DATA SET 109A-TYPE MULTIPLE PRIVATE LINE STATION USING DATA AUXILIARY SET 820E2 AND KS-20093 CABINET DESCRIPTION AND OPERATION

CONTENTS PAGE

1. GENERAL

1.01 This section covers the physical and functional description of Data Set 109A-type Multiple Private Line Station using Data Auxiliary Set (DAS) 820E2 and KS-20093 Cabinet. For the purpose of this section, the KS-20093 Cabinet equipped with Data Set 109A-type mounted in DAS 820E2 is referred to as a data station.

1.02 This section also covers information pertaining to the transmission loop used by Data Set 109A-type.

1.03 The data station is designed to provide multiple private line low-speed (up to 300 bauds), half-duplex (HDX), serial data communication over 2-wire metallic private line facilities. The data station is used with either Bell System-provided teletypewriters (TTYs) or customer-provided terminals (CPTs).

1.04 The data station can communicate only with Data Set 109-type used in one of the following arrangements:

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

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

1.05 Data Set 109A-type can operate only over a closed dc loop which consists of a 2-wire metallic line. The loop used by the data set 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 to another Data Set 109-type.

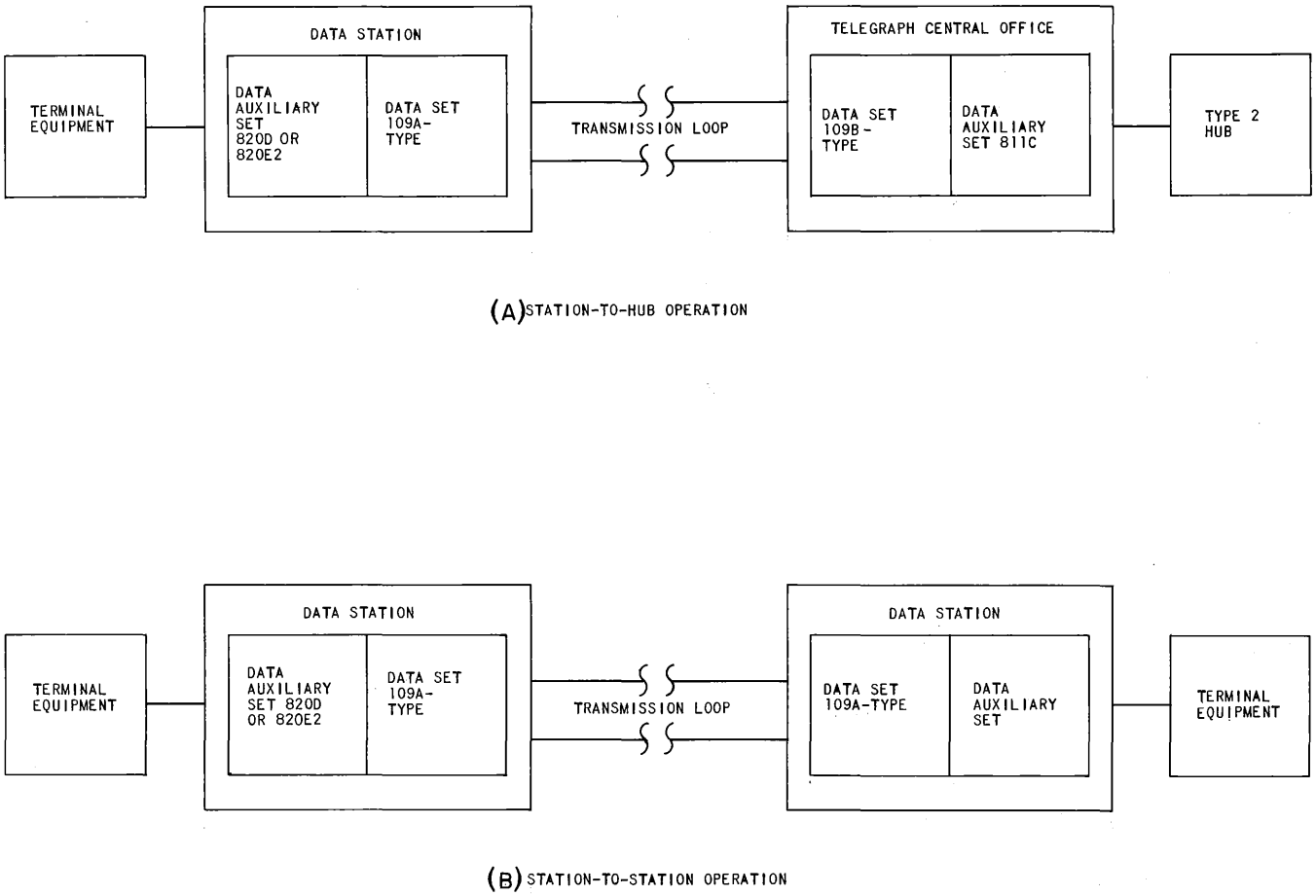


Fig. 1—System Block Diagram

1.06 The data set 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 following headings—Data Auxiliary Set 820E2, Data Set 109A-Type, and KS-20093 Cabinet.

DATA AUXILIARY SET 820E2

2.02 DAS 820E2 consists of a 59A apparatus mounting equipped with three circuit packs (CPs) AR17, three 18B power units with their respective power switches, three interface connectors for connection to the customer interface, one terminal board (TB 1), and three connectors for mounting three Data Sets 109A-type (the data sets must be ordered separately). The dimensions of DAS 820E2 are as shown in Fig. 2. The DAS is also shipped with a KS-16935 L11 power cord connected to the unit.

2.03 DAS 820E2 requires 0.5 ampere of 60-Hz supply which may range from 105 to 129 volts. Each 18B power unit supplies filtered +24 ±3 volts and -24 ±3 volts at 150 mA each to one Data Set 109A-type and its associated CP AR17. The power switch (Fig. 2) associated with an 18B power unit is used to switch off the power when not used.

