DATA SET 109G-L1

DESCRIPTION

1. GENERAL

1.01 This practice includes a description of and the applications for Data Set 109G-L1.

1.02 Data Set 109G is a low-speed, serial transmission, baseband data set designed for use in central office hub arrangements. The central office arangement of the Data Set 109G works in conjunction with a station Data Set 109-type. The Data Set 109G can also work with another Data Set 109G in a hub-to-hub link.

1.03 Data Set 109G is designed to work directly into a type-3 low-voltage hub. When the data set is used in a type-3 hub, it is mounted in a 27-type data mounting. For information on the type-3 low-voltage hub, see Section 312-807-100. Data Set 109G can also work into a type-2 (high-voltage) hub using a Data Auxiliary Set 811K as the low-voltage to high-voltage converter. In type-2 hub operation, the data set and data auxiliary set are mounted in a J70165G mounting.

1.04 Data Set 109G is designed to operate in a full-duplex (FDX) hub arrangement in either the FDX or half-duplex (HDX) mode. The data set can be used in an HDX hub arrangement by optionally strapping the data set for the HDX hub arrangement. In the FDX mode, the data set operates at speeds up to 150 bauds in each direction over metallic loops with up to 2000-ohms resistance and up to 1 μf capacitance. Loops shorter than 2000 ohms are adjusted to a nominal value of 2000 ohms by using the resistor pads located on the Data Set 109G circuit pack. In HDX operations, an extended range of up to 2500-ohms resistance and up to 1 μf is possible, however, the optimum value is 2000 ohms.

1.05 Routine maintenance of the Data Set 109G is not required. Service is maintained by replacement of the data set.

2. PHYSICAL DESCRIPTION

2.01 Data Set 109G is a single plug-in printed circuit board (see Fig. 1 and 2). The data set measures 7.34 by 5.55 by 0.56 inches. The narrow construction of the data set allows for multiple mounting arrangements.

2.02 Each data set requires approximately 2.0 watts of filtered +24 volt, and approximately 2.5 watts of filtered −24 volt, dc power. Power is supplied by the data mounting. The data set will operate over an ambient temperature range of 40°F to 120°F and a relative humidity of 20 to 95 percent.

3. FUNCTIONAL DESCRIPTION

3.01 Data Set 109G transmits and receives mark and space currents from other Data Sets 109-type. Figure 3 is a simplified block diagram of Data Set 109G.

3.02 The data set consists of monitor circuits, receiver circuits, current detector circuits, and transmitter circuits. Interface leads shown in Fig. 3 are identified in Table A.

3.03 The monitor circuits detect the mark and space current signals and provide the signals to the receiver circuits and current detector circuits. The current detector circuits provide an interface signal for system alarm and receiver clamp when loop current failure occurs. The receiver circuits provide a reshaped signal to the receive data interface lead. The directional control circuit, which can be optionally inserted in the circuit, prevents data on the receive data lead from being looped back to the remote station via the send data lead when the data set operates in conjunction with an HDX hub. The transmitter circuit transmits data received on the send data lead to the loop interface lead.

