DATA SET 109A-TYPE
SINGLE PRIVATE LINE STATION
USING DATA AUXILIARY SET 820D-TYPE
DESCRIPTION AND OPERATION

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1. GENERAL

1.01 This section covers the physical and functional description of data set 109A-type Single Private Line Station using data auxiliary set (DAS) 820D-type. ▶The data set 109A-type has been rated manufacture discontinued (MD).◀ For the purpose of this section, DAS 820D-type equipped with data set 109A-type is referred to as a data station.

1.02 This section is reissued to include:

(a) Notice that the data set 109A-type has been rated MD.

(b) Information pertaining to the DAS 820D-L1 and 820D-L1A which replace the DAS 820D1 and 820D2, respectively. The DAS 820D1 and 820D2 have been rated MD.

(c) Information pertaining to the use of DAS 830C with the DAS 820D-type to provide a 3- or 4-wire 20-mA neutral current customer interface.

1.03 This section also covers information pertaining to the transmission loop used by the data station.

1.04 The data station is designed to provide low-speed (up to ▶150◀ bauds), half-duplex (HDX), serial data communication over a 2-wire metallic private line. The data station is used with either a Bell System-provided teletypewriter (TTY) or customer-provided equipment (CPE) which conforms to the requirements of the data station.

1.05 ▶The data station can be arranged for either a voltage or neutral current interface to the TTY or CPE by options provided in the AR17 circuit pack (CP). The voltage interface option signals conform to the requirements of the Electronic Industries Association (EIA) Standard RS-232B. The neutral current option signals ***do not*** conform to any of the technical reference interface specifications.◀

1.06 ▶The DAS 820D-type arranged for EIA interface may be used with a DAS 830C to provide the TTY or CPE with either a 3- or 4-wire, 20-mA neutral current interface. In this case, the interface signals conform to the requirements of the technical references entitled 30-Baud Private

Line Channels Interface Specifications and 45-, 55-, and 75-Baud Private Line Channels Interface Specifications. The description, installation, and test procedures for the DAS 830C are given in Section 598-083-103.

1.07 The data station can communicate only with data set 109-type used in one of the following arrangements:

(a) Data station to hub operation where data set 109B-type is used at the hub [Fig. 1 (A)]

(b) Data station to data station operation where data set 109A-type is used at the distant station [Fig. 1 (B)].

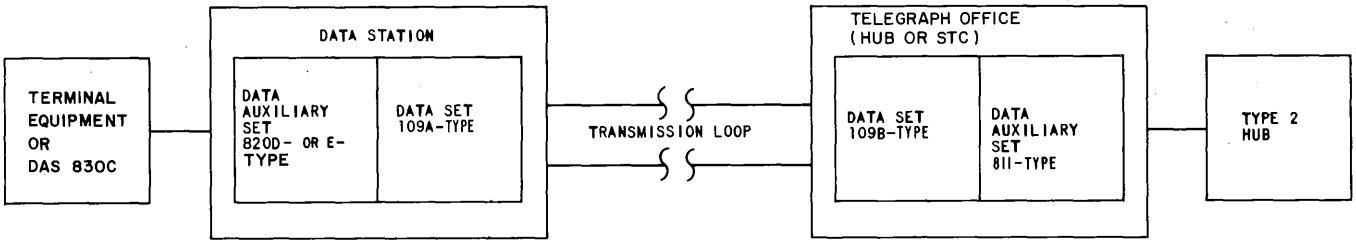
1.08 The data station can operate only over a closed dc loop which consists of a 2-wire metallic line. The loop used by the data station cannot be equipped with anything that will break the dc path of the loop. The loop cannot be carrier-derived or use ground return.

Note: For the purpose of this section, a transmission loop is the 2-wire metallic line that connects a data set 109A-type and another data set 109-type.

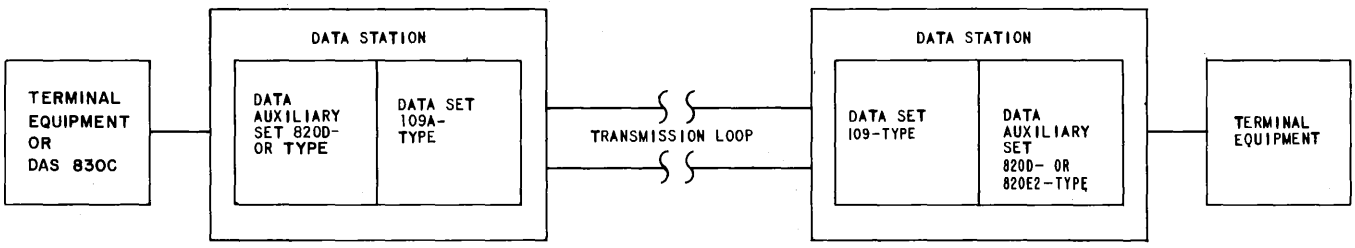
1.09 The data station is designed to operate in an ambient temperature range of 40 to 120° F and in a relative humidity range of 20 to 95 percent.

2. PHYSICAL DESCRIPTION

2.01 The physical description of the data station is covered under the headings of data auxiliary set 820D-type and data set 109A-type.



A. STATION-TO-HUB OPERATION



B. STATION-TO-STATION OPERATION

Fig. 1—System Block Diagram

DATA AUXILIARY SET 820D-TYPE

2.02 DAS 820D-type consists basically of a black plastic base which contains an 18A power unit, a 61A apparatus mounting ▸and a 6- (DAS 820D1 and D2) or 26- (DAS 820D-L1 and D-L1A) screw terminal board (TSA and TB1, respectively.◂ The 61A apparatus mounting provides for the mounting of data set 109A-type ▸and a circuit pack. When using the DAS 820D-L1 or L1A, the data set and circuit pack must be ordered separately.◂

Note: The DAS 820D1 and 820D2 came equipped with the required CP. The AR16 CP is not compatible with the DAS 820D-L1 or 802D-L1A and is now rated MD.

2.03 DAS 820D-type is 11 inches wide, 11 inches long, and 5-1/2 inches high.

2.04 The models of DAS 820D-type are as follows:

(a) ***DAS 820D1 ▸(MD):*** ◂ The 820D1 (Fig. 2) is the basic unit outlined in 2.02 and is equipped with a 2-tone gray housing and a KS-14532 L16 power cord. The 820D1 can be positioned on any surface (desk, table, etc) that is convenient for customer use and within the range of the customer-provided interface cord connected to the data terminal.

(b) ***DAS 820D2 ▸(MD):*** ◂ The 820D2 (Fig. 2) is only the basic unit outlined in 2.02. The 820D2 mounts in a model 35-type TTY which is provided by the Bell System. The 820D2 uses an M3AY cord equipped with a Harvey Hubbel 7593 connector body (Fig. 3) which must be ordered separately for a power connection.

(c) ***▸DAS 820D-L1 and 820D-L1A (Fig. 2):*** These DASs are the same as the DAS 820D1 and DAS 820D2, respectively, except:

(1) Wiring is added between the cord connectors to allow use of CPs other than AR16 and AR17 (ie, AR430 CP).

(2) Wiring is added which allows operation of the test relay and TEST lamp when the TEST key is operated at installations using half-duplex data set 109A-types. This causes continuous spacing to be sent by the station placed in the test mode.

(3) DAS 820D-L1A is supplied with an M3AY power cord (Fig. 3).◂

Note: Refer to Section 591-024-201 for a list of the equipment required to mount the DAS 820D-L1A in a 35-type TTY.

2.05 The 18A power unit of DAS 820D-type requires 0.15 amperes of a 60-Hz supply which may range from 105 to 129 volts. The power unit supplies +21 to +27 volts and −21 to −27 volts at 150 mA each to all parts of the unit.

