DATA SET 109B TYPE

DESCRIPTION

1. GENERAL

1.01 This section describes Data Set 109B type (109B1 and 109B2) physically and functionally. It also provides operation information and shows the relationship of the data set to other components of a station or system.

1.02 The only difference between Data Sets 109B1 and 109B2 is that the 109B1 provides lightning protection whereas the 109B2 does not.

1.03 Data Set 109B type with its associated Data Auxiliary Set 811C is located at a Type 2 hub circuit of a No. 2 or 9B Service Board or the Long Lines Data Observing Test Center. These sets in conjunction with Data Set 109A type, located at a station, provide low-speed, half-duplex dc data transmission on two-wire metallic private line facilities at speeds up to 150 bauds.

1.04 The dc hub voltages representing data received from other stations, are fed to Data Auxiliary Set 811C which provides the interface with the hub by converting the high-voltage hub signals to low-level signals that are compatible with the Data Set 109B type. Data Set 109B type converts the dc voltage to current (i.e., 3 ma in one direction for a mark and 3 ma in the opposite direction for space) for transmission over the telephone line to Data Set 109A type. Conversely the current signals received from the telephone line (109A station) are converted by the 109B to dc signals and interfaced to the hub by Data Auxiliary Set 811C. Refer to Fig. 1 for a block diagram showing a typical relationship of these units.

1.05 The data sets employ a 3 ma polar dc transmission scheme which is designed for a loop of 2000 ohms at a maximum allowable capacity of 1 mf. If the loop is less than 1800 ohms, it should be built out to 2000 ohms by adding the line adjusting resistor unit (J70165D) at the Serving Test Center.

1.06 ***The Data Set 109B transmission scheme***

(a) Data Sets (109B or/and 109A) at each end of the transmission loop may be considered as voltage sources from which space and mark currents are derived for use on loops of 2000 ohms.

(b) Steps (1 through 4) below explain the transmission scheme.

Note: Data Set 109A type will be the remote data station in the explanation of the transmission scheme of Data Set 109B.

(1) The voltage value for transmitting a space (Fig. 2) into the loop is three times that for transmitting a mark and of opposite polarity. (e.g., −12 volts space, +4 volts mark).

(2) Consider Fig. 2(a) where both data sets are marking (idle mode). The marking voltages applied to the line add algebraically to 8 volts which sets up a current of 3 ma in the direction indicated by Fig. 2(a). Both sets interpret this as marking current on the line.

(3) Fig. 2(b) illustrates Data Set 109B transmitting a space. The sum of the Data Set 109B space voltage and Data Set 109A mark voltage algebraically add to 8 volts, setting up a current of 3 ma in the direction indicated in Fig. 2(b). Both data sets interpret this as spacing current on the line.

(4) Fig. 2(c) illustrates the reception of a space by Data Set 109B. The sum of the mark and space voltages applied from the ends of the line algebraically add to 8 volts, setting up a current of 3 ma in the direction indicated in Fig. 2(c). Both sets interpret this as spacing current on the line.

