

**DATA SET 109C-TYPE**  
**USED IN**  
**10-TYPE DATA LINE CONCENTRATOR SYSTEM (DATREX\*)**  
**INSTALLATION**

**1. GENERAL**

**1.01** This section describes the procedure for installing Data Set 109C-type (Data Set 109C-L1 or 109C-L1/2) used with 10-type Data Line Concentrator service. Data Set 109C-type is mounted in a Bell System-provided model 33 or 35 teletypewriter (TTY).

\*Service mark of the Bell System.

**1.02** The data station is shipped from the distributing house with the data set already installed in the TTY. Installation of the station requires that the line be connected, the line current adjusted to the proper value, and power supplied to the teletypewriter.

**1.03** 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. The customer must furnish a 3-wire outlet that is not under control of a switch.

**1.04** Data Set 109C-type is limited to use on a 2-wire metallic loop. The transmission loop used by the data set cannot be equipped with anything that will break the dc path of the loop. The loop cannot be carrier derived, and ground return cannot be used.

**1.05** For 10-type Data Line Concentrator applications, a transmission loop is the 2-wire metallic line which connects Data Set 109C-L1 through the 10A concentrator to any other Data Set 109-type. The overall resistance of the loop, from Data Set 109C-type to Data Set 109-type, shall not exceed 2500 ohms, including the effective 400 ohms resistance of the concentrator.

**1.06** Data Set 109C-L1 requires approximately 2 watts and Data Set 109C-L1/2 approximately 3 watts peak power of filtered 24 volts dc, which is supplied by the TTY.

**2. TOOLS AND APPARATUS**

**2.01** The data station is assembled at the distributing house; therefore, the only special equipment required to complete the installation of the data station is KS-16979-L1 volt-ohm-milliammeter, or equivalent. This meter is used to make the line pad adjustments when installing the data station.