2.06 The power is supplied to the 18A power unit via the ac power connector (Fig. 4) in the following manner.

(a) In DAS ▸820D-L1,◂ the power is supplied by a customer-provided wall receptacle which meets the requirements outlined in 2.05 and is not under the control of a switch.

(b) In DAS ▸820D-L1A,◂ the power is supplied via the M3AY cord from the TTY in which the set is mounted.

2.07 The connection between connector J3 (Fig. 4), the data station, and the data terminal is made as follows:

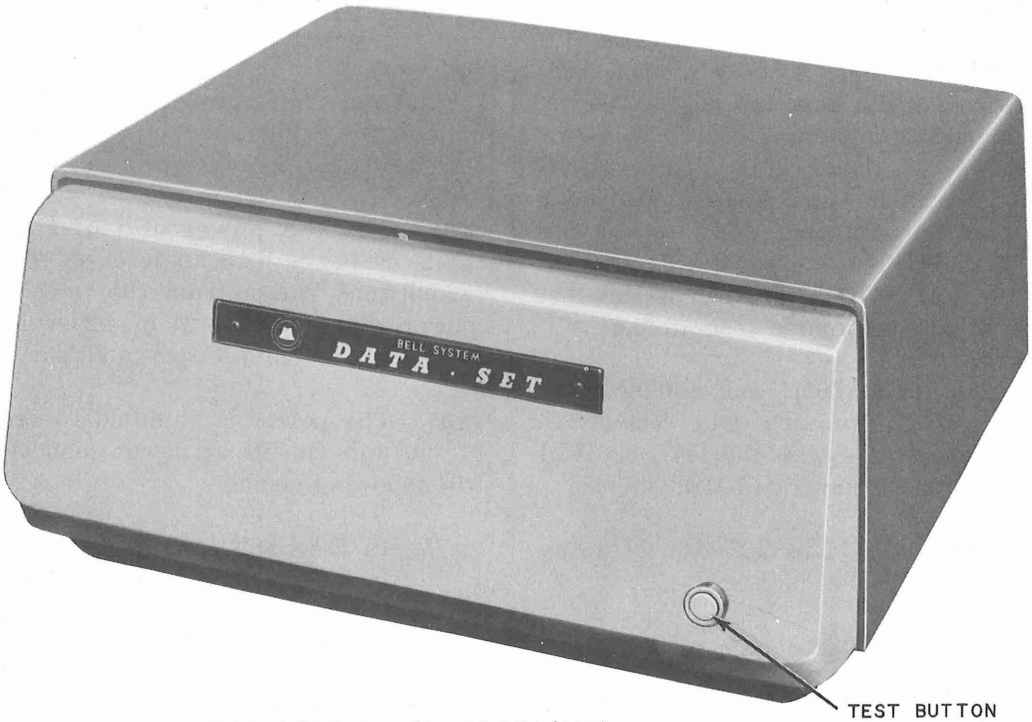
(a) In the DAS ▸820D-L1,◂ the connection is made via a customer-supplied interface cord which must not exceed 50 feet in length.

(b) In the DAS ▸820D-L1A,◂ the connection to the TTY is made via TP-327470 cable assembly which must be ordered separately.

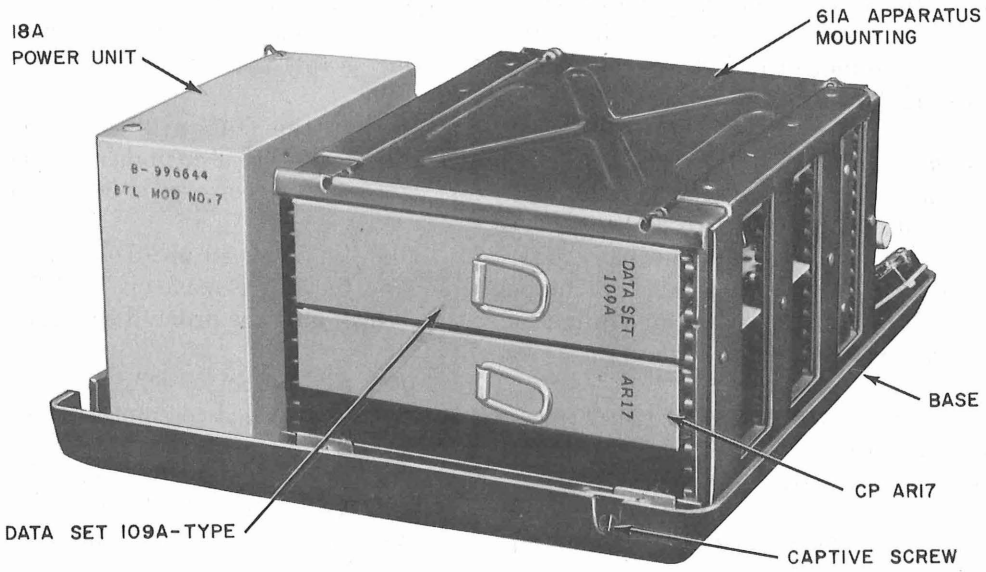
2.08 ▸TB1 (TSA of DAS 820D1 and D2)◂ (Fig. 4) is provided to connect the transmission loop (tip and ring leads) to DAS 820D-type. ▸It also provides the means for connecting an external TEST key and/or TEST lamp and for installing DAS 820D-L1 or L1A options.◂

2.09 The AR17 CP consists of a single printed wiring board which measures 7.1 inches long by 5.5 inches wide (Fig. 5). The AR17 CP is equipped with screw switches which are used to provide the options shown in Table A.

Note: The AR16 CP (Fig. 6) is similar to the AR17 except for the extra local and test



DAS 820D-LI OR 820DI (MD)



DAS 820D-LIA OR 820D2 (MD)
(DAS 820DI OR 820D-LI WITH COVERS REMOVED)

NOTE:
THE TEST KEY IS OPERATIVE ON DAS 820D-LI OR LIA ONLY. ALL OTHER DAS 820D-TYPES HAVE TEST KEY BUT IT IS NOT OPERATIVE AND DOES NOT LIGHT WHEN DEPRESSED.

