DATA SET 109F USED IN DATREX* SERVICE

DESCRIPTION AND OPERATION

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 DATREX applications for this data set.

*Service Mark of the Bell System.

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

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 one microfarad capacitance. The data set can be operated in the HDX mode at speeds up to 300 baud with an extended range to 2500 ohms with less than one 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 Used in DATREX* Service—Installation and Connections (591-035-201).

1.04 When the Data Set 109F is arranged for DATREX service, it is conditioned to operate over a metallic line to a 10-type Data Line Concentrator. Connection to the concentrator is established when the attendant at the station

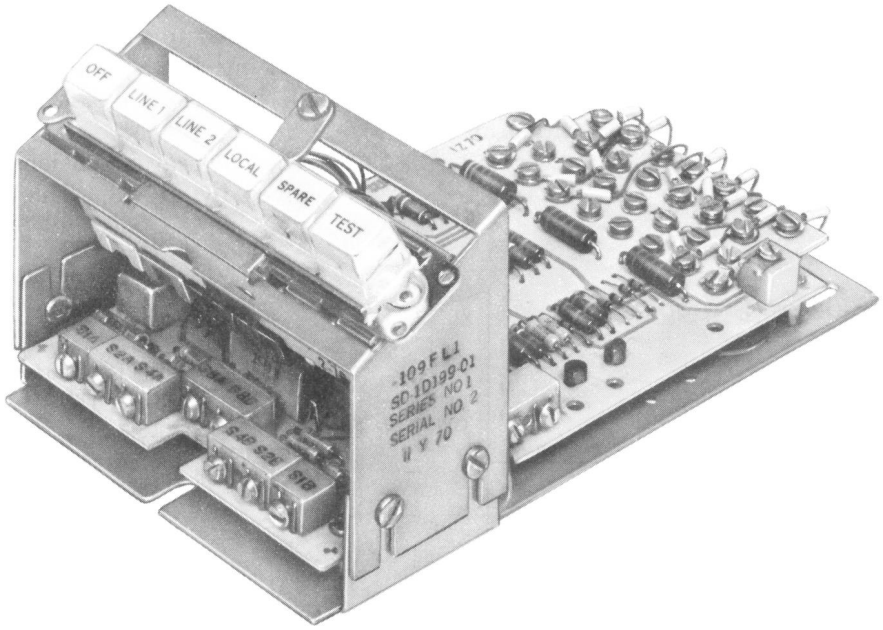


Fig. 1—Data Set 109F—Front View

operates a key that physically connects the data set to the metallic line. The concentrator then establishes a connection to one of a number of trunk-side Data Sets 109-type. By operation of an alternate key, access to a second group of trunks can be established when the concentrator is arranged for dual access.

1.05 A block diagram showing a typical DATREX system is given by Fig. 2.

1.06 The Data Set 109F-type is arranged to be mounted within a 33- or 35-type teletypewriter. The data set is mounted in the front of the Call Control Unit UCC 29.

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.

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 The Data Set 109F can be equipped with additional circuit boards and dial units to provide the flexibility required for the DATREX arrangements. When additional capabilities are provided, the data set code is changed to indicate the features provided.

1.10 Coding of the Data Set 109F is accomplished by using list numbers as follows.

- L1 - Designates the basic data set.
- L2 - ET1 circuit pack added to provide EOT and/or send space timer circuits.
- L3 - Rotary dial, 731A-61 receiver, and TP192263 hanger are provided with dial.
- L4 - TOUCH-TONE® dial, ET2 circuit pack, 731A-61 receiver, and TP192263 hanger are provided with dial.

