

DATA SET 109D-L1

DESCRIPTION

1. GENERAL

1.01 The purpose of this section is to provide a physical, functional, and operational description of Data Set 109D-L1.

1.02 Data Set 109D-L1 is a half-duplex, serial transmission data set designed for use with 2-wire metallic loop, private line facilities. It utilizes a 3-mA, polar dc transmission arrangement which will transmit and receive data at speeds up to 300 baud.

1.03 The primary uses for Data Set 109D-L1 are:

- (a) In conjunction with a 28A1 Data Mounting and a 27A1 Data Unit to provide the Data Set 109D-type multiple data set arrangement.
- (b) In conjunction with a Data Set 108A, AR463 circuit pack (CP), 28A1 Data Mounting, and 208A adapter plug to provide the private line arrangement for the line side of the DATREX* concentrator.

* Service mark of the Bell System

1.04 It can also be used as a direct replacement for Data Set 109A in arrangements such as those using Data Auxiliary Set 820D-type for single private line stations, Data Auxiliary Set 820E-type for multiple private line stations, Data Auxiliary Set 820A- and B-type used with 86 Selective Calling Service and Data Auxiliary Set 820G-type used with 85 Selective Calling Service.

1.05 The data set and associated mounting arrangements may be mounted at any place that is convenient for customer use but must be within the maximum 50-foot limit of the customer provided EIA-type interface cord. When used with a teletypewriter private line data station, brackets are available to install the Data Auxiliary Set 820D containing the data set in the teletypewriter kneewell.

1.06 The data set requires no periodic maintenance after preoperative tests and adjustments have been completed. Options for specific customer requirements and adjustment for matching loop resistance are accomplished by screw switch settings and strapping links at time of installation. A receive supervision (RS) lamp is provided at the front of the circuit board for a convenient visual indication of zero loop current.



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 per job requirement.

2. PHYSICAL DESCRIPTION

2.01 Data Set 109D-L1 consists of transistorized circuitry mounted on a single plug-in printed circuit board (see Fig. 1). The data set may be plugged into any type of data mounting or data auxiliary set which provides +24 and -24 volts dc power and accepts standard AR-type circuit boards.

