks connected to other line terminals as they disconnect.</li> </ol>	_____	_____
11	SR	_____	Mismatched	Call originated	One trunk		<ol style="list-style-type: none"> <li>1. Any selected trunk (one) connects matched line terminals.</li> <li>2. Other trunks can connect line terminals as disconnect calls are made.</li> </ol>	_____	_____
12	TC	_____	Call originated	Mismatched	One trunk		<ol style="list-style-type: none"> <li>1. All trunks, when available, can connect matched line terminals because line requesting service not cutoff.</li> </ol>	_____	_____
13	DC	No trunk connection to corresponding remote circuit line terminal.	Mismatched	Line terminal requiring disconnection	One trunk		<ol style="list-style-type: none"> <li>1. Remote circuit line terminal left in cutoff condition which corresponds to line terminal requiring disconnection.</li> </ol>	_____	_____
14	DC	Trunk connection to remote circuit line terminal used for call.	Line terminal requiring disconnection	Mismatched	One trunk		<ol style="list-style-type: none"> <li>1. Remote circuit line terminal requiring disconnection left in cutoff condition.</li> <li>2. Remote circuit line terminal used for call returned to cut-through condition, thus causing service request call and double line connection at both remote and control line terminals (Fig. 8).</li> </ol>	_____	_____

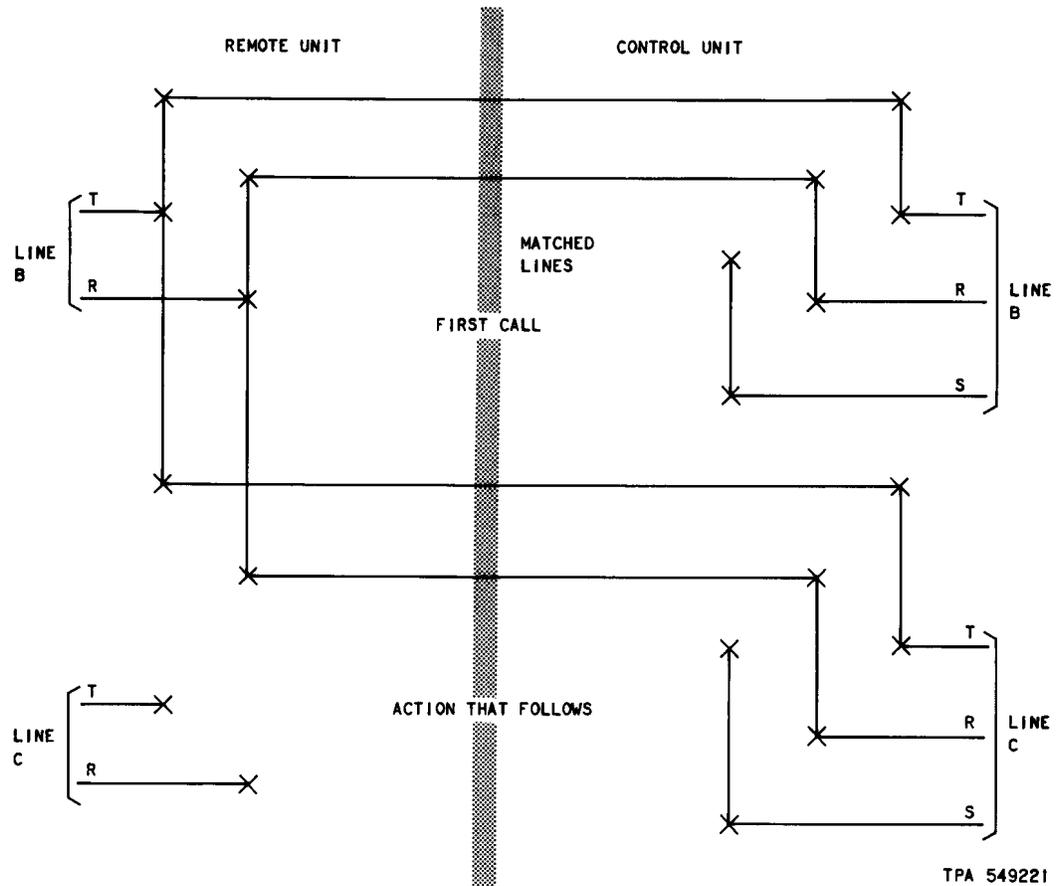
\* SR Service Request Call  
 TC Terminal Call  
 DC Disconnect Call