2.04 The power for DAS 820E2 is supplied by the power strip provided in the KS-20093 Cabinet.

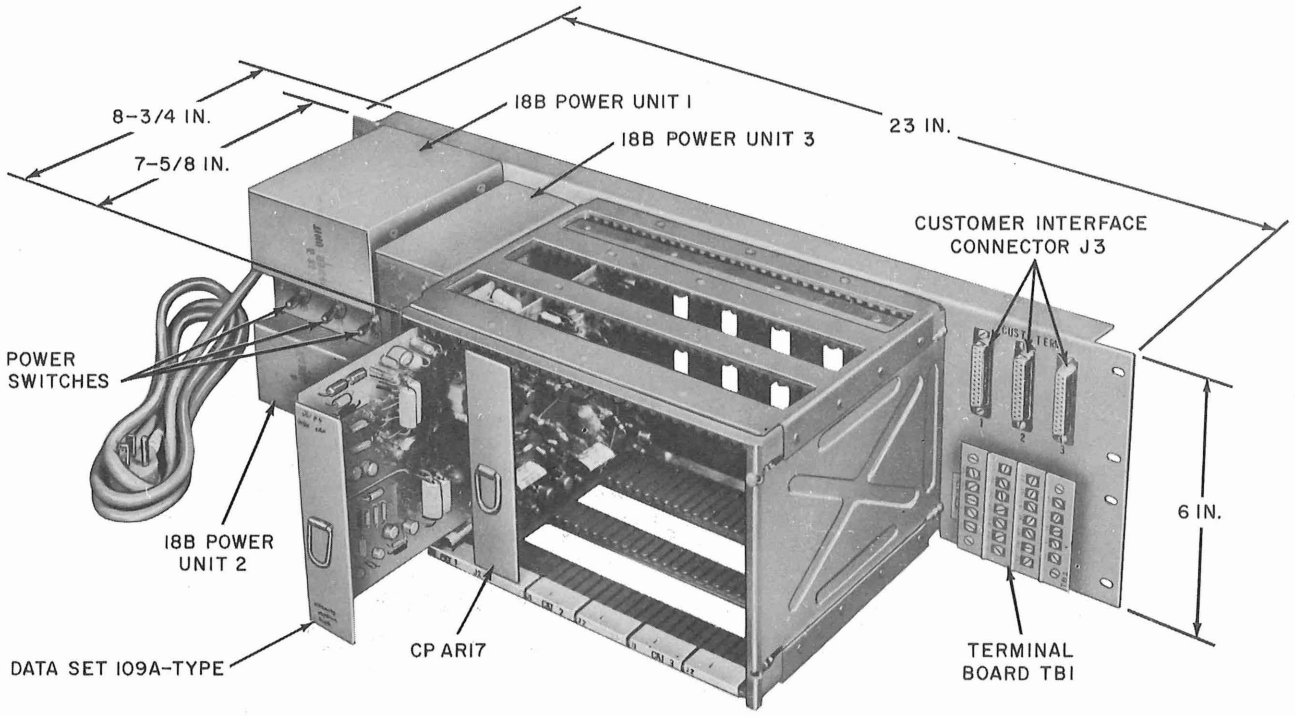


Fig. 2—Data Auxiliary Set 820E2 With Data Set 109A-Type (Extended), Front View

2.05 The connection between DAS 820E2 and the data terminal is made via the three interface connectors (Fig. 2) and the respective interface cords.

2.06 Terminal board TB 1 is provided for the connection of the incoming transmission loops to DAS 820E2 (Fig. 2).

2.07 The CP AR17 consists of a single printed wiring board which measures 7.1 inches long by 5.5 inches wide (Fig. 3). The CP AR17 is equipped with screw switches which are used to provide the options shown in Table A and mounts in the slot designated J1 of the respective data circuit on DAS 830E2.

> ***Note:*** For the purpose of this section, a data circuit consists of Data Set 109A-type and its associated CP AR17. Each DAS 820E2, when fully equipped, contains three data circuits.

2.08 Each CP AR17 in DAS 820E2 has the following two sets of interface leads:

(a) One set from CP AR17 to the associated Data Set 109A-type via connectors J2 and J1, respectively

(b) One set from CP AR17 to a data terminal via connectors J2 and J3, respectively.

2.09 The interface between CP AR17 and the data set conforms to the electrical characteristics of the Electronic Industries Association (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.

(c) ***Carrier Detector:*** The condition of this lead depends on whether the data set does

