DATA SET 209A-L1
TRANSMITTER-RECEIVER
DESCRIPTION AND OPERATION

CONTENTS PAGE

1. GENERAL

1.01 This section contains the physical and functional descriptions as well as operating procedures for data set (DS) 209A-L1. Other than a brief description of interface signals and customer options, information pertaining to the customer-provided equipment (CPE) is not given. Detailed information pertaining to DS 209A-L1 is contained in Section 592-032-150.

1.02 This section is reissued to incorporate information previously contained in Section 592-032-101. The detailed functional description and data set option information previously contained in this section are now included in Section 592-032-150. Since this reissue constitutes a general revision, arrows ordinarily used to denote changes have been omitted.

1.03 The following is a technical specification summary for DS 209A-L1.

Data Rate: Multiples of 2400 bps up to maximum of 9600 bps

Operation: Synchronous, binary, serial

Channel Requirements: 3002-type 4-wire PL with high performance data conditioning (D1-type); no C-type conditioning required

Interface Voltages: Per EIA Standard RS-232-C

Transmitter Output Level: 0 dBm

Receiver Input Level: -16 dBm ± 7 dBm

Line Impedance: 600 ohms

Operating Mode: Duplex or half duplex

Timing: Internal or external.

1.04 The data set contains a multiplexing capability which provides data channels in multiples of 2400 bps up to 9600 bps as follows:

- One 9600-bps channel
- One 7200-bps and one 2400-bps channel (72/24)
- Two 4800-bps channels (48/48)
- One 4800-bps channel and two 2400-bps channels (48/24/24)
- Four 2400-bps channels (24/24/24/24).

These channels can interface with CPE or can be extended with DSs 201C-type, 208A-type, or 209A-L1.

1.05 DS 209A-L1 has the capability of operating in DDD backup. The data set will reduce maximum operating speed in DDD backup from 9600 bps to 4800 bps as determined by the DBU1 lead from the data auxiliary set. In DDD backup, the data set contains a multiplexing capability which provides data channels as follows:

- One 4800-bps channel
- Two 2400-bps channels.

These channels can interface with CPE or can be extended with DSs 201C- or 208A-type. The automatic reduction of maximum operating speed can be overridden by modification of the telephone interface cable as described in Section 592-032-200.

1.06 Due to the multiplexing capability provided by DS 209A-L1, many different system applications are possible. Some typical applications are as follows:

- Point-to-Point—Data is exchanged between two points at the rate of 9600 bps.
- Point-to-Point Multiplexing—Up to four data channels as described in 1.04 are provided using only one voicegrade facility. For this application, the CPE must be located within 50 feet of the data set 209A-L1.
- Many-Point Multiplexing—Functionally, this arrangement is similar to point-to-point multiplexing, except the CPE may be located an arbitrary distance from DS 209A-L1. DSs 201C-type, 208A-type, or 209A-L1 (7200 bps) are used to provide the extended distance from CPE to DS 209A-L1.
- One-to-Many Multiplexing—This arrangement provides operation with a single CPE port at one location and multiple CPE ports at the remote location. For example, one CPE port may supply 9600 bps, time-division, multiplexed data to a DS 209A-L1 for transmission to a remote DS 209A-L1. The remote DS 209A-L1 will demultiplex the received 9600-bps data into two channels of 4800 bps.
- Digital Data System Subrate Off-Net Extension Service—Access to the synchronous DDS is provided in remote areas not served directly by the DDS. Data set 209A-L1 can be used to connect the customer to the nearest DDS hub office.

1.07 When DS 209A-L1 is used in a multiplex system, idle (unused) ports are permitted to be unterminated. For example, a point-to-point multiplexing system may use only three of the available channels, while the fourth channel is idle and unterminated.

2. DESCRIPTION

PHYSICAL DESCRIPTION

2.01 DS 209A-L1 (Fig. 1) consists of a transmitter, receiver, and control circuits which are mounted on 19 KD-type plug-in circuit packs. The exterior of the data set consists of front and rear molded black plastic faceplates mounted on an extruded aluminum housing with a brushed finish. The overall dimensions of the data set are approximately 20-1/2 inches across the front, 5 inches high, and 13-1/2 inches deep. The weight is approximately 42 pounds.

