

**DATA SET 109C-TYPE
USED IN
10-TYPE DATA LINE CONCENTRATOR SYSTEM (DLCS*)
DESCRIPTION AND OPERATION**

1. GENERAL

1.01 This section covers the physical and functional description and operating procedures for Data Set 109C-type when used in data line concentrator applications.

*Formerly called DATREX.

1.02 Data Set 109C-type (Fig. 1) is a low-speed (up to 300 bauds), half-duplex, serial transmission, ungrounded dc (baseband) data set. It is specifically designed to mount within a suitably configured model No. 33 or 35 teletypewriter (TTY). The data set requires approximately 3 watts peak power of filtered +24 volts dc which is supplied by the TTY call control unit.

1.03 Data Set 109C-type is installed within a model No. 33 or 35 TTY directly in front of the call control unit, under the bezel on the right-hand side. The data set provides an interface between the send contacts and selector magnet driver of the model No. 33 or 35 TTY at a metallic loop.

1.04 Data Set 109C-type is limited to use on a 2-wire metallic loop. The transmission loop used by the data set must provide dc continuity. The loop cannot be carrier derived, and ground return cannot be used.

1.05 Data Set 109C-type may be ordered by the following list numbers:

- 109C-L1
- 109C-L1/2
- 109C-L1/3
- 109C-L1/4

- 109C-L1/2/3

- 109C-L1/2/4

1.06 Data Set 109C-type operates in ambient temperatures ranging from 40° to 120° F, and in relative humidity up to 95 percent.

1.07 The schematic drawing and circuit description covering Data Set 109C-type are SD- and CD-1D164-01.

2. PHYSICAL DESCRIPTION

2.01 Data Set 109C-L1 (Fig. 1) consists of an EU1 circuit pack, a 635T2 key, a CA1 cord, and a metal bracket.

(a) The EU1 printed circuit pack is attached to the baseplate with four screws.

(b) The 635T2 key is made up of six buttons, each equipped with a lamp and a designation card, and is attached to the bracket by means of a retainer.

(c) Interconnections to the circuit packs, the 635T2 key, teletypewriter, metallic loop, and dc power are made through the screw terminals at the rear of the card.

2.02 Data Set 109C-L1/2 consists of a Data Set 109C-L1 and an ET1 circuit pack mounted on the EU1 circuit pack. The ET1 circuit pack is mounted by means of spacer/bushings which snap into holes provided in the EU1 circuit pack. Interconnections to the ET1 circuit pack are made through screw terminals and spade-tipped leads on the rear of the ET1 circuit pack (Fig. 2 and 3).

2.03 Data Set 109C-L1/3 (Fig. 4) consists of Data Set 109C-L1 with a rotary dial, a set of 106A brackets used to mount the dial to the