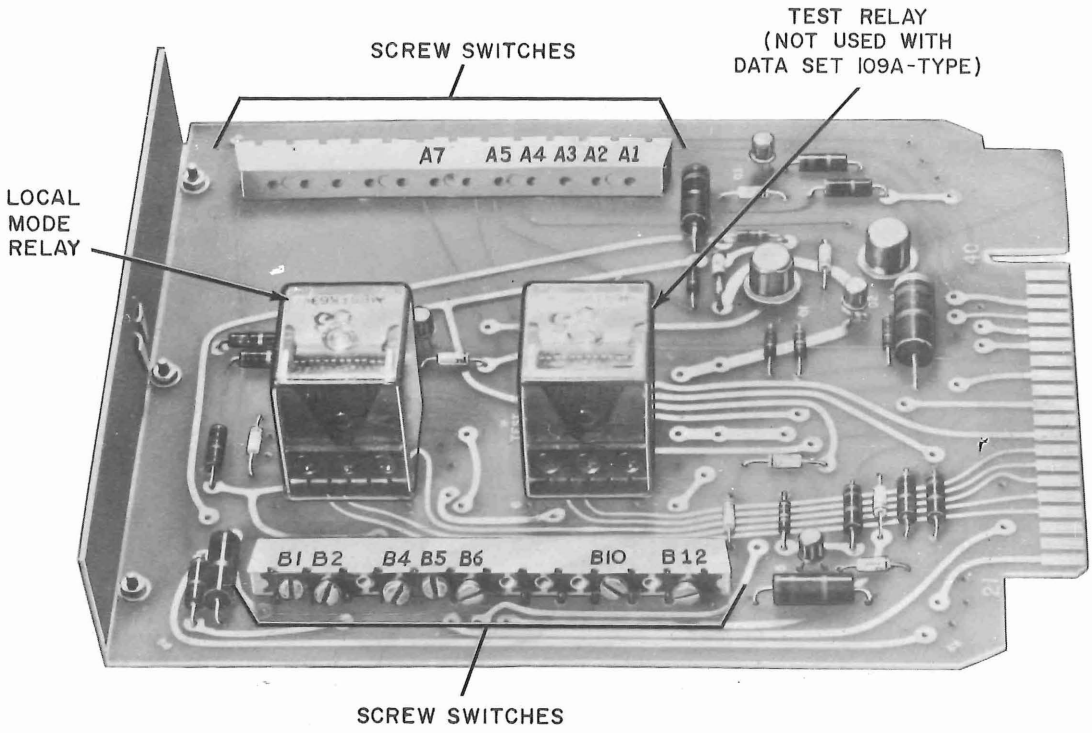


Fig. 3—Circuit Pack AR17

or does not detect 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.

2.10 The interface between CP AR17 and the data terminal can be either a voltage interface conforming to EIA Standard RS-232-B (EIA interface) or a current interface by arranging the switches on CP AR17.

(a) When EIA interface is used, the interface includes the following leads.

(1) ***AA:*** Protective ground lead.

(2) ***BA:*** Data transmitted from data terminal to DAS.

(3) ***BB:*** Data delivered to the data terminal from DAS.

(4) ***CA:*** Request-to-Send signal comes from data terminal and is looped back to the data terminal on the CB lead which gives the Clear-to-Send indication to the data terminal.

(5) ***CB:*** Clear-to-Send [see 2.10 (a) (4)].

(6) ***CC:*** Data Set Ready signal sent to data terminal when data station is prepared for normal operation. An OFF indication is given on this lead when the local relay in the DAS is operated.

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

(8) ***CE:*** Data Carrier Detector signal is sent to the data terminal when the data set detects current failure on the transmission loop.

(9) ***+P:*** +24 volt power.

(10) ***-P:*** -24 volt power.

(11) ***CX:*** Local mode control signal is sent by the data terminal to operate the local relay on CP AR17.

TABLE A

OPTION FEATURE	CP AR17			QUANTITY
	OPT DESIG	SCREW OPEN	SCREW CLOSED	
EIA Interface	W	B2, B4, B6 A2, A4	B1, B5, A1 A3	Choose One
Current Interface (See Note)	V	B1, B5, A1 A3	B2, B4, B6 A2, A4	
Copy in Test Mode	T		B12	Not used with Data Set 109A-type
No Copy in Test Mode	S	B12		
Local Copy	R		B10	Choose One
No Local Copy	Q	B10		
Mark Hold on Carr Fail	N		A5	Choose One with Current Interface
Space Hold on Carr Fail	M	A5		
Carr Squelch on Carr Fail	K		A7	Not used with Data Set 109A-type
No Carr Squelch on Carr Fail	J	A7		

Note: The 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.

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

(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, 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, 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 CP AR17 is operated by a signal on pin 12 of J3 from the TTY. This lead forms a loop from pin 3 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

2.11 Data Set 109A-type (see Table B for functional interface leads) consists of a single printed wiring board (Fig. 4). The data set is 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

2.12 Data Set 109A-type has two classifications—Data Set 109A1 (Fig. 4), 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. 4.

2.13 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 820E2.

KS-20093 CABINET

2.14 The KS-20093 L1 Cabinet is a free-standing cabinet (Fig. 5) which is designed to house a variety of rack-mounted equipment and rack-mounted data sets. If required, the cabinet can be arranged to house shelf-mounted equipment. The cabinet has a 2-tone smooth vinyl finish (the doors, off-white in color; the rest of the cabinet, dark gray).

Note: For the purpose of this section, any reference to a cabinet pertains to the KS-20093 L1 Cabinet.

2.15 The dimensions for the cabinet are shown in Fig. 5. The weight of the cabinet without any brackets or shelves mounted is 300 pounds.

To open the cabinet from the front, open the left door first, then the right and center doors to prevent damaging door panels.

2.16 The cabinet appears to have six doors of equal size, but actually has five doors (three doors in the front and two doors in the rear). The three front doors (Fig. 6) conceal two sizes of mounting enclosures.

(a) A 5-inch wide mounting space is provided behind the left front door.

(b) A 25-inch wide mounting space is provided behind the center and right doors.

