LINE CONCENTRATOR NO. 1A

WITH MF SIGNALING

TROUBLE ANALYSIS

OPERATING METHODS

1. GENERAL

1.01 This section is reissued to incorporate a method of removing a grounded trunk conductor.

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.

1.02 Before attempting to analyze a trouble condition it is necessary to determine where the normal progress of the call has stopped. Sequence charts show the normal progress of a call. The normal release timing (TM1) relay should not be blocked since holding a trouble condition may discharge the remote battery beyond the limits stated in the schematic drawing. Therefore, repeated tests should be made and relay operations observed to determine where circuit operation stops.

1.03 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 is necessary since three or four trunks are held in a cut-through condition by the trunk load control feature. A line with a trouble condition will not be released until another call is initiated or until all lines connected to trunks having higher preference release. Operation of the DP- relay is required only if the call on the line in trouble has progressed far enough to operate the hold magnets.

1.04 When a trouble condition occurs, it is necessary to determine the group and type of call, the line or lines causing the trouble condition, the trunk or trunks used on the trouble condition, the progress of the call, and the cause of operation of the RL1 relay.

1.05 ***To determine the group and type of call*** observe which preference relay is operated. An operated DP- relay indicates disconnect, an operated SRP- relay indicates a service request, and an operated TP- relay indicates a terminating call. The 0 or 1 after the relay designation indicates group 0 or 1, respectively.

1.06 ***The line or lines causing the trouble condition*** can be determined by observing the SL, A, and B relays. The SL- relay operates on terminating or disconnect calls. The A and B relays operate on service request calls.

1.07 If there is no error in the transmission of information, the line number for service request calls (A and B relays) can be obtained by using the table in note 312 of SD-96536-01 and observing the group associated with the call. The group was determined in 1.05.

1.08 The possibility exists that the LA- and LB- relays of the remote circuits and the A and B relays of the control circuit may not agree. This disagreement may be due to the trouble condition itself, incorrect signaling, or crossed wiring. This disagreement can cause a customer originating a service request call to seize the wrong central office line equipment to obtain dial tone.

1.09 When the wrong central office line equipment is seized the sleeve (SL-) relay associated with the customer line terminal and the line (L-) relay associated with the central office line terminal will not be in a cutoff condition. Under these conditions, it is possible for the customer originating the service request call to receive a terminating call, and for the customer associated with the seized central office

line equipment to place a service request call. The occurrence of either of these events will cause a double connection.

1.10 ***The trunk or trunks used on the trouble condition*** can be determined by observing which HS- or TB- relay operates when a call fails before hold magnet operation occurs, or by observing which TBA- relay or hold magnet operates after hold magnet operation occurs.

1.11 ***The progress of the call*** can be determined by observing the condition of the RK2, CCK, W-, and Z- relays of the concentrator and the MC1, MC2, MC3, and CC1, CC2, CC3 relays of the MF signaling circuits at the point of cessation of normal circuit operation and prior to concentrator release.

1.12 ***The cause of operation of the RL1 relay*** can be determined by observing the premature operation of RL1 relay. The premature operation of RL1 relay will release the call before full soak of the hold magnet occurs or before operation of CO- relay occurs.

1.13 ***When it is required to remove a grounded trunk conductor*** on the line concentrator circuit SD-96536-01 to prevent the discharge of battery before a trouble condition is cleared, the following procedure is recommended. At the central office control unit, terminate a test call to line terminal 49 or 99 over the trunk which has the trouble condition, then block operated TB relay of the trunk at the control unit.

2. TROUBLES AND TROUBLE CAUSES

Location of Trouble

2.01 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 in one portion of the concentrator. Test calls then 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 2.06.

2.02 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 for the type of call involved should be consulted to determine the succeeding concentrator operations to be expected.

2.03 If RK2 relay is not in the proper condition (operated or nonoperated) and the proper potential (battery or absence of battery) does not exist on the RS1 lead, it will be necessary to have personnel at the control MF signaling location to determine which relay failed to operate in the control MF signaling circuit.

2.04 There is also the possibility of trouble in the remote MF signaling circuit, the carrier between the control and remote MF signaling circuits, or the remote concentrator.

2.05 If RK2 relay is in the proper condition, the concentrator sequence charts should be consulted to determine which relay or which select or hold magnet failed to operate or release correctly in the control unit causing the CCK relay to be in the wrong condition. In either case, functional schematics should be consulted to determine the correct operate or release path of the equipment that failed to function correctly.

Trouble Chart

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

TROUBLE	POSSIBLE CAUSE
No Dial Tone	1. Failure of central office equipment. 2. Failure of a talking trunk due to: (a) Foreign matter between hold magnet core and armature. (b) Open crosspoints on crossbar switch.