1.07 Data Set 109B type receives the following signals from the Data Auxiliary Set 811C1.

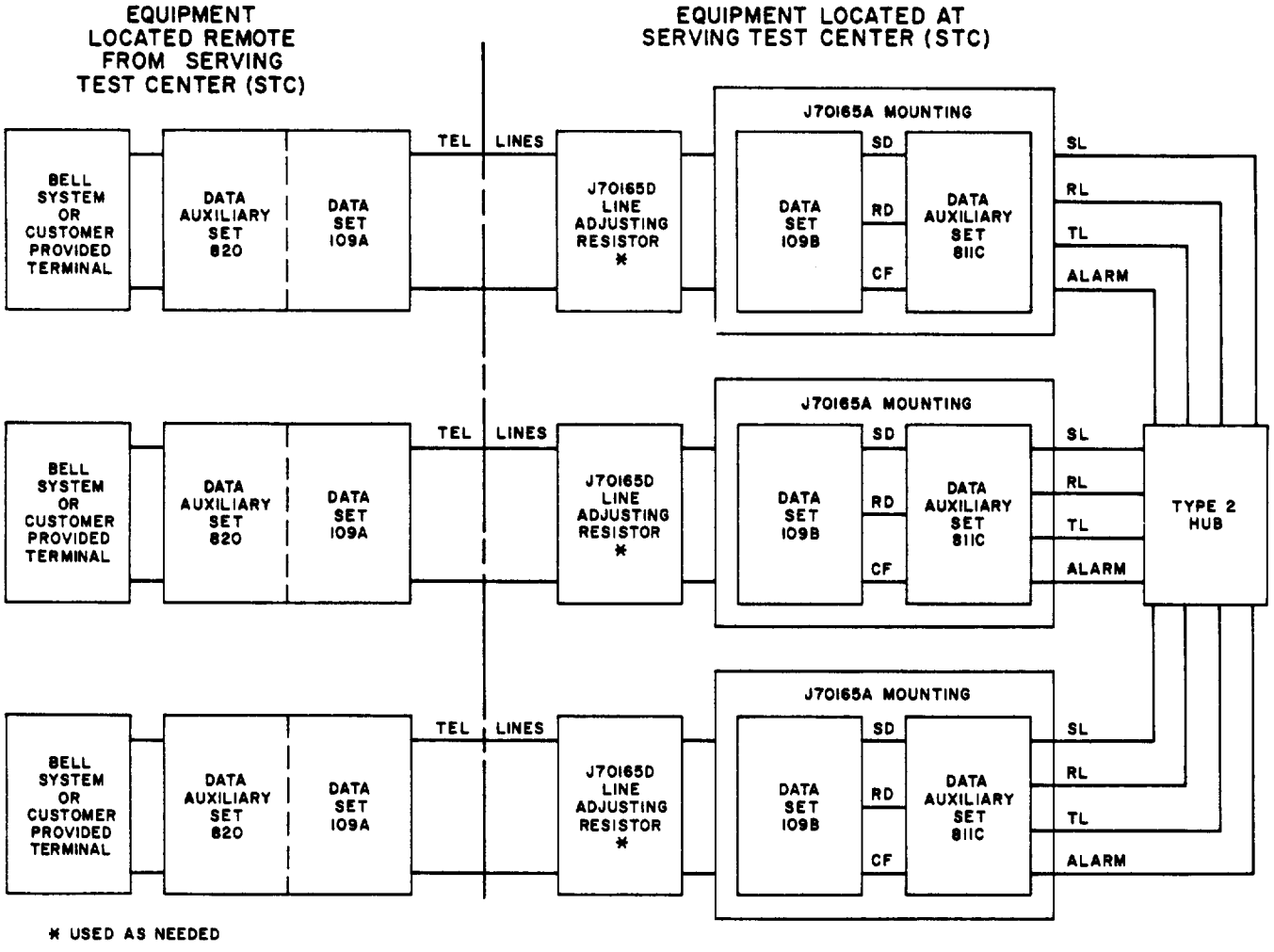
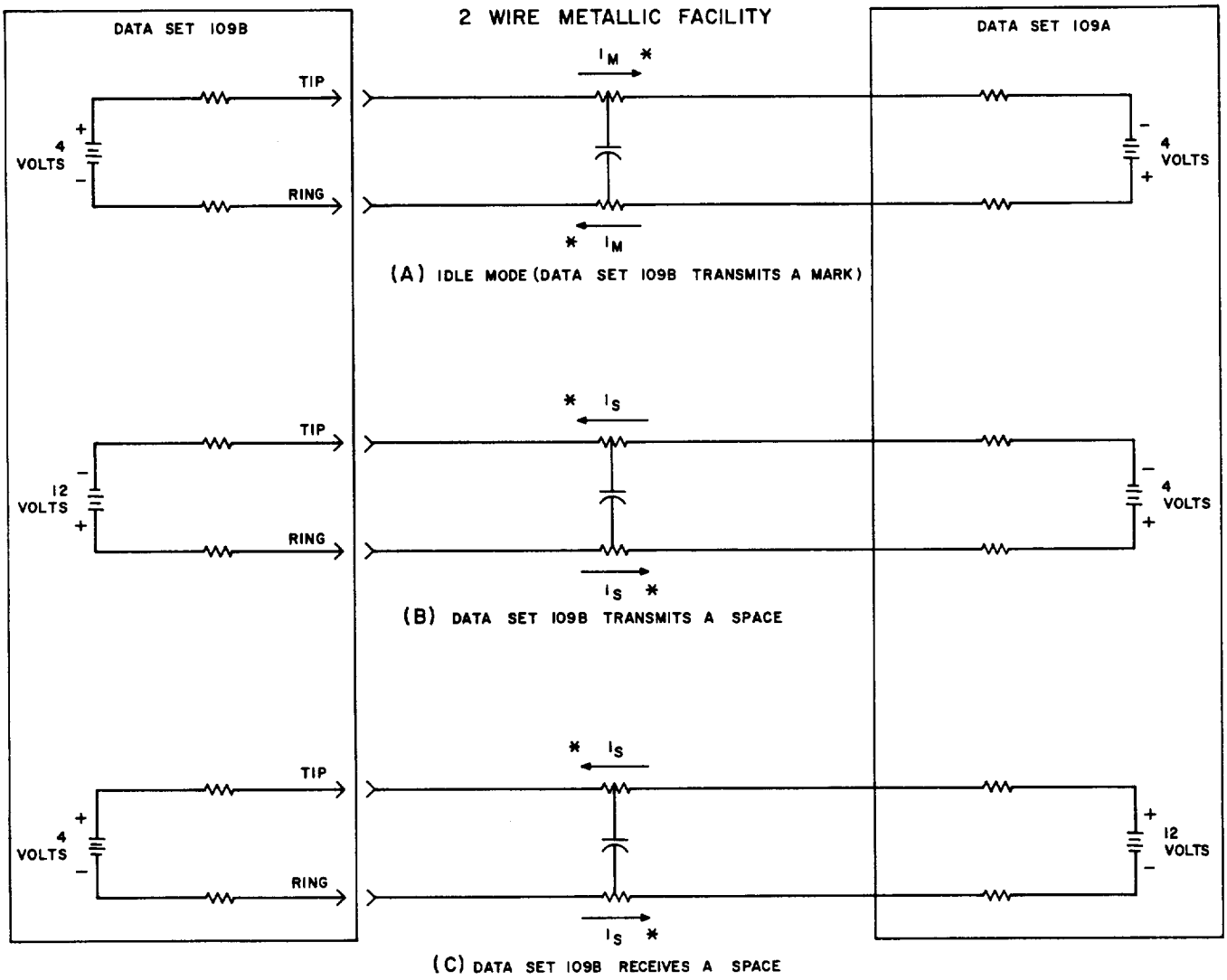


