

DATA SET 109C-TYPE
USED IN 10-TYPE DATA LINE CONCENTRATOR SYSTEM (DLCS*)
TEST PROCEDURES

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1. GENERAL	1	1.01 This section describes the test procedures to be performed at the time of installation or when investigating trouble conditions associated with Data Set 109C-type, used in the DLCS system.
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CHECK FOR POWER	2	1.02 This section is reissued to include DDD dialing capabilities. This includes Data Sets 109C-L1/3 (rotary dial) and 109C-L1/4 (TOUCH-TONE® dial). Since this reissue constitutes a general revision, arrows ordinarily used to denote changes have been omitted.
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LINE CURRENT AND VOLTAGE TESTS	3	1.03 The following tests are included in this section:
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Data Set 109C-L1/2/3 Dual Access Station	8	1.04 Data Set 109C-type and the associated TTY comprise the data station provided for the line side of the 10-type Data Line Concentrator System. The test procedures given in this section check the data station and the line to the concentrator. No attempt is made to verify the operation of the concentrator or trunk-side equipment.
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4. REFERENCES	10	1.05 All the tests given in this section can be used independently, since each test is complete

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and does not depend upon the performance or results of any preceding test.

1.06 A suggested sequence of testing to locate or isolate a trouble condition is given in Section 591-031-301. By using the recommended sequence of tests, unnecessary testing can be avoided since it may not be necessary to perform all the tests listed in this section to locate a trouble condition.

1.07 In order to perform the following tests, a telephone company employee must be dispatched to the station. In some cases a double dispatch is required when assistance is needed at the concentrator or trunk-side station to perform the test procedures.

2. TEST EQUIPMENT

2.01 In addition to the normal maintenance tools and equipment carried by craft employees, a KS-20538-L1 volt-ohm-milliammeter (VOM) with alligator-clip probes, or equivalent, is required.

3. TEST PROCEDURES

3.01 When the station being tested contains a Data Set 109C-type arranged for DLCS service, operation of the LOCAL key loops the signal from the TTY through the data set and back to the TTY selector magnet driver.

CHECK FOR POWER

3.02 A 3-conductor cord is used to connect the TTY to the customer-supplied 117-volt 60 Hz ac power. The data set is powered from the UCC-29 call control unit of the TTY. Data Set 109C-type requires approximately 2 watts and Data Set 109C-L1/2 approximately 3 watts peak power of 24 volts dc. To check for power, proceed as follows:

- (1) With the KS-20538-L1 VOM set at the 300 ACV range, measure across customer receptacle for 117-volt ac power.
- (2) With the KS-20538-L1 VOM set at the 30 DCV range, measure across terminals 11 (positive) and 9 on EU1 circuit pack for 24-volt dc power. Correct power at both checkpoints indicates that the TTY and data set are getting power.

LOCAL COPY TEST

3.03 This test provides a means of checking the operation of both the TTY and Data Set 109C-type when arranged for DLCS service. To perform this test, proceed as follows:

- (1) Depress LOCAL button. Motor starts and TTY should run closed.
- (2) Operate TTY keyboard. Type quick brown fox...and number sequence. If local copy is printed correctly, the TTY and Data Set 109C-type may be assumed to be operating.

LINE RESISTANCE MEASUREMENTS

3.04 This test checks the resistance of the line from Data Set 109C-type to the 10-type data line concentrator, and provides the information for determining if an appreciable change in line resistance has occurred, thereby requiring corrective action. This test will also indicate a shorted or open line.

3.05 The line resistance is measured as follows:

Note: This procedure requires that a telephone craft employee be dispatched to the concentrator.

- (1) Obtain access to the data set terminals. Refer to Section 591-031-301.
- (2) Use local telephone to establish voice connection with the telephone company employee at the concentrator.
- (3) Request that the telephone company employee at the concentrator short the line to be tested without disconnecting it from the concentrator.
- (4) Remove the loop lead designated as follows from screw terminal at the rear of the data set:

DATA SET 109C—	TERMINAL
L1	8
L1/2	8
L1/3	19
L1/2/3	19
L1/4	8
L1/2/4	8

This terminal is located on the EU1 circuit pack. See Fig. 1.

- (5) Measure and record the line resistance using the VOM.

Note: If an open circuit was obtained in the preceding step, verify that the line is short-circuited at the concentrator. If an open indication is received with the line shorted at the concentrator, the line must be replaced.