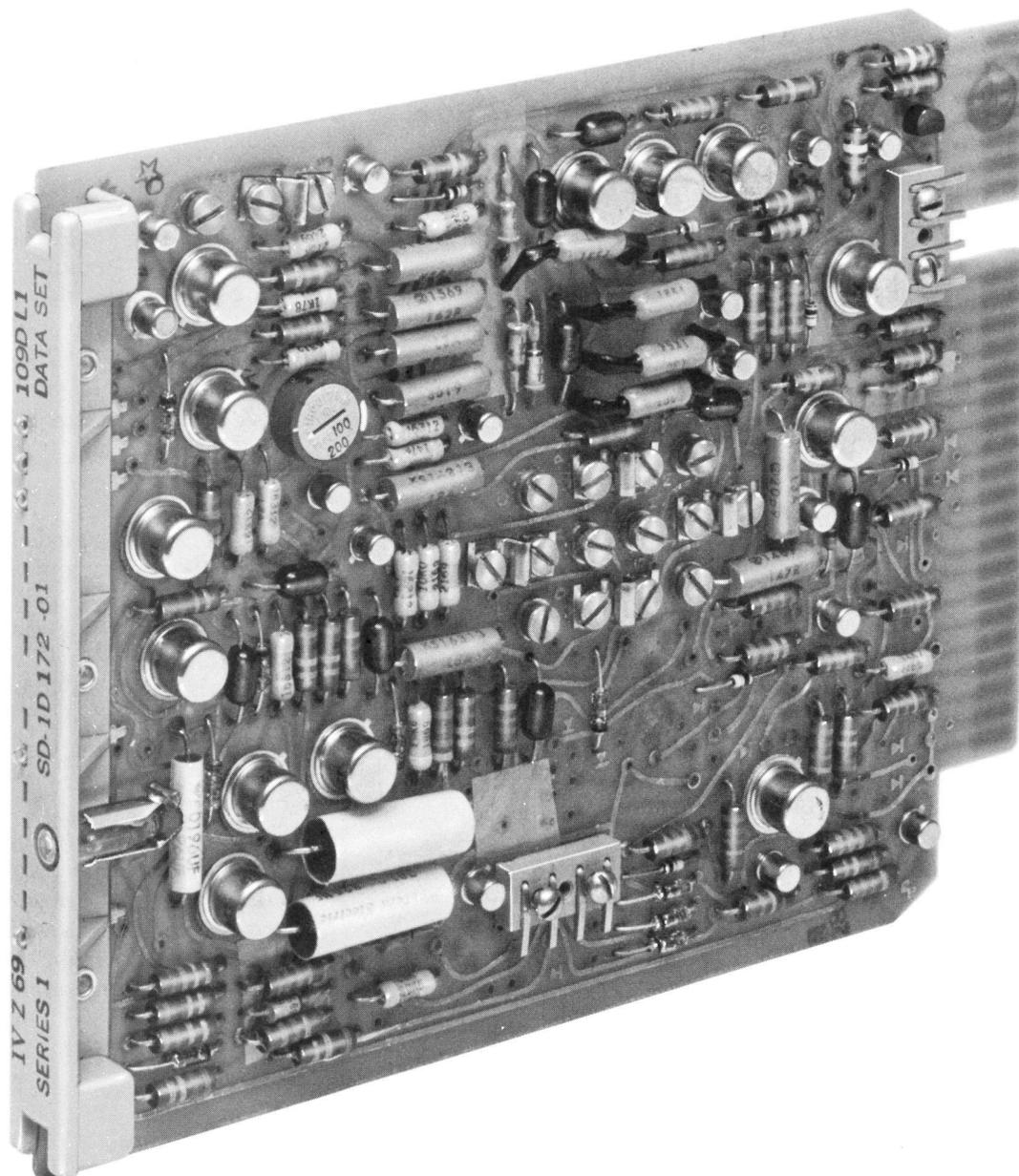


Fig. 1—Data Set 109D-L1

3. FUNCTIONAL CHARACTERISTICS

3.01 Data Set 109D-L1 uses signal characteristics which conform to standard EIA voltage requirements to connect to the data terminal. The interface leads are connected to the data terminal via the associated data mounting arrangements and are as follows:

(a) BA—Transmitted data

(b) BB—Received data

(c) RS—Receive supervision

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

- (d) ON—On voltage (connected to a positive potential at the data set)

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

- (e) CSQ—Current squelch

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

- (f) HBA—High impedance transmitted data

Note: The designation of this lead is not defined in RS-232-B, but the HBA lead, when connected in parallel with 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.

3.02 The data set is designed to operate over a metallic loop having a maximum resistance of 2500 ohms and than 1 μ F capacitance. A loop having a resistance of less than 2000 ohms must be padded to 2000 ohms by adding resistance with a padding arrangement located on the data set.

3.03 Data Set 109D-L1 employs 3-mA polar dc transmission to transmit and receive data. Transmission is accomplished by converting EIA signals into mark or space voltages which cause a corresponding mark or space current to flow in the transmission loop. The direction of current flow in the loop is recognized as mark or space and converted into EIA signals by the receiving data set. Four possible states for transmission between a data set pair are shown in Table A.

TABLE A

TRANSMISSION STATE	LOCAL STATION	REMOTE STATION	VOLTAGE AROUND LOOP	LOOP CURRENT
1	M (4V)	M (4V)*	8	3 mA
2	S (-12V)	M (4V)*	- 8	-3 mA
3	M (4V)	S (-12V)*	- 8	-3 mA
4	S (-12V)	S (-12V)*	-24	-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.

** This is a transmission state which may be precluded by data set logic.

3.04 In transmission state 1, each data set applies a marking voltage to each end of the metallic loop. The marking voltages, having a minimum value of 4 volts dc, are series aiding and develop a minimum of 8 volts dc around the loop. Considering a nominal metallic loop resistance of 2000 ohms plus a 300-ohm output resistance for each data

set, a minimum 3-mA current is developed around the loop (marking direction).

3.05 Transmission state 2 occurs when the local data set sends a space signal to the remote data station. The -12 volt dc spacing voltage, applied by the local station, and the 4-volt dc

marking voltage, applied by the remote station, are in series opposition developing -8 volts dc around the loop. This action causes a loop current of -3 mA (spacing direction) to be developed around the loop.

3.06 When the local station receives a space signal from the remote station, transmission state 3 occurs. The local station applies 4 volts dc (mark) to the loop while the remote station applies a -12 volt dc space signal. This state causes the same loop current as that during transmission state 2. The resultant loop current is a -3 mA spacing current which causes the local data set to detect a spacing signal from the remote data set.