2.17 The cabinet can house a maximum of 16 DASs 820E2 (48 data circuits) or can be partially equipped with any number of DASs 820E2 under the maximum. The cabinet must be equipped with the following items to house DAS 820E2:

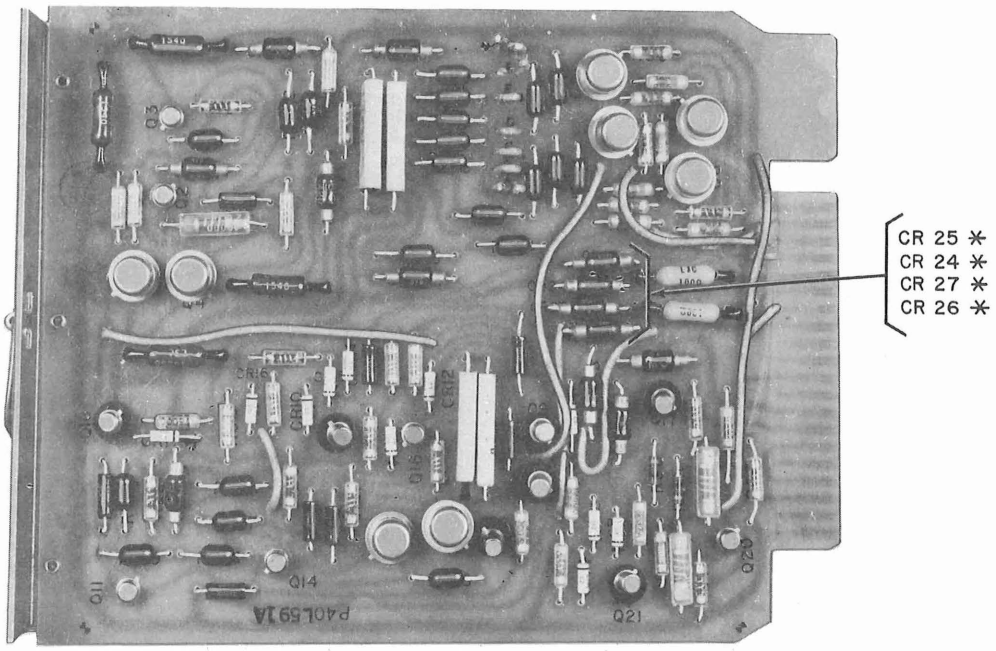
(a) One KS-20093 L5 full door panel for the middle door of the cabinet.

(b) One KS-20130 L1A mounting plate to mount four 25-pin interface connectors (12 L1As maximum per cabinet).

(c) One KS-20129 L1 power strip to provide for the units housed in the cabinet.

(d) If the cables and wiring for the cabinet are brought in through the top of the cabinet, one KS-20093 L2 duct assembly should be provided to run the wiring and cables.

2.18 To provide the connection between the data terminal or TTY and DAS 820E2, three M25A cords should be provided for each DAS 820E2 that is fully equipped in the cabinet. The connection



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

Fig. 4—Data Set 109A1

between the data terminal or TTY and the 820E2 is made in the following manner.

(a) The M25A cord is connected to connector J3 of DAS 820E2 (Fig. 2). The other end of the M25A cord is connected to the proper position of KS-20130 L1A mounting plate, which is mounted behind the left front door.

(b) The interface connection cord of the data terminal or TTY (furnished by the customer and not to exceed 50 feet in length) is to be positioned opposite the M25A cord at the KS-20130 L1A mounting plate in the cabinet.

2.19 To mount DAS 820E2 in the cabinet, KS-20180 L7-type adapter plates must be used to reduce the width of the 25-inch frame to the required 23 inches for the DAS. The adapter plates are available in various lengths to accommodate the installation arrangements of DAS 820E2 in the cabinet.

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 When filled to capacity, DAS 820E2 provides three data circuits as shown in Fig. 7. The major functions of the data circuits are transmitting data, receiving data, carrier fail detection, and local mode operation. Since all three data circuits discussed in this section function alike, the following functional description covers only one data circuit.

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 CP AR17 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 circuit, the monitor circuits, and the transmit delay circuit (Fig. 8).