2.02 The data set is primarily intended for desk top mounting, but with the addition of D-180556 mounting brackets, it may be mounted in a 23-inch rack.

2.03 The data set will operate in an environment of 20 to 95 percent relative humidity from 40 to 75°F, or 20 to 40 percent relative humidity from 75 to 120°F. For intermediate temperatures, the maximum allowable relative humidity can be determined using a linear interpolation between these limits.

2.04 The data set is provided with four customer interface connectors, a TEL interface connector, and a power cord connector located at the rear of the set, as shown in Fig. 2. Customer interface connectors 1, 2, 3, and 4 are KS-19087-L2 and provide the digital interface leads for interface with CPE or extension data sets. The CPE must be equipped with a cable terminated in a Cinch or Cannon DB-19604-432 plug wired in accordance with Table A. The TEL interface connector is a KS-19088-L2 and provides the interface for connection to the 4-wire PL channel. The TEST connector,

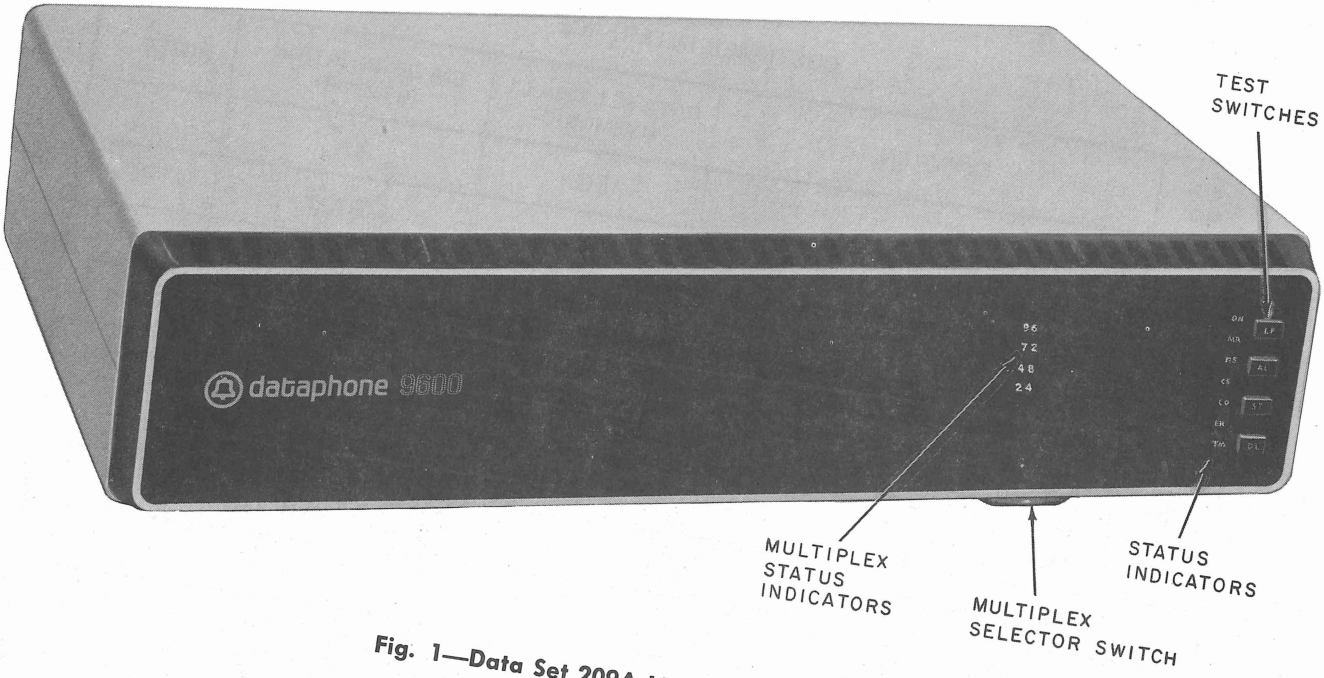

Fig. 1—Data Set 209A-L1—Front View

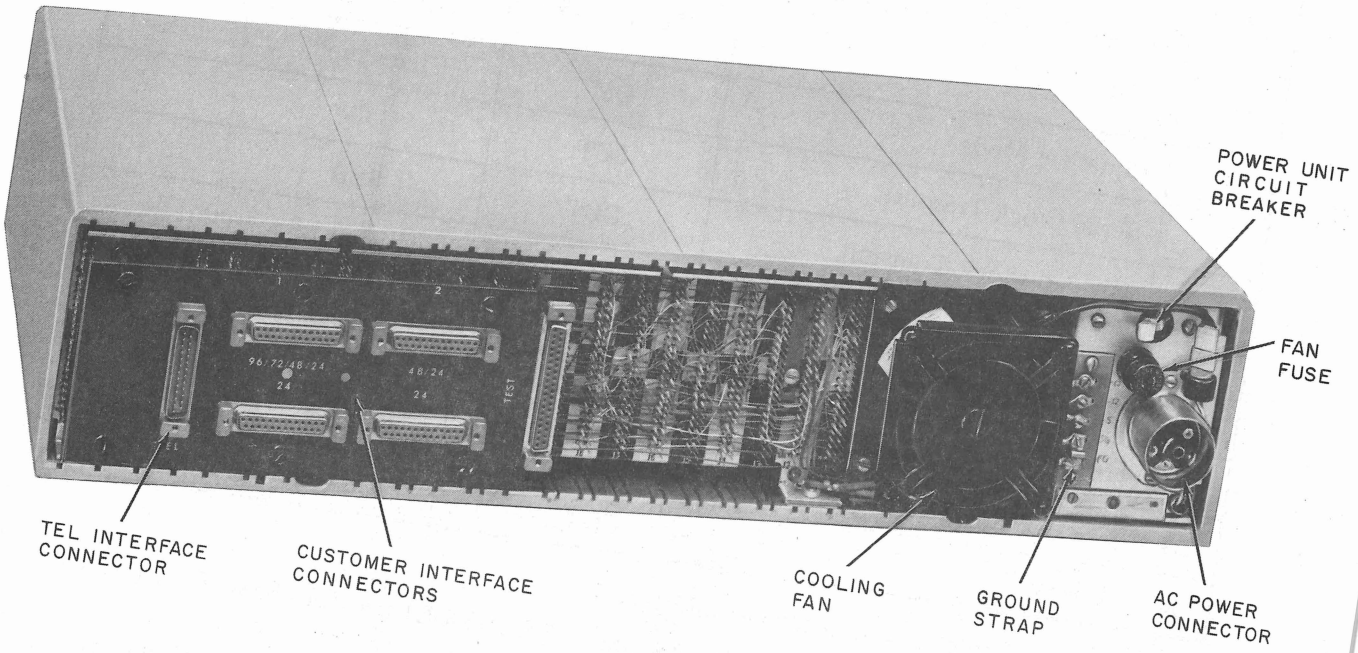

Fig. 2—Data Set 209A-L1 With Faceplate Removed—Rear View

TABLE A

CUSTOMER INTERFACE

PIN NO.	FUNCTION	DATA SET 209A-L1 MNEMONIC	EIA DESIGNATION (RS-232-C)	NOTES
1	Frame Ground	FG	AA	
2	Send Data	SD	BA	
3	Receive Data	RD	BB	
4	Request to Send	RS	CA	
5	Clear to Send	CS	CB	
6	Data Set Ready	DSR	CC	
7	Signal Ground	SG	AB	
8	Carrier On Delayed	COD	CF	
9	+12	CI9 (+12V)	Reserved for Data Set Testing	1
10	−12V	CI10 (−12V)	Reserved for Data Set Testing	1
11	Equalizer Mode	QM	Unassigned	1, 2
15	Serial Clock Transmit	SCT	DB	
16	Divided Clock Transmit	DCT	SBB	3
17	Serial Clock Receive	SCR	DD	
18	Divided Clock Receive	DCR	Unassigned	1, 2
21	Signal Quality Detector	COV	CG	
24	Serial Clock Transmitter External	SCTE	DA	
25	+5V	CI25 (+5V)	Unassigned	1, 2

Note 1: Available only at customer interface 1.