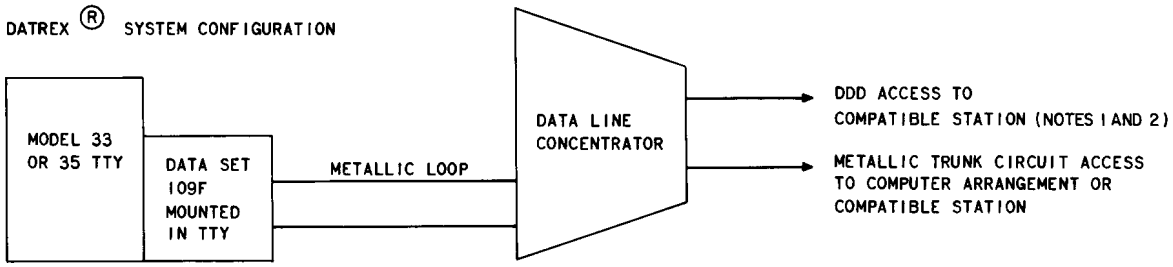
An example of the coding of a basic data set equipped with an ET1 circuit pack and TOUCH-TONE dial would be Data Set 109F-L1/2/4.

2. PHYSICAL DESCRIPTION

2.01 The Data Set 109F-L1 consists of a bracket, keystrip, cords, and EU2 circuit pack. Refer to Fig. 3 for the component designations of these units.

2.02 Configurations of the data set such as L2, L3, L4, or a combination of these list numbers can be provided. The physical configuration of the data set is changed by the addition of the boards required to provide the list number. Only the following list number combinations can be provided: L1, L1/2, L1/3, L1/4, L1/2/3, and L1/2/4.

2.03 The physical dimensions of the data set are given by Fig. 3. The addition or removal



NOTES:
1. THE DATA SET 109F AND THE DATA SET ON THE OPPOSITE END OF THE LINE MUST BOTH BE ARRANGED FOR THE SAME SERVICE MODE I.E., BOTH DATA SETS MUST BE ARRANGED EITHER HDX OR FDX.
2. DDD ACCESS IS AVAILABLE ONLY WHEN DUAL ACCESS CONCENTRATOR IS PROVIDED.

