DATA SET 109E-TYPE

IDENTIFICATION

1. GENERAL

1.01 This section covers the physical and functional descriptions of the Data Set 109E-type.

1.02 Data Set 109E-type is a full-duplex (FDX), low speed, serial transmission data set. It is designed to operate with 2-wire private line metallic facilities and utilizes a tri-current level baseband transmission scheme. Data Set 109E-type can transmit and receive data at speeds up to 150 bauds.

1.03 Although Data Set 109E-type is an FDX data set, it will also operate in the half-duplex (HDX) mode. The operational mode of the data set is entirely dependent on the associated terminal equipment. When Data Set 109E-type is used in the FDX mode, it operates in conjunction with Data Sets 109E-type, 109F-type, and 109H-type on a point-to-point basis or Data Set 109G-type on a point-to-hub basis. When operating in the HDX mode, the data set may be used with any Data Set 109-type, such as Data Set 109C-type (point-to-point) or Data Set 109B-type (point-to-hub).

1.04 Data Set 109E-type is a single plug-in printed circuit board (Fig. 1) intended for station applications. It mounts in a data mounting (eg, 28A1 Data Mounting) or most Data Auxiliary Sets (DAS) 820-types (eg, DAS 820D-type). Data Set 109E-type obtains power from the associated DAS or data mounting.

1.05 Data Set 109E-type requires no periodic maintenance. Options for specific customer requirements and adjustments for proper loop resistance are made by means of screw switches at the time of installation.

The data set is not furnished with any mounting or connecting equipment. The mounting equipment will vary with the type of installation and application and must be ordered separately in accordance with the individual installation requirements.

2. PHYSICAL DESCRIPTION

2.01 Data Set 109E-type is a single plug-in printed circuit board that is approximately 5-1/2 inches high, 7 inches deep, 1/2-inch thick, and weighs 8 ounces.

2.02 Power requirements for Data Set 109E-type are a maximum of 2.6 watts of +22 to +26 volts dc at 110 mA and 2.3 watts of −22 to −26 volts dc at 95 mA—a total of 4.9 watts per data set.

2.03 Three adjustable screw switches (S1, S2, and S3) are used to select options on Data Set 109E-type (Table A). Screw switch (S1) is subdivided into two sections (S1A and S1B); screw switch (S3) is also further subdivided into twelve sections. Two of these sections (S3-1 and S3-2) are used for options; eight of the remaining sections (S3-4 through S3-7, and S3-9 through S3-12) are used in selecting the proper line pad resistance (Table B). Sections S3-3 and S3-8 are not used and should not be equipped with screws.

3. FUNCTIONAL DESCRIPTION

3.01 Data Set 109E-type requires that signals which are received from the terminal equipment conform to the Electronic Industries Association (EIA) Standard RS-232-B. It is designed to operate over a metallic loop having a nominal resistance of 2000 ohms and a capacitance of less than one microfarad.

3.02 Although the Data Set 109E-type is designed to operate in the FDX mode, it will also operate in the HDX mode. When Data Set 109E-type is used in the HDX mode, the loop resistance may be increased to 2500 ohms with very little deterioration in the service quality.