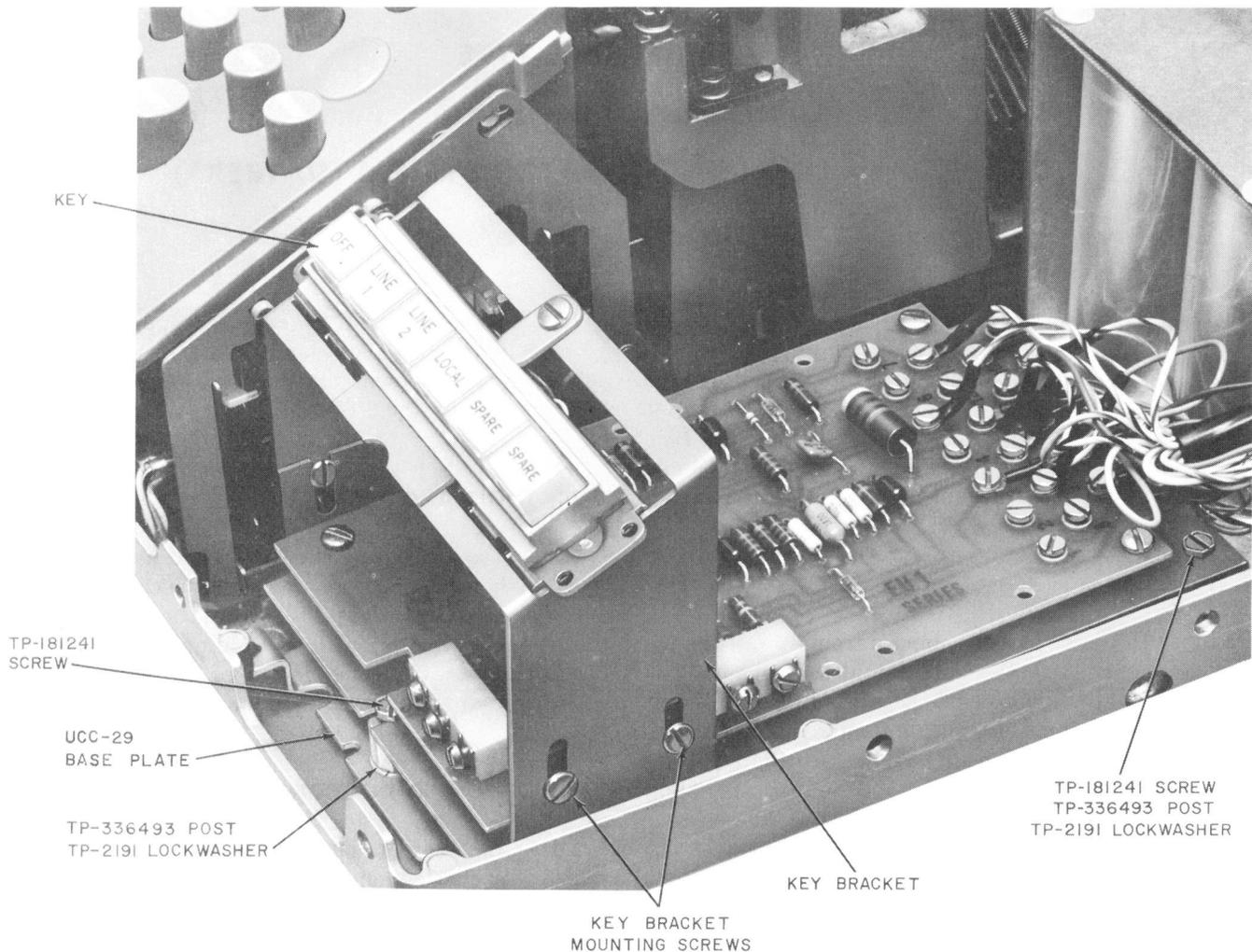
**3. OPTION CONNECTIONS**

**3.01** Before installation of the station is started, a check should be made to determine that the station is equipped with the proper features and options required to provide the service being installed. The service order should indicate the features and options required.

**3.02** Data Set 109C-type is designed to be mounted in the model 33 or 35 TTY in front of the UCC 29 call control unit (see Fig. 1). In order to check the option connections, it is necessary to remove the cover of the TTY. For information on cover removal, refer to the section entitled Data Set 109C-Type, 10-Type Data Line Concentrator (DATREX\*) System, Maintenance (591-031-301).

**DATA SET 109C-L1**

**3.03** Data Set 109C-L1 consists of an EU1 circuit pack interconnected to a 635T2 key by means of a cord CA1 (Fig. 2). The way in which the circuit board is interconnected to the key via the local cable (CA1) determines the operational function of Data Set 109C-L1.



**Fig. 1—Data Set 109C-L1 Installed in Model 33 Teletypewriter**

**3.04** For DATREX service, verify the following:

- (a) Option Z, Space Crossover Shift, is installed (screw switch Z closed, screw switch Y open).
- (b) Key cord CA1 and UCC 29 call control unit cable TP-336463 are connected to screw terminals of EU1 circuit pack as indicated in Table A.

#### **DATA SET 109C-L1/2**

**3.05** Data Set 109C-L1/2 consists of Data Set 109C-L1 (see 3.03) and a snap-on ET1 circuit pack (Fig. 3 and 4). The ET1 circuit pack provides

the additional features described in Table B when interconnected to Data Set 109C-L1.

**3.06** The ET1 circuit pack can be ordered separately and added to Data Set 109C-L1. It is mounted by aligning the four standoffs with the holes in the EU1 circuit board, and pressing into place.

**3.07** For DATREX service, verify the following:

- (a) Option Z, Space Crossover Shift, is installed (screw switch Z closed, screw switch Y open).
- (b) Key strip cord CA1, UCC 29 cable, and ET1 circuit pack are connected to proper terminals

