

LINE CONCENTRATOR NO. 1A

TROUBLE ANALYSIS

1.00 GENERAL

1.01 This section is one of a group of sections pertaining to line concentrator No. 1A. It outlines possible troubles and trouble causes experienced with the concentrator system.

1.02 This section is reissued to include further information gained by field experience. Due to extensive changes, marginal arrows have been omitted.



Apparatus which is held operated by semipermanent or permanent magnetic properties is used in this system. Precautions must be taken to ensure that when this apparatus is used in a test, it is returned to proper condition.

1.03 When trouble is experienced, it is necessary to determine where normal progress has stopped. Sequence charts (SCs) show the normal progress of a call. Normal release timing (TMI) should not be blocked since holding a trouble condition may discharge the remote battery beyond the limits stated in the schematic drawing (SD). Therefore, repeated tests should be made and relay operation observed to ascertain where normal circuit operation stops.

1.04 In order to facilitate trouble analysis, it may be necessary to initiate a disconnect call by operating the *DP-* relay until the *Z2A* relay operates. This causes a disconnect call to be made. This is necessary since three or four trunks are held in a cut-through condition by the trunk

load control feature, and a line in trouble would not be released until another call is initiated (two additional calls if only three trunks are in a cut-through condition). The line in trouble will not release until all lines connected to trunks having higher preference release. The *DP-* relay need be operated only if the call on the line in trouble has progressed far enough to operate hold magnets.

1.05 When a trouble condition occurs, it is necessary to determine the following:

1. The Group and Type of Call

This can be determined by observing which preference relay is operated. The *DP-*, *SRP-*, or *TP-* relay indicates disconnect, service request, or terminating call, respectively. The 0 or 1 after these relays indicates Group 0 or 1, respectively.

2. The Line or Lines Causing the Trouble Condition

This can be determined by observing which *SL-* relay operates on terminating or disconnect calls and which *A* and *B* relays operate on service request calls. In the latter case, using the chart on D6 of SD-96536-01 and observing the group from the previous step, the line number for service request calls can be obtained, provided there is no error in transmission of information. It must be remembered that the possibility exists that the *LA-* and *LB-* relays of the remote circuits and the *A* and *B* relays of the control circuits may not agree because of trouble, incorrect signaling or wiring, or

crosses. If this condition is suspected, a man will be required at each location. This condition can cause a subscriber, originating a service request call, to seize the wrong central office line equipment to obtain dial tone. When this happens, the sleeve relay *SL*- corresponding to the line terminal of the subscriber originating the service request, and the line *L*- relay corresponding to the line terminal of the line equipment seized will not be in a cutoff condition. Under these conditions, it is possible for the originator of the service request to receive a terminating call, and for the subscriber corresponding to the seized central office line equipment to place a service request call. If either of these events occur, it will cause a double connection.

3. The Trunk or Trunks Used on the Trouble Condition

This can be determined by observing which *HS*- or *TB*- relay operates when a call fails before hold magnet operation, or by observing which *TBA*- relay or hold magnet operates after hold magnet operation occurs.

4. The Progress of the Call

This can be determined by observing the condition of the *RK2*, *CCK*, *W*-, and *Z*- relays at the point of cessation of normal circuit operation and prior to concentrator release.

5. The Cause of Operation of the *RL1* Relay

This must be determined in those cases which cause premature operation of the *RL1*

relay, thereby releasing the call before full soak of the hold magnet or operation of the *CO*- relay occurs.

1.06 Location of Trouble

By observing which lines or trunks fail to complete calls, it is possible to determine if the trouble is associated with a particular line, *LA*- group, *LB*- group, trunk, or any combination of these items. This will allow concentration of trouble clearing effort to one portion of the concentrator, and test calls can be made using the line(s), *LA*- group, *LB*- group, or trunk(s) causing the trouble condition. Some possible troubles, and causes, are shown in 1.07. When a test call has been made on a line or trunk known to be in trouble, and the last sequence relay to operate has been determined, the sequence charts (SCs) for the type of call involved should be consulted to determine the succeeding concentrator operations to be expected. If the *RK2* relay is not in the proper condition (operated or nonoperated), it will be necessary to have personnel at the remote location to determine which relay, or which hold or select magnet, failed to operate in the remote circuit. If the *CCK* relay is in the wrong condition, the sequence charts (SCs) should be consulted to determine which relay, or which hold or select magnet failed to operate in the control circuit. In either case, functional schematics (FSs) should be consulted to determine the correct operate or release path of the equipment that failed to function correctly.

1.07 Troubles and Trouble Causes

Some possible troubles and their causes are listed in the following table.

Trouble	Possible Cause
<p>No Dial Tone</p> 	<ol style="list-style-type: none"> 1. Failure of central office equipment. 2. Failure of a talking trunk due to: <ol style="list-style-type: none"> (a) Foreign matter between hold magnet core and armature. (b) Open crosspoints on crossbar switch. (c) Open or crossed cable pairs on either line or trunk. (d) Insulated relay contacts in talking path. 3. Crossed terminals on A or BA relay, thereby causing the release of the wrong CO- relay. The customer associated with the falsely released CO- relay will be left in a cutoff condition. 4. Connection to unassigned line in central office because of improper signal information received by control circuit. A disconnect call following such a connection will leave the line in the remote circuit in a cutoff condition. 5. Connection to wrong central office line because of improper signal information received by control circuit. A disconnect call following such a connection will leave the remote circuit in a cutoff condition.