- (6) Compare the resistance measured in (5) with the resistance value shown on the line order or circuit order card. If the resistance has not changed an appreciable amount, the line can be considered acceptable.

Note: An appreciable change in resistance is any amount that causes the total resistance of the DLCS system to exceed a nominal 2000 ohms. The Data Set 109C-type line pads may be adjusted to compensate for a change in line resistance. Refer to Section 591-031-201. If the change in resistance cannot be compensated for by adjusting the line pads, the line will have to be repaired or replaced.

- (7) Since the system is ungrounded, a check for shorts to earth ground may be made directly, without disconnecting any leads, by connecting one lead of the VOM to a line lead and the other lead to earth ground. If there is a short to earth ground, the line leads may then be disconnected in order to determine whether the line or the data set is grounded.

3.06 After completing the preceding test procedure, inform the telephone company craft employee at the concentrator of the results of the test. If the line is acceptable, the short should be removed from the concentrator and the leads to the data set should be reconnected.

3.07 When the line is to be replaced, refer to Section 591-031-201 for information on setting the line pad resistance and obtaining the proper polarity when connecting the line.

LINE CURRENT AND VOLTAGE TESTS

3.08 This test checks the ability of Data Set 109C-type to provide an acceptable request-for-service signal to the 10-type concentrator.