Fig. 2—System Block Diagram for a DATREX Configuration

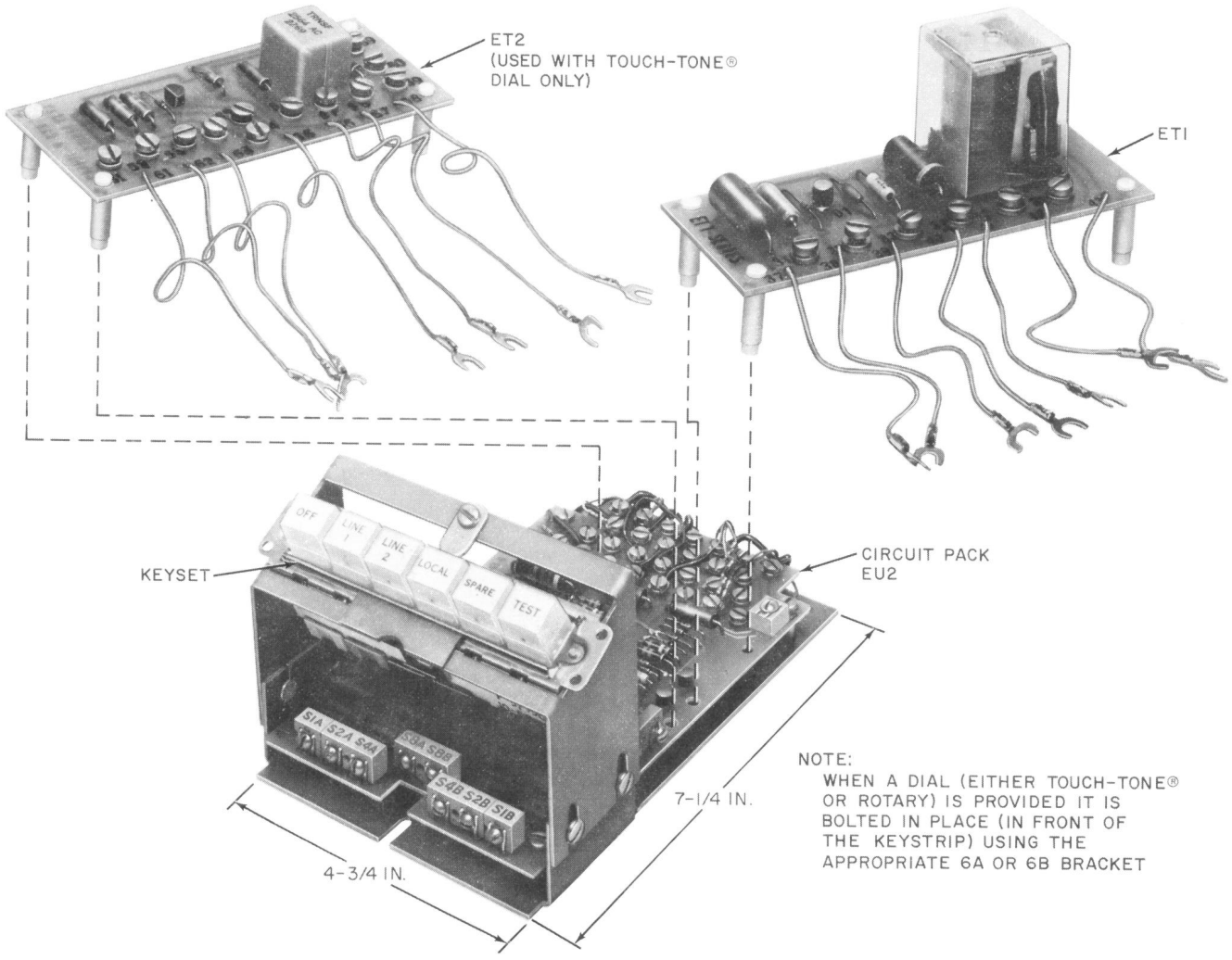


Fig. 3—Data Set 109F—Component Designation

of the stand-off mounted ET1 and ET2 circuit packs does not change the amount of space required to mount the data set.

2.04 When a dial (rotary or TOUCH-TONE) is provided as a feature, a different TTY faceplate will be required to accommodate the rotary or TOUCH-TONE version of the data set.

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

2.06 The 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 by Fig. 4. For information on setting these screw switches to obtain the required line resistance, refer to the section entitled Data Set 109F Used in DATREX* Service—Installation and Connections (591-035-201).

2.07 Attachment of the optional circuit packs to the data set is accomplished by using Teflon 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 boards to the data set, refer to the section entitled Data Set 109F Used in DATREX* Service—Installation and Connections (591-035-201).