Note 2: These pins are unassigned by RS-232-C. DS 209A-L1 provides these functions to the leads of connector 1 only. Refer to 2.15.

Note 3: DS 209A-L1 provides a DCT signal on this pin of connector 1 only. RS-232-C assigns SBB to this pin. Refer to 2.15.

which is accessible by removing the rear faceplate, is a KS-19087-L3 and provides manufacturing testing capability, as well as connection for the 156A test set. The power cord connector is a twist-lock type to accept the KS-14532-L24 cord provided with the data set.

2.05 Data set power is provided by the internally mounted 112A power unit, which provides +12, −12, and +5 volts. The power unit requires an input of 105 to 130 volts ac power at 57 to 63 Hz. Power consumption is approximately 95 watts (324.2 BTU/hr).

2.06 The data set power unit is protected by a circuit breaker mounted on the backplane inside the rear faceplate. In addition, the power unit is protected by a self-resetting thermal switch to prevent overheating. The data set cooling fan is protected by a fuse which is also mounted on the backplane. Locations of the circuit breaker and fan fuse are shown in Fig. 2.

2.07 The multiplex selector switch which extends through the bottom of the data set is accessible from the front of the data set (Fig. 1). The switch is a 6-position continuous rotary-type which selects the multiplex mode of operation and illuminates the respective multiplex status indicator. Each of five switch positions selects a unique multiplexing mode (see Table B). The sixth position is used only for manufacturing testing.

2.08 Current factory models of DS 209A-L1 are equipped with a guard to prevent inadvertent operation of the multiplex selector switch. Earlier production models can be equipped with a guard at telco expense. Refer to Section 592-032-200 for ordering and installation information.

2.09 The multiplex status indicators consist of four light-emitting diodes (LEDs) which are visible through translucent designations located on the data set front faceplate. These LEDs indicate the position of the multiplex selector switch as follows:

- 96—This indicator is lighted when the data set is capable of operating with one channel at 9600 bps.
- 72—This indicator is lighted when the data set is capable of operating with one channel at 7200 bps and one channel at 2400 bps.

TABLE B

LIGHTED MULTIPLEX STATUS INDICATORS

MULTIPLEX SWITCH POSITION	MULTIPLEX STATUS INDICATORS		INTERFACE CONNECTOR			
	PL AND 9600-BPS DDD OPERATION	4800-BPS DDD BACKUP OPERATION	1	2	3	4
1	96	48	96*	—	—	—
2	72 & 24	24	72†	24	—	—
3	48	24	48†	48†	—	—
4	48 & 24	24	48†	24	24‡	—
5	24	24	24	24	24‡	24‡
6	None	None	—	—	—	—

* Operates at 4800 bps when DBU1 telephone interface lead is closed.
† Operates at 2400 bps when DBU1 telephone interface lead is closed.
‡ Not operational when DBU1 telephone interface lead is closed.

- 48—This indicator is lighted when the data set is capable of operating with two channels at 4800 bps or one channel at 4800 bps, and two channels at 2400 bps.

- 24—This indicator is lighted when the data set is capable of operating with one channel at 7200 bps and one channel at 2400 bps; or one channel at 4800 bps and two channels at 2400 bps; or with four channels at 2400 bps.

2.10 Data set 209A-L1 is equipped with seven status indicators which monitor the power unit and certain interface leads. The status indicators are LEDs which are visible through translucent designations located on the data set front faceplate. Data set status indicators are as follows:

ON—This indicator is lighted when the power cord is plugged into a 105- to 130-volt ac, 57- to 63-Hz source.

