

DATA SET 109F
PRIVATE LINE APPLICATION
DESCRIPTION AND OPERATION

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1. GENERAL

1.01 This practice provides information on the data set 109F (Fig. 1). A physical and functional description of the data set is provided along with general information on the application and system where this data set is used. This practice covers only the private line applications for this data set.

1.02 Data set 109F is a full-duplex (FDX), low-speed, serial transmission, ungrounded, dc data set that can be operated with any other FDX data set 109-type. Data set 109F can also be operated in the half-duplex (HDX) mode and is compatible with all data set 109-type HDX or FDX sets. Data set 109-type is only for station use.

1.03 The data set is designed to operate in the FDX mode at speeds up to 150 baud in each direction over loops with less than 2000-ohms resistance and less than 1-microfarad capacitance. The data set can be operated in the HDX mode at speeds up to 150 baud with an extended range to 2500 ohms with less than 1-microfarad capacitance. Loops shorter than 2000 ohms are adjusted to a nominal value of 2000 ohms by using the resistor pads located on the EU2 circuit pack. For information on making this adjustment, refer to the section entitled Data Set 109F—Private Line Application—Installation (591-035-200).

1.04 The data set is designed for use over 2-wire metallic private line facilities, and provides an interface between a metallic loop and a teletypewriter with a send contact and a selector magnet driver. A tri-level current baseband transmission scheme is employed which allows data set 109F to work compatibly with any FDX data set 109-type.

1.05 Private line arrangements using the data set 109F at one end of a metallic loop will require a data set 109-type at the other end of the loop in conjunction with a teletypewriter, hub, or customer-provided terminal. A block diagram showing some typical private line arrangements is given in Fig. 2.

1.06 Data set 109F is arranged to be mounted *only* within a suitable 33- or 35-type teletypewriter. The data set is mounted in the front of the UCC-29 call control unit.

1.07 The data set requires approximately 3 watts of filtered +24V dc power. This power is supplied from the teletypewriter, as the data set does not contain a power supply of its own.

Caution: The power supply for data set 109F must not be connected to chassis ground. None of the interface circuits except the protective ground lead may be connected to chassis ground in the teletypewriter.

1.08 The data set has been designed to operate satisfactorily within the specified range of environmental conditions as follows:

Temperature Range—40 to 120°F

Relative Humidity—20 to 95 percent.

1.09 Data set 109F can be equipped with an additional circuit board (ET1 circuit pack) to provide EOT and/or send space timer circuits