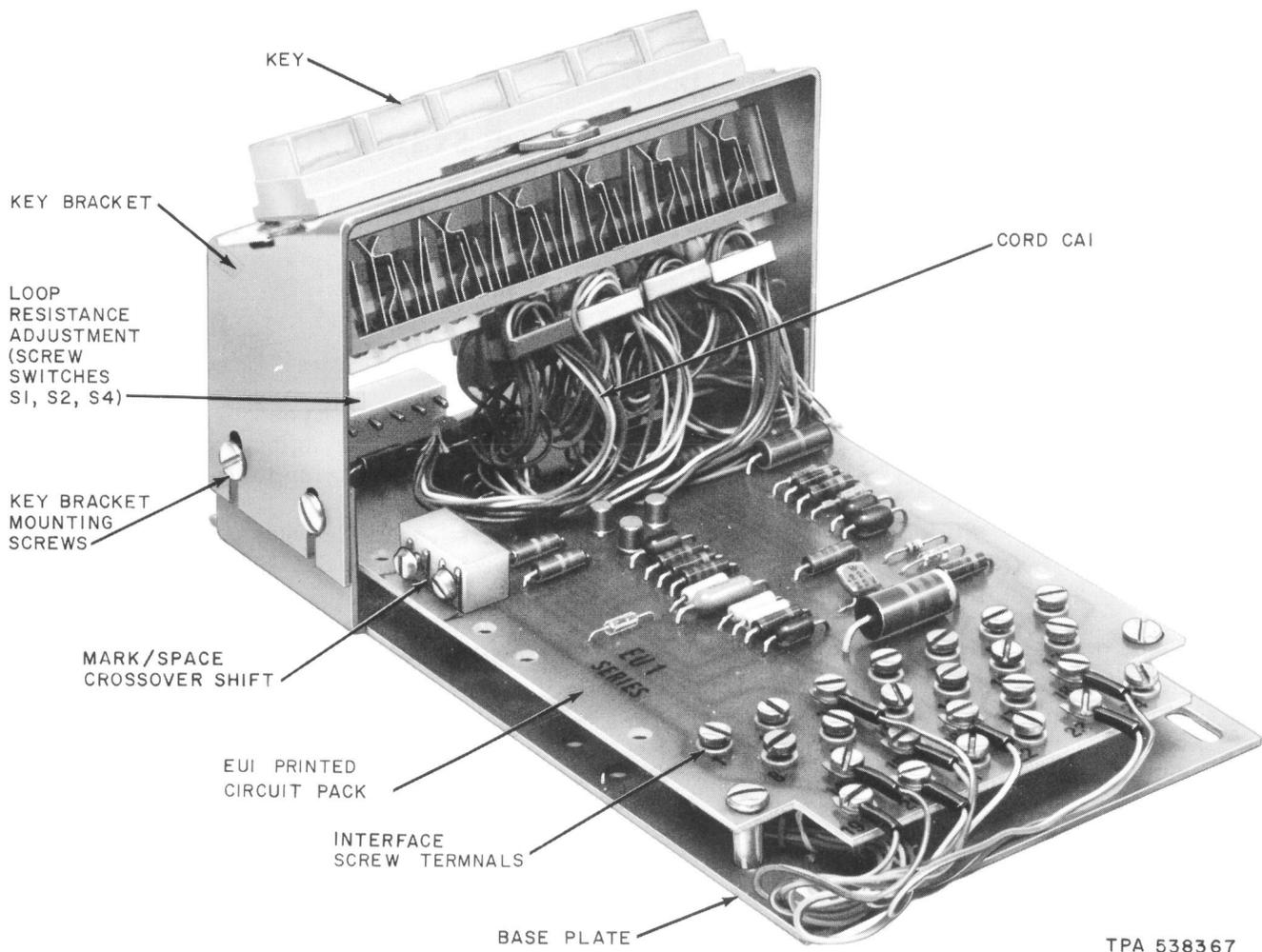


Fig. 1—Data Set 109C-L1

baseplate, a receive-only handset, and a handset hanger that is attached to the side of the teletypewriter housing.

2.04 Data Set 109C-L1/4 (Fig. 5) consists of Data Set 109C-L1 with a TOUCH-TONE® dial, a set of 106B brackets for mounting the dial to the baseplate, a receive-only handset, a hanger for the handset which attaches to the side of the teletypewriter housing, and an ET2 circuit pack which snaps into place on the EU1 circuit pack. The ET2 circuit pack measures 1.7 by 4 inches. It is mounted by aligning the four spacer/bushings with the holes in the EU1 circuit pack and snapping into place. Connection is made by means of spade-ended leads and screw terminals. See Fig. 6.

2.05 Data Set 109C-type is approximately 7.38 inches long, 3.75 inches high, and 4.25 inches wide. It weighs approximately 1 pound 6 ounces.

2.06 Table A summarizes the features of the various list numbers of the Data Set 109C-type.

3. FUNCTIONAL DESCRIPTION

3.01 Data Set 109C-type is a dc (baseband) half-duplex (HDX) data set designed to operate over a metallic loop up to 2000 ohms resistance (with an extended range to 2500 ohms) and up to 1 microfarad capacitance. Polar dc loop current of 3 mA is used to communicate over a 2-wire metallic loop with any other Data Set 109-type.