MR—This indicator monitors the status of the data-set-ready (CC) leads and is lighted whenever the CC leads are in the ***on*** condition. When a data auxiliary set (DAS) is used (option YI) and is in the test mode, or when the data set is in the self-test (ST) or digital loop-back (DL) test mode, the MR indicator is off. When the data set is in the analog loop-back (AL) mode, the MR indicator is off except when the DSR-on-in-AL-mode option (YM) is used.

RS—This indicator monitors the status of the request-to-send (CA) signal. In normal operation, this indicator is lighted whenever one or more of the active CA leads are in the ***on*** condition. When the data set is optioned for continuous request-to-send (option XI), the RS indicator is continuously lighted.

CS—This indicator monitors the condition of the clear-to-send (CB) leads and is lighted whenever one or more of the active CB leads are in the ***on*** condition. This indicates that the data set is ready and will transmit the data present on the corresponding send data (BA) leads.

CO—This indicator monitors the condition of the carrier-on (CF) signal and is lighted whenever the CF leads are in the ***on*** condition. This indicates that the receiver has detected a signal on the line which is within the data band.

ER—In the data mode this indicator monitors the condition of the equalizer mode (QM) interface lead of connector 1. The ER indicator is lighted whenever the CO indicator is off. When the CO indicator is lighted, the ER indicator is lighted, provided the QM interface lead is in the ***off*** condition. This indicates marginal performance of the data set due to either excessive channel impairments or a faulty data set, and that the automatic adaptive equalizer is in need of retraining. Data received on the received data (BB) lead during this period is not valid. When the ST switch is depressed, the ER indicator is conditioned to light for approximately 100 ms when each bit error is received.

TM—This indicator is lighted when any of the test switches (LP, AL, ST, DL) are depressed.

2.11 Data set 209A-L1 is provided with four test switches which are accessible through the front faceplate. The switches are depress-to-operate and depress-to-release type with the exception of the LP (lamp test) switch, which is nonlocking. Test switch functions are as follows:

LP (Lamp Test)—This switch, when depressed, lights ***all*** status indicators (LEDs) with the exception of the ON indicator (which should be lighted whenever power is applied to the data set). Depressing this switch does not affect data set operation.

AL (Analog Loop-Back)—This switch, when depressed, loops back the transmitter to the receiver through an internal attenuator on the line side. This permits testing of the local data set with self-contained test circuitry or with external test equipment through the customer interfaces. Depressing the AL switch lights the TM indicator and disables the slaved transmit timing option (WI). The automatic retrain option is invoked. Unless the DSR-on-in-AL-mode option (YM) is installed, the MR indicator goes off and the data set ready (CC) leads turn ***off***.

ST (Self Test)—This switch, when depressed, conditions the data set to transmit steady marks. The request-to-send (CA) lead is held ***on*** by this switch. The ER indicator blinks in response to the occurrence of error signals (spaces) on any of the receive data (BB) leads. Depressing the ST switch lights the TM indicator, disables the slaved transmitter timing option and the external timing option, extinguishes the MR indicator, and turns the CC leads ***off***.

DL (Digital Loop-Back)—This switch, when depressed, causes a loop-back at the data set customer interface. Received data (BB) leads are connected to transmitted data (BA) leads; serial clock receive (DD) leads are connected to the serial clock transmit external (DA) leads; and the signal quality detector (CG) lead is connected to the request-to-send (CA) lead of connector 1. These interface leads are disconnected from the customer interface while the data set functions as a regenerator. This permits testing of the transmission facilities and both data sets. When the DL and ST switches are depressed jointly, the voltage at quality monitor 1 test point is applied to the send data (BA) leads. This facilitates compromise equalization of the data channel from a remote data set location.

Note: The DL and AL test switches should not be operated simultaneously.

FUNCTIONAL DESCRIPTION

2.12 This part contains information pertaining to the data set test modes, interface leads, and options. Refer to Section 592-032-150 for a detailed functional description of the data set.