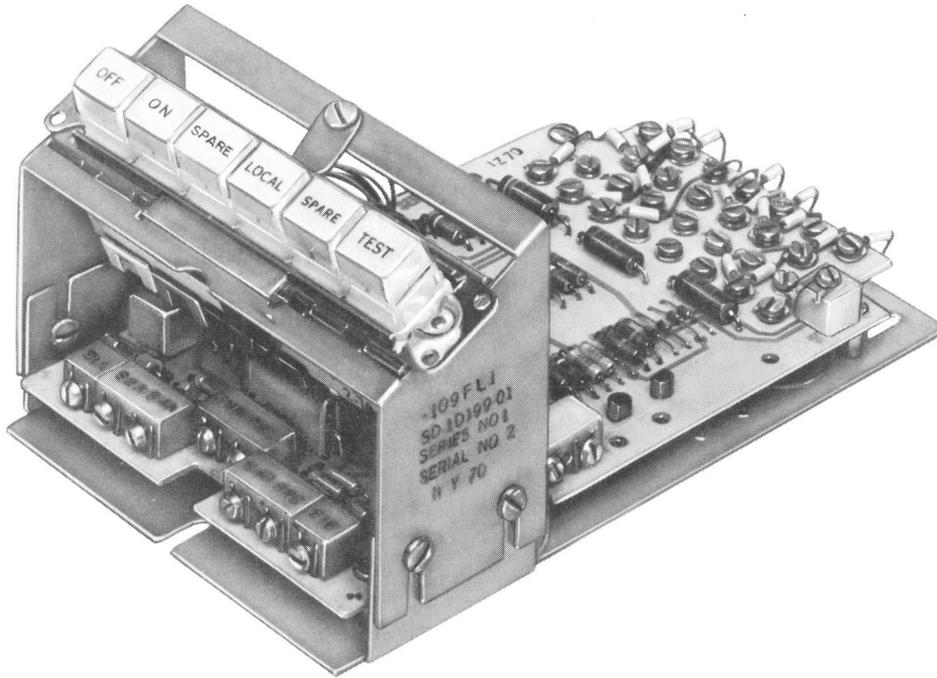
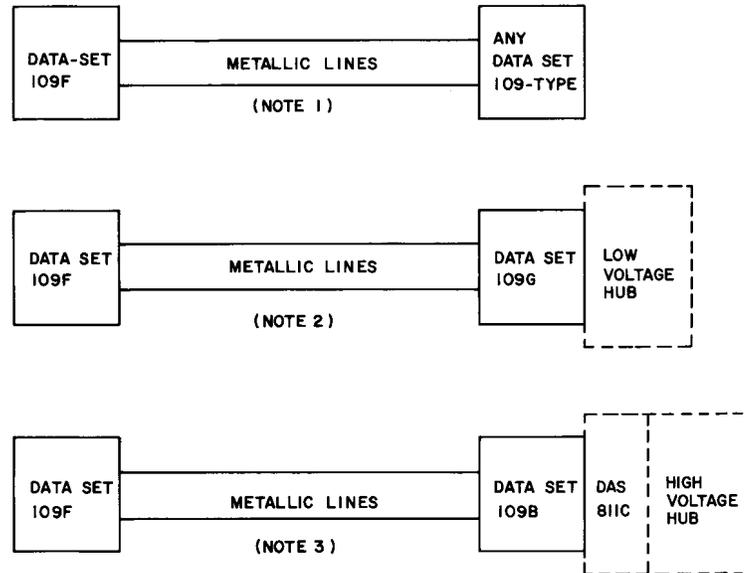


Fig. 1—Data Set 109F—Front View



NOTES:

1. FOR POINT-TO-POINT SERVICE, THE BALANCE OF 2000 OHMS RESISTANCE NOT FURNISHED BY THE LINES IS EQUALLY DIVIDED BETWEEN THE DATA SETS.
2. WHEN LINE RESISTANCE IS LESS THAN 1500 OHMS, THE DATA SET 109G WILL BE PADDED WITH 522 OHMS AND THE BALANCE OF 2000 OHMS WILL BE PADDED AT THE DATA SET 109F. WHEN LINE RESISTANCE IS 1500 OHMS OR MORE, THE ENTIRE BALANCE OF 2000 OHMS WILL BE PADDED AT THE DATA SET 109F.
3. THE BALANCE OF 2000 OHMS RESISTANCE NOT FURNISHED BY THE LINE IS PADDED AT DATA SET 109F.

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Fig. 2—Block Diagram for Typical Private Line Configurations

in the private line arrangement. The data set code is changed to indicate the features provided by the ET1 circuit pack.

1.10 Coding of data set 109F is accomplished by using the following list numbers:

- L1—Designates the basic data set
- L2—ET1 circuit pack added.

Data set 109F-L1 and data set 109F-L1/2 are the only two orderable codes for private line applications of the data set.

2. PHYSICAL DESCRIPTION

2.01 Data set 109F-L1 consists of a bracket, keystrip, cords, and EU2 circuit pack. Data set 109F-L1/2 also contains an ET1 circuit pack.

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Refer to Fig. 3 for the component designations of these units.

2.02 The physical configuration of the data set is changed by the addition of the ET1 board required to provide the list number. The addition or removal of the stand-off mounted ET1 circuit pack does not change the amount of space required to mount the data set. The physical dimensions of the data set are given in Fig. 3.