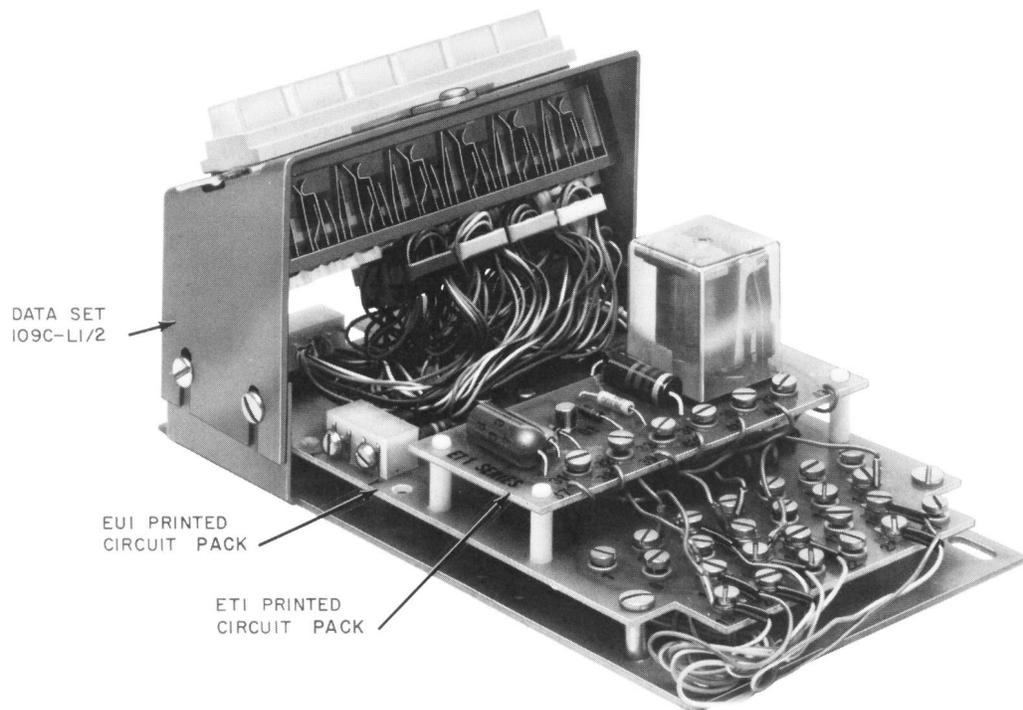


Fig. 1—Data Set 109C-L1/2

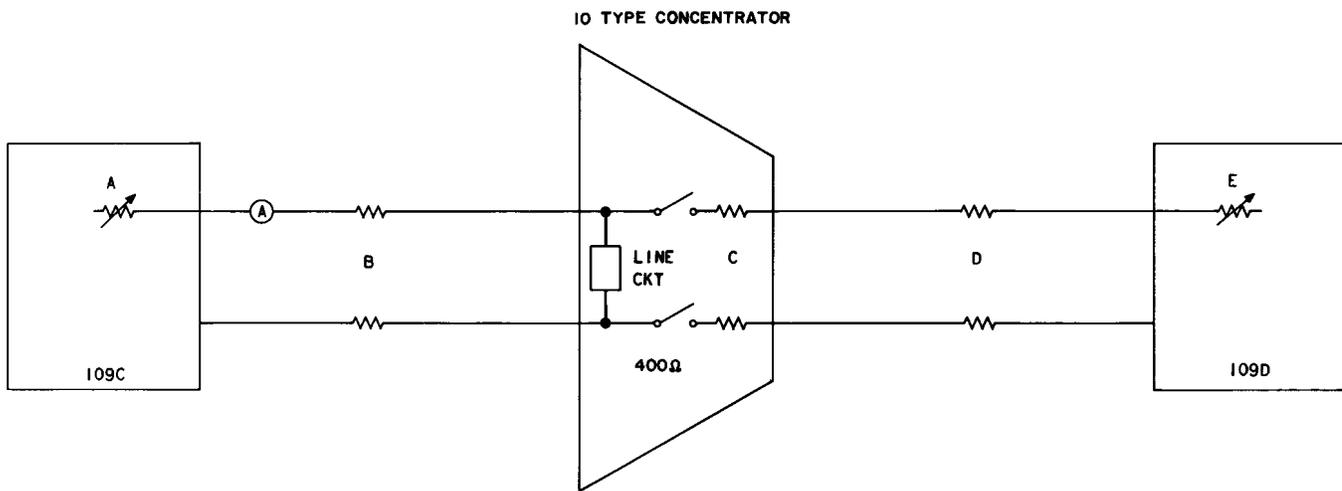
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3.09 The line current test can be made under three conditions:

- (a) **Connection condition**, which may be recognized by an answer-back from the computer (Test A).
- (b) **A camp-on condition**, which may be recognized by a wink signal (short spacing signal) sent back to the station every 3 or 4 seconds during an all-trunks-busy condition (Test B).

(c) **Short circuit at the concentrator**, which requires two telephone company employees, one at the station and one at the concentrator (Test C).

The procedures for applying Tests A and B are the same. Current values are different for the camp-on and connection conditions, as shown by the table accompanying Fig. 2. The procedure for Test C will be given separately.



NORMAL RANGE STATIONS KNOWN VALUES (OHMS)		APPROXIMATE VALUE (OHMS)	LINE PAD ADJUSTMENT WITH CAMP-ON SIGNAL: OR HOLDING TRUNK LOOP CURRENT (MA)	LINE PAD ADJUSTMENT-WITH SHORT CIRCUIT AT CONCENTRATOR: LOOP CURRENT (MA)	CONNECTION CONDITION CURRENT VALUES (MA)
C+D+E	D+E				
400 TO 500	0 TO 100	1600 TO 1400	1.4 TO 1.8	2.0 TO 2.4	2.8 TO 3.6 FOR ALL READINGS
500 TO 600	100 TO 200	1500 TO 1300	1.5 TO 1.9	2.1 TO 2.6	
600 TO 700	200 TO 300	1400 TO 1200	1.6 TO 2.0	2.2 TO 2.7	
700 TO 800	300 TO 400	1300 TO 1100	1.7 TO 2.1	2.4 TO 2.9	
800 TO 900	400 TO 500	1200 TO 1000	1.8 TO 2.3	2.5 TO 3.1	
900 TO 1000	500 TO 600	1100 TO 900	1.9 TO 2.4	2.7 TO 3.4	
1000 TO 1100	600 TO 700	1000 TO 800	2.0 TO 2.6	2.8 TO 3.7	
1100 TO 1200	700 TO 800	900 TO 700	2.2 TO 2.8	3.0 TO 4.0	
1200 TO 1300	800 TO 900	800 TO 600	2.3 TO 3.1	3.3 TO 4.4	
1300 TO 1400	900 TO 1000	700 TO 500	2.5 TO 3.4	3.5 TO 4.9	
1400 TO 1500	1000 TO 1100	600 TO 400	2.7 TO 3.8	3.9 TO 5.5	
1500 TO 1600	1100 TO 1200	500 TO 300	3.0 TO 4.3	4.3 TO 6.4	

NOTE:
 EXTENDED RANGE STATION (B=1600 TO 2100 OHM) SET A TO ZERO AND CHECK LINE CIRCUIT
 (a) CAMP ON CURRENT MUST BE GREATER THAN 1.1 MA
 (b) CURRENT WITH SHORT CIRCUIT MUST BE GREATER THAN 1.5 MA

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Fig. 2—Verification of Loop Pad Resistance Settings Using Camp-On or Short Circuit Current Measurements

Line Current Tests A and B

3.10 Line current tests A and B may be made by performing the following steps.

- (1) Obtain access to the data set. Refer to Section 591-031-301.
- (2) Remove the loop lead designated as follows from the screw terminal at the rear of the data set:

DATA SET 109C—	TERMINAL
L1	8
L1/2	8
L1/3	19
L1/2/3	19
L1/4	8
L1/2/4	8

This terminal is located on the EU1 circuit pack. See Fig. 1.