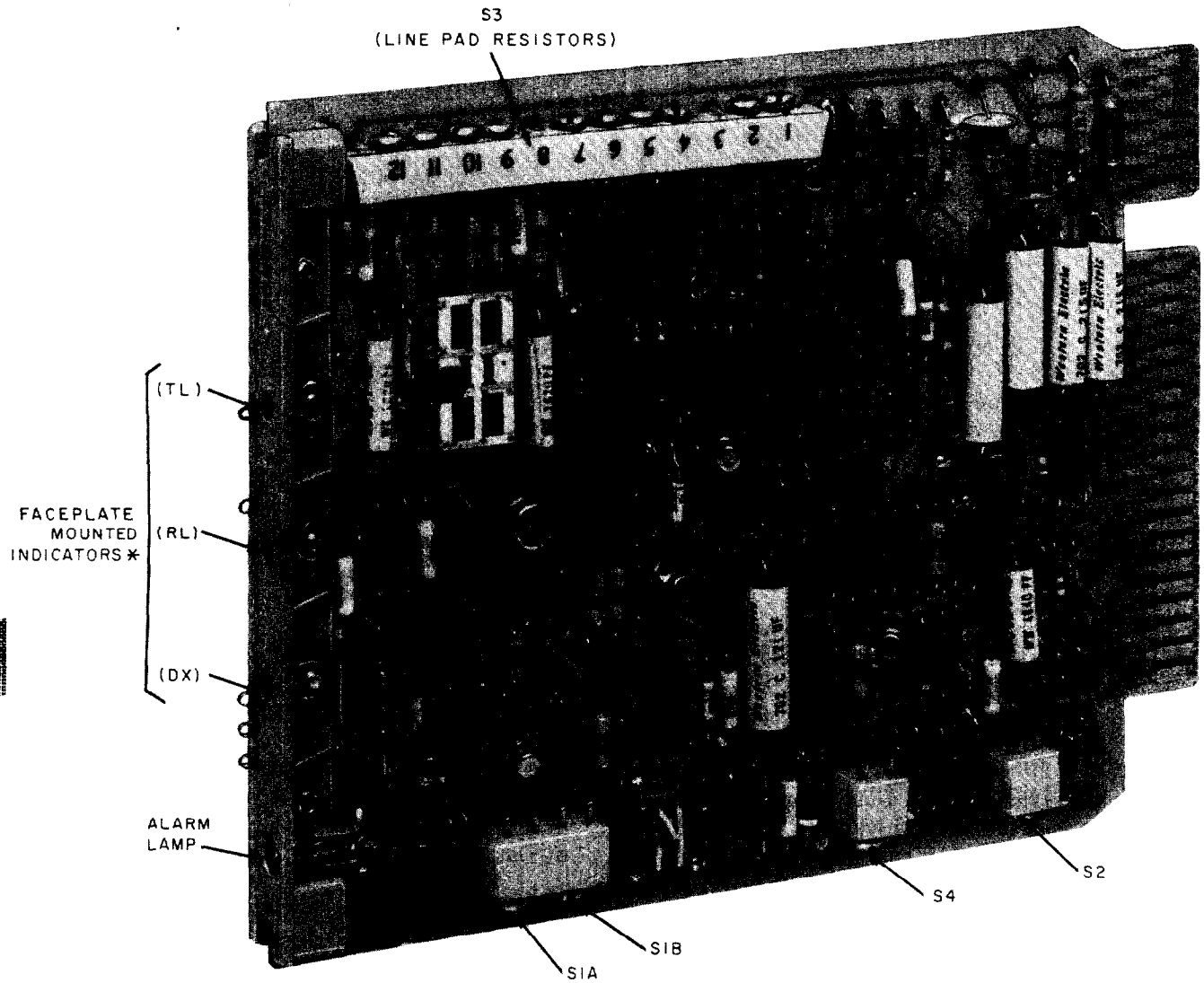

Fig. 1—Data Set 109G-L1, Series 1

TRANSMISSION STATES

3.04 Four transmission states are possible between two Data Sets 109-type when used in the FDX transmission mode. The data set applies +4 volts dc to the metallic loop when transmitting a mark and −12 volts dc when transmitting a space. The loop is arranged so that when both data sets transmit marks simultaneously, the voltage applied to the loop will be series aiding. The four possible states for FDX transmission are shown in Table B.

3.05 In transmission state 1, both data sets apply a marking voltage of +4 volts dc to the loop, resulting in a net sum of +8 volts dc around the loop. With a total loop resistance of approximately 2000 ohms, the loop current is approximately +3 mA (marking direction) around the loop (see Fig. 4-A).