**Fig. 1—Trouble Condition: Because Nonassigned Line Terminals, and Both Remote and Control Line Terminals Not Connected on Previous Call**



**Fig. 2—Trouble Condition: Because Both Remote and Control Circuit Line Terminals Not Connected On Previous Call When Service Request Call Originated at Remote Circuit Line Terminal Connected to Control Circuit**



**Fig. 3—Trouble Condition: Because Both Remote and Control Line Terminals Not Connected For Previous Call When A Terminating Call is Made To Line Terminal That Originated Service Request Call**

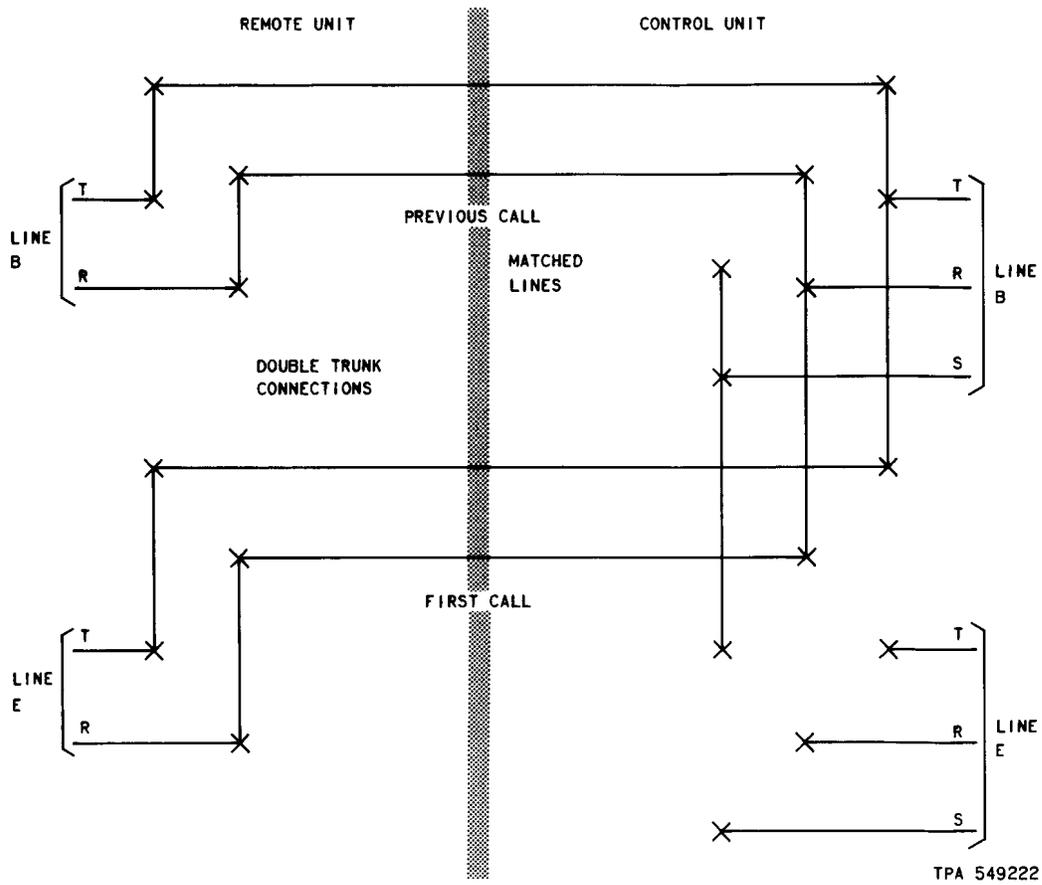
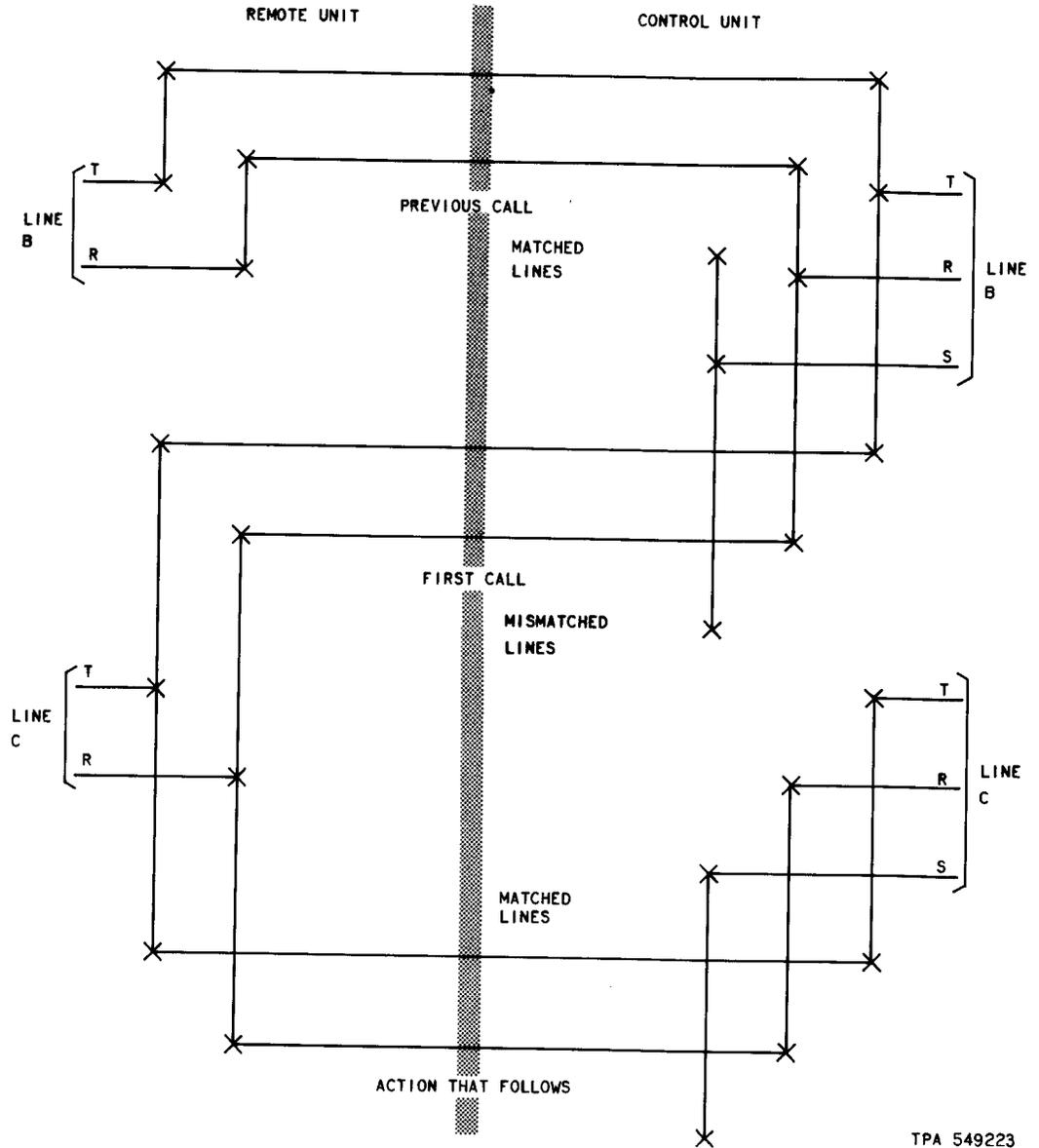
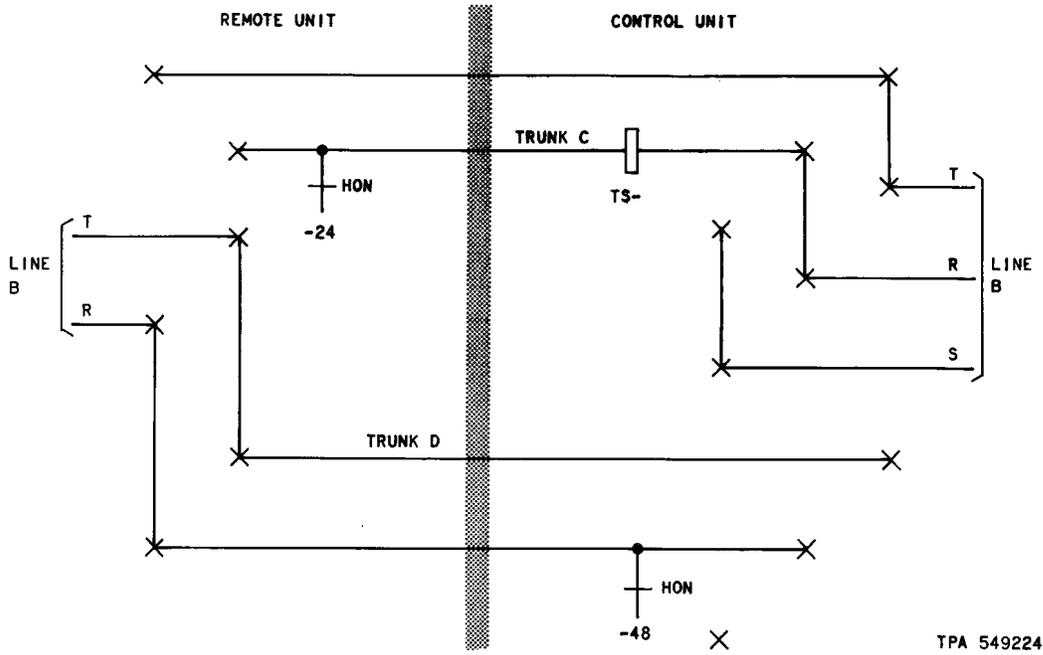