2.03 The data set has a 6-button key. The individual button designation and functions are given in Part 3 of this practice.

2.04 Data set 109F provides screw switches for adjusting loop resistance to a nominal value of 2000 ohms. The location of the screw switches is shown in Fig. 4. For information on setting these screw switches to obtain the required line resistance, refer to Section 591-035-200.

2.05 Attachment of the optional ET1 circuit pack to the data set is accomplished by using snap-on spacer/bushings provided for this purpose. Electrical connections are made by connecting spade-tipped wires to the proper screw terminals of the data set. For information on connecting the optional board to the data set, refer to Section 591-035-200. The function performed by this circuit pack is given in Part 3 of this section.

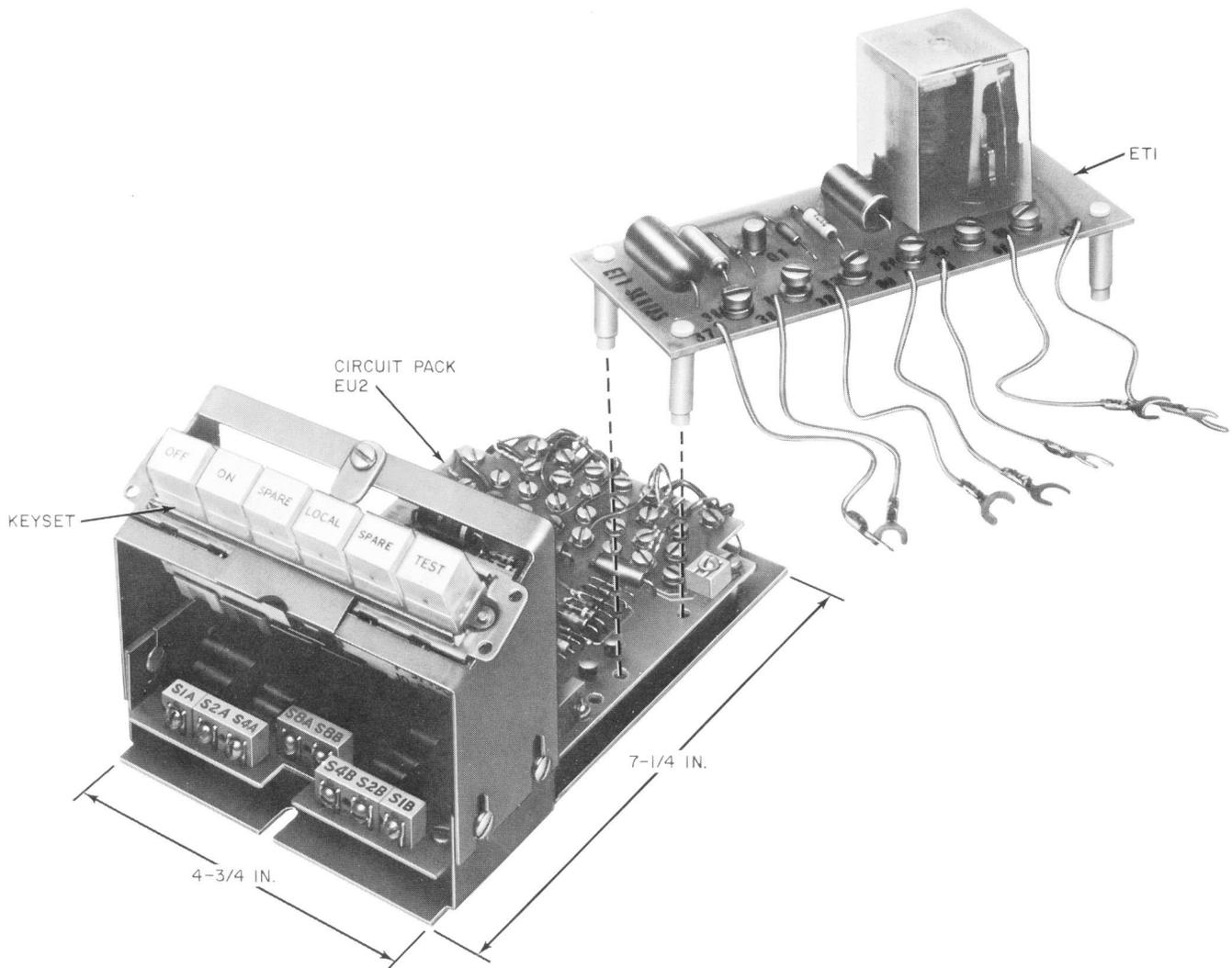


Fig. 3—Data Set 109F—Component Designation

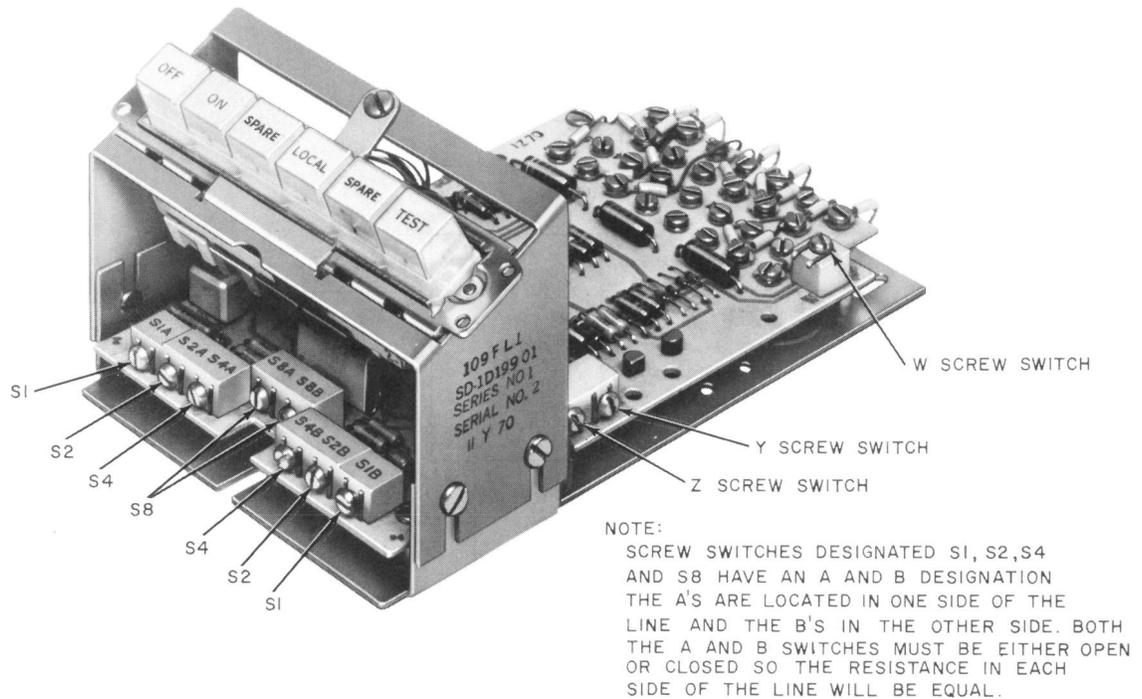


Fig. 4—Data Set 109F—Location of Screw Switches

2.06 The keystrip is connected to the circuit pack screw terminals by means of a CA1 and CA2 cord. These cords are equipped on one end with a color-coded 508 plug and on the other end with spade lugs. The plug end of the cord is connected to the keystrip as indicated in Table A. The required connections to the screw terminals depend on the service being provided. Refer to Section 591-035-200 for information on these connections.