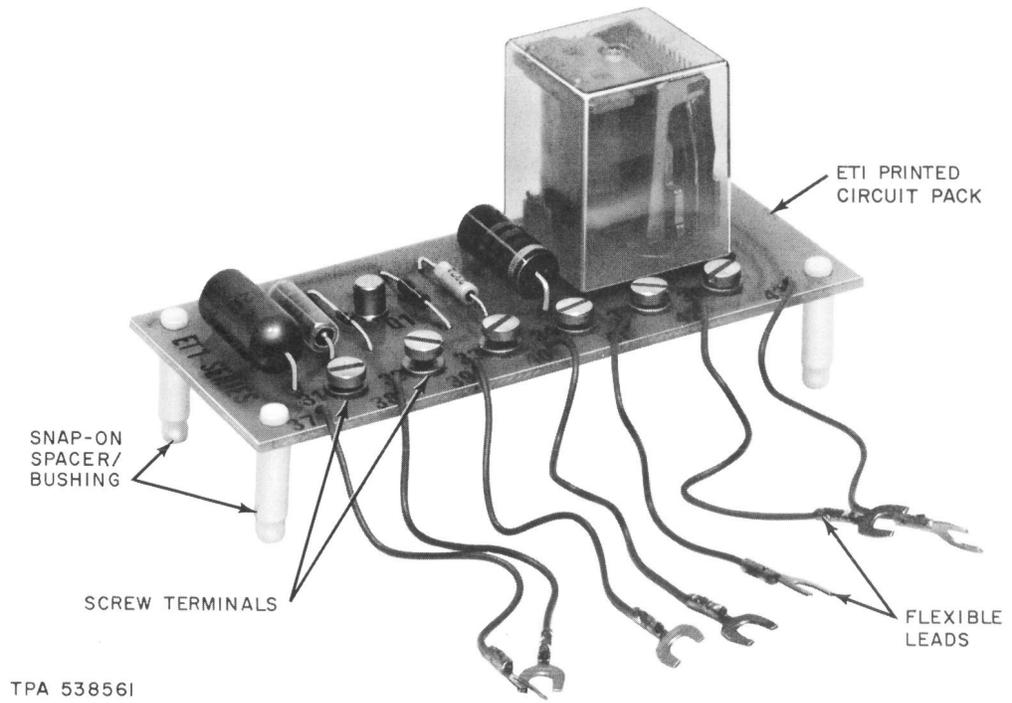


Fig. 2—Circuit Pack ET1

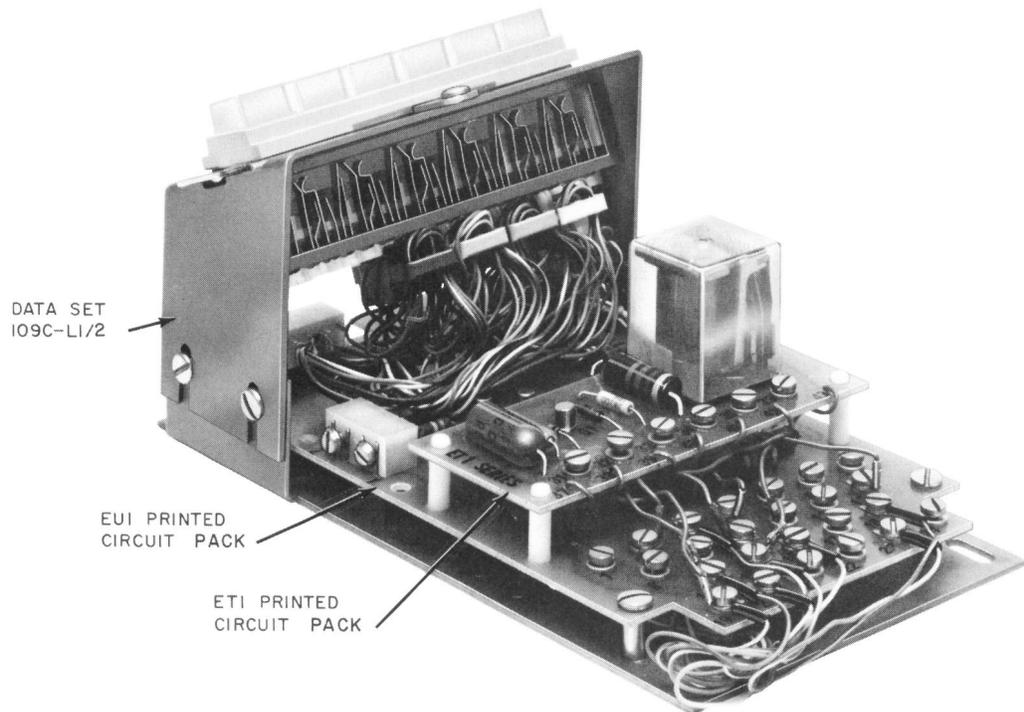


Fig. 3—Data Set 109C-L1/2

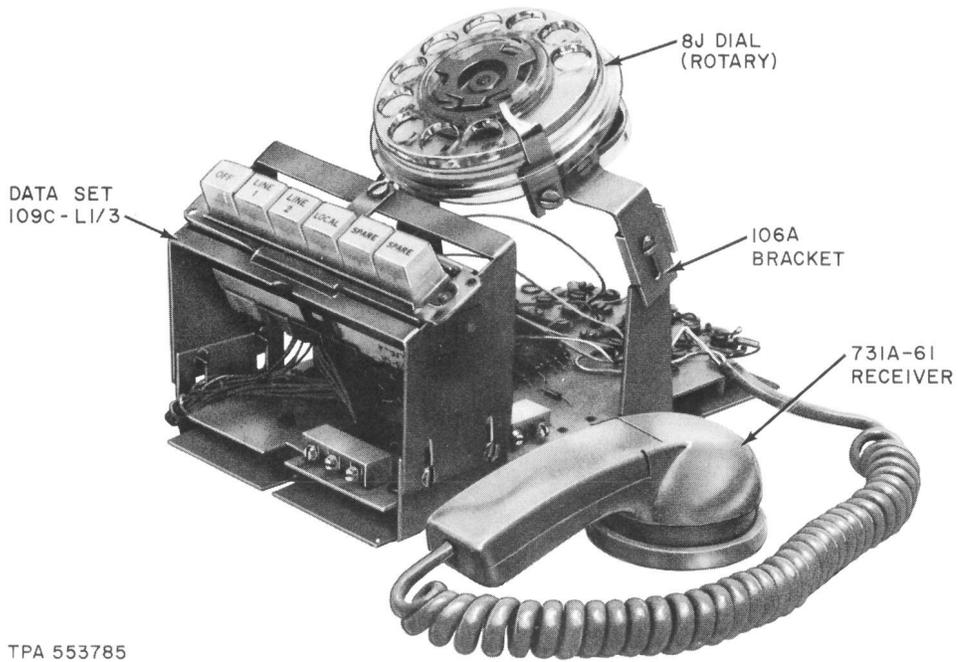


Fig. 4—Data Set 109C-L1/3

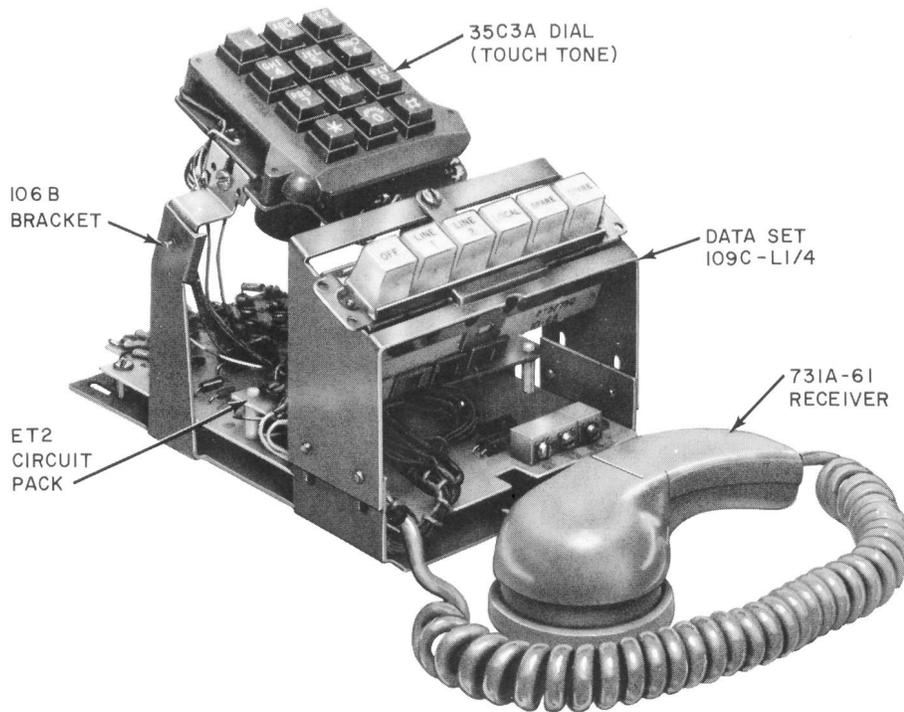
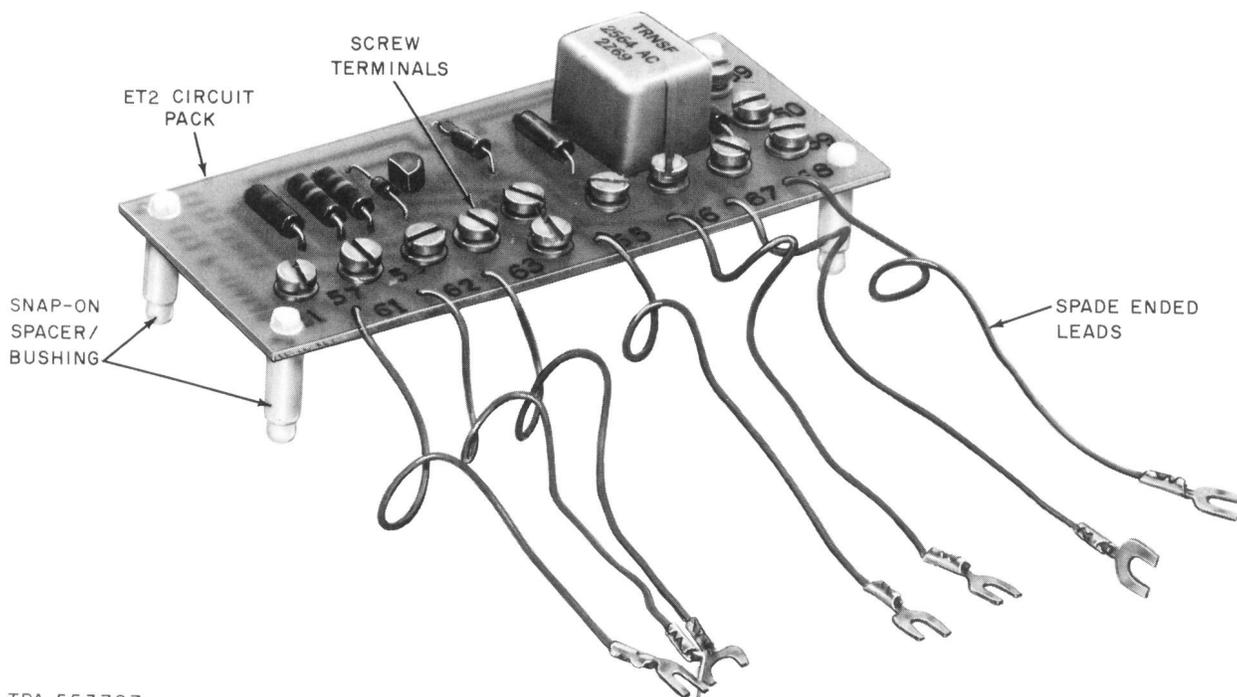


Fig. 5—Data Set 109C-L1/4

TABLE A
FEATURES OF DATA SET 109C-TYPE

DATA SET	CIRCUIT PACK ASSEMBLY			DIAL ASSEMBLY		RECEIVER (LISTEN-ONLY HANDSET)
	EU1	ET1	ET2	ROTARY	TOUCH-TONE	
109C-L1	X					
109C-L1/2	X	X				
109C-L1/3	X			X		X
109C-L1/4	X		X		X	X
109C-L1/2/3	X	X		X		X
109C-L1/2/4	X	X	X		X	X



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Fig. 6—Circuit Pack ET2

3.02 Data Set 109C-L1 includes an EU1 circuit pack which functionally consists of a transmitter, a receiver, and a built-in line pad. See Fig. 7.

3.03 The transmitter is keyed by the send contacts in the TTY. When the send contacts are closed, the transmitter sends a marking voltage

(+4.3 volts); when the send contacts are open, the transmitter sends a spacing voltage (-12.9 volts). These signal voltages are applied to the loop through a line pad.