3.06 Transmission state 2 occurs when the local data set sends a space signal to the remote station which is transmitting a mark. The −12 volts dc spacing voltage and the +4 volts dc

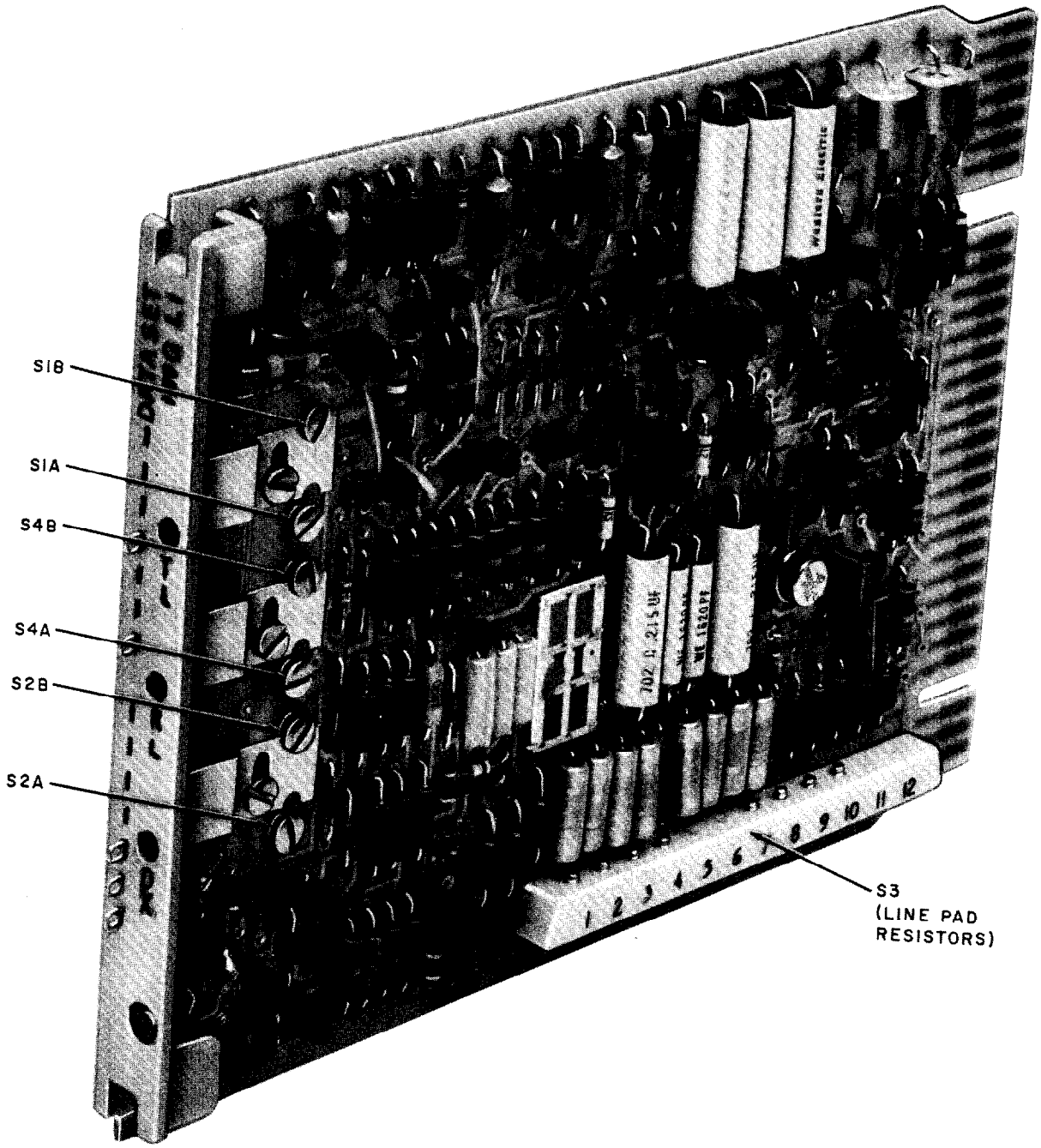

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Fig. 2—Data Set 109G-L1, Series 2