Fig. 2—DAS 820D-Type, Front View

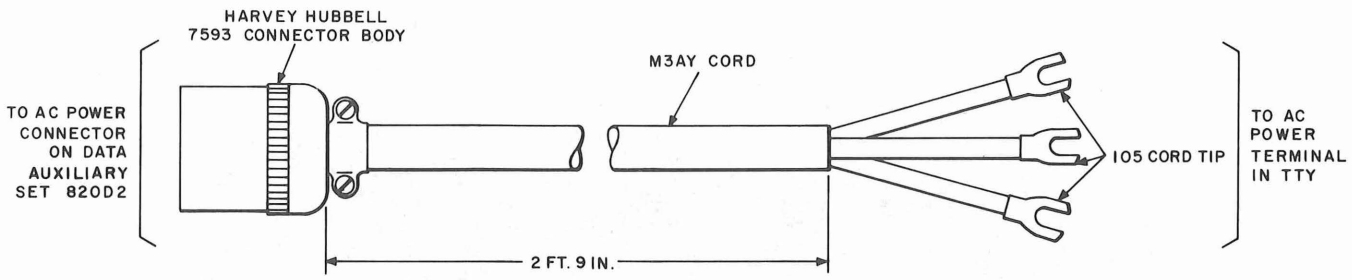


Fig. 3—M3AY Power Cord for DAS 820D-L1/A

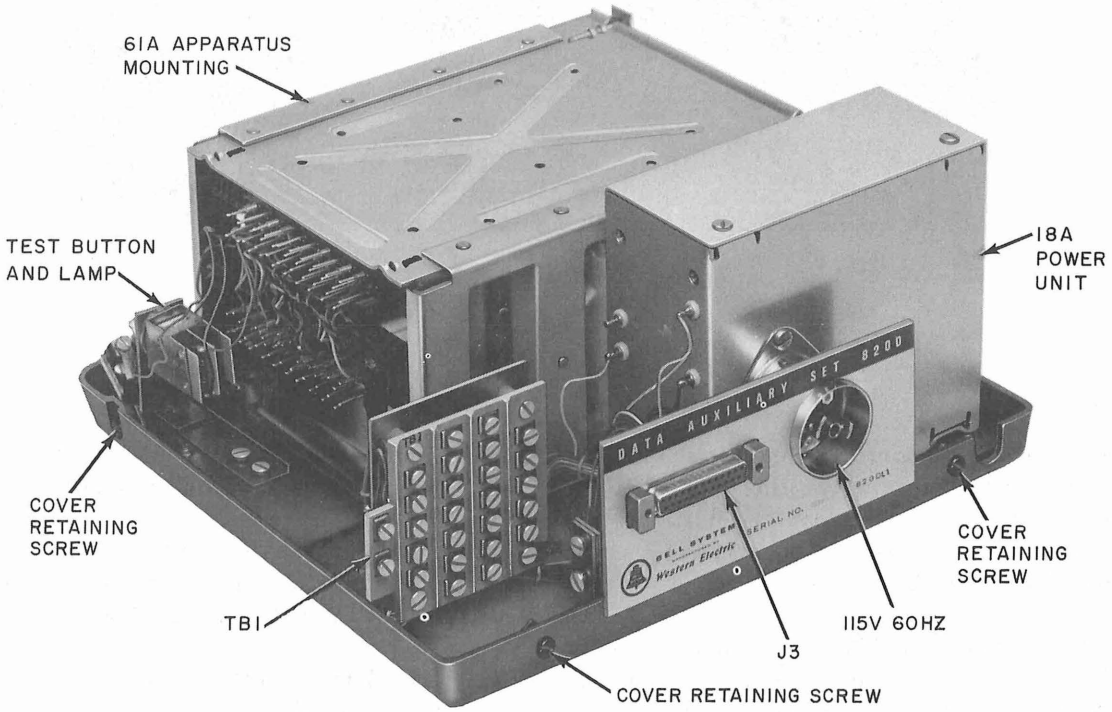


Fig. 4—DAS 820D-L1 (Rear View—Cover Removed) or DAS 820D-L1/A

transfer contacts that are accessible on the AR17.

2.10 The DAS 820D-type has the following two sets of interface leads.

(a) One from AR17 CP to the data set 109A-type via connectors J2 and J1 (Fig. 4)

(b) One from AR17 CP to the data terminal via connectors J2 and J3 (Fig. 4).

2.11 The interface between AR17 CP and the data set 109A-type conforms to the electrical characteristics of the EIA Standard RS-232-B and includes the following leads.

(a) ***Transmit:*** Data on this lead is to be transmitted to the distant station. This lead connects to the BA lead of data set 109A-type.

(b) ***Receive:*** Data on this lead is received from the distant station. This lead connects to the BB lead of data set 109A-type.

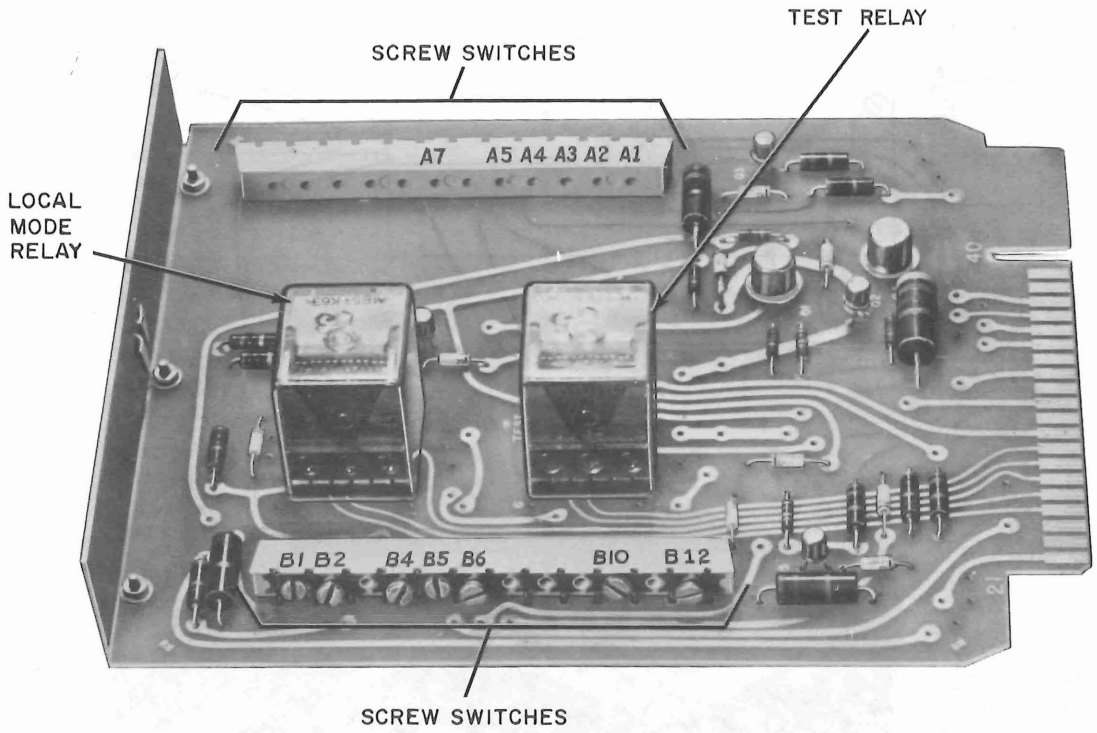


Fig. 5—AR17 Circuit Pack

(c) ***Carrier Detector:*** The condition of this lead depends on whether the data set does or does not detect the low current on the transmission loop. This lead connects to the CF lead of data set 109A-type.

(d) ***Carrier Squelch:*** This lead is not used with data set 109A-type and does not conform to EIA standards but exists in the interface leads to the data set.

2.12 The interface between AR17 CP and the data terminal ▶or DAS 830C◀ can be either a voltage interface conforming to EIA Standard RS-232-B (EIA interface) or a ▶neutral◀ current interface by arranging the screw switches on AR17 CP.

▶Signals provided by the AR17 CP neutral current interface DO NOT conform to any technical reference interface specification. If the data terminal requires an interface that DOES conform to the specifications of the technical references given in 1.06, the DAS 830C must be used. This requires the AR17 CP to be equipped with the EIA interface option.◀

(a) When ▶the AR17 CP◀ EIA interface is used, the interface provides the following leads ▶to the TTY, CPE, or DAS 830C:◀

(1) ***AA:*** Protective ground lead ▶(not used by DAS 830C).◀

(2) ***BA:*** Data transmitted from ▶TTY, CPE, or DAS 830C◀ to DAS.