3.04 The receiver consists of a differential amplifier and a selector magnet driver (SMD) coupling circuit. The input to the differential amplifier is

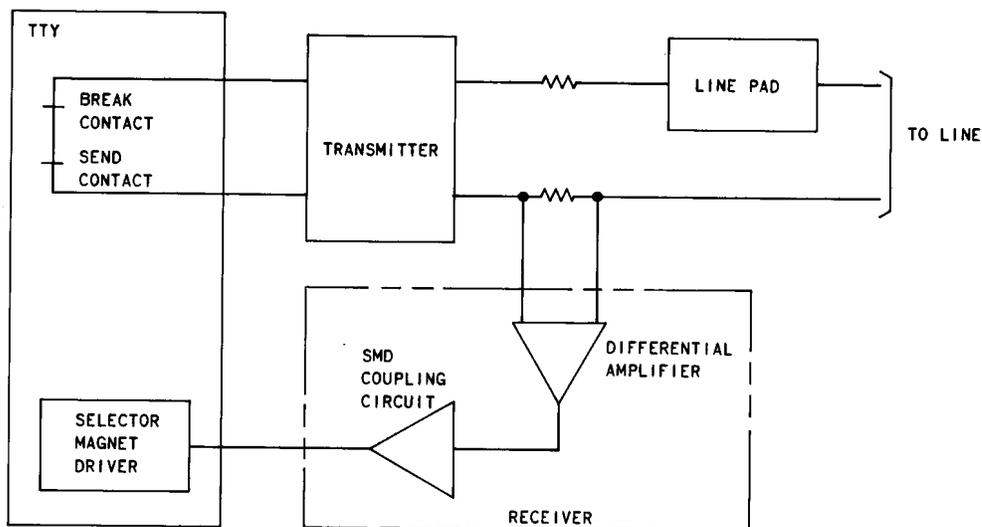


Fig. 7—Block Diagram of Data Set 109C-L1

derived from a resistor in series with the metallic loop. See Fig. 7. Voltage across the resistor is proportional to the loop current signals. When the differential amplifier detects a marking current on the metallic loop, the SMD coupling circuit is driven into saturation. When the differential amplifier detects a spacing current on the loop, the SMD coupling circuit is cut off. These two states of the SMD coupling circuit cause the teletypewriter to receive a mark or a space, respectively.

3.05 External to the EU1 circuit pack but interconnected to it is a 635T2 key, which provides a switching control for selecting the mode of operation. Connections between the key and circuit pack are made via a spade-ended cord (CA1) and screw terminals located on the rear of the circuit pack. The CA1 cord plugs into the key at one end. The free end is terminated with spade lugs which permit the installer to rearrange connections to the circuit pack for different required features. Key designations are shown in Fig. 8 and explained in Table B.

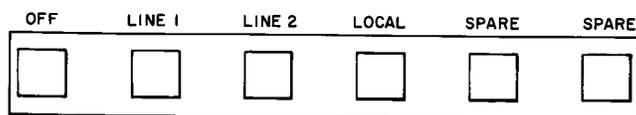


Fig. 8—Data Set 109C-L1 Key Arrangement

3.06 An additional feature of the Data Set 109C-type is the mark/space crossover shift. Screw switches Y and Z associated with this option are shown in Fig. 1. They function as follows:

- (a) Closing switch Y and opening switch Z causes the incoming data lead to be marking when the loop is opened.
- (b) Closing switch Z and opening switch Y causes the incoming data lead to be spacing when the line is open with LINE 1 or LINE 2 button depressed. With the OFF button depressed, the incoming data lead is clamped to a mark when the loop is opened. This prevents hits when the TTY motor is turned on and off.

3.07 A resistor pad arrangement is built into the data set EU1 circuit pack, allowing resistance to be added to the metallic loop. By opening or closing various screw switch combinations, the line can be built out to a nominal value of 2000 ohms, in 8 steps of approximately 270 ohms each. See Fig. 1 and Table C.

3.08 Data Set 109C-L1/2 includes Data Set 109C-L1 and a snap-on circuit pack ET1. Functionally, it provides two additional features not provided by Data Set 109C-L1. These are end of transmission (EOT) disconnect and send-space timer (SST). See Fig. 3.

TABLE B
KEY FUNCTIONS DLCS

BUTTON POSITION	BUTTON DESIGNATION	FUNCTION
1	OFF*	The data set is disconnected from the loop. Motor control relay in TTY is released.
2	LINE 1†	The data set is connected to the loop.
3	LINE 2†	The data set is connected to the loop with the connections to tip and ring reversed. <i>Note:</i> Operation of this button gives dual access. For single access, this button is permanently blocked mechanically.
4	LOCAL†	The data set is disconnected from the line and terminated in a dummy line circuit to derive local copy.
5	SPARE	
6	SPARE	

* If Data Set 109C-type is equipped with an ET1 circuit pack and EOT is received, the OFF lamp is lighted, LINE 1 or LINE 2 lamp remains lighted, the loop is opened via relay contacts on the ET1 circuit pack, and the TTY motor is switched off via the interface lead to the motor control relay. Before another call may be placed, the OFF button must be depressed. Depressing the OFF button extinguishes both lamps and releases EOT relay on ET1 circuit pack.

† Operating button LINE 1, LINE 2, or LOCAL lights a lamp under the depressed button and closes a contact which will permit the TTY motor control relay to be turned on via interface lead.