3. FUNCTIONAL DESCRIPTION

3.01 Data set 109F for FDX (optional HDX) service using a tri-level current dc transmission scheme. A block diagram showing the basic elements of the data set is shown in Fig. 5. The optional ET1 circuit pack is indicated by dotted lines to show that it is not part of the basic data set.

3.02 Table B gives the key designation and functions of the key when the data set is used in a private line arrangement.

TABLE A

PLUG CONNECTIONS TO KEYSTRIP

KEY NO. OR POSITION	PLUG		CABLE
	COLOR	CODE	
1 or F	White	508F	CA1
2 or E	Slate	508E	
3 or D	Brown	508D	
4 or C	Green	508C	
5 or B	—	—	—
6 or A	Red	508G	CA2

3.03 The transmitter provides a mark or space signal to the line through the bridge circuit and line pads. Incoming data from the line is detected by the bridge circuit and is connected to the receiver circuit, which is connected to the TTY selector magnet driver circuit. The TTY

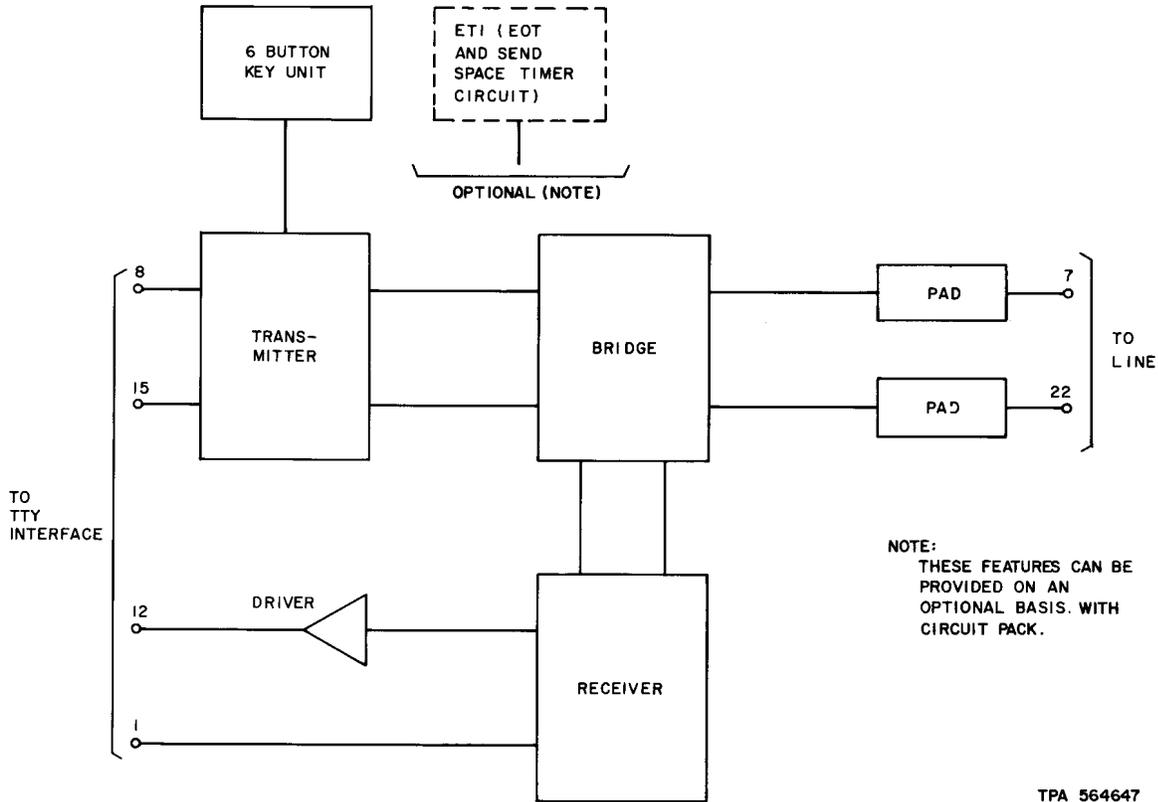


Fig. 5—Data Set 109F—Functional Block Diagram

motor control relay is also operated from the data set, thereby providing motor control.