Fig. 1—System Block Diagram



* ARROWS DENOTE CONVENTIAL CURRENT FLOW

Fig. 2—Data Set 109B-Type Transmission Schematic

(a) A +24 volt through a resistor on the Send Data (SD) lead represents a mark.

(b) A ground voltage applied to the SD lead represents a space.

1.08 Data Set 109B supplies the following signals to the Data Auxiliary Set 811C:

(a) A ground voltage to the Received Data (RD) lead represents a mark.

(b) A -24 volt through a resistor on the RD lead represents a space.

(c) A ground voltage on the CF lead represents signal fail.

1.09 Data Set 109B type requires approximately 5 watts of filtered +24 and -24 vdc power and one-half watt of filtered -48 vdc power which is normally supplied by the central office battery. When +24 volt and -24 volt potentials are not available in the office they may be obtained from a -48 volt dc to +24 volt and -24 volt converter.

1.10 The Data Set 109B type is designed to operate satisfactorily within the environmental condition ranges specified below.

- Ambient temperature range: 40 to 120°F
- Relative humidity range: 20 to 95 percent

2. PHYSICAL DESCRIPTION

2.01 The Data Set 109B type is a printed circuit board and is shown by Fig. 3.

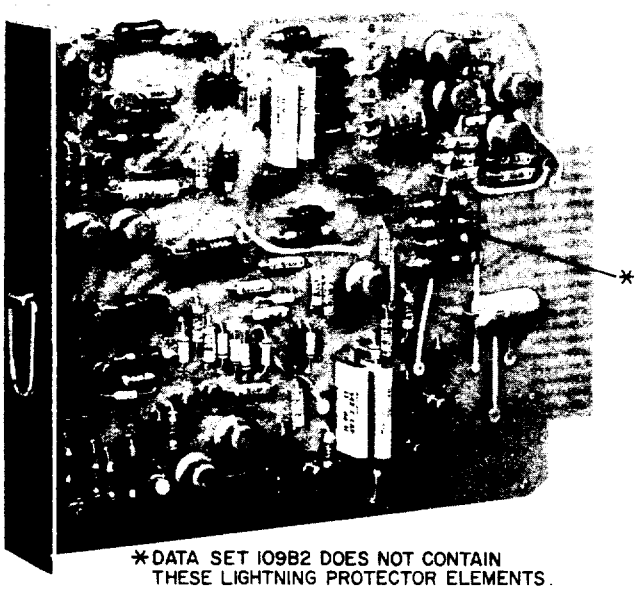


Fig. 3—Data Set 109B-Type

2.02 The Data Auxiliary Set 811C is a printed circuit board and is shown by Fig. 4. Refer to the section entitled Data Auxiliary Set 811C, Description (314-421-100) for additional information on the Data Auxiliary Set 811C.

2.03 The Data Set 109B type and Data Auxiliary Set 811C are both inserted into a J70165A Mounting Panel which provides the necessary fuses and connections to central office battery for proper operation of the sets. The J70165A is designed for rack mounting in a 23-inch mounting space and occupied 6 inches of space as shown in Fig. 5.

2.04 The J70165D line adjusting resistor unit which provides adjustment of the loop to

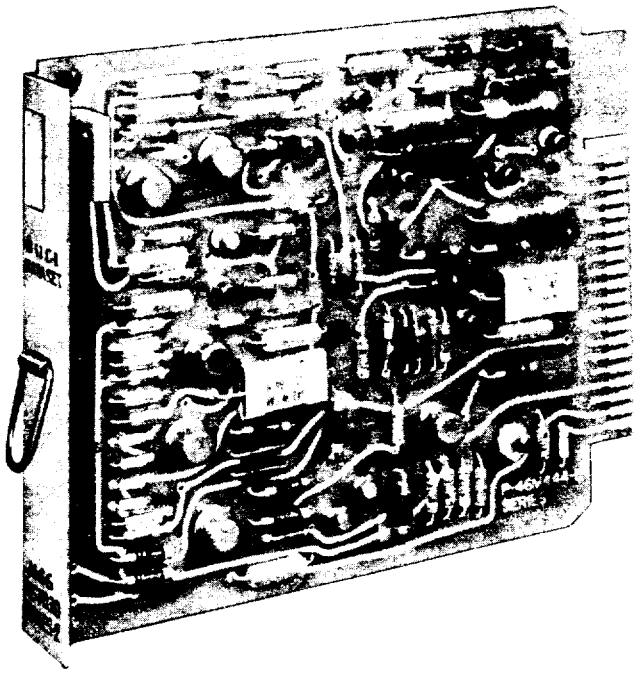


Fig. 4—Data Auxiliary Set 811C

2000 ohms, may be physically located any place within the central office between the main frame and data set.

3. FUNCTIONAL DESCRIPTION

3.01 The Data Set 109B transmits and receives mark and space currents (3 ma in one direction for a mark, and 3 ma in the opposite direction for a space) from another 109 type Data Set.

3.02 These currents are converted to low-level dc voltages by the 109B receiver and are then supplied to Data Auxiliary Set 811C.

3.03 The Data Set 109B transmitter accepts dc voltages from the Data Auxiliary Set 811C and converts them to mark and space currents for transmission to the Data Set 109 type. Fig. 6 gives a functional block diagram of Data Set 109B.