TABLE C
LINE PAD RESISTANCE VALUES

PAD RESISTANCE	SCREW SWITCH POSITION		
	S4	S2	S1
0	CLOSE	CLOSE	CLOSE
270	CLOSE	CLOSE	OPEN
510	CLOSE	OPEN	CLOSE
780	CLOSE	OPEN	OPEN
1100	OPEN	CLOSE	CLOSE
1370	OPEN	CLOSE	OPEN
1610	OPEN	OPEN	CLOSE
1880	OPEN	OPEN	OPEN

3.09 EOT disconnect is a feature of the optional ET1 circuit pack. When an EOT signal is detected by the TTY, the LINE 1 or LINE 2 lamp remains lighted, the OFF lamp is lighted, and the loop is opened via the relay on the ET1 circuit pack.

3.10 The send-space timer is another feature of the ET1 circuit pack. When the break key on the TTY is depressed and held, a delay circuit is activated limiting the length of the transmitted spacing signal to approximately 500 ms.

Note: The key must be held down in excess of 500 ms to ensure proper operation of the SST circuit.

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3.11 Data Set 109C-L1/3 includes Data Set 109C-L1, a rotary dial, and a receive-only handset. Functionally it provides the additional feature of Direct Distance Dialing (DDD) through the DATA-PHONE® interconnection arrangement using a 10B concentrator. See Fig. 4.

3.12 The pulsing contacts of the dial are arranged to key the transmitter of the data set. Dial pulses are transmitted as a series of mark and space data signals. The listen-only receiver is wired in series with the dc loop at the input of the data set. This provides a means for monitoring dial tone and call progress tones. An off-normal contact shorts out the receiver, keeping dial pulses out of the receiver. An additional off-normal contact shorts out the select-magnet-driver, preventing local copy from being printed during dialing.

3.13 Data Set 109C-L1/4 consists of Data Set 109C-L1 equipped with a TOUCH-TONE dial, an ET2 circuit pack and a receive-only handset. Functionally it provides the same additional purpose as the 109C-L1/3 (DDD access). The handset is used for monitoring dial tone and call progress tones. See Fig. 5.

3.14 The ET2 circuit pack, Fig. 6, provides the necessary circuitry to activate and couple the TOUCH-TONE dial to the dc loop. The circuit

pack utilizes a 3-winding transformer which performs the following:

- (a) Couples the TOUCH-TONE signals into the dc loop
- (b) Couples the TOUCH-TONE signals into the listen-only receiver
- (c) Couples dial tone from the dc loop into the listen-only receiver.

An off-normal contact of the dial controls a transistor switch on the ET2 circuit pack that is arranged to key the transmitter of the data set. TOUCH-TONE signals are transmitted simultaneously with a spacing data signal over the dc loop. The DDD access arrangement on the trunk side of the concentrator couples the TOUCH-TONE signals to the Central Office loop.

3.15 The TOUCH-TONE dial is powered from the same teletypewriter power supply as Data Set 109C-type. The ET2 circuit pack provides the necessary biasing for the TOUCH-TONE dial.

4. OPERATION

4.01 When used for data line concentrator (DATREX) service, Data Set 109C-type is arranged as shown in the simplified block diagram (Fig. 9). Table B lists the key and lamp positions, designations, and functions for this application.

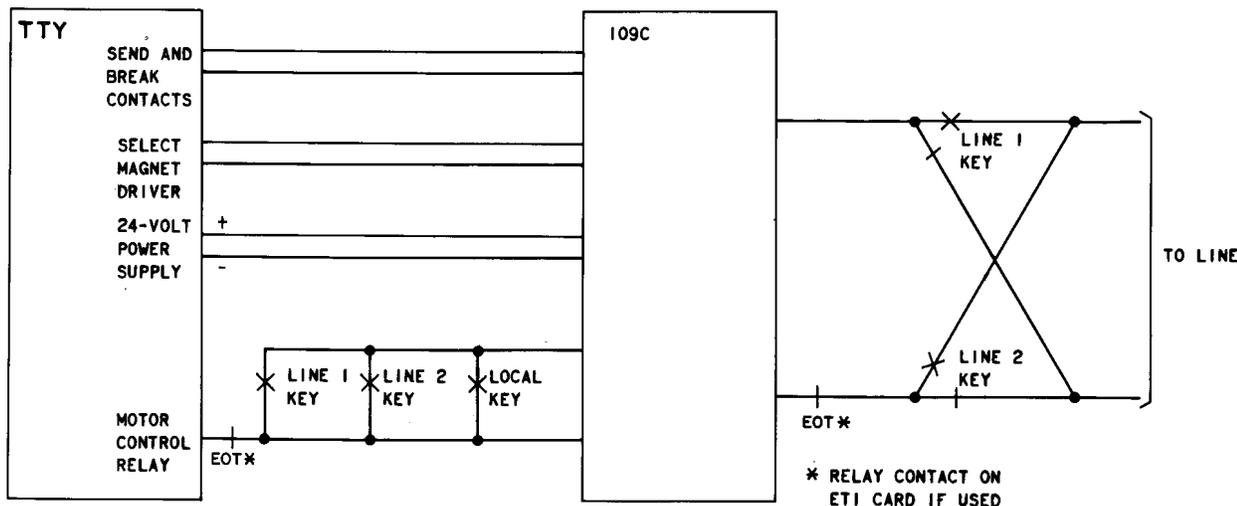


Fig. 9—Data Set 109C-L1/2 Dual Access, Data Line Concentrator System Major Switching Functions

4.02 OFF: When the OFF button is depressed, the data set is disconnected from the metallic loop, and the motor control relay is released.