Fig. 4—Trouble Condition: Because Remote Circuit Line Terminal Used For Call Not Connected On Previous Call But Control Circuit Line Terminal Connected On Previous Call



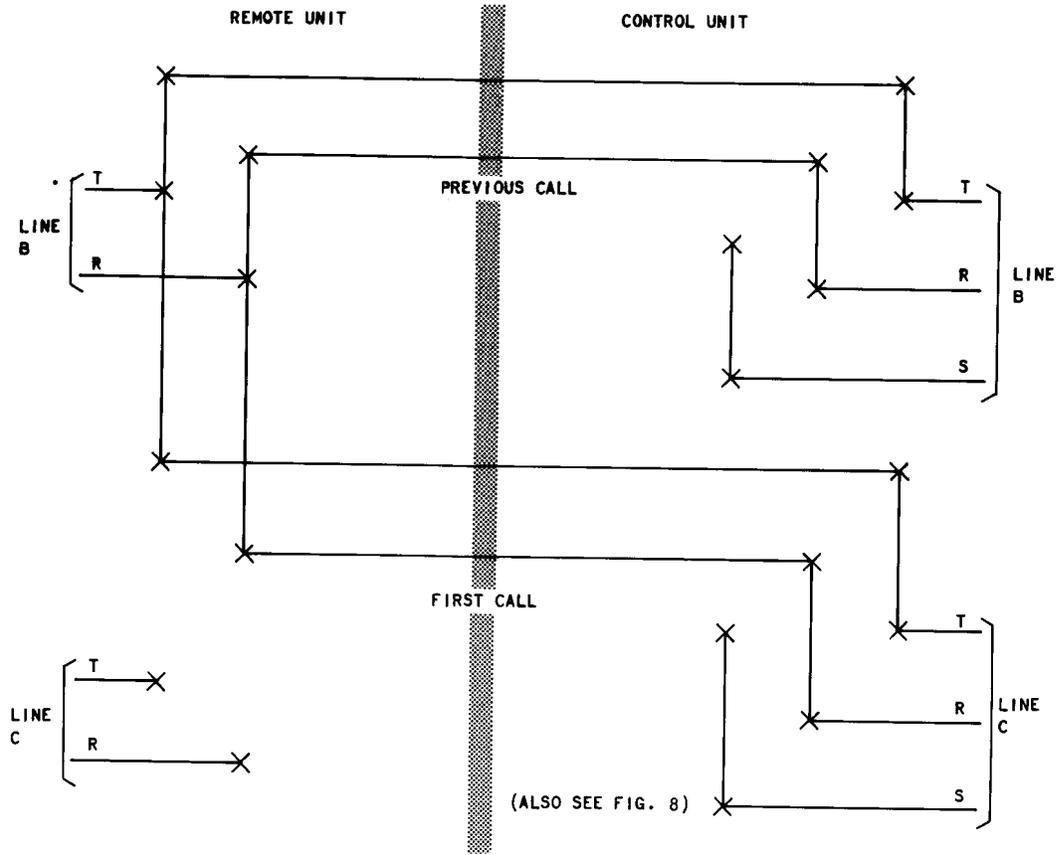
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**Fig. 5—Trouble Condition: Because Terminating Call To