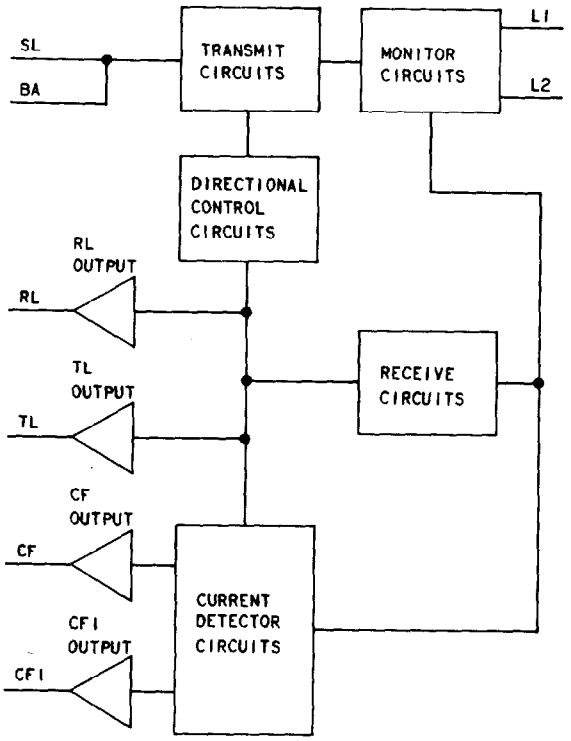

Fig. 3—Simplified Block Diagram of Data Set 109G-L1

marking voltage are series opposing, thereby developing −8 volts dc around the loop. A loop current of −3 mA (spacing direction) is developed around the loop (see Fig. 4-B).

3.07 When the local station transmits a mark (+4 volts dc) and the remote station transmits a space (−12 volts dc), transmission state 3 occurs. In this state, conditions around the loop are the same as in transmission state 2 (see Fig. 4-C).

3.08 Transmission state 4 occurs when both data sets simultaneously apply a spacing voltage to the metallic loop. Both spacing voltages are series aiding, resulting in a net sum of −24 volts dc and a loop current of approximately −9 mA (spacing direction) around the loop (see Fig. 4-D).

3.09 In the HDX transmission mode, the first three states of transmission are the same as in FDX transmission. In HDX operations, transmission state 4 provides a control function.

TABLE A

INTERFACE LEAD IDENTIFICATION

TERMINAL NUMBER	DESIGNATION	DESCRIPTION
3*	BA	Transmitted Data Lead
5	SL	Send Data Lead
9	RL	Receive Data Lead
10	TL	Hit Indicator Lead
7	CF	Data Carrier Detector
12	CF1	Data Carrier Detector (System Alarm)
15	L2	Connection to Metallic Loop
16	L1	Connection to Metallic Loop

* The BA lead is not required for low-voltage hub operation, but may be useful for test purposes.

TABLE B

TRANSMISSION STATES

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 connection to the metallic loop has been made in such a manner to allow the voltage around the loop, when both data sets transmit marks, to be series aiding.

TRANSMISSION OF DATA

3.10 The data signals from the hub interface are applied through the send data lead (SL) of the Data Set 109G to the transmit driver (see Fig. 5). The output of the transmit driver is dependent upon the state of the input from the SL lead and the input from the directional control circuit (see 3.11 for information on the directional control circuit). The output of the transmit driver is fed to the transmitter and slicing level shifter. The output of the transmitter is applied through the monitor bridge and line pads to the metallic loop. The slicing level shifter is employed to maintain a constant slicing level with respect to the loop current when the data set transmitter changes from mark to space or vice versa.

3.11 When Data Set 109G is used at an FDX hub, the directional control circuit is disabled using a screw switch actuated option (option Z, see Part 4 of this section). With the directional control circuit disabled, the output of the transmit driver will be either a mark or space corresponding to the signal applied to the SL lead of the data set.