3.07 Transmission state 4 occurs when both data sets simultaneously apply a spacing voltage to the metallic loop. In this case, the current developed around the loop results in a -9 mA (double spacing) signal. This condition will be terminated by Data Set 109D-L1 internal logic when either data set goes marking.

TRANSMISSION OF DATA

3.08 The mark or space data signals originating from a data terminal (computer, teletypewriter, etc) are applied to the BA lead of Data Set 109D-L1 (see Fig. 2).

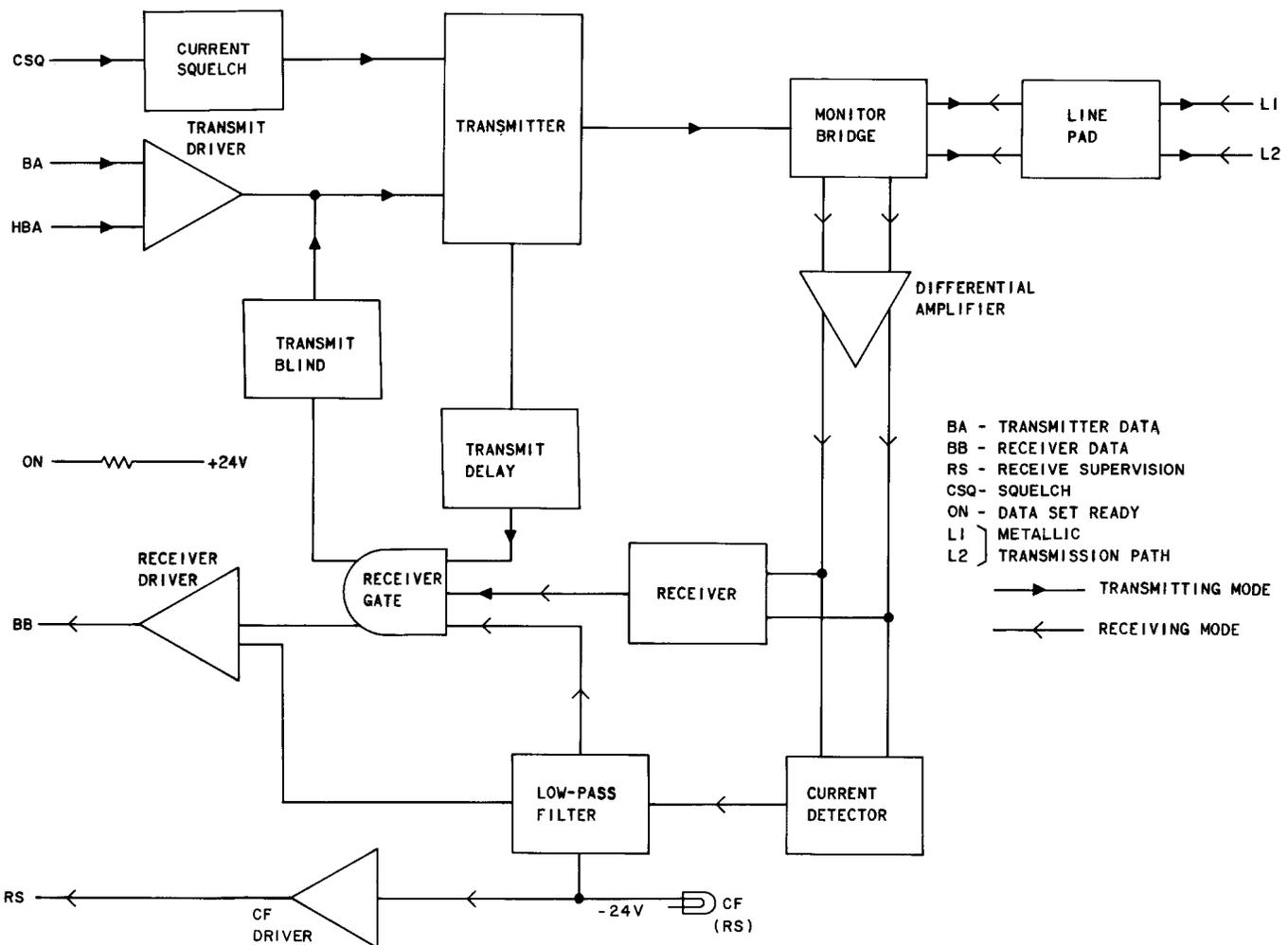


Fig. 2—Data Set 109D-L1—Block Diagram

3.09 Mark or space signals applied to the transmit driver are amplified and fed directly to the transmitter. Two other signals, one from the current squelch circuit and one from the transmit blind circuit, are also applied to the transmitter.