Originating Call Line Terminal When Remote Line Terminal Not Connected On Previous Call But Control Circuit Line Terminal Connected On Previous Call**



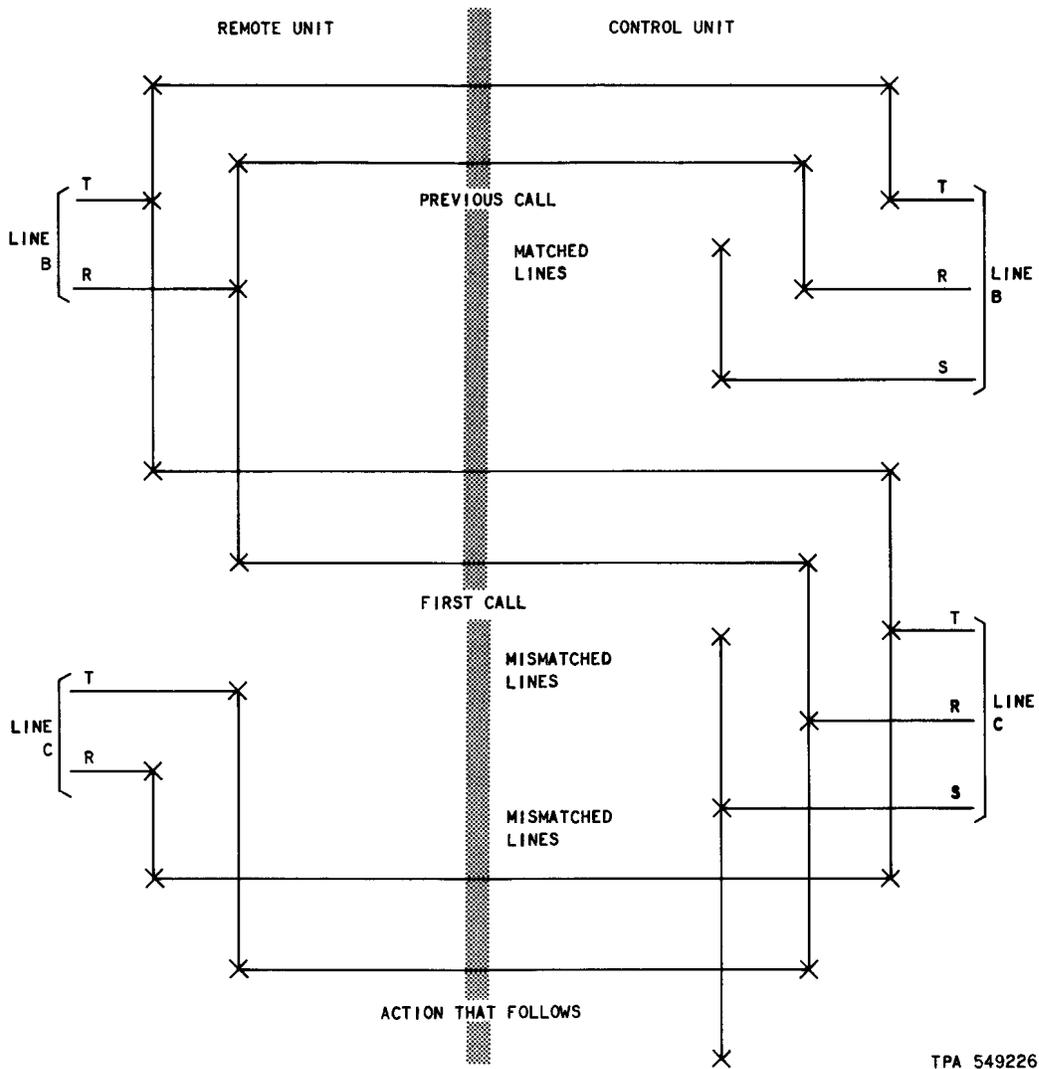
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Fig. 6—Trouble Condition: When Trunk Used For Call Not Connected On Previous Call