3.03 The interface leads of Data Set 109E-type are connected to the data terminal via the

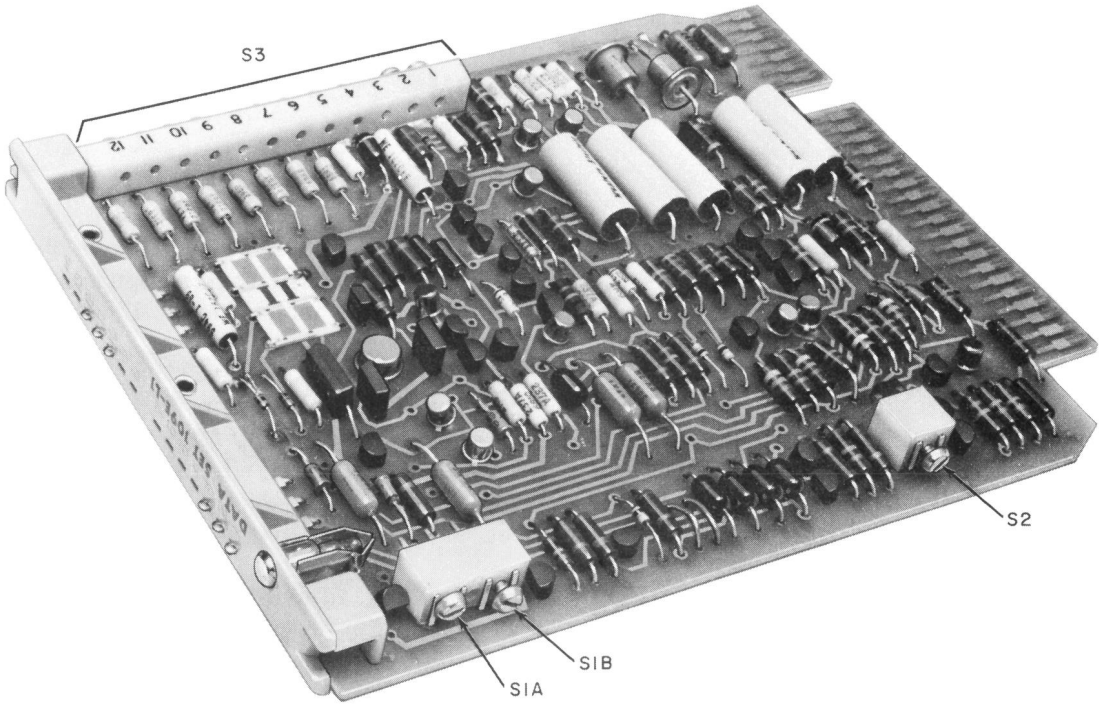

Fig. 1—Data Set 109E-L1

TABLE A

SCREW SWITCH SETTINGS FOR OPTIONS

FUNCTION PROVIDED		OPTION DESIG	FACTORY EQUIPPED	SCREW SWITCH SETTING	
				CLOSE	OPEN
Current Squelch		Z	√	S2	
No Current Squelch		Y			S2
BB LEAD	SPACE HOLD	V		S1A*	S1B*
	MARK HOLD	U	√	S1B*	S1A*
CROSSOVER SHIFT	SPACE	R		S3-2	S3-1
	MARK	Q	√		S3-1 & S3-2
	NONE	P		S3-1	S3-2

* Screw switch should not be inserted in the center positions of screw switches S1A and S1B.

TABLE B

LINE PAD ADJUSTMENTS

LINE PAD RESISTANCE (OHMS)	SCREW SWITCH S3 SETTINGS	
	CLOSE S3-	OPEN S3-
00.0	4,5,6,7,9,10,11,12	
136.2	4,5,6,10,11,12	7,9
266.0	4,5,7,9,11,12	6,10
402.2	4,5,11,12	6,7,9,10
522.0	4,6,7,9,10,12	5,11
658.2	4,6,10,12	5,7,9,11
788.0	4,7,9,12	5,6,10,11
924.2	4,12	5,6,7,9,10,11
1022.0	5,6,7,9,10,11	4,12
1158.2	5,6,10,11	4,7,9,12
1288.0	5,7,9,11	4,6,10,12
1424.2	5,11	4,6,7,9,10,12
1544.0	6,7,9,10	4,5,11,12
1680.2	6,10	4,5,7,9,11,12
1810.0	7,9	4,5,6,10,11,12
1946.2		4,5,6,7,9,10,11,12

associated data mounting. These leads are defined as follows:

(a) BA—Transmitted data

(b) BB—Received data

(c) RS—Receive supervision

Note: The designation of this lead is not defined in EIA Standard RS-232-B, but it can be connected to a defined lead, eg, the data carrier detector lead (CF) for a particular system application.

(d) ON—On voltage (positive potential in the data set)

Note: The designation of this lead is not defined in EIA Standard RS-232-B, but can be connected to a defined lead, eg, the data set ready lead (CC), for a particular system application.

(e) CSQ—Current squelch

Note: The designation of this lead is not defined in EIA Standard RS-232-B, but CSQ can be connected to a defined lead, eg, the data terminal ready lead (CD), for a particular system application.

(f) HBA—High impedance transmitted data

Note: The designation of this lead is not defined in EIA Standard RS-232-B, but this lead, when connected in parallel to one BA lead of another data set, or two to four HBA leads of other data sets, will meet EIA impedance requirements. Using this arrangement, up to five data set transmitters can be paralleled for broadcast arrangements.