3.12 When Data Set 109G is used at an HDX hub (option Y, see Part 4 of this section), the directional control circuit prevents data on the RL lead from being looped back to the remote sending station via the SL lead. When a space is received from the remote station, the directional control circuit is set to prevent the incoming space from being sent back to the remote station. A space may be transmitted to the remote station while receiving a space from the remote station by applying a double space to the SL lead of the data set. The double space overrides the directional control circuit but does not reset the circuit while the space is being received. When the remote station changes to the transmission of a mark, the directional control circuit may be reset by application of a double space or a mark to the SL lead of the data set. After the directional control is reset, a space on the SL lead will cause the transmit driver to send a space.

RECEIVING DATA

3.13 The Data Set 109G uses a monitor bridge to sense the magnitude and direction of the loop current. The output of the monitor bridge is fed to the monitor amplifier. The output of the monitor amplifier is fed to the mark-space slicer where it is compared to the slicing level that is set by the slicing level shifter and is fed to the current detector circuit (see 3.16 for information on current detection). When the monitor amplifier output is more negative than the slicing level, the mark-space slicer outputs a space. When the monitor amplifier output is more positive than the slicing level, the mark-space slicer outputs a mark.

3.14 The output of the mark-space slicer is fed to a pulse-shaping network (a low-pass filter and hysteresis slicer) which reshapes the signal into square pulses. The circuit also blocks any

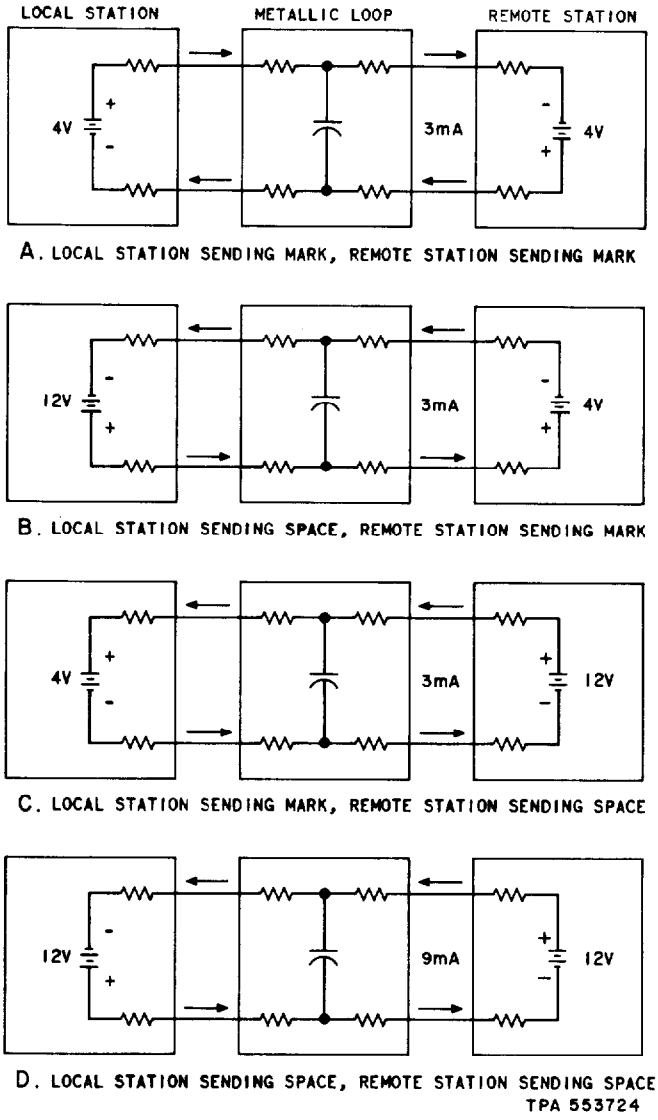

Fig. 4—Transmission States of a Data Set 109-Type, Full-Duplex (FDX) System

spurious pulses which may appear at the slicer output from reaching the RL and TL leads.