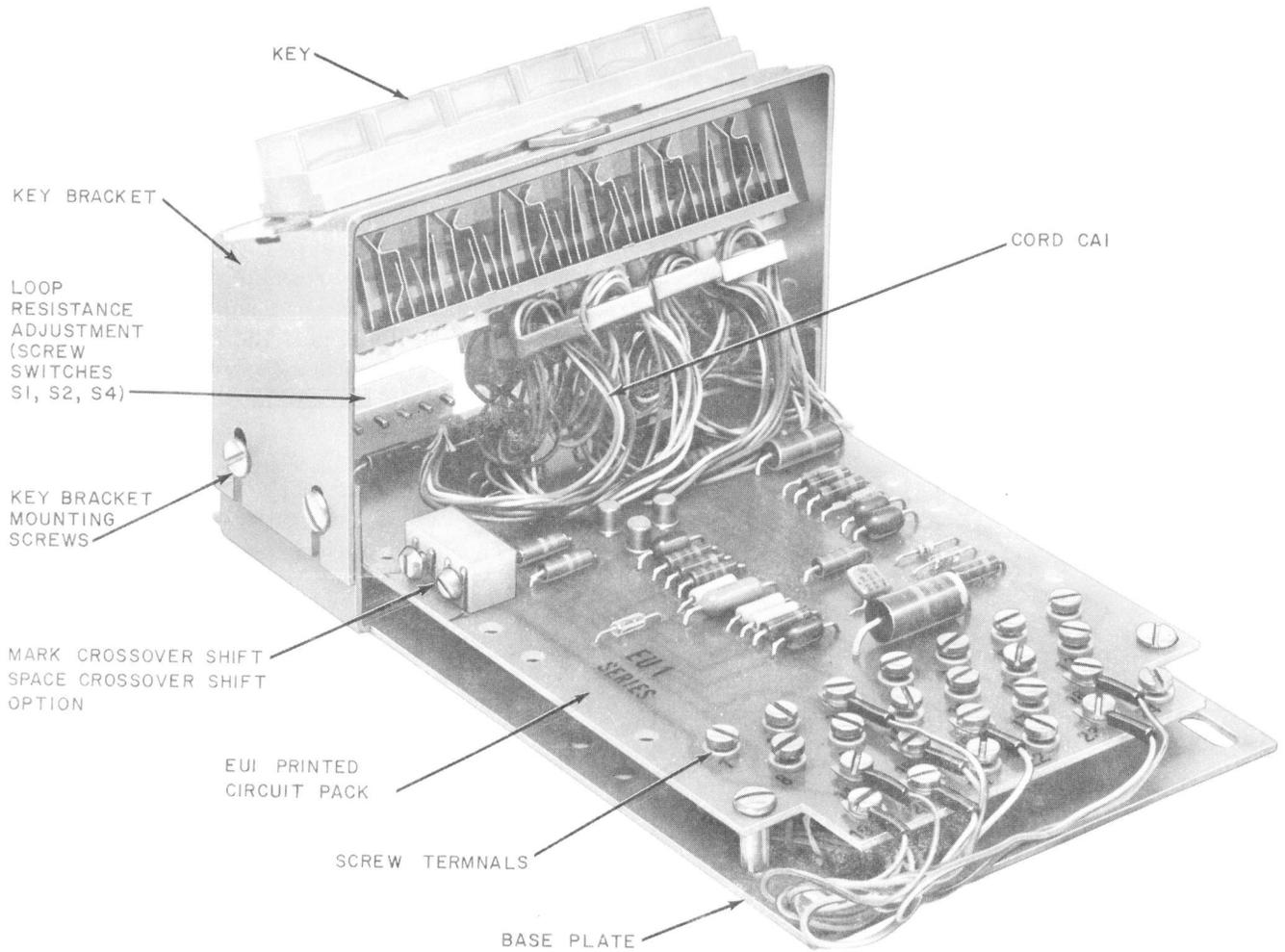


Fig. 2—Data Set 109C-L1

for wiring optional feature (R, S, or T) specified on work order. See Table C and Fig. 5.

#### DETERMINATION OF LOOP RESISTANCE (DATREX) (Fig. 6)

**4.02** For proper operation of the system, the total resistance between a pair of Data Sets 109C-type must be limited to 2500 ohms. If the total resistance is less than 2000 ohms, it must be adjusted to that nominal value. If total resistance is between 2000 and 2500 ohms, no pad resistance is required. The total resistance of a concentrator system is made up of the following:

- The pad supplied by the line-side data set (adjustable). (A)

- The resistance of the line link from the data set to the concentrator. (B)
- The concentrator effective resistance (400 ohms). (C)
- The resistance of the trunk link. (D)
- The pad supplied by the trunk-side data set (adjustable). (E)

**4.03** Since the trunk link resistance for each trunk-side data set may vary, each trunk-side data set pad must be set so that the total trunk-side resistance presented to the concentrator is equal for all trunks; that is, D plus E is constant for all trunks.

**TABLE A**  
**WIRING INTERCONNECTIONS FOR**  
**DATA SET 109C-L1 (DATREX)**

INTERCONNECTING WIRES	EUI CIRCUIT BOARD SCREW TERMINALS
<i>Cord (CA1)</i>	
G-W	2
BR-W	3
O-W	12
G-R	14
BL-W	15
O-R	16
BR-R	17
BL-BK	17
S-W	18
BL-R	20
S-R	22
BR-BK	22
R-BL*	
R-O*	
R-G*	
R-BR*	
<i>UCC-29 Cable</i>	
W-O-G	1
R	1
W-BK-P	5
W-P	9
W-O-BL	10
W-BK-O	10
BL	11
W-O-BR	13
S	14
O	15
R-Y	19
W-R-G	19
R-BL	21
R-G	21
W-G	23

\* CA1 may include these wires; if present, tape and store.