- (3) Set the KS-20538-L1 VOM to the 10 MA range.
- (4) Connect the negative lead of the VOM to the lead removed from the terminal in (2).
- (5) Connect the positive lead of the VOM to the terminal of the EU1 circuit pack, from which the lead was removed in (2).
- (6) Depress LINE 1 button on the data set.
- (7) Record the indicated loop current.

Note: If answer-back from computer is received, a connection condition exists (Test A). If a downward momentary flick of the meter is observed every 3 or 4 seconds and the TTY receives a delete character every 3 or 4 seconds, a camp-on condition exists. If after camp-on is obtained the kick disappears and no answer-back from a computer is received, the station may be connected to a holding trunk. The current values for these conditions are the same (Test B).

- (8) Refer to Fig. 2. Find the total resistance of the data set pads and the facility in the table accompanying the figure. If the current recorded in (7) is between the limits given in the appropriate line and column of the table, the data set and line are acceptable.

Voltage Test

- (9) Disconnect the negative lead of the VOM from the loop lead.
- (10) Set the KS-20538-L1 VOM to the 30 DCV range.
- (11) Connect the negative lead of the VOM to terminal 20 on the EU1 circuit pack.
- (12) With the loop lead still disconnected, measure the voltage between terminal 20 and terminal specified in Table A.
- (13) After completing the line current and voltage tests, reconnect the line at the data set.

Line Current Test C

3.11 Test C checks the ability of Data Set 109C-type to provide an acceptable request-for-service signal to the 10-type concentrator.

3.12 In order to perform a valid line current test, both the line to the concentrator and the output of the data set must be acceptable. When the line is known good from the performance of the line resistance test, any trouble encountered indicates a malfunction of the data set.

3.13 Test C consists of the following steps:

Note: This procedure requires a telephone company craft employee at the concentrator.

- (1) Obtain access to the data set terminals. Refer to Section 591-031-301.

TABLE A

DATA SET 109C-- TYPE OPEN CIRCUIT VOLTAGE

DATA SET 109C--	POSITIVE LEAD OF VOLTMETER TO TERMINAL	NEGATIVE LEAD OF VOLTMETER TO TERMINAL	MARKING VOLTAGE VOLTS	SPACING VOLTAGE VOLTS
L1	8	20	4.0 to 4.6	-12.2 to -14.2
L1/2	8	20	4.0 to 4.6	-12.2 to -14.2
L1/3	19	20	4.0 to 4.6	-12.2 to -14.2
L1/2/3	19	20	4.0 to 4.6	-12.2 to -14.2
L1/4	8	20	4.0 to 4.6	-12.2 to -14.2
L1/2/4	8	20	4.0 to 4.6	-12.2 to -14.2

- (2) Use local telephone to establish voice communication with the telephone company employee at the concentrator.
- (3) Request that the line of the station being tested be shorted at concentrator.
- (4) Remove the loop lead designated as follows from the screw terminal at the rear of the data set:

DATA SET 109C--	TERMINAL
L1	8
L1/2	8
L1/3	19
L1/2/3	19
L1/4	8
L1/2/4	8

This terminal is located on the EU1 circuit pack. See Fig. 1.

- (5) Set the KS-20538-L1 VOM to the 10 MA range.
- (6) Connect the negative lead of the VOM to the lead removed from the terminal in (4).
- (7) Connect the positive lead of the VOM to the terminal of the EU1 circuit pack from which the loop lead was disconnected.

- (8) Depress LINE 1 key on the data set.
- (9) Record the indicated loop current.
- (10) Refer to Fig. 2 and find the total resistance of the data set pads and the facility in the table accompanying Fig. 2. If the current recorded in (9) is between the limits given in the appropriate line and column of the table, the data set is acceptable.