Trouble	Possible Cause
<p>No Dial Tone</p> 	<ol style="list-style-type: none"> 6. Connection of a central office line terminal to a wrong remote line terminal because of improper signal information received by the remote unit on a terminating call. A disconnect call following such a connection may leave the remote line in a cutoff condition. <p><i>Note: Improper signal information may be caused by:</i></p> <ol style="list-style-type: none"> (a) Defective signal relays. (b) Insulated relay contacts of the LA- or LB- relays or any relay in the operating paths of the signal relays. (c) AC interference, cable capacity, or high resistance ground less than 30,000 ohms or cross on signal leads. (d) False identification of line due to false operation of LA- or LB- relays. An example is a false ground on an SL- resistor in the control circuit or an L- resistor in the remote circuit. (e) Improper registration of signal information. (Wrong A- or B- relay registered is an example.)

Trouble	Possible Cause
<p>No Dial Tone</p> 	<ol style="list-style-type: none"> 7. Low battery voltage in remote circuit. When battery voltage is low, trouble will usually be experienced on several lines. 8. All concentrator trunks busy or all central office trunks busy. 9. <i>CO-</i> relay in remote unit may fail to operate on a disconnect call.
<p>Dial Tone Received But Number Cannot Be Dialed</p> 	<ol style="list-style-type: none"> 1. Failure of <i>CO-</i> relay to release in either the control or remote unit. A terminating or service request call following such a <i>CO-</i> relay failure will cause a double connection, and the customer will be unable to dial. 2. False potential on tip or ring in cable pairs, crossbar switches, cross connections, or relay contacts. 3. Two trunks connected to dialing line at one end and only one trunk connected at other end.
<p>Terminating Call Cannot Be Made</p>	<ol style="list-style-type: none"> 1. <i>CO-</i> relay in control circuit is in released condition when terminating call is attempted (see items 3 and 6 of No Dial Tone).

Trouble	Possible Cause
<p>Terminating Call Cannot Be Made</p> 	<ol style="list-style-type: none"> 2. Sleeve lead open from central office line equipment to control unit. 3. Failure of central office equipment. 4. Low battery voltage (see item 7 of No Dial Tone). 5. All concentrator trunks busy or all central office trunks busy. 6. Failure of <i>CO-</i> relay in control unit to operate on disconnect call.
<p>Wrong Customer Reached On Terminating Call</p> 	<ol style="list-style-type: none"> 1. Customer connected to wrong line terminal at remote unit. 2. Central office line equipment connected to wrong line terminal at control unit (see item 6 of No Dial Tone). 3. Tip and ring leads reversed. 4. Interference on signaling leads, causing wrong signals to be sent. (See note under item 6 of No Dial Tone.)
<p>Ringing Cannot Be Tripped (See Several Lines Connected to One Trunk)</p>	<ol style="list-style-type: none"> 1. Sleeve not connected to same line terminal as <i>T</i> and <i>R</i> leads in control unit. 2. Open <i>T</i> or <i>R</i> lead. (See item 2 of No Dial Tone.)

Trouble	Possible Cause
Several or All Trunks Connected to One Line ↓	<ol style="list-style-type: none"> 1. Failure of <i>SL-</i> relay in control unit or <i>L-</i> relay in remote unit to release on a terminating call or service request call respectively. When this condition exists, all available trunks will be connected to this line. 2. Manual operation of <i>SL-</i> relay for too long an interval. 3. Test operation of <i>CO-</i> relay with 4.5-volt battery while call is in progress on that line. 4. Manually holding <i>CO-</i> relay operated with 4.5-volt battery for more than length of one call when remote customer's <i>subset</i> is in off-hook condition or sleeve lead is grounded at control unit. 5. Connection to a wrong line circuit because of improper signal information while a call is in progress on that line. Subsequent calls may cause double connections. (See Systems Tests.) 6. Failure of <i>CO-</i> relay to release when a call is set up.
Several Lines Connected to One Trunk ↓	<ol style="list-style-type: none"> 1. Operation of two or more line select magnets simultaneously. 2. When a customer is connected to two different trunks because of trouble the trunk connected in the remote circuit will not test busy in the control circuit. Another customer may therefore select this trunk.

Trouble	Possible Cause
Showering ↓	<ol style="list-style-type: none"> 1. Double trunk connection. 2. High resistance ground on ring lead of customer's line. 3. Low leakage resistance between tip and ring on customer's side of remote unit. 4. Tip or ring not connected at one unit and call originated at other end. 5. Open tip or ring on trunk with all other trunks busy or trunk with open leads is the preferred trunk.
Alarm Signals ↓	<ol style="list-style-type: none"> 1. All alarm signals will occur if a call is not completed within a specified time. 2. CAL (control) alarm occurs when control circuit fails to receive a check of the control circuit function. This will be indicated by the CCK relay being in wrong condition when time out occurs. 3. RAL (remote) alarm occurs when the control circuit fails to receive a check signal from the remote circuit. This will be indicated by the <i>RK2</i> relay being in the wrong condition when time out occurs.

Trouble	Possible Cause
Alarm Signals 	<p>4. RAL (remote) alarm occurs when the CHG fuse in the remote unit operates; <i>CF</i> relay in control unit operates in addition to the <i>RAL</i> relay.</p> <p>5. SAL alarm occurs when a signal fails to be sent or received. The <i>RK2</i> and <i>CCK</i> relays will be in the same condition (operated or released).</p> <p>6. FA alarm occurs when a fuse operates in the control unit. <i>Note:</i> Since the circuit is arranged to release when a trouble condition occurs with only the alarm relays locked operated, it will be necessary to have recurring troubles or duplicate the trouble by using test calls (see Systems Tests) to locate and clear the trouble. Since an occasional alarm can be caused by interference with signaling, both manmade and electrical, the testing effort necessary to assure that all lines and trunks are working properly does not seem advisable unless alarms continue to occur.</p>