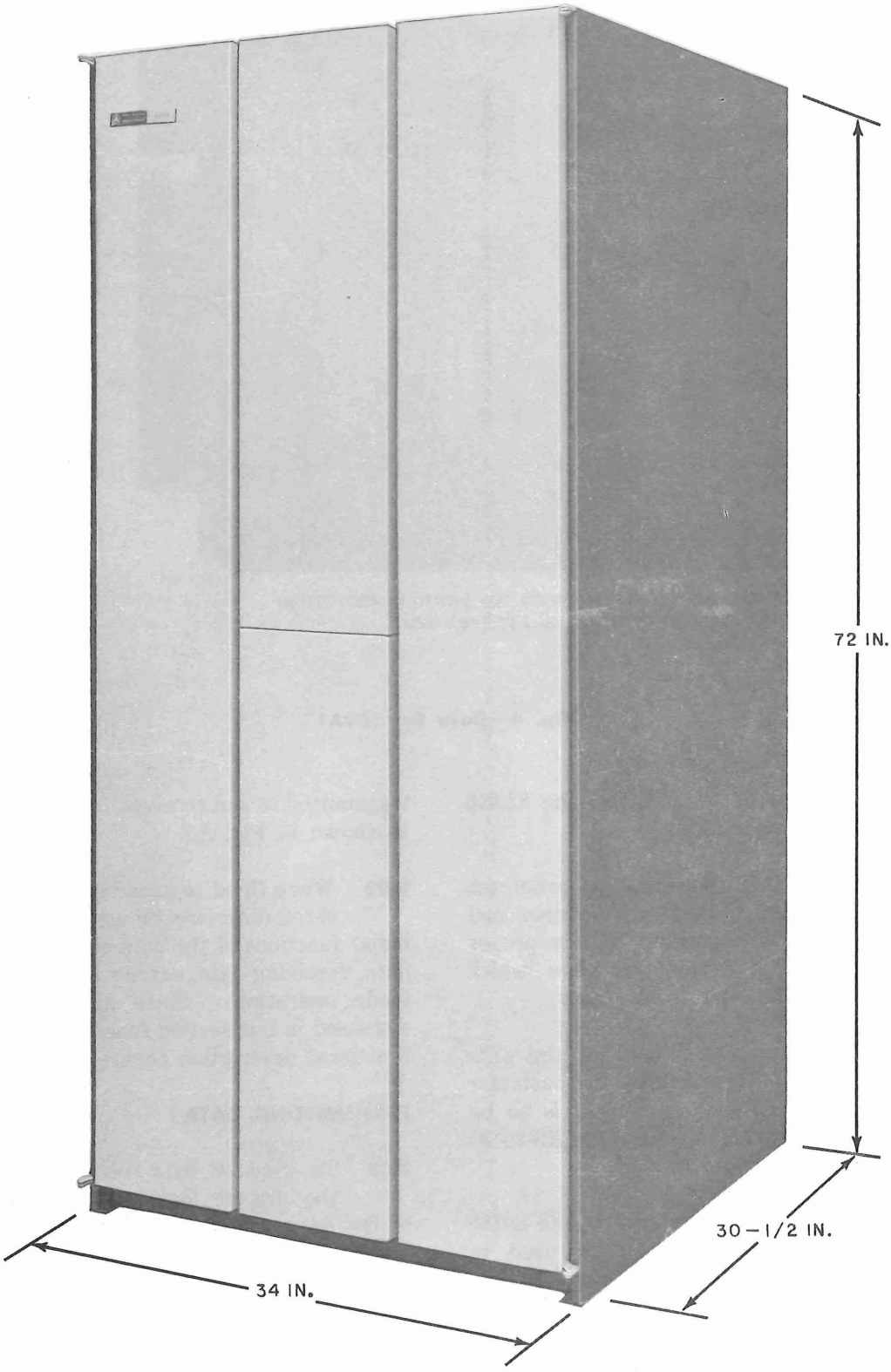


Fig. 5—KS-20093 Cabinet, Front View

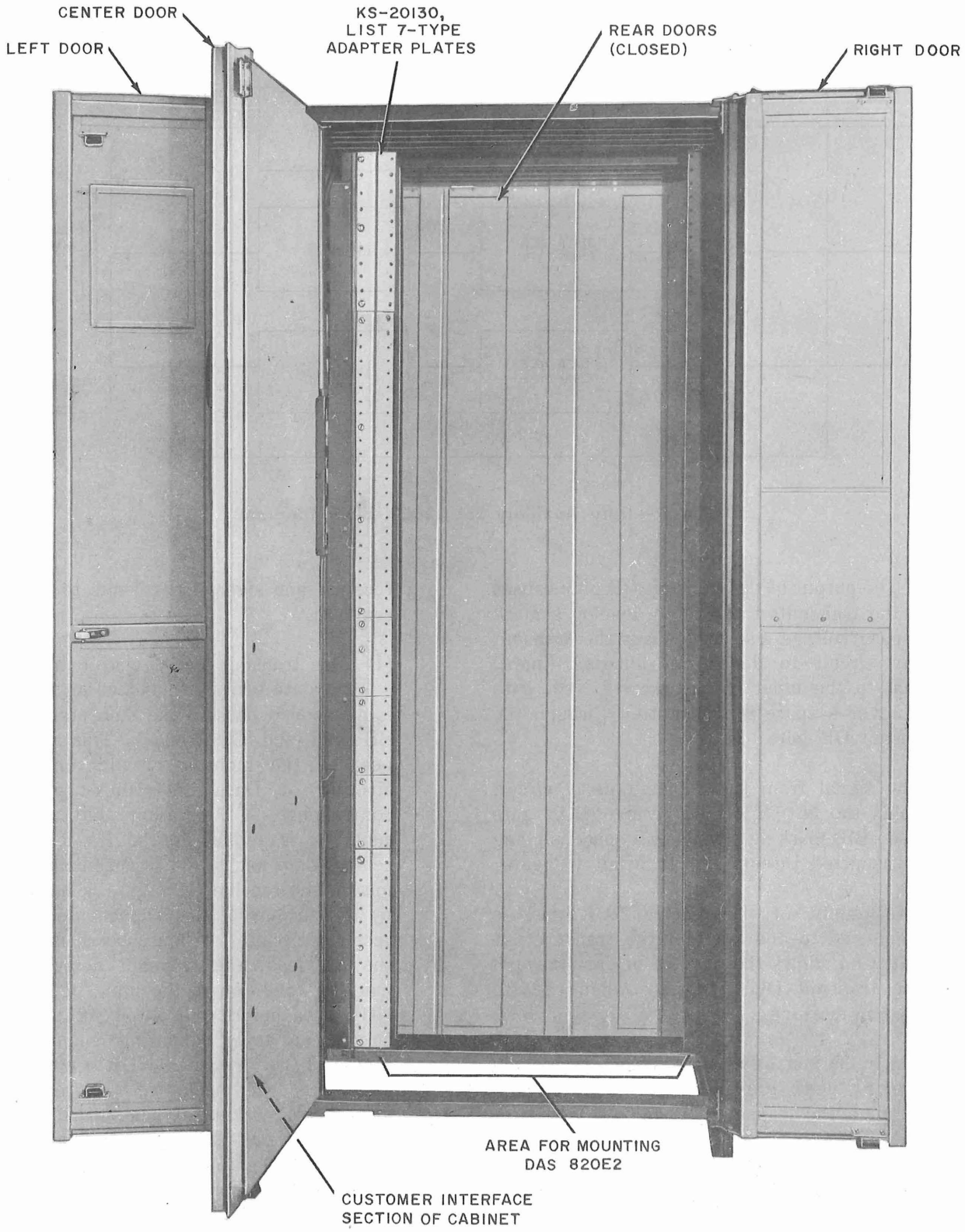


Fig. 6—KS-20093 L1 Cabinet (Front Doors Open) With KS-20130 List 7 Type Adapter Plates Installed