3.10 The transmitter develops the mark and space voltages that are applied to the metallic transmission loop through the monitor circuits. A marking input to the transmitter develops 4 volts dc at the transmitter output and a spacing input produces a -12 volt dc output.

3.11 The transmitter output voltages are applied to the monitor circuits. This circuit is a balanced bridge which is connected across the data set loop leads (L1, L2). The bridge is designed so that the voltage at the midpoint of the bridge is proportional to the loop current. Adjustable line pads in the loop leads are used to insert balanced resistances in both legs of the loop. This permits padding out the loop to approximately 2000 ohms for a nominal 3-mA loop current.

3.12 The purpose of the transmit delay circuit is to eliminate local copy on the BB lead when data is being transmitted. The input to the transmit delay is in parallel with the input to the transmitter. When a space is transmitted, a signal is passed through the transmit delay circuit that clamps the receiver gate output to a mark. It should be noted that there is a spacing current on the loop (due to the locally transmitted space) which would normally be detected and applied to the BB lead if it were not for the clamp provided by the transmit delay. The result is that the BB lead is always marking when the local data set is transmitting a space.

RECEIVING DATA

3.13 To receive data, the transmitter of the local data set must be in a marking condition. This condition enables the remote data set to switch the loop current between a mark and a space. The resultant current change, detected by the monitor bridge, develops a voltage at the bridge midpoint which is proportional to the loop current.

3.14 The voltage from the bridge midpoint is then applied to a linear differential amplifier. The amplifier output is then applied to the receiver and current detector circuits.

3.15 The receiver circuit consists of a saturating differential amplifier. The output of the receiver is a mark or space, depending upon the direction of current in the metallic loop. The receiver output is then applied to the receive gate. Two other signals are also applied to the gate; one from the transmit delay, and another from the current detector.

3.16 The receive gate output is dependent upon the condition of these three input signals. The transmit delay signal clamps the output of the receive gate to a mark when a space is being transmitted as explained in 3.12.

3.17 The current detector is arranged to indicate the loss of loop current. Operation results in a mark hold signal being applied to the receive gate which clamps the output of the receive gate to a mark.

3.18 The output from the receive gate is applied to the transmit blind and the receive driver. The transmit blind clamps the transmitter to a mark when a space appears on the receive gate output, ie, when a space is received from the remote data set. This condition allows an incoming break (long space) from the remote data set to be detected at the local data set without interference generated by local outgoing transmissions.

3.19 The receive driver develops an EIA signal from received data. Inputs from the receive gate and current detector determine the receive driver output. The signal from the receive gate is data from the remote data set, a steady mark when transmitting, or a steady mark due to current detector operation. The inverter associated with the current detector applies a space hold, generated by loss of loop current when the space hold option is used. The space hold option effectively clamps the BB lead to a spacing condition upon loss of loop current.

CURRENT DETECTION

3.20 The monitor differential amplifier output is applied to the current detector circuits as well as the receiver. When this output exceeds a value which corresponds to approximately 1-mA loop current (either mark or space) for at least 15 milliseconds, the current detector bridge conducts and applies a signal to the low-pass filter. The low-pass filter eliminates the loss of current

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indications that appear during normal transitions between mark and space signals.

3.21 The output of the filter is simultaneously applied to the receive gate, receive supervision lamp, and the inverter. With loss of loop current, the receive gate is clamped to a mark and the receive supervision lamp is lighted to provide a visual indication of loop current failure.

CURRENT SQUELCH

3.22 This is an optional feature that when operated causes the data set current to reduce near

zero. The transmitter output is normally either marking (4 volts dc) or spacing (-12 volts dc). When the current squelch option is used and the positive voltage is removed from the CSQ lead, the current squelch circuit clamps the transmitter input to ground causing the transmitter output to be zero volts. The combination of voltages, impedances of the monitor bridge, line pad, and remote data set causes the loop current to drop to approximately .35 mA, which causes the current detectors at each data set to indicate low current.