3.15 The output of the pulse-shaping network is fed through the inverters to the output circuit driver. The output circuit driver simultaneously drives both the RL and TL output circuits. The RL output circuit is a current interface circuit which provides 10 mA for a space and zero mA for a mark. The TL output circuit conforms to EIA Standard RS-232-B.

CURRENT DETECTION

3.16 The output of the monitor amplifier is also fed to a current detection circuit which monitors the loop current for a zero current condition. When the loop current falls within the range of approximately +1.4 mA to −1.4 mA, the current detector activates an RC timing circuit.

3.17 The RC timing circuit provides a 15-ms delay before the CF, and CF1 leads are turned off, giving a loss of current condition which turns the alarm lamp on. Similarly, when loop current returns, a 15-ms delay is provided before the CF, and CF1 leads are turned on causing the alarm lamp to turn off. The mark-space transitions result in a momentary zero current condition being detected at the monitor amplifier. The 15-ms delay provided by the timing circuit allows for these normal transitions without causing a current fail alarm.

3.18 The timing circuit also activates the clamp circuit that clamps the TL and RL output circuits. The status of the RL and TL leads is determined by the option installed (X option—RL and TL clamped to mark; W option—RL and TL clamped to space, V option—RL clamped to mark, TL clamped to space). The options are set by screw swtiches (Refer to Table C and Part 4 of this section).

4. OPTIONS AND LINE PAD RESISTORS

4.01 Table C lists the options provided by Data Set 109G. Refer to Table C for a description of the options provided and the action required to install these options in either series 1 or series 2 data sets. (See Fig. 1 and 2).

4.02 When the options listed in Table C are installed in the Data Set 109G, flag indicators on the faceplate of the series 1 data set must be set to indicate the status of the data set (see Fig. 1 for location of indicators).

- Option Z—Indicator DX set to F (FDX)
- Option Y—Indicator DX set to H (HDX)
- Option X—Indicators RL and TL set to M (mark hold)