(3) ***BB:*** Data ▶transmitted to the TTY, CPE, or DAS 830C◀ from DAS ▶820D-type.◀

(4) ***CA:*** Request-to-Send signal comes from ▶TTY or CPE◀ and is looped back to the ▶TTY or CPE◀ on the CB lead. This gives the Clear-to-Send indication to the ▶TTY or CPE (not used by DAS 830C).◀

(5) ***CB:*** Clear-to-Send [see (4) above] ▶(not used by DAS 830C).◀

→TABLE A←

AR17 AND AR16 CP OPTIONS

OPTION FEATURE	AR17 CP			AR16 CP (MD)		QUANTITY
	OPT DESIG	SCREW OPEN	SCREW CLOSED	SCREW OPEN	SCREW CLOSED	
EIA Interface (Note 1)	W	B2, B4, B6 A2, A4	B1, B5, A1 A3	I2, I3, I5 I7, I9	I1, I4, I6 I8	Choose One
Current Interface (Note 2)	V	B1, B5, A1 A3	B2, B4, B6 A2, A4	I1, I4, I6 I8	I2, I3, I5, I7, I9	
Copy in Test Mode	T	—	B12	M2	M1	Not Used With Data Set 109A-Type
No Copy in Test Mode	S	B12	—	M1	M2	
Local Copy	R	—	B10	—	LC	Choose One
No Local Copy	Q	B10	—	LC	—	
Mark Hold on Carr Fail	N	—	A5	—	SH	Choose One With Current Interface
Space Hold on Carr Fail	M	A5	—	SH	—	
Carr Squelch on Carr Fail	K	—	A7	—	S	Not Used With Data Set 109A-Type
No Carr Squelch on Carr Fail	J	A7	—	S	—	

Note 1: When DAS 830C is to be used with DAS 820D-type, AR17 CP must be equipped with option W (EIA interface).

Note 2: The AR17 CP current interface option can only be used when the terminal equipment (Bell System-provided or customer-provided) is equipped with 680-ohm resistance impedance input in the receiver and a contact closure output in the transmitter with both isolated from ground.

(6) ***CC:*** Data Set Ready signal sent to ▶TTY or CPE◀ when data station is prepared for normal operation. An OFF indication is given on this lead when the local relay ▶on the AR17 CP◀ is operated ▶(not used by DAS 830C).◀

(7) ***AB:*** Signal ground.

(8) ***CF:*** Data Carrier Detector signal is sent to the ▶TTY or CPE◀ when the data set detects current failure on the transmission loop ▶(in the DAS 830C, one end of CF lead is connected to the EIA connector. The other end is taped and stored in the DAS 830C housing).◀

(9) ***+P:*** +24 volt power ▶from DAS 820D-type.◀

(10) ***−P:*** −24 volt power ▶from DAS 820D-type.◀

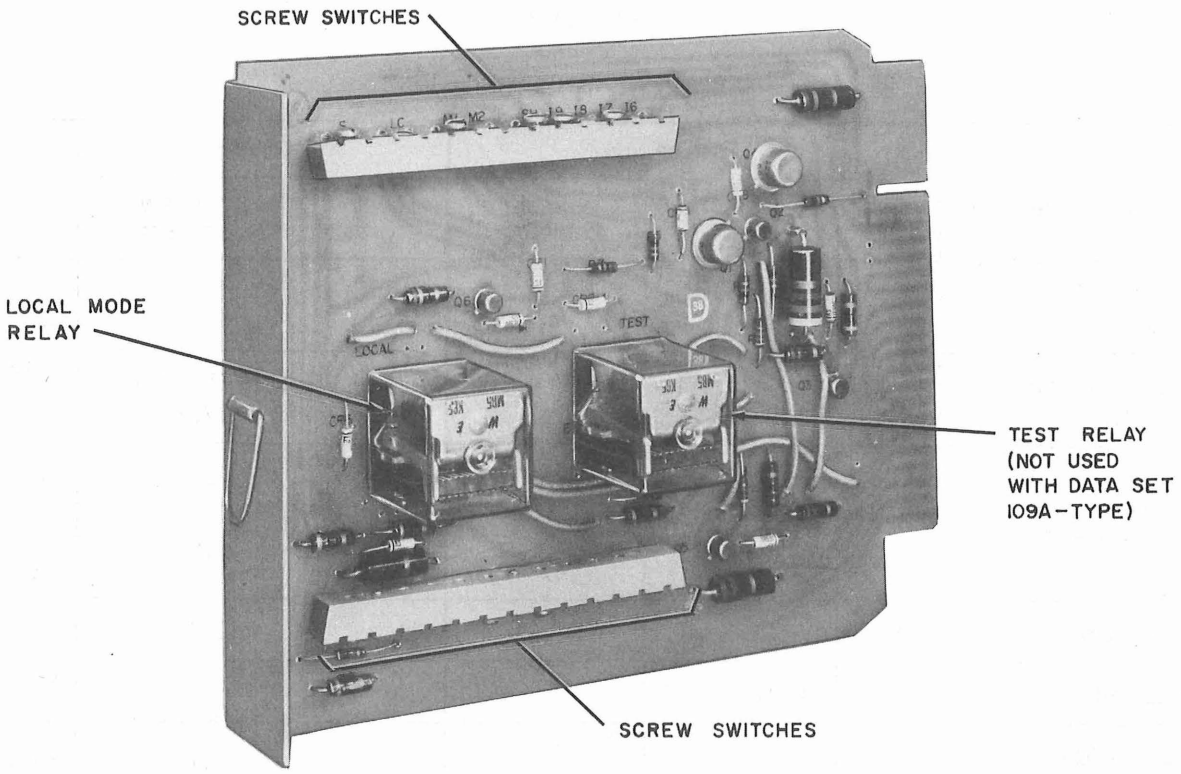


Fig. 6—AR16 Circuit Pack (MD)

(11) ***CX:*** Local Mode Control signal is sent by the ▶TTY or CPE◀ to operate the local relay on AR17 CP ▶(not used by DAS 830C).◀

(b) The ▶AR17 CP◀ current interface arrangement is intended to be used with a TTY and includes the following leads.

THINK ▶***This interface option MUST NOT be used when DAS 830C is provided.***◀

(1) ***Transmit:*** Data is sent by the data terminal to the DAS. A send loop is formed which consists of a lead from pin 2 of J3 (Fig. 4), through the send contact of the TTY, and back to pin 10 of J3.

(2) ***Receive:*** Data is sent by the DAS to the TTY. A receive loop is formed which consists of a lead from pin 3 of J3 (Fig. 4), through the selector magnet driver (SMD) of the TTY (which must be arranged to provide a noninductive input impedance of 680 ohms), and back to pin 10 of J3.

(3) ***Carrier Detector:*** If operation is normal, a short to ground appears on pin 8 of J3 to the TTY. Loss of current on the transmission loop will produce an open on pin 8 of J3 to the TTY. This lead forms a loop from pin 8 of J3, through the alarm circuits of the TTY which must have an input impedance greater than 2000 ohms, and back through a lead to pin 9 of J3.

(4) ***Local Mode Control:*** The local relay on AR17 CP is operated by a signal on pin 12 of J3 (Fig. 4) from the TTY. This lead forms a loop from pin 12 of J3 through the local mode contact in the TTY, and back through a lead to pin 9 of J3. Closing the local mode contact in the TTY will put the station in local mode.

DATA SET 109A-TYPE

2.13 Data set 109A-type (see Table B for functional interface leads) consists of a single printed wiring board (Fig. 7). The dimensions of the data set are 7.1 inches long by 5.5 inches wide.