3.04 When the data set is operated in the HDX mode, the typical metallic line current (representing a transmitted mark and space signal) is shown in Fig. 6A. A typical received signal (HDX operation) is shown in Fig. 6C. During HDX operation each of these signals will be transmitted or received separately; however, if the data set is operating in the FDX mode and these signals are transmitted and received simultaneously, the resulting line current signal would be as shown in Fig. 6B.

3.05 Recovery of the incoming data signal (in FDX operation) from the signal shown in Fig. 6B is accomplished by shifting the mark-space slicing level to eliminate the effect of the transmitted data signal. The dotted line in Fig. 6B represents the slicing level as determined by the transmitter signals. Signals above this level are considered a mark; signals below this level are a space.

3.06 Figures 6A, 6B, and 6C are drawn so that the signals can be compared to show how the shifting of the mark-space slicing level is used. The grid at the top of the page is used as an arbitrary reference to aid in explaining the incoming signal recovery. The output (dotted line) of the transmitter (Fig. 6A) determines the slicing level (dotted line) shown in Fig. 6B. The FDX signal (solid line) compared to the slicing level (dotted line in Fig. 6B) determines whether the incoming signal is considered as a mark or space as shown in Fig. 6C. A current value higher than the slicing level represents a received mark; a lower value is recognized as a space.

3.07 The incoming data (Fig. 6C) is derived or recovered as follows: When the transmitter is sending a mark (interval 0-1) the L1 splicing level is used to determine whether a mark or space is being received (Fig. 6B). During the 0 to 1 interval the resulting signal level seen by the receiver is above the L1 level (Fig. 6B); therefore, the data set sees a mark during this interval (Fig.

TABLE B

PRIVATE LINE ARRANGEMENT – DESIGNATION AND FUNCTION OF DATA SET KEYS

KEY NO. OR POSITION	DESIGNATION	FUNCTION
1 or F	OFF	The data set transmits a steady mark (or optionally, a space) and the teletype motor is turned off.
2 or E	ON	When this button is depressed the lamp under the button is lighted, data may be transmitted, and the TTY motor is turned on.
3 or D	SPARE	Not used.
4 or C	LOCAL	When this button is depressed the lamp under the button is lighted and the TTY motor is turned on. Local copy is derived by arranging the send contacts in series with the SMD.
5 or B	SPARE	Not connected.
6 or A	TEST	When this button is depressed in conjunction with the ON button, the receive lead is connected to the send lead for looparound testing, the send contact is disabled, the lamp under the button is lighted, and a copy of the receive data is delivered to the selector magnet driver.

Note: All keys are locking keys.

6C). When the transmitter sends a space (Fig. 6A interval 1-2), the L2 slicing level is used. In this case, the FDX signal level is above the L2 level (Fig. 6B interval 1-2) so the data set sees a mark in this interval also (Fig. 6C). During the 2-4 interval, the transmitter is marking (Fig. 6A) and the combined signal (Fig. 6B interval 2-4) is above the L1 level so a mark is seen by the receiver. During the 4-5 interval, a space is detected since the FDX signal level (Fig. 6B) is below the L2 slicing level that is used when the transmitter is

spacing (Fig. 6A). The transmitter continues to send a space during the interval 5-6; however, the FDX signal level is above the L2 slicing level (Fig. 6B) indicating an incoming mark (Fig. 6C). By checking the output of the transmitter (Fig. 6A), the slicing level to be used in Fig. 6B can be determined. After determining the slicing level, the level of the FDX signal compared to the slicing level determines whether a mark or space is being received. In this way the incoming signal is recovered as shown by comparing it with Fig. 6C.