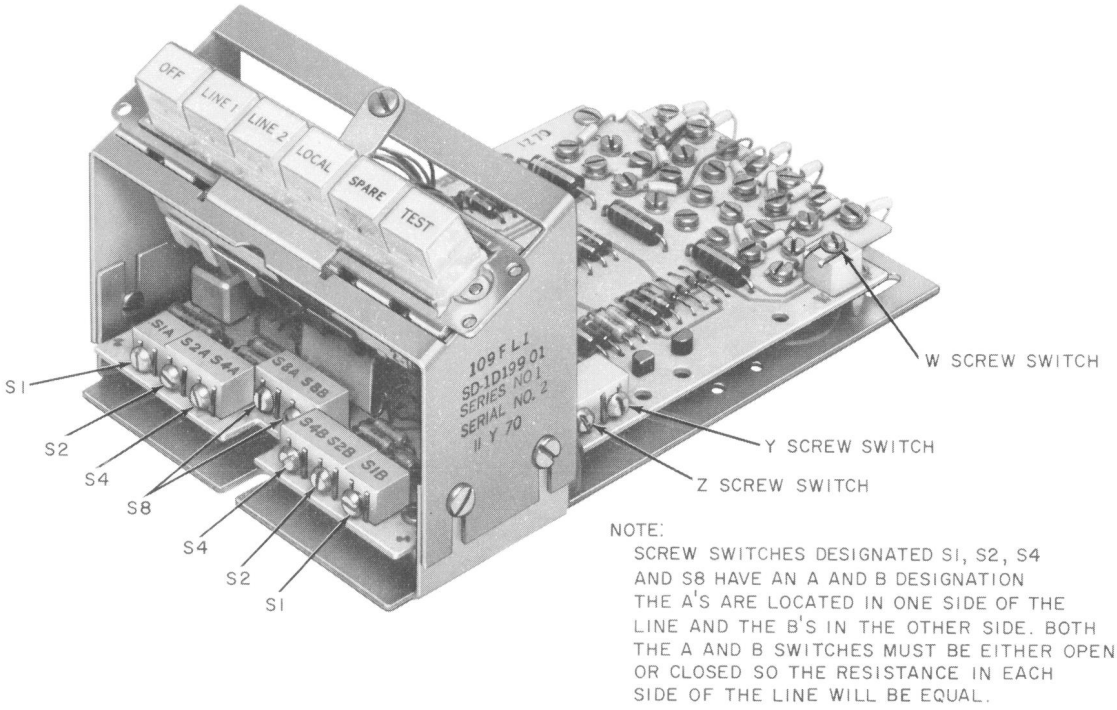


Fig. 4—Data Set 109F—Location of Screw Switches

The function performed by each of the circuit packs is given in Part 3 of this section.

2.08 When dial capabilities are provided by the 109F, the dial is mounted by using a bracket that attaches to the data set. The rotary dial uses a 106A bracket while the TOUCH-TONE dial requires a 106B bracket.

2.09 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 the section entitled Data Set 109F Used in DATREX* Service—Installation and Connections (591-035-201) for information on these connections.

TABLE A

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. FUNCTIONAL DESCRIPTION

3.01 The Data Set 109F provides for full-duplex (optional half-duplex) service using a tri-current-level dc transmission scheme. A block diagram showing the basic elements of the data set is shown by Fig. 5.

3.02 The basic data set is composed of a keystrip, brackets, cords, and an EU2 circuit pack which contains a transmitter, bridge, two pads, a