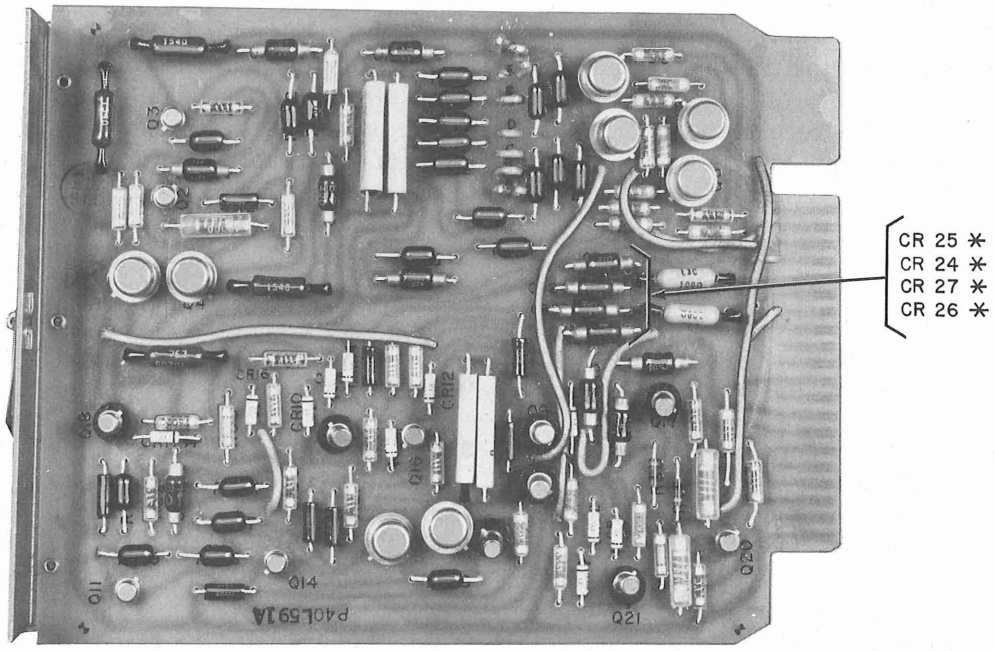
TABLE B

DATA SET 109A-TYPE
FUNCTIONAL INTERFACE LEADS

DESIG	DESCRIPTION
BA	Transmitted Data
BB	Received Data
CF	Data Carrier Detector

2.14 Data set 109A-type has two classifications—data set 109A1 (Fig. 7) and data set 109A2. Both data sets are identical, except that data set 109A1 is equipped with a lightning protection network which consists of diodes CR24 through CR27 as shown in Fig. 7.

2.15 The data set requires approximately 5 watts of filtered +24 ±3 volts and −24 ±3 volts dc peak power. The power for the data set is supplied by DAS 820D-type (see 2.05).



* THESE COMPONENTS ARE USED FOR LIGHTNING PROTECTION AND ARE ONLY PROVIDED ON DATA SET 109A1.

Fig. 7—Data Set 109A-Type

3. FUNCTIONAL DESCRIPTION

3.01 The basic function of the data station is to provide the means by which data can be transmitted to and received from the distant location as shown in Fig. 1.

3.02 The functional description of the data station is covered under four major functions which are transmitting data, receiving data, carrier fail detection, and local mode operation.

TRANSMITTING DATA

3.03 To transmit data from the data terminal to the distant location, the following circuits of the data station are used.

(a) Data to be transmitted from the data terminal is passed through the local and test contacts on AR17 CP and is applied to the transmit input lead BA (pin 3 of J1) of data set 109A-type as shown in Fig. 8.

(b) In data set 109A-type, the transmitting circuits consist of the transmit OR gate, the transmitter, the monitor circuits, and the transmit delay circuit (Fig. 8).

(1) The output of the transmit OR gate causes the transmitter circuit to develop a mark or space voltage and also causes the transmit delay circuit to develop a blinding (a mark) signal to the input of the receive NOR gate whenever a space is transmitted through the transmit OR gate.

- The signal from the transmit delay circuit holds the output of the receive NOR gate (lead BB) marking whenever a space is being transmitted through the transmit OR gate.

- The output of the receive NOR gate is connected to one input of the transmit OR gate and allows the passage of data through the transmit OR gate only when the BB lead is marking.

- The reception of a break (a space) signal on the BB lead prevents data from passing through the transmit OR gate.

(2) The transmitter circuit converts the mark and space signals of the data source into voltages that cause mark or space current to flow in the transmission loop.

(3) The monitor circuits continually sense the direction and magnitude of the transmission loop current that is applied through the tip and ring leads (Fig. 8). This enables the receiver and signal fail circuits to function as required.

(4) The transmit delay circuit insures that the data being transmitted on the BA lead is not looped back to the data station via the BB lead and AR17 CP. This is required because the monitor circuits and the receiver circuit of data set 109A-type operate continuously. Assuming that a marking condition is applied to the BA lead and the remote data set is idle (transmitting steady mark), the receive NOR gate is held marking by the outputs of the transmit delay and the receiver circuits. When a space is applied to the BA lead, the transmit delay couples a marking condition to the input of the receive NOR gate before the output of the receiver circuit can apply a spacing condition to the input of the receive NOR gate (Fig. 8); therefore, the output of the receive NOR gate is held marking. When a mark is reapplied to the BA lead, the transmit delay holds the receive NOR gate to a marking condition for about 200 μs before the output of the receive NOR gate is allowed to follow the signals from the receiver circuit. The output of the receiver circuit by that time is marking. The resulting effect is that the BB lead (the output of the receive NOR gate) is held to a steady mark during the transmission of data on the BA lead.

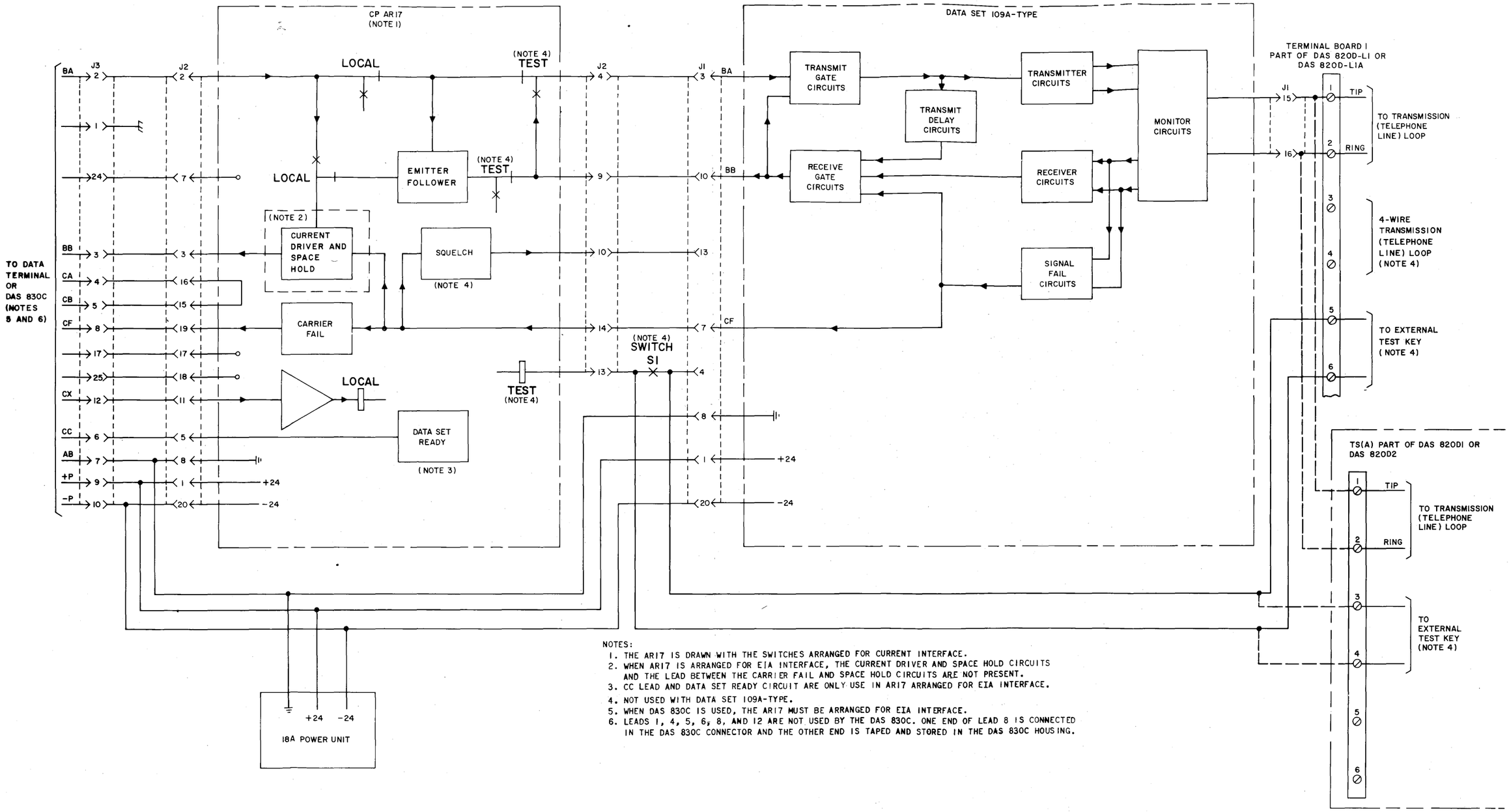
3.04 Data is applied from the data terminal through the BA lead of the DAS and AR17 CP to the BA lead of data set 109A-type (Fig. 8). In the data set, the transmit OR gate will pass the data signals to the transmitter circuit and the transmit delay circuit, if the BB lead (the output of the receive NOR gate) is marking. The transmitter circuit converts the mark and space signals of the data into +4 volt mark signals and −12 volt space signals. The mark and space signals are then passed to the monitor circuits, which apply the signals to the transmission loop.