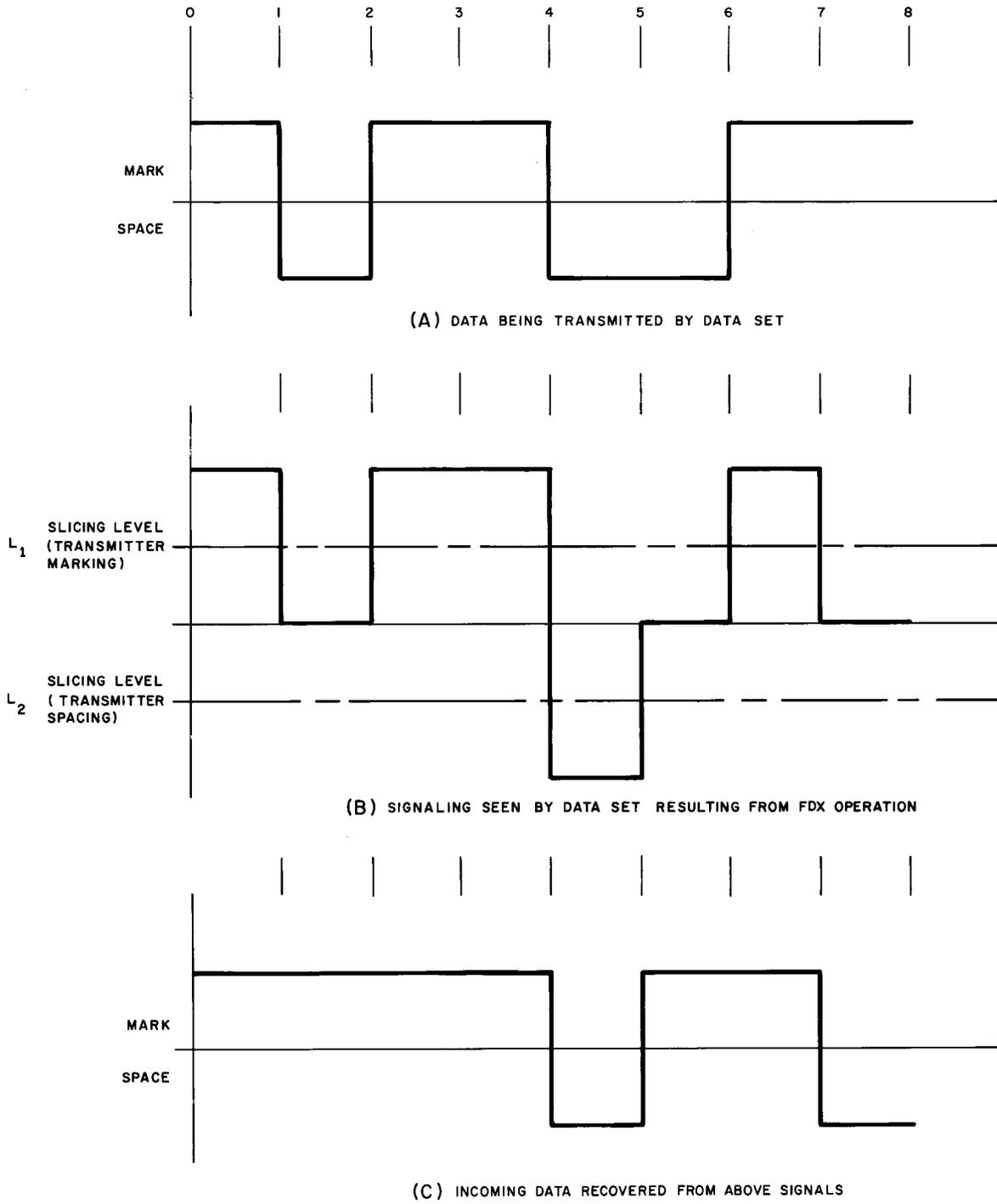


Fig. 6—Data Set 109F FDX Signals—Transmitted and Recovered Incoming Signal

3.08 The interface leads between the data set and the teletypewriter are given in Table C.

4. OPERATION FEATURES AND OPTIONS

4.01 Data set 109F is operated by the signals from the teletypewriter interface and the line. The six keys on the data set allow for mode selection by the station operator. Refer to Table B for information on the designation and functions of each key.