TPA 549225

**Fig. 7—Trouble Condition: Because Line Terminal To Trunk Connection In Normal Use When Another Call Made To Remote Circuit Line Terminal**



TPA 549226

**Fig. 8—Trouble Condition: Because Service Request Call From Control Circuit Line Terminal When Matched Line Terminals Are Connected In Use**

**TABLE C**  
**SYMPTOMS, CAUSES, AND SUGGESTED REMEDIES**

TROUBLE SYMPTOM	POSSIBLE CAUSE	SUGGESTED REMEDY
No Dial Tone	1. Failure of central office equipment.	1. Refer to trouble record or office trouble indicating facilities.
	2. Failure of concentrator trunk due to: (a) Foreign matter between hold magnet core and armature. (b) Open crosspoints on cross-bar switch. (c) Open or crossed cable pair on either line or trunk. (d) Insulated relay contacts in talking path.	1. Isolate faulty trunk in accordance with 1.04 and check causes (a) through (d).
	3. Crossed terminals on A- or B-relay causing release of wrong CO- relay. (The customer associated with the falsely released CO- relay is left in a cut off condition.)	1. To remove a falsely released CO-relay and cut-off condition — (1) Connect positive terminal of 4.5 volt battery to ground at remote unit, and (2) Momentarily connect negative voltage to terminal 1 of associated relay. 2. Check associated terminals for crosses.
	4. Connection to unassigned central office line due to improper signaling information received by control unit. (A disconnect call which follows such a connection leaves the line at the remote circuit in a cut-off condition.)	1. To remove the customer cut-off condition — (a) Connect positive terminal of 4.5 volt battery to ground at remote unit, and (b) Momentarily connect negative voltage to terminal 1 of associated CO- relay. 2. <b>Note:</b> Improper signaling information can be caused by (a) through (f). Check for: (a) Defective signal relay (s). (b) Insulated LA- or LB- relay contacts, or other relay contacts in the signaling relay operating path. (c) AC interference — perform Interference on Signal Leads Test in Section 067-105-502 and refer to SD-96556-01 for circuit modification information as appropriate.