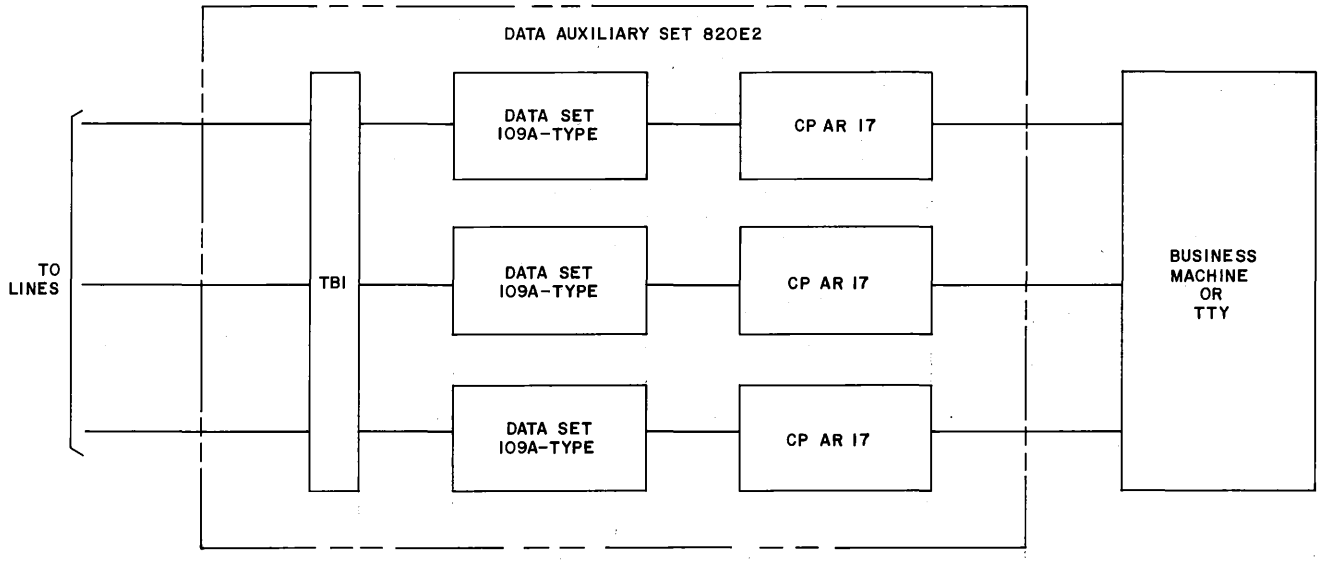


Fig. 7—Data Auxiliary Set 820E2, Block Diagram

(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 (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.

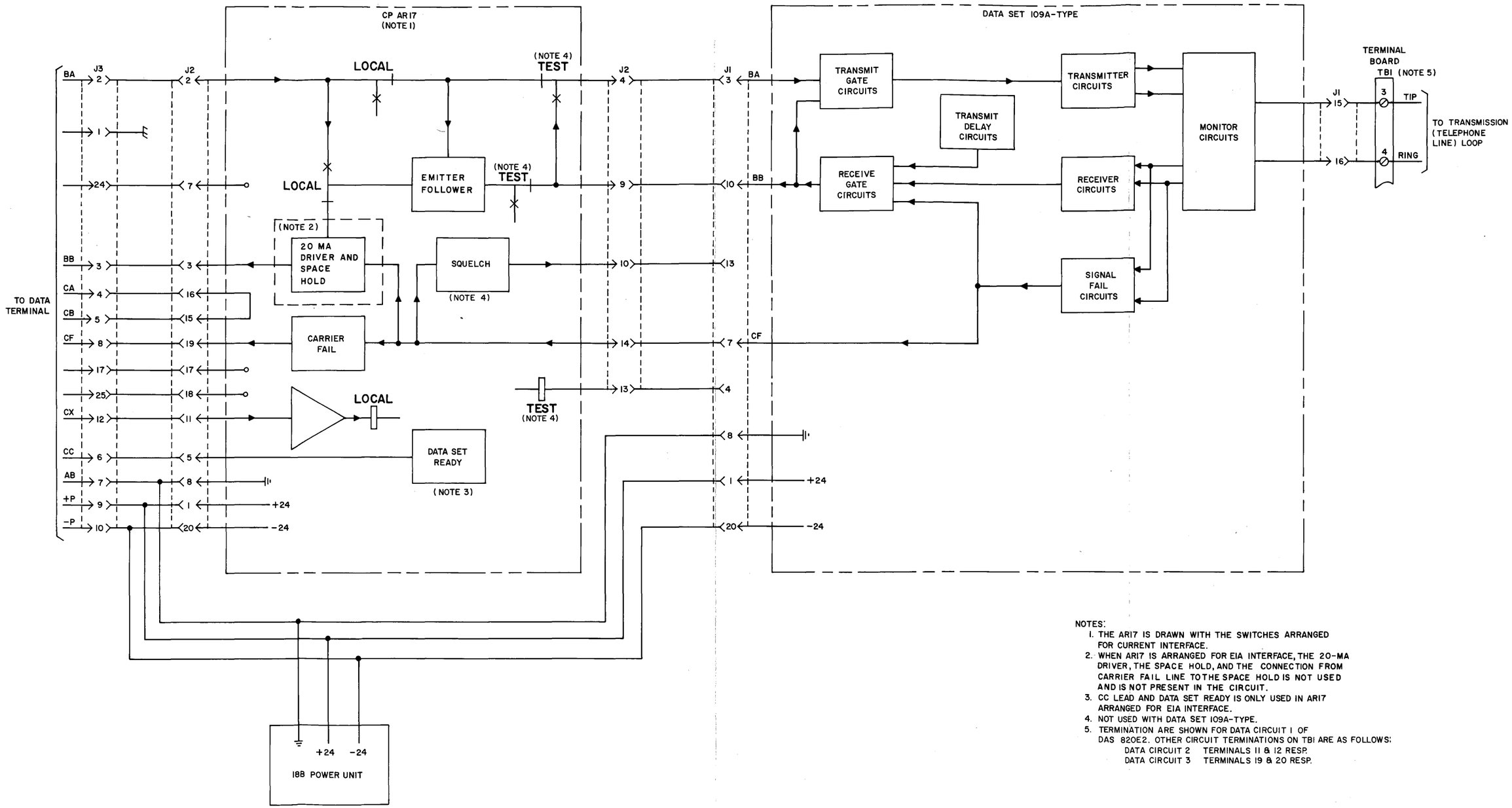
- The output of the receive NOR gate is connected to one input of the transmit OR gate and allows the passage of data through the transmit OR gate only when the BB lead is marking.