**4.04** Since the line link resistance for each data station will vary with the physical location of the station, each line-side data set pad must be set so that the total line-side resistance presented to the concentrator is equal for all stations; that is, A plus B is constant for all stations.

**4.05** The metallic line-link resistance (B) plus the metallic trunk-link resistance (D) is a maximum

of 1600 ohms for normal range stations and a maximum of 2100 ohms for extended range stations.

#### DATA SET 109C-L1 AND 109C-L1/2 LINE PAD

#### ADJUSTMENTS

**4.06** When the line-side data station is installed, the effective resistance seen by this data set is the total of the resistances presented to the trunk side of the concentrator plus the concentrator resistance (400 ohms) plus the line loop resistance. The line data set pad is adjusted to make the total circuit resistance a nominal 2000 ohms. This is accomplished as follows:

(1) Obtain the total trunk-concentrator resistance (this can be obtained from the service order or circuit layout record card).

(2) Request the line loop be shorted at the concentrator and measure the short circuit resistance of this loop using the KS-16979-L1 volt-ohm-milliammeter.

(3) Add the resistance obtained in (1) and (2). Refer to Fig. 6 to determine the screw switch settings required to increase this total resistance value to a nominal 2000 ohms. The screw switches are designated S1, S2, and S4.

(4) Make the screw switch settings determined in (3). The location of the screw switches is shown by Fig. 2.

**4.07** After the loop resistance has been determined and the loop pad adjusted, connect the ring side of the incoming transmission loop to the 109C-L1 circuit board terminal 8. Do not connect the tip lead until instructed in Part 5 of this section.

**4.08** After completing installation of the data station as outlined in this section, apply ac power to the station by inserting the ac power cord of the TTY to the customer-provided receptacle.

#### 5. INSTALLATION TESTS

**5.01** Installation tests described are performed to determine if Data Set 109C-type is operable and if proper connections have been made. The tests to be made are controlled by the status of the DATREX 10-type Data Line Concentrator