To Place a Call From Stations Using Data Set 109C-L1 or 109C-L1/2

4.03 LINE 1: When the LINE 1 button is depressed, the data set is connected to the metallic loop, the LINE 1 lamp is lighted, and the TTY motor control relay is operated via the interface lead to the TTY. The data set applies a marking voltage of approximately +4 volts to the metallic loop. The line scanner of the data line concentrator recognizes the +4 volts as a request for service to trunk group A, and connects the line to an available trunk which terminates in a Data Set 109D-type. When the metallic line between the data sets is completed, exchange of data can begin. If there is no idle trunk available, the scanner seizes the first line requesting service and stops while waiting for the next idle trunk. The concentrator is equipped with a camp-on generator which sends a short spacing signal to all stations requesting service and unable to connect during the all-trunks-busy condition. This camp-on signal can be recognized by the fact that a nonprinting character (DEL) is selected by the TTY receiving mechanism every 3 or 4 seconds.

Note: If the camp-on signal ceases and the station is not connected through to the computer (no answer-back), the calling station has been placed on a holding trunk. When this occurs, it will be necessary to depress the OFF button and place another call.

4.04 LINE 2 (Used in dual access only): When the LINE 2 button is depressed, the LINE 2 lamp is lighted, the motor control relay is operated via the interface lead to the TTY, and the data set is connected to the metallic loop with the connection to tip and ring reversed (see Fig. 9). The concentrator senses this reversal of polarity, and proceeds as described for LINE 1, except the data set is connected to trunk group B.

Note: If a single-access concentrator is used, the LINE 2 button is blocked.

Local Mode

4.05 LOCAL: When this button is depressed, the data set is disconnected from the metallic

loop and connected to a dummy line circuit, the motor control relay is operated via the interface lead to the TTY, and the LOCAL lamp is lighted. The receiver detects current that flows through the dummy line circuit and drives the selector magnet driver, causing local copy to be printed.

4.06 EOT Option: When an EOT character is detected by the local TTY station equipped with the optional ET1 circuit pack, the following conditions exist.

- (a) The LINE 1 or LINE 2 lamp (whichever is the case) remains lighted.
- (b) The OFF lamp is lighted.
- (c) The metallic loop is opened via the relay on the ET1 circuit pack.
- (d) The TTY motor is turned off via the interface lead to the motor control relay.

In order to place another call, it is necessary to depress the OFF button (this extinguishes both lamps) and then depress the desired LINE 1 or LINE 2 button again.

To Place a Call From Stations Using Data Set 109C-L1/3 or 109C-L1/4

4.07 Line 1: LINE 1 is the same functionally as described in 4.03.

4.08 LINE 2: LINE 2 on stations using Data Set 109C-L1/3 or 109C-L1/4 is associated with the DATA-PHONE interconnection arrangement (DDD). The dial and listen-only handset (receiver) are arranged as shown in Fig. 10 and Fig. 11. Key functions are given in Table D.

4.09 To place a call on LINE 2 of a station using Data Set 109C-L1/3 or 109C-L1/4, proceed as follows.

- (a) Depress LINE 2 key.
- (b) Listen for dial tone in the listen-only handset.

Note: During an all-trunks-busy condition, a camp-on signal will be received. This can be recognized by a reception of a nonprinting DEL character which results in a click every 3 or 4 seconds.

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- (c) When dial tone is received, dial desired number.
- (d) Call progress tones may be monitored by listening to the listen-only receiver. (When

a short burst of energy is heard, the connection is complete).

- (e) When answer-back is received on teletypewriter, exchange of data can begin.