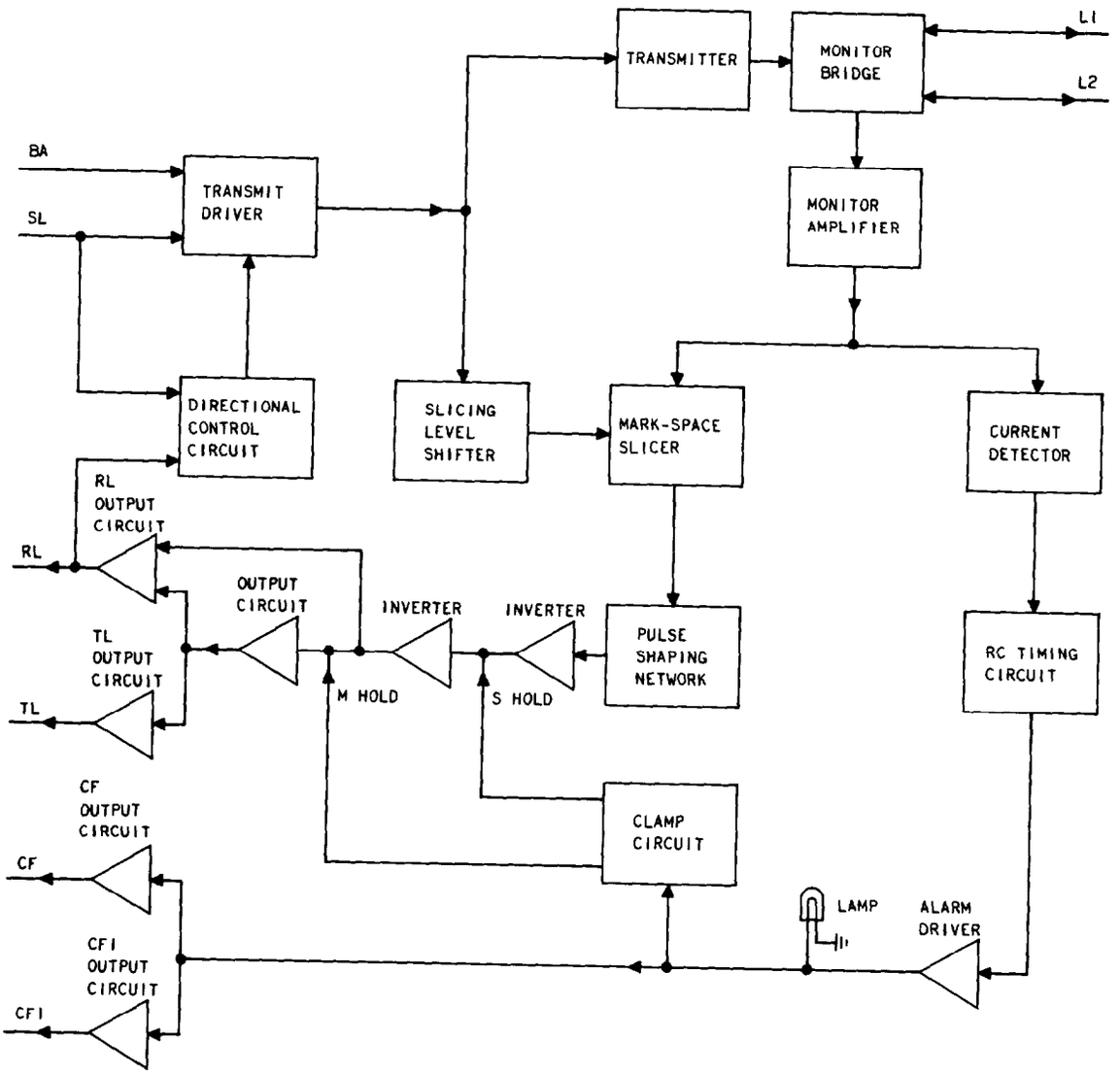

Fig. 5—Data Set 109G-L1—Functional Block Diagram

- Option W—Indicators RL and TL set to S (space hold).

- Option V—Indicator RL set to M and Indicator TL set to S.

The flag indicators on the faceplate of series 2 data sets are automatically set by installing the options, therefore, they do not require separate setting. However, care should be taken to make sure the better designations are visible through the holes in the faceplate (Refer to Fig. 2).

4.03 The Data Set 109G-type provides line pad resistors. These resistors are inserted or removed from the line circuit by setting the S3 screw switches shown in Fig. 1 and Fig. 2. Table D provides the resistance values that are obtained for each screw switch setting.

4.04 When installing a Data Set 109G-type, the padding must be set as follows:

- For loops with less than 1500-ohms resistance, the Data Set 109G-type pad is set to provide 522 ohms (see Table D).

- For loops with 1500-ohms or greater resistance, no pad resistance will be provided by the Data Set 109G. Any additional resistance

required will be provided by the station data set.

Note: The loop resistance can be obtained from the service order or the loop can be shorted and the resistance measured with a KS-14510-L5 volt-ohm-milliammeter.

4.05 After the Data Set 109G-type has been installed, the data set pad resistance provided by the station data set may have to be set in order to provide a nominal 2000-ohms total resistance. Refer to the applicable BSP for the 109-type far-end data set being used to determine the appropriate action required.

5. REFERENCES

5.01 Additional information on Data Set 109G-L1 may be found in the following documents.

(a) Data Set 109G CD- and SD-73069-01.

For information on the associated equipment of the Data Set 109G refer to the following.

(b) Type-3 Low Voltage Hub Sections—312-807-Series and CD-73059-01.

(c) 27-Type Data Mounting—Identification (590-102-123).