3.04 Data Set 109B consists of the transmitting circuits, receiving circuits, signal fail circuits, and the monitor circuits. The monitor circuits are common to the transmitter, receiver, and signal fail circuits. The signal fail circuits provide an

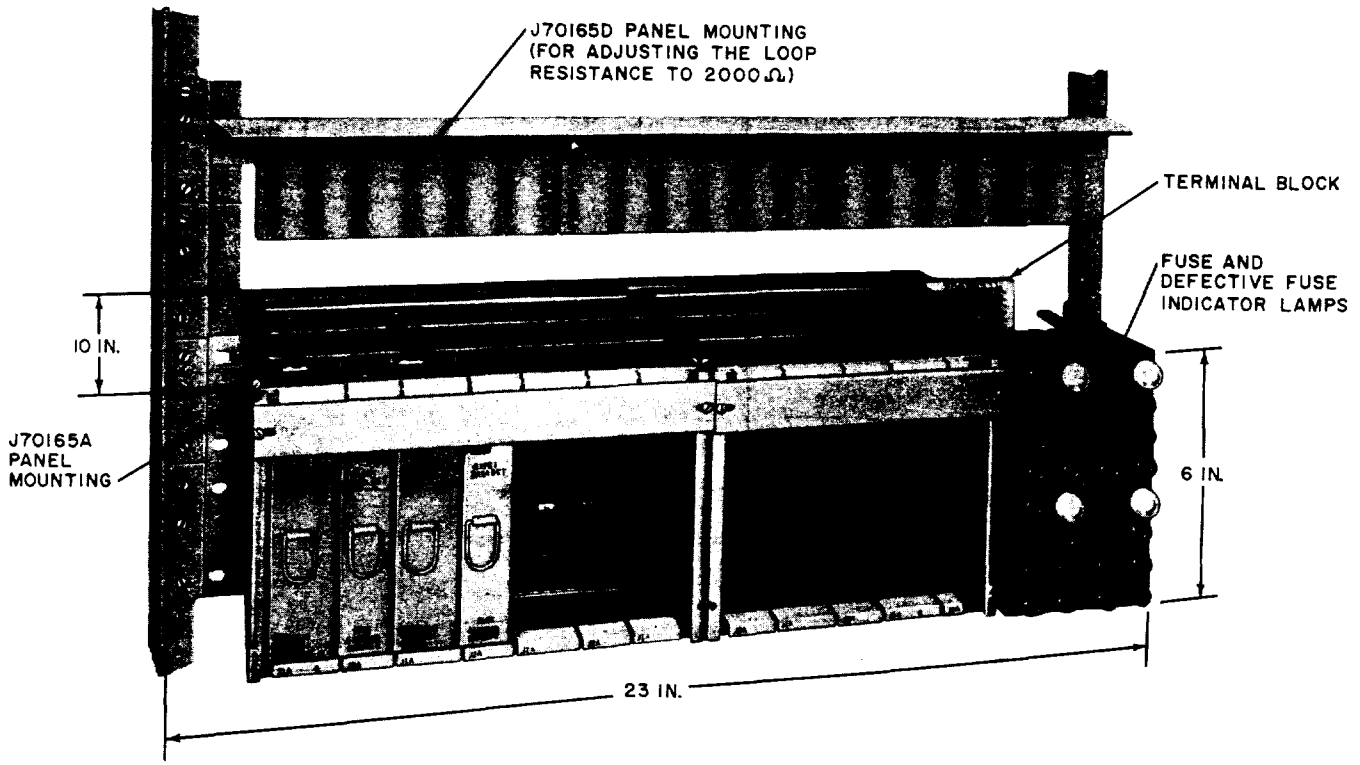


Fig. 5—Data Set 109B-Type and Data Auxiliary Set 811C Installed in Panel J70165A With Attached J70165D Panel

interface signal when the amplitude of the line current drops below 1.5 ma. The receiver circuits and common monitor circuits convert the line current into voltages whose polarity is determined by the direction of the line current. The transmit circuit and common monitor circuit convert the positive 24-volt mark signal and ground space signal from the data auxiliary set into voltages whose amplitude and polarity develope the required line currents for mark and space signals.