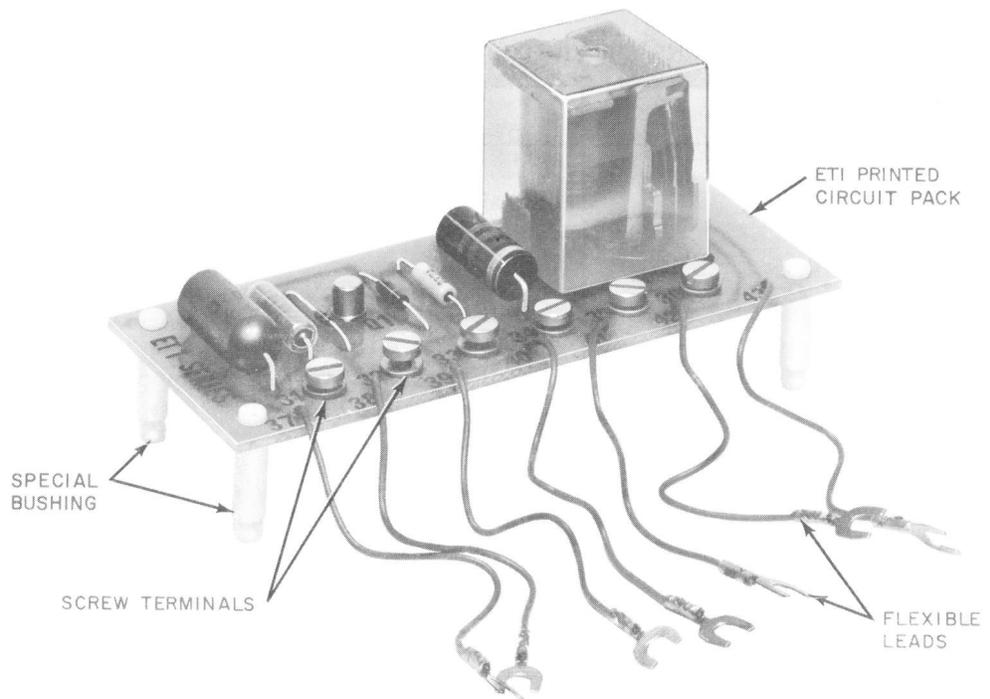


Fig. 3—Circuit Pack ET1

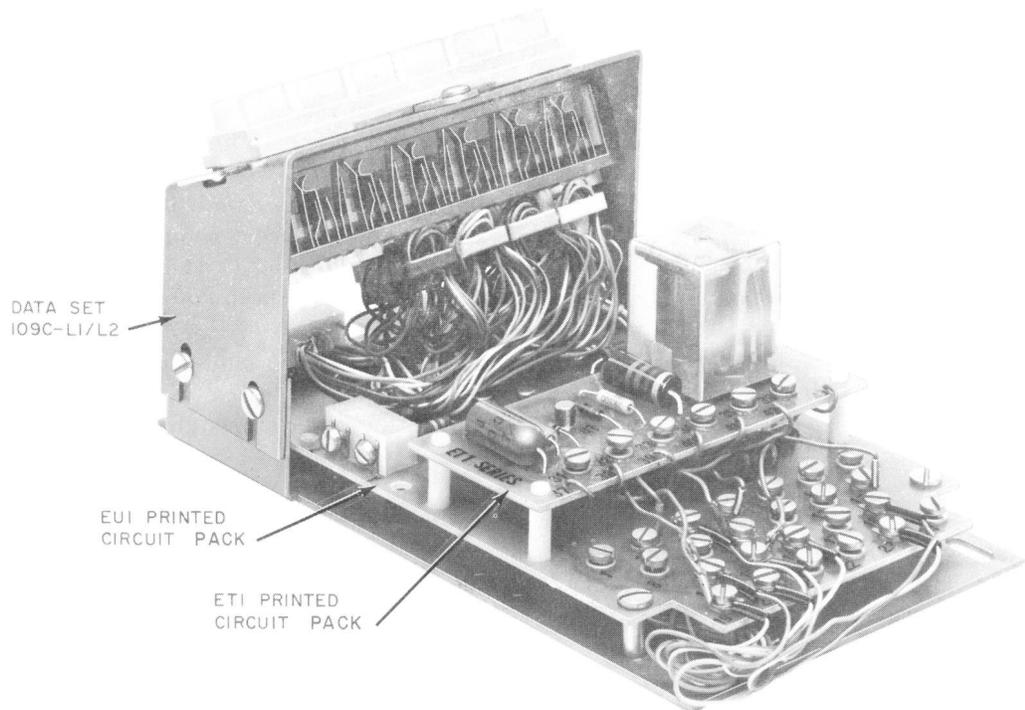


Fig. 4—Data Set 109C-L1/2

**TABLE B**  
**OPTIONS PROVIDED BY ET1 CIRCUIT PACK**

WIRING OPTION	FEATURE	DESCRIPTION
R*	EOT	EOT Disconnect — Receipt of an EOT character will stop teletypewriter motor, disconnect data set from line and light OFF lamp.
T	SST	Send-Space Timer — Prevents sending spaces longer than required for normal data or break signal. This protects quasi-ternary channels from false operation.
S	EOT and SST	Provides both EOT disconnect and send-space timer.

\* Factory-wired on Data Set 109C-L1/2.

installation. The tests are performed under the following conditions:

- (1) Tests A—Concentrator is not installed
- (2) Tests A, B, C—Concentrator and trunk-side data sets installed.

#### Test A. Local Test

**5.02** Depress the OFF key of Data Set 109C-L1 and operate the ac power switch on the TTY to the ON position. Verify that the TTY motor is *not* running.

**5.03** Depress the LOCAL button of the data set and verify the following:

- (a) The LOCAL lamp is lighted.
- (b) The motor starts and the TTY is running closed.
- (c) Local copy is printed correctly when TTY keyboard is operated.



*If the condition described in 5.01 (1) exists, depress the OFF button and connect tip lead to terminal 20 on EU1 circuit pack.*

#### Test B. Verification of Tip and Ring Connection

**5.04** With the KS-16979-L1 volt-ohm-milliammeter, or equivalent, set to the 75-mA scale, connect the meter negative probe to terminal 20 of the circuit board and the positive probe to the tip lead.

**5.05** Depress the LINE 1 button. Check to see if current is indicated by the meter. Switch to the 15-mA scale if necessary. Current should be between 1 and 10 mA. If no current is indicated (or less than 0.3 mA), reverse the tip and ring connections to the circuit pack (applicable to single access only). Current should now flow when LINE 1 button is depressed. Depress the LINE 1 button again and verify the following:

- (a) The LINE 1 lamp is lighted.
- (b) The motor starts and the TTY runs closed.

#### Test C. Verification of Loop Pad Resistance Settings

**5.06** Any one of three conditions may be present at this time:

- (1) Camp-on
- (2) Connection to computer through concentrator
- (3) Lines to concentrator not terminated.