TABLE C

OPTION	DESIGNATION OR FUNCTION	SWITCH SETTINGS FOR SERIES 1 SETS (See Note 1)	SWITCH SETTINGS FOR SERIES 2 SETS (See Note 2)	AVAIL
Z	Provides for Full-Duplex (FDX) Operation	Close Switch S2	Set Switch S2 to the S2B position	One per Data Set
Y	Provides for Half-Duplex (HDX) Operation	Open Switch S2	Set Switch S2 to the S2A position	
X	Provides a mark hold on the TL and RL leads	Open Switch S1B Close Switches S1A and S4	Set Switch S1 to the S1A position Set Switch S4 to the S4B position	One per Data Set
W	Provides a space hold on the TL and RL leads	Open Switches S1A and S4 Close Switch S1B	Set Switch S1 to the S1B position Set Switch S4 to the S4A position	
V	Provides a mark hold on the RL lead and a space hold on the TL lead	Open Switch S1A Close Switches S1B and S4	Set Switch S1 to the S1B position Set Switch S4 to the S4B position	

Notes: (1) On series 1 data sets, the switches are closed by turning the designated screw so the head makes contact with the metal bars of the terminal strip. Opening a switch requires the screw to be backed out until the connection is opened. Care should be taken to avoid using excessive force, thereby stripping the screw threads when making an option connection. Refer to Fig. 1 for screw terminal designations for series 1 data sets.

(2) On series 2 data sets, an option is set by loosening the slide locking screw and positioning the metal contact bar so it makes contact with the required screw head terminal. The screw is then tightened to hold the metal strap in place. Excessive force should not be used to avoid stripping the screw threads. Refer to Fig. 2 for screw terminal designations on series 2 data sets.

TABLE D

S3 SCREW SWITCH SETTINGS

RESISTANCE LINE PAD	DATA SET 109G — L1 SERIES 1		DATA SET 109G — L1 SERIES 2	
	CLOSE	OPEN	CLOSE	OPEN
0	3, 4, 5, 6, 8, 9 10, 11		1, 2, 3, 4, 7, 8, 9 10	
136.2	3, 4, 5, 9, 10, 11	6, 8	2, 3, 4, 8, 9, 10	1, 7
266.0	3, 4, 6, 8, 10, 11	5, 9	1, 3, 4, 7, 9, 10	2, 8
402.2	3, 4, 10, 11	5, 6, 8, 9	3, 4, 9, 10	1, 2, 7, 8
522.0	3, 5, 6, 8, 9, 11	4, 10	1, 2, 4, 7, 8, 10	3, 9
658.2	3, 5, 9, 11	4, 6, 8, 10	2, 4, 8, 10	1, 3, 7, 9
788.0	3, 6, 8, 11	4, 5, 9, 10	1, 4, 7, 10	2, 3, 8, 9
924.2	3, 11	4, 5, 6, 8, 9, 10	4, 10	1, 2, 3, 7, 8, 9
1022.0	4, 5, 6, 8, 9, 10	3, 11	1, 2, 3, 7, 8, 9	4, 10
1158.2	4, 5, 9, 10	3, 6, 8, 11	2, 3, 8, 9	1, 4, 7, 10
1288.0	4, 6, 8, 10	3, 5, 9, 11	1, 3, 7, 9	2, 4, 8, 10
1424.2	4, 10	3, 5, 6, 8, 9, 11	3, 9	1, 2, 4, 7, 8, 10
1544.0	5, 6, 8, 9,	3, 4, 10, 11	1, 2, 7, 8	3, 4, 9, 10
1680.2	5, 9	3, 4, 6, 8, 10, 11	2, 8	1, 3, 4, 7, 9, 10
1810.0	6, 8	3, 4, 5, 9, 10, 11	1, 7	2, 3, 4, 8, 9, 10
1946.2		3, 4, 5, 6, 8, 9, 10, 11		1, 2, 3, 4, 7, 8 9, 10