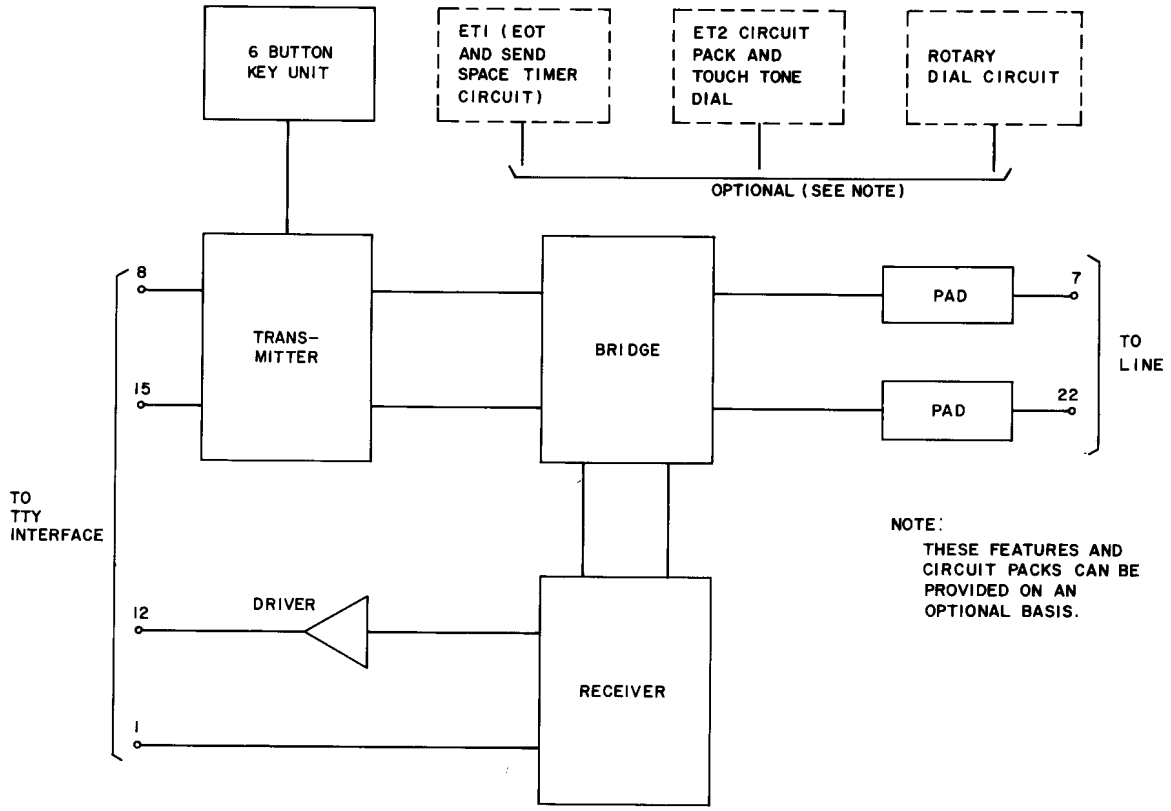


Fig. 5—Data Set 109F—Functional Block Diagram

receiver circuit, and a driver circuit. In addition to these circuits, two optional circuit boards can be added. The ET1 circuit pack provides an EOT disconnect circuit and a send space timer circuit.

3.03 Table B gives the key designation and functions of the key when the Data Set is used in a DATREX arrangement.

3.04 The optional dials and associated circuits that can be provided for DATREX applications are shown by a functional block diagram (Fig. 5). The dials and associated circuits are shown as options (by dotted lines) to indicate that this is not part of the basic data set.

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

3.06 When the data set is operated in the HDX mode, the metallic line current (representing a transmitted mark and space signal) is given by Fig. 6A. A line current received signal (HDX operation) is shown by 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 shown by Fig. 6B.

3.07 Recovery of the incoming data signal (in FDX operation) from the signal shown by Fig. 6B is accomplished by shifting the mark-space slicing level to eliminate the effect of the transmitted data signal.

3.08 Fig. 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.

TABLE B

DATREX* ARRANGEMENT

KEY NO. OR POSITION	DESIGNATION	FUNCTION
1 or F	OFF	The data set is disconnected from the line and the teletype motor is turned off.
2 or E	LINE 1	When this button is depressed the lamp under the button is lighted, the data set is connected to the line, and the TTY motor is turned on.
3 or D	LINE 2	When this button is depressed, the lamp under the button is lighted and the data set is connected to the line. The tip and ring connections are reversed with respect to the LINE 1 connections and the TTY motor is turned on. (See Note 1.)
4 or C	LOCAL	When this button is depressed the lamp under the button is lighted, the TTY motor is turned on, and the data set is disconnected from the line. In the FDX mode of operation, the data set is terminated in a dummy line to derive local copy. In the HDX mode, 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 LINE 1 or LINE 2 button, the receive lead is connected to the send lead for loop around 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 1: Operation of this key permits dual access features if the data line concentrator is properly equipped. With a dual access concentrator, limiting the service to single access at the station may be achieved by blocking the LINE 2 button.

Note 2: All keys are locking keys.

The 0 to 8 grid at the top of the page is used as an arbitrary reference to aid in the explanation of the incoming signal recovery.

3.09 The incoming data (Fig. 6C) is derived or recovered as follows: When the transmitter is sending a mark (interval 0-1) the L_1 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 L_1 level (Fig. 6B); therefore, the data set sees a mark during this interval (Fig. 6C). When the transmitter sends a space (Fig. 6A interval 1-2), the L_2 slicing level is used. In this case, the FDX signal level is above the L_2 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 L_1 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 L_2