**TABLE C (Cont)**  
**SYMPTOMS, CAUSES, AND SUGGESTED REMEDIES**

TROUBLE SYMPTOM	POSSIBLE CAUSE	SUGGESTED REMEDY
No Dial Tone (Cont)		<p>(d) High resistance ground, less than 30,000 ohms, or cross on signal leads.</p> <p>(e) False identification of the line due to false operation of LA- or LB- relay. (For example, a false ground on an SL- resistor in the control circuit, or a L- resistor in the remote circuits.)</p> <p>(f) Improper registration of signaling information (Wrong A- or B- relay registered).</p>
	5. Connection to a mismatched central office line due to improper signaling information received by control circuit. (A disconnect call which follows such a connection leaves the line at the remote circuit in a cut-off condition.)	1. Refer to Cause 4 Suggested Remedy.
	6. Connection of central office line to a mismatched remote circuit line due to improper signaling information received by the remote circuit for terminating call. (A disconnect call which follows such a connection may leave the remote line in a cut-off condition.)	1. Refer to Cause 4 Suggested Remedy.
	7. Low remote circuit battery voltage. (Low battery voltage usually causes trouble on several lines.)	1. Perform Measuring Remote Unit Battery Voltage Test in Section 067-105-502. High charge or replace battery as appropriate.
	8. All concentrator trunks busy or all central office trunks busy.	1. To confirm, inspect all TB- relays. No further concentrator trouble locating action required.
	9. CO- relay in the remote circuit failed to operate for a disconnect call.	1. Refer to Cause 4 Suggested Remedy.

**TABLE C (Cont)**  
**SYMPTOMS, CAUSES, AND SUGGESTED REMEDIES**

TROUBLE SYMPTOM	POSSIBLE CAUSE	SUGGESTED REMEDY
Dial Tone Received But Number Cannot Be Dialed	1. Failure of CO- relay to release in either control or remote circuit. (The terminating or service request call which follows such a CO- relay failure causes a double connection and the customer cannot dial.)	1. To release CO- relays — (a) Connect positive terminal of 4.5 volt battery to ground on the remote unit, and (b) Momentarily connect negative voltage to terminal 1 on the associated relay.
	2. False battery on tip or ring of the cable pair, crossbar switches, cross connections or relay contacts.	1. Refer to central office testing facility.
	3. Two trunks connected to dialing line and only one trunk connected at the other end.	1. Initiate terminating calls for both associated trunks.
Terminating Call Cannot Be Made	1. CO- relay in the control circuit is in the released condition when a terminating call is attempted.	1. Refer to Cause 4 Suggested Remedy 2 for No Dial Tone.
	2. Sleeve lead open from central office line equipment to control unit.	1. Check SL- lead between CO equipment and control unit, repair or replace as required.
	3. Failure of central office equipment.	1. Refer to trouble record or office trouble indicating facilities.
	4. Low battery voltage.	1. High charge or replace battery, as appropriate.
	5. All concentrator trunks busy or all central office trunks busy.	1. Inspect all TB- relays and central office trunk busy indicating features.
	6. Failure of CO- relay in control unit to operate on disconnect call.	1. Refer to Cause 4 Suggested Remedy 2 for No Dial Tone.
Wrong Subscriber Reached on terminating Call	1. Subscriber connected to wrong line at remote circuit.	1. Refer to Cause 4 Suggested Remedy 2 for No Dial Tone.
	2. Central office line equipment connected to wrong line at control circuit.	1. Refer to Cause 4 Suggested Remedy 2 for No Dial Tone.
	3. Tip and ring leads reversed.	1. Trace and reverse leads as required.
	4. Interference on signaling leads, causing wrong signaling information to be sent.	1. Refer to SD-96536-01 and SD-96537-01 or SD-95957-01 for information on increased ac voltage working limits of signal circuits.