TRANSMIT CIRCUIT

3.05 The transmit circuits include the transmit OR gate, the transmitter, common circuits in the monitor, and the transmit delay circuit.

3.06 The transmit OR gate is controlled by mark and space voltages on the SD lead and by control voltages from the NOR gate. When the NOR gate is operated by a space signal on the SD lead the transmitter develops −12 volts, which is coupled to the line through the monitor circuits, Fig. 2B. The signal is polarized so that the 3 ma space current flows through the loop. When a mark voltage is applied to the SD lead, the OR gate causes the transmitter and monitor to return to their idle state, i.e. apply +4 volts, polarized to produce the 3 ma mark current, to the line.

3.07 Because the transmitting data set's monitor circuit recognizes both received and transmitted signals without distinction, it is necessary to block transmitted signals to prevent them from appearing on the RD lead and being connected to the hub. This is accomplished by the transmit delay and NOR gate circuits. The NOR gate is operated by a positive voltage on either of the input leads. The output of the receiver is positive for a mark and the transmit delay circuit output is positive for a space, consequently one or the other of these signals will operate the gate and hold the RD lead marking. To compensate for any delays due to line capacity in detecting a mark transmission, the transmit delay circuit holds the NOR gate operated for approximately 200 μsec after a space-to-mark transition. To ensure that the NOR gate is operated before the receiver