3.04 Data Set 109E-type employs a tri-current level baseband transmission scheme to transmit and receive data. Transmission is accomplished by converting EIA signals into mark or space voltages which cause a corresponding current to flow in the transmission loop. The direction and magnitude of current flow in the loop is recognized and converted to EIA signals by the receiving data set. There are four possible states which exist for FDX transmission (Table C and Fig. 2).

3.05 In transmission state 1, both the local and remote stations, A and B, respectively, are marking (+4V dc). These stations are connected so that the marking voltage that each data set applies to the loop is series aiding, producing a total of 8 volts dc to be felt on the loop. Considering a nominal resistance around the loop as 2000 ohms, plus a 300-ohm output resistance for each data set, approximately +3 mA of current is developed around the loop (marking direction).

3.06 In transmission state 2, station A is transmitting a space (−12V dc) while station B is transmitting a mark (+4V dc). These voltages are series opposing, producing a total of 8 volts dc to be felt on the loop. In this case, however, the voltage is of the opposite polarity as that in state 1. Using the same loop resistance and data set output resistance, approximately −3 mA of current is developed around the loop (spacing direction).

3.07 Transmission state 3 occurs when station A is transmitting a mark (+4V dc) and station B is transmitting a space (−12V dc). The

TABLE C

TRANSMISSION STATES

TRANSMISSION STATE	STATION A	STATION B	VOLTAGE AROUND LOOP	LOOP CURRENT
1	M (+4V)	M (+4V)*	+8V	+3 mA
2	S (−12V)	M (+4V)*	−8V	−3 mA
3	M (+4V)	S (−12V)*	−8V	−3 mA
4	S (−12V)	S (−12V)*	−24V	−9 mA

* Indicates that the tip and ring (L1, L2) connections are reversed so that the voltage around the loop is series aiding in the idle condition.

total loop voltage is −8 volts dc and the loop current is −3 mA (spacing direction).

3.08 When both stations are transmitting a space (−12V dc) simultaneously, transmission state 4 exists. In this case the loop voltage is −24V dc and the loop current is −9 mA (double spacing direction).

TRANSMISSION OF DATA

3.09 The mark or space from the data terminal is applied through the BA lead of Data Set 109E-type to the transmit driver (Fig. 3). The transmit driver amplifies the signal and feeds it to the transmitter and the mark-space detector.

3.10 The transmitter applies the marks and spaces to the metallic transmission loop through the monitor circuit and adjustable line pads. This monitor circuit is a balanced bridge whose midpoint output is proportional to the loop current. Adjustable line pads are provided in the output of the data set to adjust the loop to 2000 ohms where needed.

RECEIVING DATA

3.11 The balanced monitor bridge monitors the direction and magnitude of the loop current. The output from this circuit is fed to the monitor amplifier where it is amplified. This amplified signal, which is proportional to the loop current, is then fed to the mark-space detector. At the same time, an output from the transmit driver causes a reference level to be established in the mark-space detector. The monitor amplifier output is compared to this reference level. The operation of these three circuits (monitor amplifier, transmit driver, and mark-space detector) allows received signals (BB lead) to be detected as marks and spaces and prevents the transmitted data from appearing as received data.

3.12 The output of the mark-space detector is fed through a low-pass filter to the receive driver. Erroneous spikes are generated when the transmitter changes from a mark to a space or from a space to a mark. The low-pass filter prevents these erroneous spikes from reaching the receive driver. The receive driver adjusts the received signals so that they conform to EIA Standards in RS-232-B.

CURRENT DETECTION

3.13 The current detector is fed by the monitor amplifier and generates a signal when the current falls between +0.8 to −1.3 mA. This signal is applied to a 15-ms time delay circuit. If the current remains between +0.8 and −1.3 mA for a minimum of 15 ms, a lamp on the data set will light, the RS lead will be turned off, and an optional mark-hold or space-hold will be placed on the BB lead.