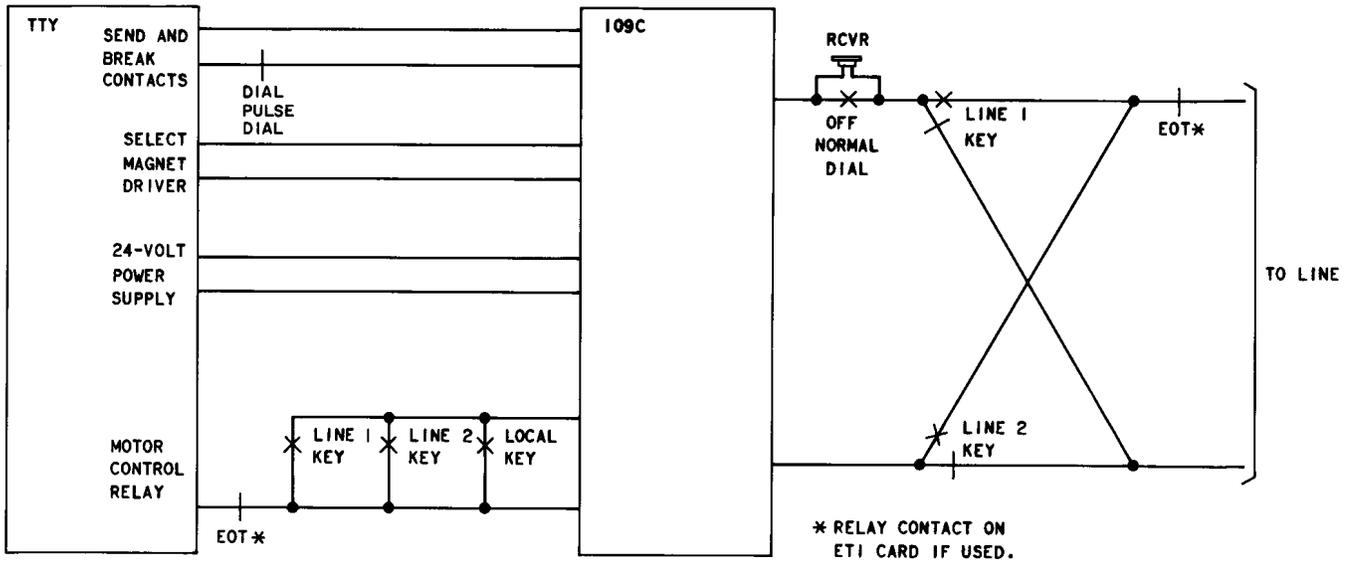


Fig. 10—Data Set 109C-L1/2/3 Dual Access, Data Line Concentrator System Major Switching Functions

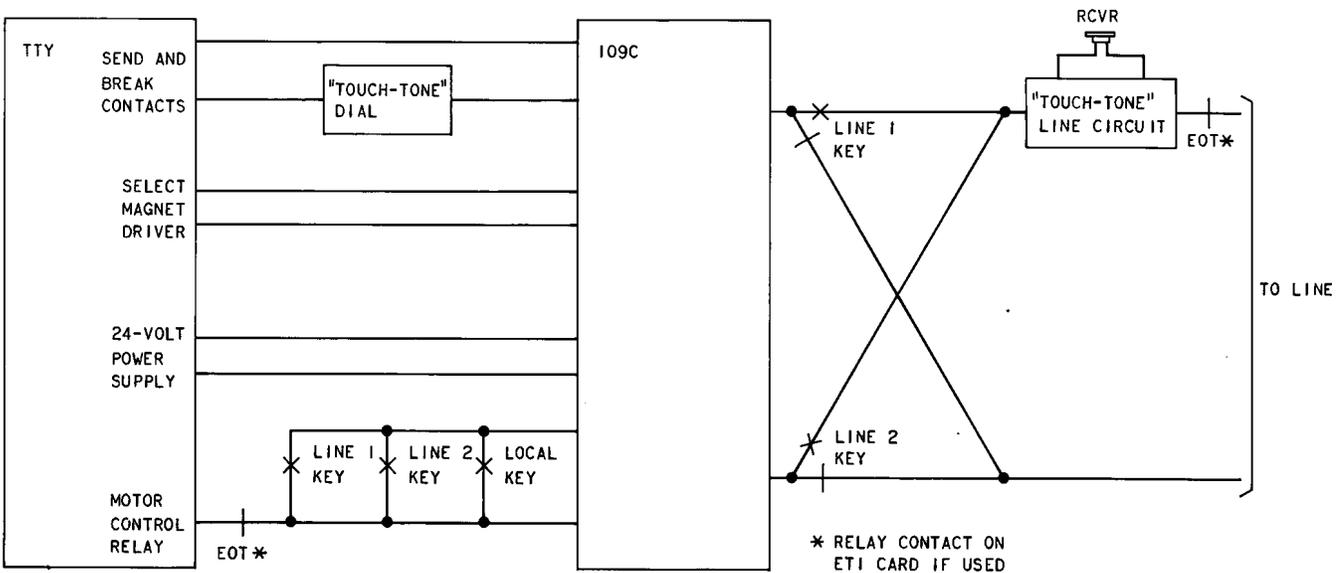


Fig. 11—Data Set 109C-L1/2/4 Dual Access, Data Line Concentrator System Major Switching Functions

TABLE D
KEY FUNCTIONS, DATA 109C-L1/2/3 AND 109C-L1/2/4
WHEN UED IN DLCS

BUTTON POSITION	BUTTON DESIGNATION	FUNCTION
1	OFF*	The data set is disconnected from the loop. Motor control relay in TTY is released.
2	LINE 1†	The data set is connected to the loop.
3	LINE 2†	DDD access — The data set is connected to the loop with the connection to tip and ring reversed. The dial pulse contacts are arranged to key the transmitter of the data set. The listen-only receiver is used to monitor dial tone.
4	LOCAL†	The data set is disconnected from the line and terminated in a dummy line circuit to derive local copy.
5	SPARE	
6	SPARE	

* If Data Set 109C-type is equipped with an ET1 circuit pack and EOT is received, the OFF lamp is lighted, LINE 1 or LINE 2 lamp remains lighted, the loop is opened via relay contacts on the ET1 circuit pack, and the TTY motor is switched off via the interface lead to the motor control relay. Before another call may be placed, the OFF button must be depressed. Depressing the OFF button extinguishes both lamps and releases EOT relay on ET1 circuit pack.

† Operating button LINE 1, LINE 2, or LOCAL lights a lamp under the depressed button and closes a contact which will permit the TTY motor control relay to be turned on via interface lead.