- The reception of a break (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 CP AR17. This is required because the monitor circuits and receiver circuits 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 a 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.



NOTES:

1. THE AR17 IS DRAWN WITH THE SWITCHES ARRANGED FOR CURRENT INTERFACE.
2. WHEN AR17 IS ARRANGED FOR EIA INTERFACE, THE 20-MA DRIVER, THE SPACE HOLD, AND THE CONNECTION FROM CARRIER FAIL LINE TO THE SPACE HOLD IS NOT USED AND IS NOT PRESENT IN THE CIRCUIT.
3. CC LEAD AND DATA SET READY IS ONLY USED IN AR17 ARRANGED FOR EIA INTERFACE.
4. NOT USED WITH DATA SET 109A-TYPE.
5. TERMINATION ARE SHOWN FOR DATA CIRCUIT 1 OF DAS 820E2. OTHER CIRCUIT TERMINATIONS ON TBI ARE AS FOLLOWS:
   DATA CIRCUIT 2 TERMINALS 11 & 12 RESP.
   DATA CIRCUIT 3 TERMINALS 19 & 20 RESP.

Fig. 8—Data Circuit, Block Diagram

3.04 Data is applied from the data terminal through the BA lead of the DAS and CP AR17 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 CP AR17, to the BA lead of Data Set 109A-type) is the method by which the signals are generated.

(a) When EIA interface is used, the data signals consist of marks (negative signals) and spaces (positive signals).

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 current interface is used, the data signals consist of a mark (a closed send contact in the TTY) and a space (an open send contact in the TTY). The signals are converted by the CP AR17 into EIA signals which are applied to the BA lead of Data Set 109A-type.

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 Data Set 109A-type, the receiving circuits consist of the monitor circuit, the receiver circuit, and the receive NOR gate.

(1) The monitor circuit senses the direction and amplitude of the current on the transmission loop and passes 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 CP AR17 via the BB lead when the remote data set is transmitting data.

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

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

- The emitter follower circuit passes the data from the data set to the data terminal.
- Local copy can be gated into the emitter follower circuit on an optional basis.

(2) If the current interface is used, the receiving circuits of CP AR17 consist of the emitter follower circuit and the 20-mA driver circuit.

- The emitter follower circuit passes the data from the data set to the 20-mA driver circuit.
- The 20-mA driver circuit is connected to the receive loop which drives the SMD in the TTY as outlined in 2.10 (b) (3).
- 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 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 current fail condition has not been detected by the signal fail circuits, the receive NOR gate passes the data signals to CP AR17 via the BB lead of the data set. If CP AR17 is arranged for EIA interface, the incoming data is applied to the emitter follower circuit which passes the data to the data terminal. If required, local copy 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 data terminal via the BB lead [see 2.10 (a) (3)]. If CP AR17 is arranged for current interface, the incoming data is applied to the emitter follower circuit which passes the data on to the 20-mA driver circuit. The 20-mA driver circuit operates, driving the receive loop to the data terminal. When a marking condition (a negative signal) is applied to the 20-mA driver circuit, the circuit operates (20 mA of current), driving the SMD of the TTY to a marking condition. When a space condition (a positive signal) is applied to the 20-mA driver circuit, the circuit does not operate (0 mA of current), driving the SMD of the TTY to a spacing condition.

Note: The SMD must be equipped with a noninductive 680-ohm impedance input.

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 the data terminal 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 circuit 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 will 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 current fail 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 CP AR17, the circuits used in the carrier fail detection circuits will depend on the type of interface used by CP AR17.

(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 data terminal [see 2.10 (a) (8)] to an ON condition during normal operation but switches to an OFF condition when low current is detected on the transmission loop.

- The squelch circuit functions, but the output is not connected back to Data Set 109A-type. The squelch circuit is cut off during normal operation but operates when low current is detected on the transmission loop.

- 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

a short to the carrier detector loop when low current is detected on the transmission loop [see 2.10 (b) (4)].

- 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 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 CP AR17. (See Fig. 8).

(2) If CP AR17 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 data terminal via the CF lead of AR17 (Fig. 8) and which indicates normal operation. Both the squelch circuit and the space hold circuit function, but the squelch circuit is not used with Data Set 109A-type and the space hold circuit has no effect on EIA interface.

(3) If CP AR17 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 CP AR17 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 CP AR17.

(2) If CP AR17 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 data terminal via the CF lead, which indicates a low current condition on the transmission loop. Both the squelch circuit and the space hold circuit function, but the squelch circuit is not used with Data Set 109A-type and the space hold circuit does not affect the EIA interface.

(3) If CP AR17 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 CP AR17 is to provide an off-line loop-around connection between the transmit and receive leads of the data terminal or TTY. This allows the data terminal or TTY 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 CP AR17 (Fig. 8). The contacts of the local relay are arranged to contact the transmit lead to the receive lead in CP AR17. 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 CP AR17 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, 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 the 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 line build-out unit (either a 13A1 Data Unit or a J70165D-1 Line Adjusting Resistor Unit). Refer to Section 591-024-202 for installation information on the line build-out unit.