CROSSOVER SHIFT

3.14 The Data Set 109E-type can be arranged (optionally) to provide mark,space,or no crossover shift. When either a mark or space crossover shift is provided and the loop current drops to near zero, the crossover shift circuit will

clamp the BB lead to a mark or space during the 15-ms delay explained in 3.13. When a space is to be provided on the BB lead, the crossover shift circuit shifts the slicing level to +0.6 mA, causing a near zero current to appear as a space. When a mark is to be provided on the BB lead, the crossover shift circuit shifts the slicing level to −0.6 mA, causing a near zero current to appear as a mark.

CURRENT SQUELCH

3.15 The current squelch option provides a means for the terminal equipment to cause the data set to remove its voltage from the loop. This no-voltage condition may be used to indicate to the remote station that the local station is turned off.

4. REFERENCES

4.01 The following Bell System Practices (BSPs) contain information pertaining to Data Set 109E-type.

SECTION	TITLE
591-811-102	Private Line Interconnection Arrangement for the Line Side of the 10-Type Data Line Concentrator—Description
591-811-103	DATA-PHONE® Interconnection Arrangement for the Line Side of the 10-Type Data Concentrator—Description
591-811-104	DATA-PHONE Interconnection Arrangement for the Trunk Side of the 10-Type Data Concentrator—Description
591-036-Z01	Data Set 109E-Type Multiple Data Set Arrangement Using 28A1 Data Mounting and 27A1 Data Unit.

4.02 The following schematic diagrams and circuit descriptions contain information which pertains to Data Set 109E-type:

SD-&CD-1D198-01 Data Set 109E-L1

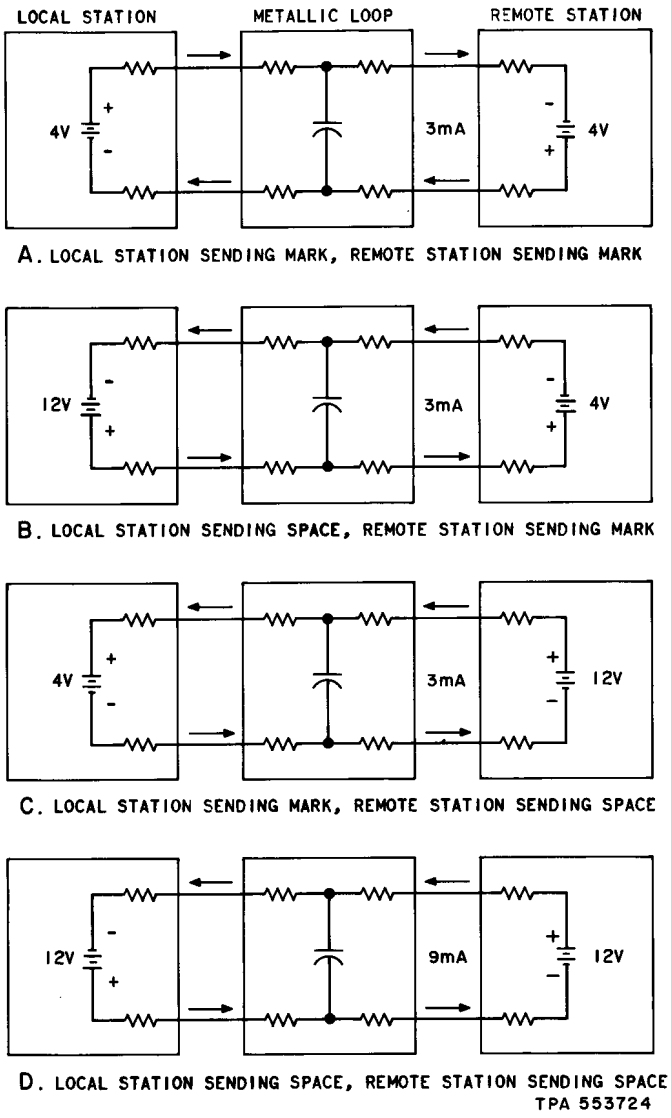

Fig. 2—Transmission States of a Data Set 109-Type FDX System

SD-&CD-1D197-01 DDD Incoming Circuit for the Data Line Concentrator

SD-&CD-1D200-01 Private Line Data Line Concentrator Interconnection Circuit (Line Side)