A. Test Modes

2.13 DS 209A-L1 provides three test modes which enable the customer or telco employee to test the data set in analog loop-back, digital loop-back, and end-to-end test modes.

- ***Analog Loop-Back:*** The purpose of this test is to check the local data set by using any one of the following methods: duplex CPE, data set self-test feature, or a 914-type DTS.

If the CPE requires that an <u>on</u> condition be present on the CC lead, the DSR-on-in-AL-mode option must be enabled.

This test mode is entered by depressing the AL test switch, which disconnects the data set from the telephone line and loops the transmitter output back to the receiver through an internal pad. In this test mode, the ON, RS, CS, CO, and ER indicators operate as in the normal data mode. The MR indicator is off unless the DSR-on-in-AL-mode option is enabled, and the TM indicator is lighted. A self test of the data set without the use of additional test equipment can be initiated by depressing the AL switch and then the ST switch. The ST switch turns the CA lead ***on***, turns the CC lead ***off***, and conditions the BA lead to transmit steady marks. A received space represents an error, resulting in momentary illumination of the ER indicator.

- ***Digital Loop-Back:*** The purpose of this test is to check, from one location, both data sets (local and remote) in conjunction with the transmission facility. This test can be performed with duplex CPE, the data set self-test feature, or a 914-type DTS. The test mode is entered by depressing the DL switch at the remote data set, which causes the remote data set to function as a regenerator. Test data from the CPE or the 914-type DTS can be transmitted by the local data set over the facility to the remote data set, looped back, and retransmitted to the local data set. A self test of the data channel without the use of additional equipment can be initiated by depressing the DL switch of the remote data set and then the ST switch of the local data set. Test data in the form of steady marks is transmitted by the local data set, looped back at the customer interface of the remote data set and retransmitted to the local data set. A received space represents an error, resulting in momentary illumination of the ER indicator at the local data set. The total error count (blinks of the ER indicator at the local data set) is a cumulative total of errors detected at the remote data set and errors detected at the local data set.

- ***End-to-End:*** The purpose of this test is to check the end-to-end performance of the data channel by using any of the following methods: duplex CPE, data set self-test feature, or a 914-type DTS. Test data is transmitted through the customer interfaces of both local and remote data sets. An end-to-end test utilizing the data set self-test feature can be initiated by depressing the ST switches of both data sets to condition them to transmit steady marks. A received space represents an error in one direction of transmission only and is shown by momentary illumination of the ER indicator at the receiving data set. The ON, RS, CS, CO, and TM indicators are lighted, while the ER and MR indicators are off.

B. Customer Interface

2.14 The customer interface is accessible through the four connectors (1, 2, 3, and 4) located at the rear of the data set. The connector pin numbers and the corresponding lead designations are given in Table A. For a detailed description of the interface leads, refer to Section 592-032-150. With the following exceptions, the interfaces are identical, independent, and functionally the same:

- Divided clock receive (DCR), divided clock transmit (SBB), and equalizer mode (QM) interface leads are provided only to customer connector 1.

- Test voltages +12V, −12V, and +5V are present at connector 1 only.

- The serial clock transmit external (DA) interface lead of connector 1 is the only DA signal which can be used to externally time the data set.

2.15 The four interfaces of DS 209A-L1 conform to the EIA Standard RS-232-C with the following exceptions. The exceptions occur only on connector 1, which provides four signals not defined in EIA RS-232-C.

(a) On pin 11, no assignment is given in EIA Standard RS-232-C. DS 209A-L1 has provided the equalizer mode (QM) signal on this lead.

(b) On pin 16, EIA Standard RS-232-C calls for secondary received data (SBB) if the data set is equipped with secondary channel. DS 209A-L1 has provided the divided clock transmit signal on this lead.

(c) On pin 18, no assignment is given in EIA Standard RS-232-C. DS 209A-L1 has provided the divided clock receive (DCR) signal on this lead.