4.02 The following features are provided by data set 109F.

- (1) The teletypewriter motor is turned on and the data set can send and receive data signals when the ON key is depressed.
- (2) The teletypewriter motor is turned off and the data set applies a steady mark (or space) to the line when the OFF key is depressed. A

mark or, optionally, a space is transmitted in the OFF condition.

- (3) The data set 109F may be used in either the half-duplex or full-duplex mode. The only difference between an HDX- and FDX-arranged data set 109F is that local copy is applied to the receive lead in HDX operation.
- (4) The data set ready lead actuates the motor control mechanism of the teletypewriter.
- (5) When the data set is in the local mode, local copy is printed on the teletypewriter and a steady mark (or space) is transmitted to the line.
- (6) The data set provides facilities for loop-around testing.
- (7) The data set provides a mark or space crossover shift option which will cause a

TABLE C

DATA SET 109F INTERFACE LEAD ARRANGEMENT

DESIGNATION	FUNCTION
Signal Ground	This lead is the common reference for the data set and power supply voltages. <i>Note:</i> This lead should not be connected to the chassis ground.
Teletypewriter Ready	Supplies positive 24 volts dc from the teletypewriter.
Send Data	These leads are connected to the floating (nongrounded) send contacts in the teletypewriter.
Incoming Data	Data signals from the data set are applied over this pair of leads to the selector magnet driver.
Send Break	These leads are connected to the floating (nongrounded) break contacts in the teletypewriter.
Data Set Ready	A signal applied to this lead by the data set is a request to the teletypewriter to start the teletypewriter motor.
EOT	The EOT lead indicates detection of an EOT character by the teletypewriter and is used in the list 2 versions of the data set 109F.

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zero line current condition to be seen as a mark or space, depending on the option installed.

4.03 When an ET1 circuit pack is provided, the data set provides the following additional features.

- (1) Detection of the EOT character by the teletypewriter causes the TTY motor to be turned off and the OFF lamp lighted.
- (2) When the BREAK key on the TTY is depressed, the send space timer (SST) transmits a timed space interval (410 to 750 ms) to the loop.

4.04 The optional arrangements applicable to private line that are provided by the data set 109F are shown in Table D. This table indicates the arrangements that are standard or factory-wired and the additional options that can be installed or

provided. When the data set 109F is used for other services or arrangements, ie, in Data Line Concentrator Service, additional options are provided that are not covered in this practice or in this table. For information on the installation and connection of the options shown in Table D in this BSP, refer to Section 591-035-200.

5. REFERENCES

- 5.01** For additional information on the data set 109F, refer to the following documents.
- (1) SD-1D199-01—Data Systems Station—Data Set 109F-Type—Schematic Diagram
 - (2) CD-1D199-01—Data Systems Station—Data Set 109F-Type—Circuit Description
 - (3) Section 591-035-200—Data Set 109F—Private Line Application—Installation

TABLE D
FEATURES AND OPTIONS

FEATURE OR OPTION	DESIGNATION
Private line arrangement	Q
Receiver arranged for space crossover shift	Z (See Note)
Receiver arranged for mark crossover shift	Y
No crossover shift	X
Full-duplex operation	W (See Note)
Half-duplex operation	V
Motor stops upon reception of an end-of-transmission character (EOT) and transmission of a timed space signal (SST)	EOT R (See Note)
	SST T
	EOT & SST S
Send mark in idle condition	K
Send space in idle condition	M

Note: Options referred to by this note are the options that are installed at the factory. The data set is shipped with these options wired in and the wiring will have to be changed in order to provide a different option or feature.