SD-&CD-1D201-01 DATA-PHONE Interconnection Arrangement

SD-&CD-73055-01 No. 10A Data Line Concentrator

SD-&CD-1D212-01 No. 10B Data Line Concentrator

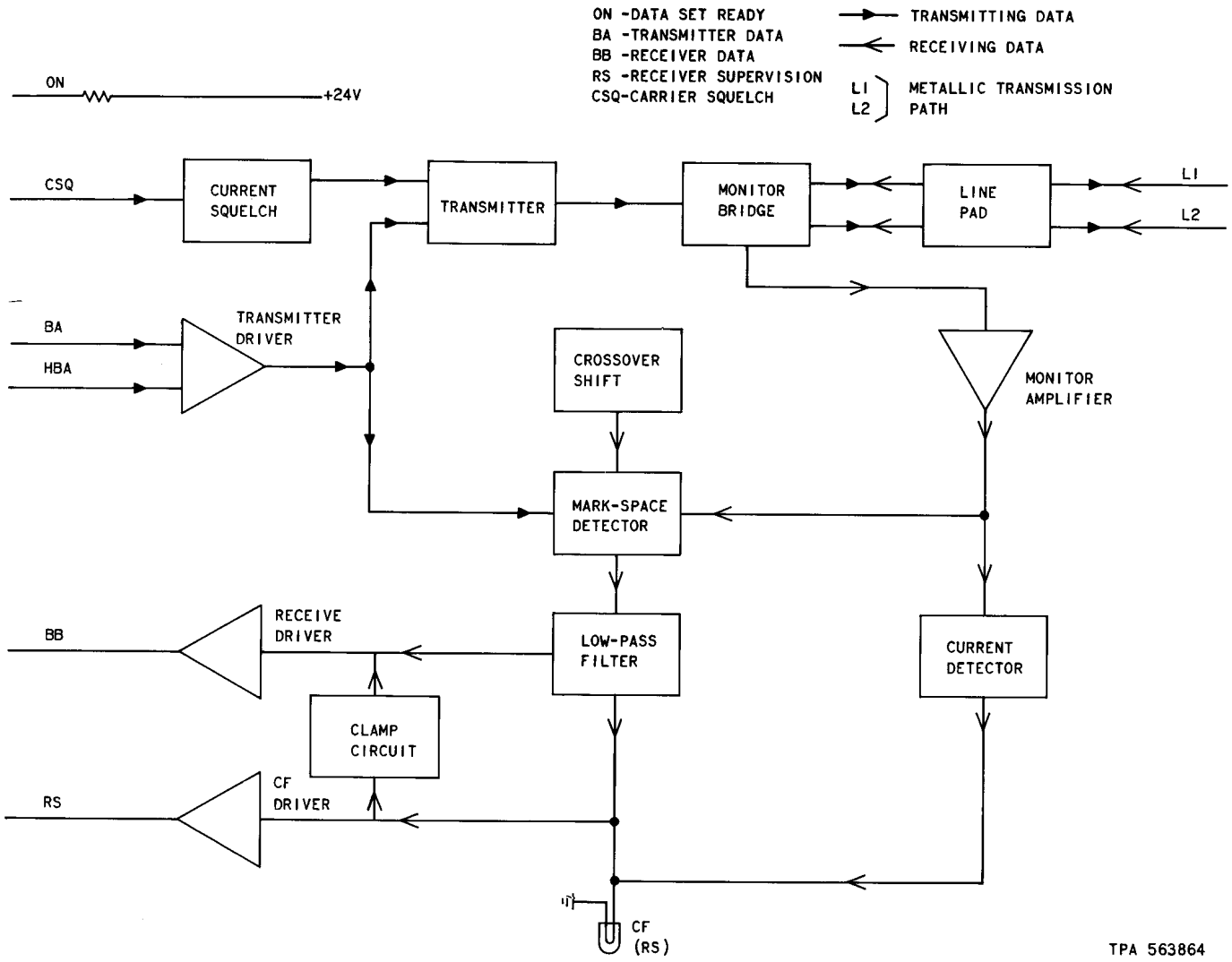

Fig. 3—Data Set 109E-L1—Block Diagram

SD-&CD-1D176-01	28-Type Data Mounting
SD-&CD-1D183-01	27-Type Data Unit
SD-3D031-01	Data Auxiliary Sets 820D- and E-Type
SD-3D038-01	Data Auxiliary Set 820B-Type
SD-3D041-01	Data Auxiliary Set 820G-Type.