**TABLE C**  
**WIRING INTERCONNECTION FOR DATA SET 109C-L1/2 (DATREX)**

INTERCONNECTING WIRES	EU1 CIRCUIT BOARD SCREW TERMINALS WIRING OPTION			ET1 CIRCUIT PACK SCREW TERMINALS WIRING OPTION		
	R	T	S	R	T	S
<b><i>ET1 Circuit Pack Spade Lugs</i></b>						
37	9	9	9			
38		10	10	31		
39		13	13	31		
40	4	4	4			
41	14		14		35	
42	2		2		32	
43	19		19		32	
<b><i>Cord (CA1)</i></b>						
BR-W	3	3	3			
O-W	12	12	12			
BL-W	15	15	15			
O-R	16	16	16			
BR-R	17	17	17			
BL-BK		17		34		34
S-W	18	18	18			
G-W	19	2	19			
BL-R	20	20	20			
BR-BK	22	22	22			
G-R		14		35		35
S-R	22	22	22			
R-BL*						
R-O*						
R-G*						
R-BR*						
<b><i>UCC-29 Cable</i></b>						
W-O-G	1	1	1			
R	1	1	1			
W-BK-P	5	5	5			
W-P	9	9	9			
W-O-BL	10				33	33
W-BK-O	10	10	10			
BL	11	11	11			
W-O-BR	13				31	31
S	14	14	14			
O	15	15	15			
W-R-G	17	19	17			
R-BL	21	21	21			
R-G	21	21	21			
W-G	23	23	23			
R-Y				36	36	36

\* CA1 may include these wires; if present, tape and store.

**Note:** If line to concentrator is not terminated, the TTY will run open.

**5.07** *A camp-on condition* can be recognized by the fact that a nonprinting character (DEL) is selected by the TTY receiving mechanism every 3 to 4 seconds. When DEL is received, the meter needle kicks downward slightly. The apparent momentary change is likely to be less than 0.1 mA. The current reading on the meter during the camp-on condition should be as indicated in Fig. 7. If out of limits, the resistance pad screw switches must be adjusted. If the current is too low, set the screw switches to the next lower resistance value. If the current is too high, set the screw switches to the next higher resistance value. Continue changing the screw switch positions until the reading is within limits.

**Note:** The station may go out of camp-on condition at any time and enter the connection condition. This can be noted by the fact that the TTY stops receiving DEL characters every 3 seconds. Whenever this occurs, follow the instructions in 5.08.

**5.08** *The connection condition* is recognized when the station receives an answer-back sequence from the computer. Following these characters, the line current for a normal range

station should be  $3.2 \pm 0.4$  mA. If out of limits, follow the instructions given in 5.07 about changing the screw switch settings, until a reading of  $3.2 \pm 0.4$  mA is obtained.