3.05 The only difference between the EIA and current interface (when data is being transmitted from the data terminal, through the AR17 CP, to the BA lead of the data set 109A-type) is the method by which the signals are generated.

(a) When ▶AR17 CP◀ EIA interface is used, the data signals consist of marks (negative ▶voltages)◀ and spaces (positive ▶voltages). The AR17 CP ***must*** be arranged for the EIA interface (option W) when the DAS 820D-type is to be used with DAS 830C.◀

Note: The EIA interface signals concur with EIA Standard RS-232-B which states that a mark ranges from −5 to −25 volts and a space ranges from +5 to +25 volts.

(b) When ▶the AR17 CP◀ current interface is used, the data signals consist of a mark (a closed contact in the TTY ▶or CPE)◀ and a space (an open contact in the TTY ▶or CPE).◀ These signals are converted by the AR17 CP into EIA signals which are applied to the BA lead of the data set 109A-type.



NOTES:
1. THE AR17 IS DRAWN WITH THE SWITCHES ARRANGED FOR CURRENT INTERFACE.
2. WHEN AR17 IS ARRANGED FOR EIA INTERFACE, THE CURRENT DRIVER AND SPACE HOLD CIRCUITS AND THE LEAD BETWEEN THE CARRIER FAIL AND SPACE HOLD CIRCUITS ARE NOT PRESENT.
3. CC LEAD AND DATA SET READY CIRCUIT ARE ONLY USE IN AR17 ARRANGED FOR EIA INTERFACE.
4. NOT USED WITH DATA SET 109A-TYPE.
5. WHEN DAS 830C IS USED, THE AR17 MUST BE ARRANGED FOR EIA INTERFACE.
6. LEADS 1, 4, 5, 6, 8, AND 12 ARE NOT USED BY THE DAS 830C. ONE END OF LEAD 8 IS CONNECTED IN THE DAS 830C CONNECTOR AND THE OTHER END IS TAPED AND STORED IN THE DAS 830C HOUSING.

Fig. 8—Data Station Block Diagram

THINK ***The AR17 CP current interface DOES NOT conform to any technical reference interface specification.***

RECEIVING DATA

3.06 To receive data from the distant station and pass it to the data terminal, the following circuits in the data station are used.

(a) In the data set 109A-type, the receiving circuits consist of the monitor circuits, the receiver circuit, and the receive NOR gate.

(1) The monitor circuits sense the direction and amplitude of the current on the transmission loop and pass the signal to the receiver circuit.

(2) The receiver circuit differentially detects the signals (rejecting longitudinal currents) from the monitor circuits as mark and space signals and passes the appropriate mark or space signal to the receive NOR gate.

(3) The receive NOR gate provides the following three separate functions:

- Holds the BB lead of the data set (Fig. 8) to a mark when a space is transmitted through the transmit OR gate on the BA lead.
- Holds the BB lead to a mark when low current on the transmission loop is detected by the signal fail circuits.
- Passes signals from the receiver circuit to AR17 CP via the BB lead when the remote data set is transmitting data.

(b) Incoming data to the AR17 CP takes a path which depends on whether the AR17 CP is arranged for EIA or current interface.

(1) If the EIA interface is used, the only circuit used in AR17 CP is the emitter follower circuit.

- The emitter follower circuit passes the data from the data set to the ▸TTY, CPE, or DAS 830C.◂
- Local copy can be gated into the emitter follower circuit on an optional basis.

(2) If ▸the AR17 CP◂ current interface is used, the receiving circuit of the AR17 CP consist of the emitter follower circuit and the ▸current◂ driver circuit.

- The emitter follower circuit passes the data from the data set to the ▸current◂ driver circuit.
- The ▸current◂ driver circuit is connected to the receive loop, which drives the SMD in the TTY as outlined in 2.12 (b) (2).
- Local copy can be gated into the emitter follower circuit on an optional basis.
- An optional space hold can be added to the receive loop which causes the SMD to go spacing when low current is detected on the transmission loop.

3.07 The data signals on the transmission loop are passed by the monitor circuits to the receiver circuit of data set 109A-type (Fig. 8). The receiver circuit detects the signals as marks and spaces and passes them to the receive NOR gate. If a low current condition has not been detected by the signal fail circuits, the receive NOR gate passes the data signals to AR17 CP via the BB lead of the data set. If AR17 CP is arranged for EIA interface, the incoming data is applied to the emitter follower circuit which passes the data on to the ▸TTY, CPE, or DAS 830C.◂ If required, local copy ▸of transmitted data◂ can be gated into the receive path through the emitter follower circuit on an optional basis. The emitter follower circuit passes negative (mark) signals and positive (space) signals to the ▸TTY, CPE, or DAS 830C◂ via BB lead [See 2.12 (a) (3)]. If AR17 CP is arranged for current interface, the incoming data is applied to the emitter follower circuit which passes the data on to the ▸current◂ driver circuit. The ▸current◂ driver circuit operates, driving the receive loop to the data terminal. When a marking condition (a negative signal) is applied to the ▸current◂ driver circuit, the circuit operates (current flows in the receiver loop), driving the SMD of the TTY to a marking condition. When a space condition (a positive signal) is applied to the ▸current◂ driver circuit, the circuit does not operate (0 mA

of current), driving the SMD of the TTY to a spacing condition.

Note: For use with the AR17 CP current interface option, the data terminal receive circuit must provide a noninductive 680-ohm impedance termination. For use with the DAS 830C, the data terminal send ***and*** receive circuits must provide terminations with less than 150-ohm resistance and 0.5-H inductance for speeds up to 75 baud. For speeds from 75 baud to 150 baud, a noninductive termination of less than 150-ohm resistance is required.

CARRIER FAIL DETECTION

3.08 When the level of the transmission loop current falls below a satisfactory level, the data station will produce an indication of this situation to ▶a TTY or CPE◀ by using the following circuits in the data station.