Voltage Test

- (11) Disconnect the negative lead of the VOM from the loop lead.
- (12) Set the KS-20538-L1 VOM to the 30 DCV range.
- (13) Connect the negative lead of the VOM to terminal 20 on the EU1 circuit pack.
- (14) With the loop lead still disconnected, measure the voltage between terminal 20 and terminal specified in Table A.
- (15) After completing the line current and voltage test, reconnect the line at the data set and request that the telephone company employee reconnect the line at the concentrator.

OPERATIONAL TESTS**Data Set 109C-L1 Single Access Station**

3.14 To check station on line, proceed as follows:

- (1) Depress LINE 1 button.
- (2) If camp-on is received, wait for connection and answer-back from computer.
- (3) Type appropriate message.
- (4) Depress OFF button.

Note: Depressing the OFF button drops the connection with no indication that the connection has been dropped.

Data Set 109C-L1 Dual Access Station

3.15 To check station on line, proceed as follows:

- (1) Depress LINE 1 button.
- (2) If camp-on is received, wait for connection to computer.
- (3) Verify with customer that connection obtained in (2) is to that computer associated with trunk group A.
- (4) Depress OFF button.
- (5) Depress LINE 2 button.
- (6) If camp-on is received, wait for connection to computer.
- (7) Verify with customer that connection obtained in (6) is to that computer associated with trunk group B.
- (8) Depress OFF button.

Data Set 109C-L1/2 Single Access Station

3.16 To check station on line, proceed as follows:

- (1) Depress LINE 1 button.
- (2) If camp-on is received, wait for connection to computer.

(3) Type EOT character.

(4) Verify that connection has been dropped.

Note: When connection is dropped by EOT feature, the OFF lamp lights, LINE 1 lamp remains lighted, and the TTY motor stops.

(5) Depress the OFF button.

(6) Verify that both lamps (OFF and LINE 1) are extinguished.

Data Set 109C-L1/2 Dual Access Station

3.17 To check station on line, proceed as follows:

(1) Depress LINE 1 button.

(2) If camp-on is received, wait for connection and answer-back from computer.

(3) Verify with customer that connection obtained in (2) is to computer associated with trunk group A.

(4) Type EOT character.

(5) Verify that connection has been dropped.

Note: When connection is dropped by EOT feature, the OFF lamp lights, LINE 1 lamp remains lighted, and the TTY motor stops.

(6) Depress the OFF button.

(7) Verify that both lamps (OFF and LINE 1) are extinguished.

(8) Depress LINE 2 button.

(9) If camp-on is received, wait for connection and answer-back from computer.

(10) Verify with customer that the connection obtained in (9) is from the computer associated with trunk group B.

(11) Type EOT character.

(12) Verify that connection has been dropped.

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Note: When this connection is dropped by EOT feature, the OFF lamp lights, LINE 2 lamp remains lighted, and the TTY motor stops.

- (13) Depress the OFF button.
- (14) Verify that both lamps (OFF and LINE 1) are extinguished.

Data Set 109C-L1/3 Dual Access Station

3.18 To check station on line, proceed as follows:

- (1) Depress LINE 1 button.
- (2) Verify that LINE 1 lamp lights and TTY motor starts.
- (3) If camp-on is received, wait for connection to computer.
- (4) Verify that connection obtained is to computer associated with trunk group A.
- (5) Depress OFF button.
- (6) Verify that LINE 1 lamp is extinguished and that TTY motor stops.
- (7) Depress LINE 2 button.
- (8) Verify that LINE 2 lamp lights and TTY motor starts.
- (9) If camp-on is received, wait for dial tone.
- (10) After dial tone is heard in listen-only handset, dial desired number.
- (11) After a number is dialed, a supervisory tone may be received (busy signal, etc). In this case, depress the OFF button and place another call. If the call progresses through the switched network, a short burst of tone will be heard and a connection to the computer will be established.
- (12) When answer-back is received, verify that the connection obtained is to the computer associated with trunk group B.
- (13) Depress OFF button.

- (14) Verify that the OFF lamp is extinguished and that TTY motor stops.

Data Set 109C-L1/2/3 Dual Access Station

3.19 To check station on line, proceed as follows:

- (1) Depress LINE 1 button.
- (2) Verify that LINE 1 lamp lights and TTY motor starts.
- (3) If camp-on is received, wait for connection to computer.
- (4) Verify that the connection obtained is to the computer associated with trunk group A.
- (5) Type EOT character.
- (6) Verify that the connection has been dropped.