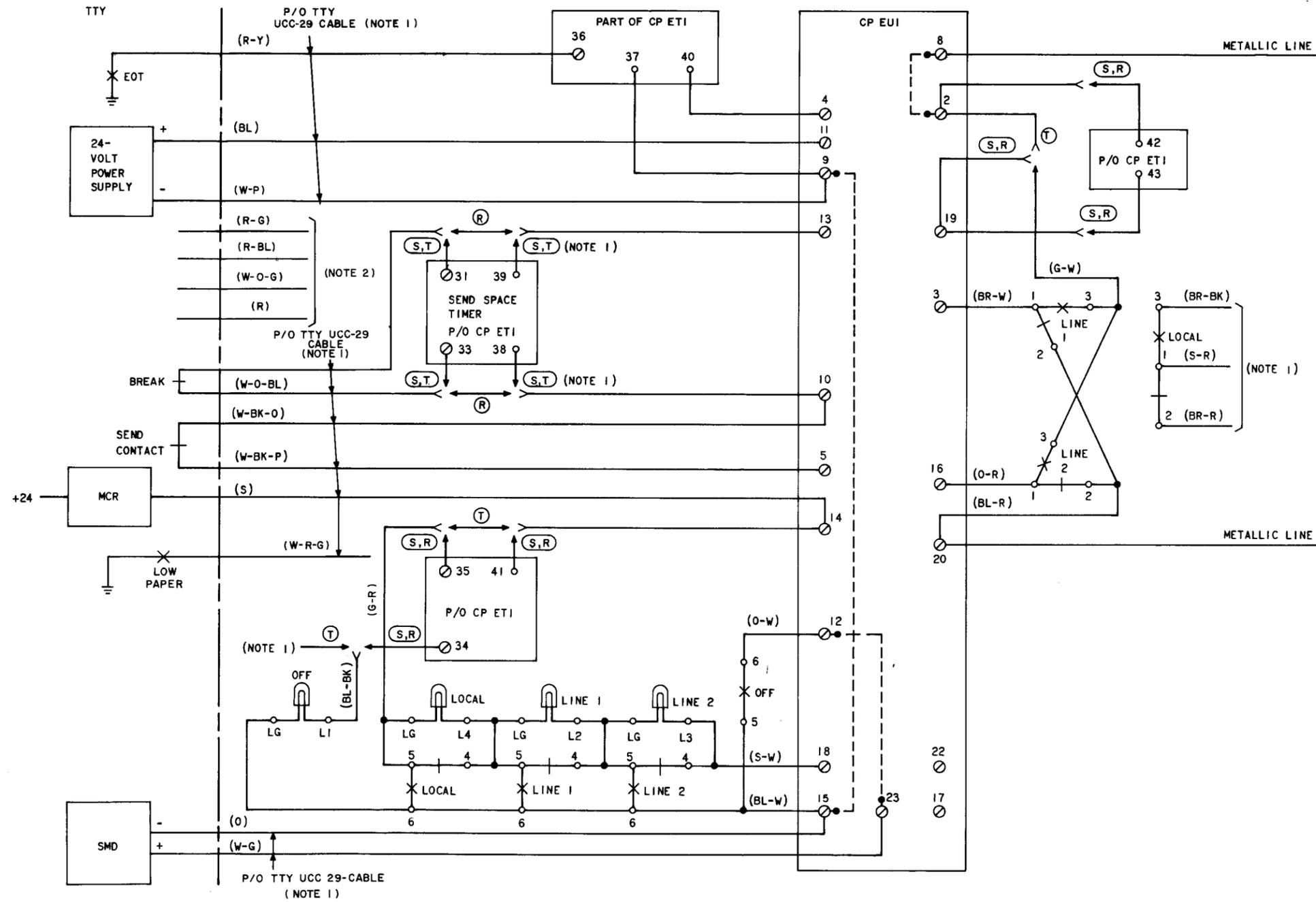
**Note 1:** Extended range stations are those stations served over a total loop resistance of from 2100 to 2500 ohms. They may have a minimum current level of 2.4 mA. All padding resistance is removed for extended range stations.

**Note 2:** If for any reason the connection is dropped, it will be necessary to depress the OFF button, and then depress the LINE 1 button again in order to reestablish a connection.

**5.09** *Lines to Concentrator Not Terminated:*

When the station is being installed and the line has not been connected to the concentrator, the line pad settings can be verified per Fig. 7. Request the line be shorted at the concentrator and measure the short circuit loop current. The loop current should be within the tolerances contained in the LINE PAD CURRENT ADJUSTMENT WITH SHORT CIRCUIT AT CONCENTRATOR column.

**Note:** Extended range stations (A set to zero) short circuit current must be greater than 1.5 mA.



NOTES:

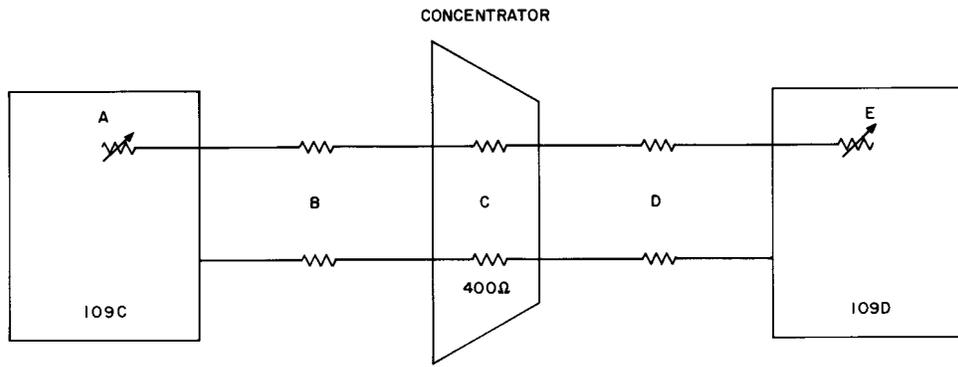
1. SPARE LEADS SHOWN IN TABLE BELOW MAY BE STORED ON INDICATED TERMINALS.