Note: It is suggusted that the 13A1 Data Unit be used if the number of loops to be built out is less than eight. If the number of loops to be built out is eight or more, a J70165D-1 Line Adjusting Resistor Unit should be used.

(1) The line build-out units can be located at either station of the transmission loop.

(2) The line build-out units must be in series with the transmission loop.

(3) The 13A1 Data Unit must be located external to the data station.

- A 13A1 Data Unit provides resistance to build out only one transmission loop.

- The location and mounting procedures for the 13A1 Data Unit must be provided by the local telephone company engineering group.

(4) The J70165D-1 Line Adjusting Resistor Unit can be mounted in the cabinet of the data station.

- If the resistor unit is to be mounted in the cabinet, the unit should be installed approximately 32 inches from the bottom of the cabinet.

- The J70165D-1 L1 provides the mounting panel and resistors for building out eight transmission loops. The mounting panel provides space to mount two L2s (each L2 provides eight build-out circuits) for a total of 24 build-out circuits in a fully equipped J70165D-1 Line Adjusting Resistor Unit.

- If more than 24 loops must be built out, a second resistor unit can be mounted in the rear of the cabinet. A maximum of 48 build-out circuits can be provided.

(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, 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 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. 9) 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.

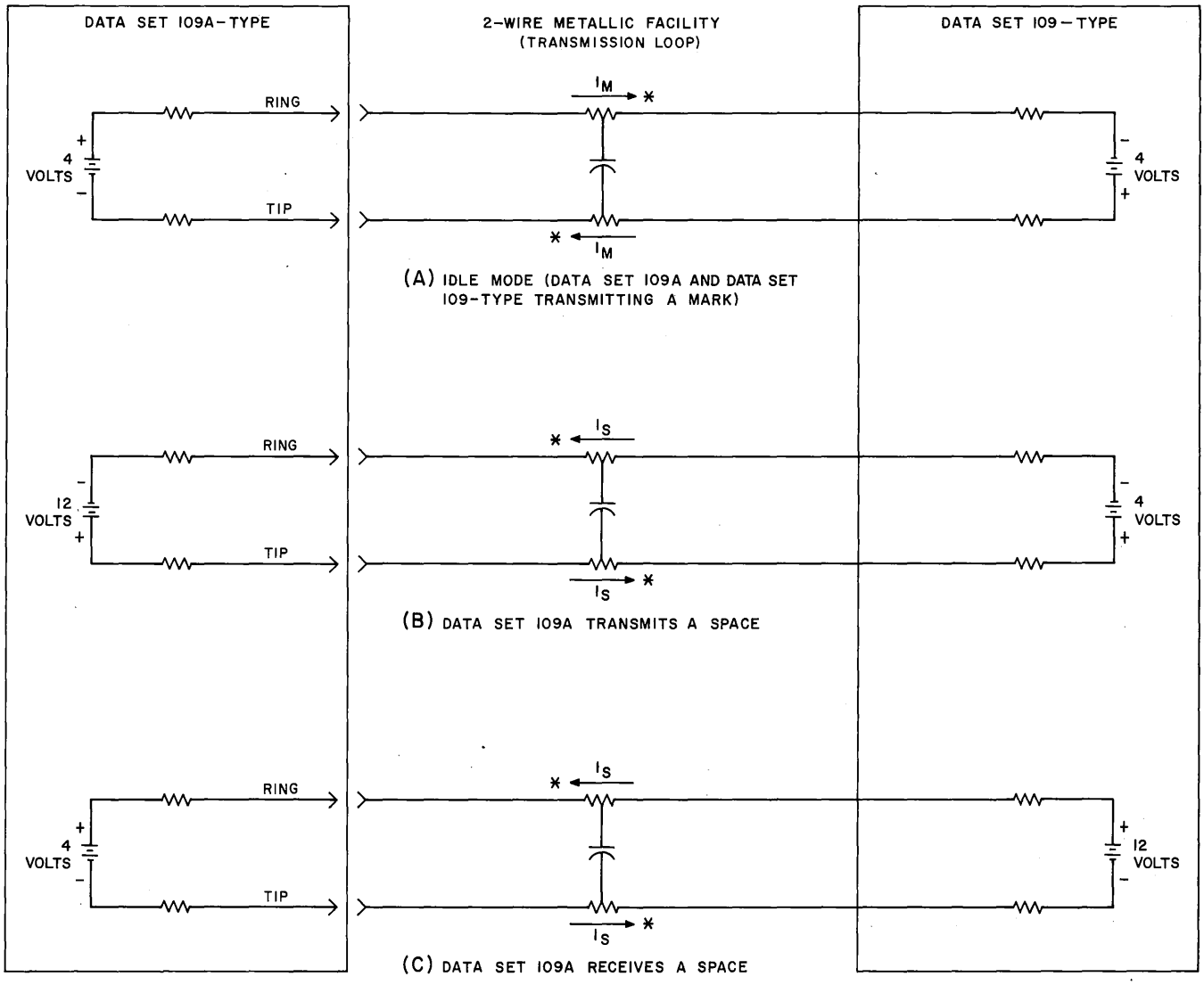


Fig. 9—Data Set 109A-Type, Transmission Scheme

(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 is 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 is Receiving:*** Data Set 109A-type transmits a steady mark 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) explain the 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) Fig. 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) Fig. 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 in the same 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.

5. REFERENCES

5.01 For more detailed information about the data station, refer to the following list:

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

(b) SD-3D025-01 (Data Set 109A-Type, Schematic Drawing)

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

(d) SD-3D031-01 (Data Auxiliary Set 820D- and 820E-Type, Schematic Drawing).

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 further information about DAS 820E-type, refer to the section entitled Data Auxiliary Set 820E-Type, Identification (598-059-100).

5.04 For more information on the KS-20093 Cabinet, refer to the section entitled Data Sets Multiple Installation Information (590-010-201).