(a) The signal fail circuits of data set 109A-type consist of a bi-directional bridge circuit, an integrator circuit, and an inverter circuit.

(1) The bi-directional bridge detects current flow, regardless of polarity, as long as the current level of the transmission loop exceeds a satisfactory level and conducts, producing a negative output to the integrator circuit. When the current level of the transmission loop falls below a satisfactory level, the bridge will cease to conduct and pass a positive output to the integrator circuit.

(2) The integrator circuit eliminates the amplitude variations of the negative output from the bi-directional bridge and passes the signals to the inverter. The integrator directly passes the positive signals from the bridge to the inverter.

(3) The inverter circuit clamps the CF lead of data set 109A-type to an ON condition during normal operations and to an OFF condition when a low current condition is detected.

Note: These signals concur with EIA control signals according to RS-232-B which states that an ON condition is a positive signal and an OFF condition is a negative signal.

(b) In AR17 CP, the circuits used in the carrier fail detection circuits will depend on the type of interface used by AR17 CP.

(1) If EIA interface is used, the CF signal from the data set is applied to three separate circuits (carrier fail circuit, squelch circuit, and space hold circuit) as shown in Fig. 8.

- The carrier fail circuit clamps the CF lead to the ▶TTY, CPE, or DAS 830C◀ [see 2.12 (a) (8)] to an ON condition during normal operation but switches to an OFF condition when low current is detected on the transmission loop.

Note: ▶On the DAS 830C, one end of the CF lead is connected in the EIA connector. The other end is taped and stored in the DAS 830C housing.◀

- The AR17 CP squelch circuit functions, but the data set 109A-type is not equipped to provide the carrier squelch feature.

- The space hold circuit functions but does not affect the operation with EIA interface.

(2) If current interface is used, the CF signal from the data set is applied to three separate circuits (carrier fail circuit, squelch circuit, and space hold circuit) as shown in Fig. 8.

- The carrier fail circuit applies a short to ground during normal operation and applies an open to the carrier detector loop when low current is detected on the transmission loop [see 2.12 (b) (3)].

- The squelch circuit functions as outlined above.

- The space hold circuit provides an optional space hold on the receive loop to the SMD in the TTY when low current is detected on the transmission loop.

3.09 The carrier fail detection circuit operates as follows:

(a) ***Normal Operation:***

(1) The current signal of the transmission loop is passed constantly to the bi-directional bridge circuit of data set 109A-type by the monitor circuits. The bi-directional bridge conducts, passing a negative output signal to the integrator circuit. The integrator eliminates the transition ripples from the negative signal and passes a constant negative signal to the inverter circuit. The inverter clamps the CF lead of the data set to an ON condition (positive EIA voltage), which connects to the carrier fail detection circuits of AR17 CP. (See Fig. 8.)

(2) If AR17 CP is arranged for EIA interface, the ON condition is applied to the carrier fail circuit, the squelch circuit, and the space hold circuit. The carrier fail circuit produces a positive signal, which is applied to the ▶TTY, CPE, or DAS 830C◀ via the CF lead of AR17 CP (Fig. 8) and which indicates normal operation. Both the squelch and space hold circuits function, and the space hold circuit has no effect on EIA interface.

▶***Note:*** On the DAS 830C, one end of the CF lead is connected in the EIA connector. The other end is taped and stored in the DAS 830C housing.◀

(3) If AR17 CP is arranged for current interface, the ON condition is applied to the space hold circuit, the carrier fail circuit, and the squelch circuit. The space hold circuit allows the data being received by the AR17 CP to pass over the receive loop to the TTY. The carrier fail circuit produces a ground, which is applied to the TTY via the carrier detector loop and indicates normal operation.

(b) ***Transmission Loop Current Failure:***

(1) When current level of the transmission loop falls below a satisfactory level, the bridge circuit ceases to operate and applies a positive output signal through the integrator circuit to the inverter circuit. The inverter clamps the CF lead of data set 109A-type to an OFF condition (negative EIA voltage) which connects to AR17 CP.

(2) If AR17 CP is arranged for EIA interface, the OFF condition is applied to the carrier fail circuit, the squelch circuit, and the space hold circuit. The carrier fail circuit clamps a negative signal to the ▶TTY, CPT, or DAS 830C◀ via the CF lead, which indicates a low current condition on the transmission loop. Both the squelch circuit and the space hold circuit function, and the space hold circuit does not affect the EIA interface.

(3) If AR17 CP is arranged for current interface, the OFF condition is applied to the carrier fail circuit, the space hold circuit, and the squelch circuit. The carrier fail circuit applies an open to the TTY via the carrier detector loop, which indicates a current failure on the transmission loop. The space hold circuit clamps the receive loop to a space, if this option is used. The squelch circuit functions, but is not used with data set 109A-type.

LOCAL MODE OPERATION

3.10 The function of the local mode relay on AR17 CP is to provide an off-line loop-around connection between the transmit and receive leads of the data terminal or TTY. This allows the TTY, ▶CPE, or DAS 830C◀ to receive the data that it is transmitting for test purposes or off-line operation.

3.11 The local mode relay is operated by a positive voltage applied to the CX lead of AR17 CP (Fig. 8). The contacts of the local relay are arranged to connect the transmit lead to the receive lead in AR17 CP. In addition, the relay will clamp a marking condition to the transmit (BA) lead of data set 109A-type and block the data being received on the receive (BB) lead from the data set. An OFF indication is applied to the CC lead of AR17 CP when the local relay is operated with either EIA or current interface. However, the CC lead should only be used by the data terminal for EIA interface.

4. TRANSMISSION INFORMATION

4.01 Data set 109A-type employs the 3-mA polar dc transmission scheme to transmit and receive data with data set 109-type. The dc resistance of the transmission loop to obtain the nominal 3 mA of current depends on the operational

arrangement of the data set [station-to-hub operation or station-to-station operation (see 1.04)].

STATION-TO-HUB OPERATION

4.02 In the data station to hub operation [Fig. 1(A)], the design dc loop resistance to obtain the nominal 3 mA of current is 2000 ohms with a maximum capacitance of 1 μF.

(a) Loops of less than 1800 ohms must be built out to the nominal value of 2000 ohms by using a line-adjusting resistor unit coded J70165D-1. The line-adjusting resistor should be located in the hub office. Loops which have resistances that range between 1800 and 2000 ohms do not require the build-out unit.

(b) Loops of greater resistance than 2000 ohms may be used, up to a maximum of 2500 ohms, as long as the maximum capacitance does not exceed 1 μF.

(1) For such loops, the nominal loop current of 3 mA decreases up to 15 percent with the increasing resistance.

(2) Similarly, the distortion may increase with the increasing resistance to an additional 0.5 percent as compared to loops of nominal resistance. The increased distortion does not materially affect the quality of the transmission.

STATION-TO-STATION OPERATION

4.03 In station-to-station operation [Fig. 1(B)], the design dc loop resistance to obtain the nominal 3 mA of current is 1800 ohms with a maximum capacitance of 1 μF.

(a) Loops of less than 1500 ohms must be built out to the nominal value of 1800 ohms by using a 13A1 data unit. Refer to Section 591-024-201 for installation information about the 13A1 data unit.

(1) The data unit can be located at either station of the transmission loop.

(2) The data unit must be in series with the loop and is located external to the data set in a location prescribed by the local telephone company engineering group.

(3) The 13A1 data unit provides resistance for building out one transmission loop.

(b) Loops which range between 1500 and 1800 ohms of resistance do not require any additional resistance in series with the loop.

(c) Loops of greater resistance than 1800 ohms may be used to a maximum of 2500 ohms, as long as the maximum capacitance does not exceed 1 μF.