TROUBLE	POSSIBLE CAUSE
No Dial Tone (Cont)	(c) Open or crossed cable pairs on either line, trunk, E1L, E1S, or carrier terminals. (d) Insulated relay contacts in talking path. (e) Inoperative or poorly adjusted carrier, E1L, or E1S. 3. Crossed terminals on A or BA relay causing release of wrong CO- relay. Customer associated with falsely released CO- relay will be left in 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. 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.

TROUBLE	POSSIBLE CAUSE
No Dial Tone (Cont)	*Note:* Improper signal information may be caused by: (a) Defective signal relays. (b) Insulated relay contacts of any relay in the operating paths of the signal relays. (c) AC interference, cable capacity, high resisttance ground less than 30,000 ohms, or cross on signal leads. (d) Malfunctioning MF signaling circuits (remote or control ends). (e) Malfunctioning carrier facilities used for tone transmission. (f) 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 L- resistor in the remote circuit. (g) Improper registration of signal information (wrong A- or B- relay registered). 7. Low battery voltage in remote circuit if concentrator battery is used. When battery voltage is low, trouble will usually be experienced on several lines.

TROUBLE	POSSIBLE CAUSE
	8. All concentrator trunks busy or all paths busy in central office. 9. CO- relay in remote circuit may fail to operate on disconnect call. 10. Trouble in control and/or remote MF signaling circuits (SD-95971-01, SD-95972-01). Refer to Section 067-106-501 for out-of-service test on MF signaling circuits. 11. Inoperative or poorly adjusted carrier between remote and control MF signaling circuits.
Dial Tone Received But Cannot Break Dial Tone	1. Failure of CO- relay to release in either the control or remote unit. A terminating or service request call following such a CO- 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 the other end. 4. Low battery voltage (see item 7 of No Dial Tone). 5. CO- relay in control unit may fail to operate on disconnect call.

TROUBLE	POSSIBLE CAUSE
Terminating Call Cannot Be Made	1. CO- relay in control circuit is in released condition when terminating call is attempted (see items 3 and 6 of No Dial Tone). 2. Sleeve lead open from central office line equipment to control unit. 3. Failure of central office equipment. 4. CO- relay does not release. 5. No trunk selection.
Wrong Customer Reached on Terminating Call	1. Customer connected to wrong line terminal at remote unit. 2. Central office line equipment connected to wrong line terminal at control unit (see items 5 and 6 of No Dial Tone). 3. Tip and ring leads reversed. 4. Interference on signaling leads causing wrong signals to be sent (see items 6 and 10 of No Dial Tone). 5. Improperly operating MF signaling circuits.
Ringing Cannot Be Tripped (see Several Lines Connected to One Trunk)	1. Sleeve not connected to same line terminal as T and R leads in control unit. 2. Open T or R lead (see item 2 of No Dial Tone).

TROUBLE	POSSIBLE CAUSE
Several or All Trunks Connect to One Line	1. Failure of SL- relay in control unit or L- 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 SL- relay for too long an interval. 3. Manual test operation of CO- relay while call is in progress on that line. 4. Manually holding CO- relay operated for more than length of one call when remote customer subset 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 Section 067-106-502.) 6. Failure of CO- relay to release when a call is set up.
Several Lines Connected to One Trunk	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 only in the remote circuit will not test busy in the control circuit. Therefore, another customer may select this trunk.

TROUBLE	POSSIBLE CAUSE
Showering (Connection and Disconnection of a Particular Line Occurring In Rapid Succession)	1. Double trunk connection. 2. High resistance ground on ring lead of customer line. 3. Low leakage resistance between tip and ring on customer side of remote unit. 4. Tip or ring not connected at one unit and call originated at other unit. 5. Open tip or ring on trunk with all other trunks busy or trunk with open leads is the preferred trunk.
Alarm Signals	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 the wrong condition when time-out occurs. 3. RAL (remote) alarm occurs when the control circuit fails to receive a check signal from the control MF signaling circuit. This will be indicated by the RK2 relay being in the wrong condition when time-out occurs. 4. FA lamp (remote unit) operates when a fuse operates in the remote unit. If the FA lamp operates as a result of the operation of the CF relay, the CHG fuse has operated.

TROUBLE	POSSIBLE CAUSE
Alarm Signals (Cont)	5. SAL alarm occurs when a signal fails to be sent or received. The RK2 and CCK relays will be in the same condition (operated or released). 6. FA alarm (control unit) occurs when a fuse operates in the control unit. *Note:* 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 to duplicate the trouble by using test calls (see Section 067-106-502) to locate and clear the trouble. Since an occasional alarm can be received by interference with signaling, both man-made (ac interference) and electrical (lightning), the testing effort necessary to assure that all lines and trunks are working satisfactorily does not seem advisable unless alarms continue to occur.