Note: When this connection is dropped by the EOT feature, the OFF lamp lights, LINE 1 lamp remains lighted, and the TTY motor stops.

- (7) Depress the OFF button.
- (8) Verify that the OFF and LINE 1 lamp are extinguished.
- (9) Depress the LINE 2 button.
- (10) Verify that LINE 2 lamp lights and the TTY motor starts.
- (11) If camp-on is received, wait for dial tone.
- (12) After dial tone is heard in listen-only handset, dial desired number.
- (13) After a number is dialed, a supervisory tone may be received (busy signals, etc).

In this case, depress the OFF button and place another call. If the call progresses through the switched network, a short burst of tone will be heard and a connection to the computer will be established.

- (14) When answer-back is received, verify that the connection is correct.

- (15) Type EOT character.
- (16) Verify that the connection has been dropped.

Note: When this connection is dropped by EOT feature, the OFF lamp lights, LINE 2 lamp remains lighted, and the TTY motor stops.

Data Set 109C-L1/4 Dual Access Station

3.20 To check station on line, proceed as follows:

- (1) Depress LINE 1 button.
- (2) Verify that LINE 1 lamp lights and TTY motor starts.
- (3) If camp-on is received, wait for connection to computer.
- (4) Verify that the connection obtained is to the computer associated with trunk group A.
- (5) Depress OFF button.
- (6) Verify that LINE 1 lamp is extinguished and the TTY motor stops.
- (7) Depress LINE 2 button.
- (8) Verify that LINE 2 lamp lights and TTY motor starts.
- (9) After dial tone is heard in listen-only handset, dial desired number.
- (10) After a number is dialed, a supervisory tone may be received (busy signal, etc). In this case, depress the OFF button and place another call. If the call progresses through the switched network, a short burst of tone will be heard and a connection to the computer will be established.
- (11) When answer-back is received, verify that the connection is correct.
- (12) Depress OFF button.
- (13) Verify that LINE 2 lamp is extinguished and that TTY motor stops.

Data Set 109C-L1/2/4 Dual Access Station

3.21 To check station on line, proceed as follows:

- (1) Depress LINE 1 button.
- (2) Verify that LINE 1 lamp is lighted and that TTY motor starts.
- (3) If camp-on is received, wait for connection to computer.
- (4) Verify that the connection is to the computer associated with trunk group A.
- (5) Type EOT character.
- (6) Verify that the connection has been dropped.

Note: When this connection is dropped by the EOT feature, the OFF lamp lights, LINE 1 lamp remains lighted, and the TTY motor stops.

- (7) Depress OFF button.
- (8) Verify that OFF and LINE 1 lamps are extinguished.
- (9) Depress LINE 2 button.
- (10) If camp-on is received, wait for dial tone.
- (11) After dial tone is heard in listen-only handset, dial desired number.
- (12) After a number is dialed, a supervisory tone may be received (busy signal, etc). In this case depress the OFF button and place another call. If the call progresses through the switched network, a short burst of tone will be heard and a connection to the computer will be established.
- (13) Type EOT character.
- (14) Verify that connection has been dropped.

Note: When this connection is dropped by EOT feature, the OFF lamp lights, LINE 2 lamp remains lighted, and the TTY motor stops.

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- (15) Depress the OFF button.
- (16) Verify that OFF lamp and LINE 2 lamp are extinguished and that TTY motor stops.

3.22 If the local test, line resistance measurement, and line current tests can be performed satisfactorily and the trouble condition still exists (inability to connect to the computer), the trouble probably lies in the concentrator, trunk groups, or at the computer port. In this case, refer trouble to immediate supervisor.

4. REFERENCES

4.01 For additional information on the DLCS, refer to the following BSPs and the additional practices referred therein.

SECTION	TITLE
591-031-201	Data Set 109C-Type Used in 10-Type Data Line Concentrator System (DLCS*)—Installation
591-031-301	Data Set 109C-Type Used in 10-Type Data Concentrator System (DLCS*)—Maintenance
591-810-100	10-Type Data Line Concentrator System (DLCS*)—Description
591-810-210	33 and 35 Teletypewriter Stations—Installation and Checkout
591-810-300	10-Type Data Line Concentrator System (DLCS*)—Maintenance
591-810-500	10-Type Data Line Concentrator System (DLCS*)—Test Procedures
591-811 Series	10-Type Data Line Concentrator System (DLCS*)

SECTION	TITLE
574-000-000	Numerical Index—Division 574 Teletypewriter 30 Series