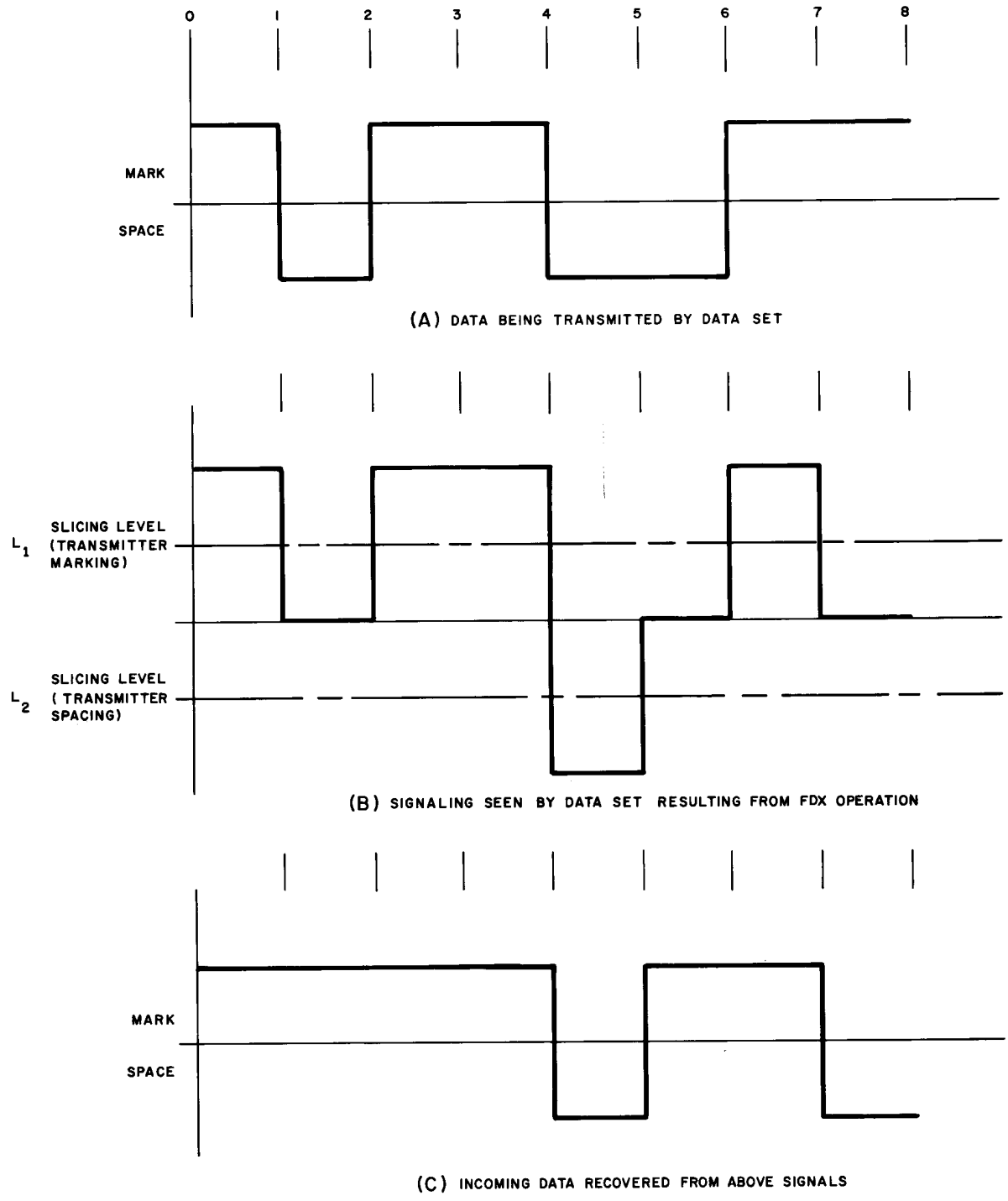


Fig. 6—Data Set 109F FDX Signals—Transmitted and Recovered Incoming Signal

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 L_2 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.

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

4. OPERATION FEATURES AND OPTIONS

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

4.02 The following features are provided by the Data Set 109F.

(1) A signal applied to the 10-type Data Line Concentrator by the Data Set 109F enables a connection to be established to any one of a number of trunks.

(2) A camp-on signal originated by the concentrator and indicating that all trunks are busy is converted by the Data Set 109F to a space which causes the TTY receive mechanism to be actuated.

(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

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. *Note:* 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) break 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.

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 the data set is isolated from 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 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, the OFF lamp lighted, and the data set to be disconnected from the metallic line.

(2) The send space timer (SST) converts the signal developed when the break key is depressed into a timed space interval.

4.04 The optional arrangements applicable to DATREX that are provided by the Data Set 109F are shown by 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, private line service, additional options are provided that are not covered in this practice or by this table. For information on the installation and connection of the options shown by Table D, refer to the section entitled Data Set 109F Used in DATREX* Service—Installation and Connections (591-035-201).

4.05 When Data Set 109F is equipped with a dial (L3 or L4), a 731A-61 receiver is also provided to enable the operator to monitor progress tones when placing a call.

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 Descriptions

TABLE D

FEATURE OR OPTION		DESIGNATION
DATREX arrangement		N (See Note)
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

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.