SPADE ENDED LEAD	EUI CIRCUIT PACK TERMINAL FOR OPTION		
	(R)	(S)	(T)
LOCAL CABLE			
BR - BK	22	22	22
S - R	22	22	22
BR - R	17	17	17
BL - BK	—	—	17
UCC 29 CABLE			
W-R-G	17	17	19
ETI CIRCUIT PACK	ETI CIRCUIT PACK SCREW TERMINALS		
38	31	—	—
39	31	—	—
41	—	—	35
42	—	—	32
43	—	—	32

2. WHEN USING TELETYPE CORP CABLE TP 336463, THE FOLLOWING LEADS FROM THE CALL CONTROL UNIT MUST BE TERMINATED AS INDICATED:

SPADE ENDED LEAD	EUI CIRCUIT PACK TERMINAL
W-O-G	1
R	1
R - G	21
R - BL	21

Fig. 5—Wiring Diagram, Data Set 109C-L1/2, Showing EOT and SST Options

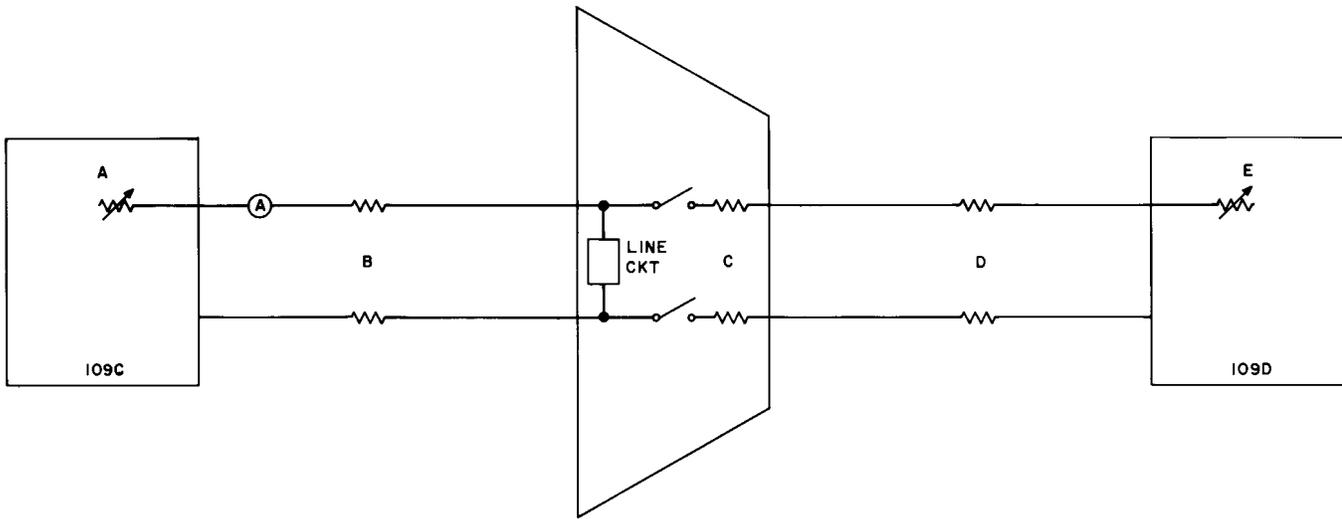


LINE PAD RESISTANCE SETTINGS

TOTAL KNOWN RESISTANCE		REQUIRED PAD RESISTANCE	SCREW SWITCH POSITION		
B+C+D+E	B+D+E	A	S4	S2	S1
2500 TO 1800	2100 TO 1400	0*	CLOSED	CLOSED	CLOSED
1800 TO 1500	1400 TO 1100	270	CLOSED	CLOSED	OPEN
1500 TO 1300	1100 TO 900	510	CLOSED	OPEN	CLOSED
1300 TO 1000	900 TO 600	780	CLOSED	OPEN	OPEN
1000 TO 700	600 TO 300	1100	OPEN	CLOSED	CLOSED
700 TO 500	300 TO 100	1370	OPEN	CLOSED	OPEN
500 TO 400	100 TO 0	1610	OPEN	OPEN	CLOSED

\* WITH MAXIMUM METALLIC LINE AND TRUNK, THE PAD RESISTANCE IS ZERO (A=0)

Fig. 6—Data Set 109C-Type Line Pad Adjustment



NORMAL RANGE STATIONS KNOWN VALUES (OHMS)		APPROXIMATE VALUE (OHMS)	LINE PAD ADJUSTMENT WITH CAMP-ON SIGNAL: LOOP CURRENT (MA)	LINE PAD ADJUSTMENT - WITH SHORT CIRCUIT AT CONCENTRATOR: LOOP CURRENT (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
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 STATIONS (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

Fig. 7—Verification of Loop Pad Resistance Settings Using Camp-On or Short Circuit Current Measurements