(1) For such loops, the nominal loop current of 3 mA decreases up to 20 percent with the increasing resistance.

(2) Similarly, the distortion may increase with the increasing resistance to an additional 0.8 percent as compared to loops of nominal resistance. The quality of transmission is within design limits at the distortion level.

DATA SET 109A-TYPE TRANSMISSION SCHEME

4.04 The data sets at each end of the transmission loop (Fig. 8) may be considered as voltage sources from which space and mark currents are derived for use on the loop.

4.05 The signal conditions on the transmission loop are as follows:

(a) ***Idle Condition:*** Both data sets are transmitting a mark condition [Fig. 9 (A)].

Note: The idle condition exists when both data sets are transmitting a steady mark.

(b) ***Data Set 109A-Type Transmitting:*** Data set 109A-type transmits either a mark [Fig. 9 (A)] or a space [Fig. 9 (B)] while the distant data set 109-type transmits a steady mark condition.

(c) ***Data Set 109A-Type Receiving:*** Data set 109A-type transmits a steady mark condition while the distant data set 109-type is transmitting a mark [Fig. 9 (A)] or a space [Fig. 9 (C)].

4.06 Steps (a) through (d) below explain the transmission scheme.

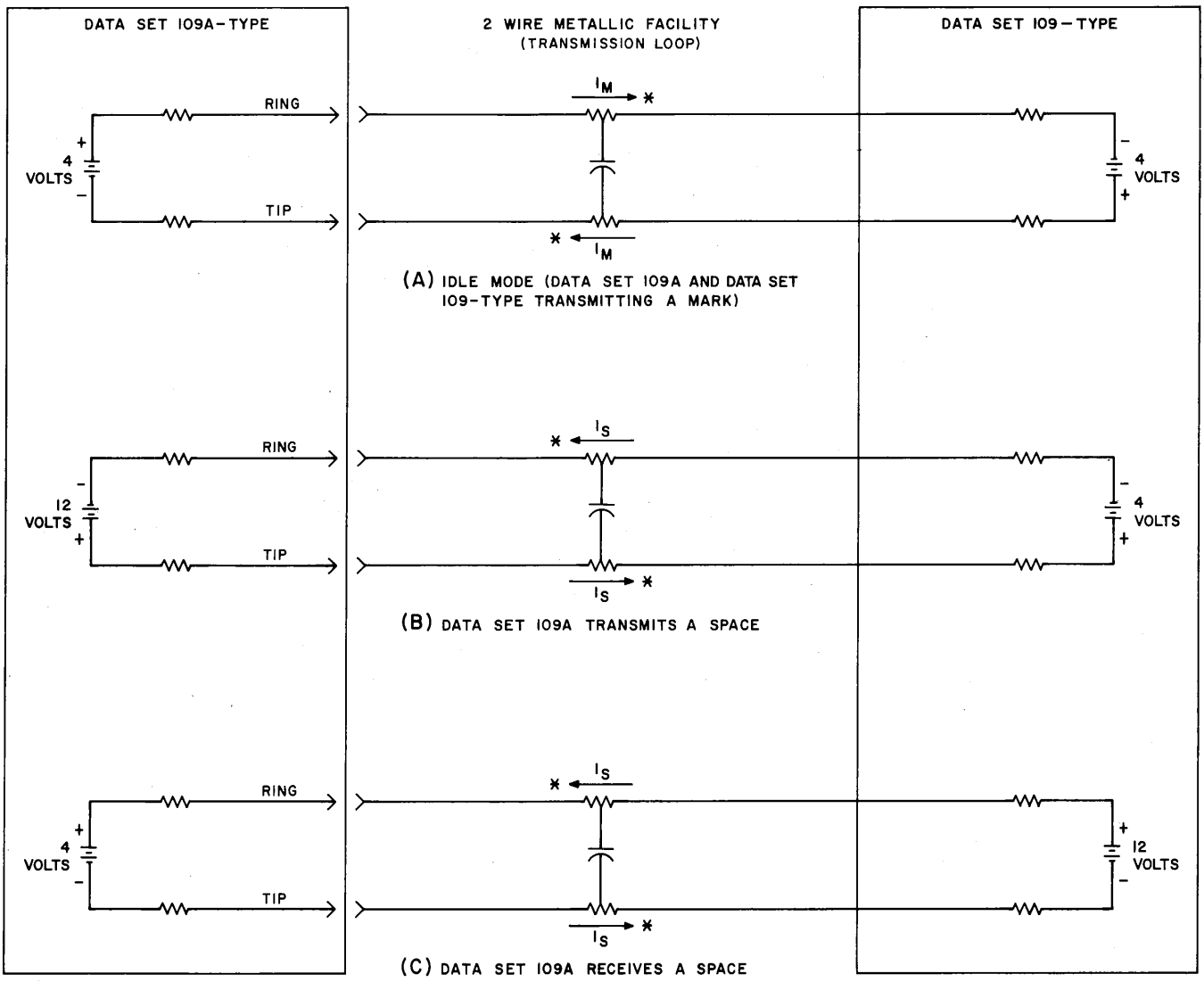


Fig. 9—Data Set 109A-Type, Transmission Scheme

(a) The voltage value for transmitting a space (−12 volts) into the loop is three times that for transmitting a mark (+4 volts).

(b) Consider Fig. 9 (A) where both data sets are transmitting marks (the idle condition). The marking voltages applied to the loop add algebraically to 8 volts. This sets up a current of 3 mA in the direction indicated in Fig. 9 (A). Both data sets interpret this as marking current in the loop.

(c) Figure 9 (B) illustrates data set 109A-type transmitting a space (−12 volts). The sum of the data set 109A-type space and the data set 109-type mark (+4 volts) algebraically adds to 8 volts which sets up a current of 3 mA in the direction indicated in Fig. 9 (B). Both data sets interpret this as spacing current in the loop.

(d) Figure 9 (C) illustrates the reception of a space by data set 109A-type from data set 109-type. The voltages produce the 3 mA of current as described above, and the direction of the current is as indicated in Fig. 9 (C). The loop current is the same in direction and amplitude

as in Fig. 9 (B). Likewise, both data sets interpret this as spacing current in the loop.

4.07 ***Breaking Signal:*** Either station of the loop can interrupt the data transmission by transmitting a break signal (a long spacing signal). The break signal must be long enough to enable the transmitting station to recognize the signal as a break and not as a character.

4.08 ***Simultaneous Starts:*** Both stations attempting to transmit a space at the same time is uncommon. When a simultaneous start occurs, the station sending a longer spacing signal seizes control of the transmission path the instant that the other station sends a marking signal. Data set 109A-type transmits a steady mark condition while data set 109-type is transmitting a mark [+4 volts, Fig. 9 (A)] or a space [−12 volts, Fig. 9 (C)].

5. REFERENCES

5.01 For more detailed information about the data station, refer to the following schematic drawings (SDs) and circuit descriptions (CDs).

(a) SD- & CD-3D025-01 (Data Set 109A-Type, Circuit Description)

(b) SD- & CD-3D031-01 (Data Auxiliary Set 820D- and 820E-Type, Circuit Description)

(c) ◗SD- & CD-1D250-01 Data Auxiliary Sets 830A-, 830B-, and 830C-Types◖

5.02 For further information about data set 109A-type, refer to the section entitled Data Set 109A-Type, Identification (591-024-100).

5.03 For futher information about DAS 820D-type, refer to the section entitled Data Auxiliary Set 820D-Type, Identification (598-058-100).

5.04 ◗For further information on DAS 830C, refer to the section entitled Data Auxiliary Set 830C-Type, Description, Installation, and Test Procedures (598-083-103).◖