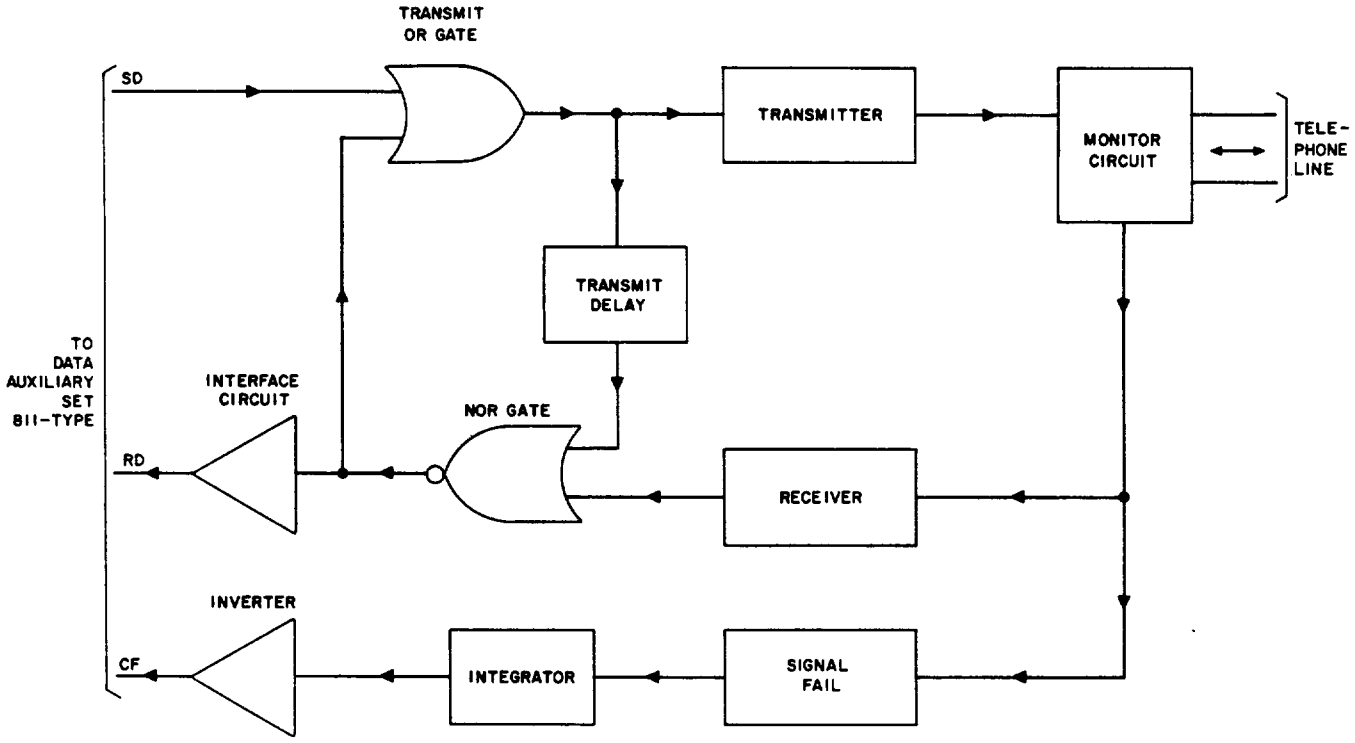


Fig. 6—Data Set 109B Functional Block Diagram

detects a space transmission, the delay circuit will operate the NOR gate before the receiver output goes negative, following a mark-to-space transition.

3.08 The NOR gate in the receive circuits and the transmit OR gate provides for the transmitting data set to recognize a break signal from the receiving data set. The incoming break, a long space, will be detected by the receiver circuit as soon as the signal on the SD lead becomes a mark. Both inputs to the NOR gate, under these conditions, are negative. The positive output of the gate is inverted and applied to the RD lead as a space. The positive voltage is also applied to the transmit OR gate which causes the transmit circuits to be clamped in a marking condition.

RECEIVE CIRCUITS

3.09 The receive circuits (Fig. 6) include common circuits in the monitor, the receiver, the NOR gate, and the interface inverter.

3.10 When the data set is receiving spacing signals from the line the SD lead is clamped marking by signals from Data Auxiliary Set 811C. This action places a negative voltage on the input to the NOR gate from the transmit delay, permitting the receiver to control the operation of the gate.

3.11 The monitor circuits sense the magnitude and polarity of the line current and provide voltage indications to the receiver representing marks and spaces. The receiver recognizes the difference between these indications and converts them into a negative voltage for a space and a positive voltage for a mark. These voltages cause the NOR gate to operate and invert the input signals. The signals are again inverted by the interface inverter to provide the ground potential mark signal and -24 volt space signal to the Data Auxiliary Set 811C.

3.12 When the data set is receiving a space current from the line the positive output of the NOR gate holds the transmit OR gate marking, thus preventing the transmission of a break. As soon as the NOR gate output goes negative, by receiving a mark, the transmit circuits are unblinded and the break signal can be transmitted. The break signal blinds the receiver through the transmit

delay and NOR gate, and permits the receiving data set to seize control of the line.

SIGNAL FAIL CIRCUITS

3.13 The signal fail circuits (Fig. 6) include a bi-directional bridge, an integrator, and an inverter.

3.14 The bridge circuit conducts whenever the line current exceeds approximately 1.5 ma in either direction, producing a negative output. The output tends to decrease in amplitude during a signal transition. The integrator eliminates amplitude variations and presents a constant negative voltage to the inverter. The inverter then puts a +24 volt signal on the CF lead indicating normal operation.

3.15 When line currents fall below 1.5 ma the bridge circuit ceases to conduct and a positive voltage is presented to the inverter. The inverter then applies a ground potential to the CF lead indicating carrier failure.

4. REFERENCES

4.01 For additional information on the Data Set 109B type and the associated equipment, refer to the items listed below.

(a) SD-70944-01 (Data Set 109B Type Schematic Diagram)

(b) CD-70944-01 (Data Set 109B Type Circuit Description)

(c) SD-70963-01 (Data Auxiliary Set 811C Schematic Diagram)

(d) CD-70963-01 (Data Auxiliary Set 811C Circuit Description)

(e) SD-70955-01 (connecting circuit for Data Sets 108B, 109B, 110B and Data Auxiliary Set 811C in central office, schematic diagram)

(F) CD-70955-01 (Connecting Circuit for Data Sets 108B, 109B, 110B and Data Auxiliary Set 811C in Central Office, Circuit Dexcription)

(g) J70165 (Mounting and Connecting Units for Central Office Data Sets, Data Systems)

(h) Section 314-421-100 (Data Auxiliary Set 811C, Description).