TABLE C (Cont)

## SYMPTOMS, CAUSES, AND SUGGESTED REMEDIES

TROUBLE SYMPTOM	POSSIBLE CAUSE	SUGGESTED REMEDY
Ringing Cannot Be Tripped	1. Sleeve not connected to same line as tip and ring leads in control unit.	1. Trace SL- lead between CO equipment and control unit, repair or replace as required.
	2. Open tip or ring lead.	1. Trace and repair as required.
Several or All Trunks Connected to One Line	1. Failure of SL- relay in the control circuit or L- relay in the remote circuit to release on a terminating call or service call, respectively. (When either failure occurs, all available trunks will connect to the line.)	1. Repeat origination of terminating call until all trunks released. 2. Trace associated SL-/L- relay operating path for faulty lead or contact(s).
	2. Manual operation of SL- relay for too long an interval.	1. Reduce interval for manual test operation of SL- relay.
	3. Test operation of CO- relay with 4.5 volt battery while call is in progress on that line.	1. Reidentify line under test.
	4. Manually holding CO- relay operated with 4.5 volt battery for more than length of one call when remote subscriber subset is ROH condition or sleeve lead is grounded at control circuit.	1. Suspend testing effort until service call by subscriber is complete. 2. Check for grounded SL- lead between CO equipment and control unit.
	5. Connection to mismatched line because of improper signaling information while a call is in progress on that line. (Subsequent calls may cause double connections.)	1. Refer to Cause 4 Suggested Remedy for No Dial Tone.
	6. Failure of CO- relay to release when a call is set up.	1. To release CO- relay(s) — (a) Connect positive terminal of 4.5 volt battery to ground, and (b) Momentarily connect negative voltage to terminal 1 of associated relay.
Several Lines Connected to One Trunk	1. Operation of two or more line select magnets simultaneously.	1. Trace associated select magnets operating paths for multicross.
	2. When a subscriber line is connected to two trunks, the trunk connected in the remote circuit will test idle in the control circuit.	1. Initiation of another service request call may select the trunk.
Showering	1. Double trunk connection.	1. Originate terminating call for both associated trunks.

TABLE C (Cont)

## SYMPTOMS, CAUSES, AND SUGGESTED REMEDIES

TROUBLE SYMPTOM	POSSIBLE CAUSE	SUGGESTED REMEDY
Showering (Cont)	2. High resistance ground on the ring lead of subscriber line.	1. Trace subscriber line for HRG, replace as required.
	3. Low leakage resistance between tip and ring on subscriber side of remote circuit.	1. Check subscriber line and tel set for required resistance, replace as required.
	4. Tip or ring not connected at one circuit and call originated at other end.	1. Refer to CO testing facilities.
	5. Open tip or ring on trunk when all other trunks busy or trunk with open lead (s) is the preferred trunk.	1. Block associated TB- relay operated and repair as required.
Alarm Signals	1. All alarm signals will sound if a call is not completed within a specified time.	1. Isolate faulty circuit in accordance with 1.04.
	2. CAL (control) alarm sounds when control circuit fails to receive a control circuit function check. (Indicated by CCK relay in wrong condition when time-out occurs.)	1. Refer to Cause 4 Suggested Remedy 2 for No Dial Tone.
	3. RAL (remote) alarm sounds when control circuit fails to receive a remote circuit check signal. (Indicated by RK2 relay in wrong condition when time-out occurs.)	1. Refer to Cause 4 Suggested Remedy 2 for No Dial Tone.
	4. RAL (remote) alarm sounds when the remote circuit CHG fuse operates. (CF relay in control circuit also operates.)	1. Check charging circuit at remote unit for faulty CF2 diode and grounded concentrator trunk ring conductors, (1.08).
	5. SAL alarm sounds when a signal fails to be sent or received. (The RK2 and CCK relays will be in the same operated or released condition.)	1. Refer to Cause 4 Suggested Remedy 2 for No Dial Tone.
	6. FA alarm sounds when a fuse operates.	<i>Note:</i> Since the circuit is arranged to release when a trouble occurs with only the alarm relay locked operated, recurring troubles are required or duplicate the trouble by using test calls to locate and clear the trouble. Also, since an occasional alarm

TABLE C (Cont)

SYMPTOMS, CAUSES, AND SUGGESTED REMEDIES

TROUBLE SYMPTOM	POSSIBLE CAUSE	SUGGESTED REMEDY
Alarm Signals (Cont)		can be caused by interference with signaling, both man made and electrical, the testing effort required to assure that all lines and trunks are working properly does not seem advisable unless the alarm continues to sound.