(d) On pin 25, no assignment is given in EIA Standard RS-232-C. DS 209A-L1 has provided +5 volts (to connector 1 only) for data set testing by telco personnel.

C. Telephone Line Interface

2.16 The telephone interface is accessible through the TEL connector (Fig. 2) at the rear of the data set. The connector pin numbers and the corresponding lead designations are given in Table C.

D. Customer Options

2.17 DS 209A-L1 is provided with a number of features which may be requested as options by the customer. A detailed description of these options is given in Sections 592-032-150 and 592-032-200. All options, with the exception of the ground option, are added and removed by switches shown in Fig. 3 and Table D. Options installed in the data set should be identified on the option label which is attached to the front of the power unit.

E. Telco Options

2.18 In addition to the customer options, DS 209A-L1 provides the following options for selection by the telco employee.

- DAS 828- or 829-type used

- 1-second holdover

- Automatic equalizer retraining

- Compromise equalizer.

TABLE C

TELEPHONE LINE INTERFACE

PIN NO.	DESCRIPTION
2	—12 volts dc
3	+5 volts dc
6	DBU1
7	Data tip 1 (DT1) } Transmit Pair
8	Data ring 1 (DR1) } Transmit Pair
9	Data tip (DT) } Receive Pair
10	Data ring (DR) } Receive Pair
11	TEK6 } CC Lead Control from DAS
13	TEK5 } CC Lead Control from DAS
14	DBU2—With DBU1 provides DDD backup control
20	+12 volts dc

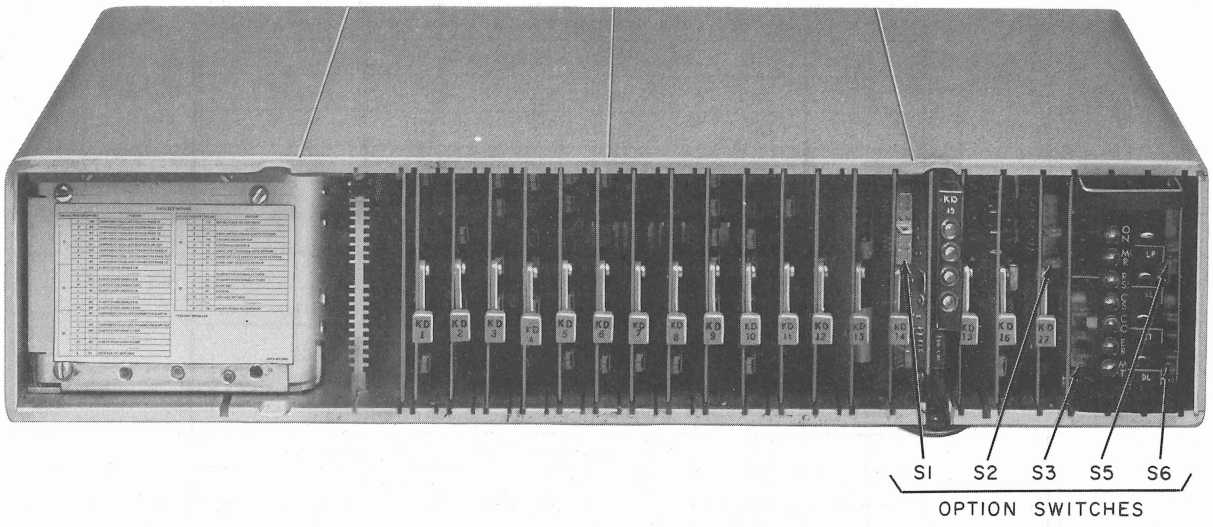

Fig. 3—Data Set 209A-L1 With Faceplate Removed—Front View

TABLE D

DATA SET 209A-L1 OPTIONS

SWITCH	STRAP* POSITION	OPTION	FEATURE
S1	1	WM	Compromise Equalizer Receive Phase HI
	2	WN	Compromise Equalizer Receive Phase OUT
	3	WO	Compromise Equalizer Receive Phase LO
	4	WK†	Compromise Equalizer Receive Slope IN
	5	WL†	Compromise Equalizer Receive Slope OUT
	6	WR	Compromise Equalizer Transmitter Phase HI
	7	WS	Compromise Equalizer Transmitter Phase OUT
	8	WT	Compromise Equalizer Transmitter Phase LO
S2	1	WA	Elastic Store Enable 1 IN
	2	—	Not Used
	3	WC	Elastic Store Enable 2 IN
	4	WF	Elastic Store Enable 3 OUT
	5	WE	Elastic Store Enable 3 IN
	6	—	Not Used
	7	WG	Elastic Store Enable 4 IN
	8	WH	Elastic Store Enable 4 OUT
S3	1	WP‡	Compromise Equalizer Transmitter Slope IN
	2	—	Not Used
	3	WQ‡	Compromise Equalizer Transmitter Slope OUT
	4	WB	Elastic Store Enable 1 OUT
	5	—	Not Used
	6	WD	Elastic Store Enable 2 OUT
	7	—	Not Used
	8	YJ	DAS 828- or 829-Type Not Used
S4	11	YM	DSR-ON-in-Analog-Loop Mode
	2	—	Not Used
	3	XF	4-Wire Switched Carrier and Auto. Retrain
	4	YW	1-Second Holdover OUT
	5	YX	1-Second Holdover IN
	6	XG	4-Wire Cont. Carrier and Auto. Retrain
	7	XH	4-Wire Switched Carrier No Auto. Retrain
	8	XI	4-Wire Cont. RS and Auto. Retrain
S5	1	—	Not Used
	2	YC	Internal Timing
	3	YD	External Timing
	4	WJ	Slave OUT
	5	WI	Slave IN
	6	YI	DAS 828- or 829-Type Used
	7	—	Not Used
	8	YN	DSR-OFF-in-Analog-Loop Mode

* The option switch is numbered from top to bottom with the number 1 strap position at the top.

† Option WK or WL must be installed.

‡ Option WP or WQ must be installed.

3. OPERATION

3.01 Attendant operation of DS 209A-L1 is limited to the four test switches, the multiplex selector switch, and observation of the status indicators. The data set is in data mode under the following conditions:

- All test switches are in the ***out*** position.
- ON and MR status indicators are lighted.
- The multiplex selector switch is in the proper position and the respective multiplex status indicator is lighted.

3.02 The data set is in the test mode when any one of the test switches is depressed and the TM status indicator is lighted. Refer to Section 592-032-500 for detailed information concerning the use of these test switches.

- Momentarily depress the LP switch to light the status indicators for test purposes.
- Depress the AL switch to initiate an analog loop-back test.
- Depress the DL switch to initiate a digital loop-back test.
- Depress the ST switch on the local data set and have the DL switch on the remote data set depressed to initiate a self test independent of external test equipment.

4. REFERENCES

4.01 Documents listed in this part contain information pertaining to DS 209A-L1.

4.02 The following BSPs are listed for reference.

SECTION	TITLE
167-440-203	112A Power Unit—Identification, Installation, and Connection
314-919-100	Digital Data System—Subrate Off-Net Extension Arrangement—Description
590-002-115	9600-Bits Per Second (BPS) Multiplexing Service Using Data Set 209A-L1—Reference Guide
Data Set 209A-L1—Transmitter-Receiver	
592-032-180	Summarizing Specification
592-032-200	Installation and Connections
592-032-300	Maintenance
592-032-500	Test Procedures
666-511-504	Test of Data Services Provided by Data Set 209A-L1 From a Private Line Test Room
999-100-143	How to Operate Manual
Data Auxiliary Set 828A	
598-080-100	Description and Operation
Data Auxiliary Set 829-Type—Channel Interface Units	
598-082-100	Description
Data Auxiliary Set 829-Type—Supplementary Functions	
598-082-101	Description
598-082-102	Installation and Connections

4.03 Detailed information pertaining to DS 209A-L1 is contained in CD- and SD-1D249-01.