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Bell System

TECHNICAL REFERENCE

1A DATA STATION, MULTICHANNEL ARRANGEMENT USED IN PROVISION OF TWO-POINT CHANNELIZING SERVICE

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ENGINEERING MANAGER - DATA SYSTEMS

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1. INTRODUCTION

This reference describes the features and operating characteristics of a two-point multiplexing service which provides the means for deriving a number of low-speed data channels from a private line voiceband facility. Hence, efficient use of the available bandwidth of voice-grade facilities can be attained when serving a multiplicity of such low-speed data services on a point-to-point basis.

2. GENERAL DESCRIPTION

Figure 1 depicts a typical system configuration for this service. The 1A Data Station, Multichannel Arrangement is located on the customer's premises and is used to (1) terminate each end of a private line voice-grade facility, (2) derive the desired low-speed data circuits, and (3) provide suitable interfaces for interconnection with Bell System provided and customer-provided terminal devices.

The 1A Data Station operates over 4-wire (Duplex) private line voiceband facilities.* This service uses one of four different grades of conditioning offered under the 3002-type private line channel. The arrangements vary from a basic voice-grade channel without equalization to C4 conditioning. The 1A Data Station is capable of deriving both 75-baud and 150-baud data channels from a private line voice-grade facility. Individual 75-baud channels are code insensitive and are capable of operating at any speed up to 75 bauds. Individual 150-baud channels are code insensitive and are capable of operating at any speed up to 150 bauds. The number of usable data channels that the 1A Data Station can derive from a given facility is a function of the facility conditioning employed. Table A indicates the recommended maximum number of usable 75-baud channels or 150-baud channels that can be derived for each type of conditioning offered.

* Reference should be made to:

Bell System Data Communications Technical Reference — Transmission Specifications for Voice Grade Private Line Channels — March, 1969

TABLE A

Maximum Number of Usable 2-Way Data Channels That a 1A Data Station Can Derive From a 3002-Type Channel (With and Without Conditioning)

	75-Baud Channels	**150-Baud Channels**
3002 Channel	12	6
C1 Conditioning	14	6 (Plus two 75-baud channels)
C2 Conditioning	16	7 (Plus two 75-baud channels)
C4 Conditioning	17	8 (Plus one 75-baud channel)

Each 150-baud channel occupies the frequency spectrum of two 75-baud channels. Consequently, a 150-baud channel may be replaced by the two 75-baud channels occupying the same frequency spectrum. As a result, various combinations of 75-baud and 150-baud channels can be accommodated in a given two-point multiplexing service.

Three interface options are available with each individual channel of the 1A Data Station equipment. These are the industry standard voltage interface described in Electronics Industries Association (EIA) Standard RS-232B**, a 3-wire 20-mA neutral current interface, and a 2-wire 62.5-mA (optional 20-mA) neutral current interface. Access to these interfaces is via the Data Auxiliary Sets 811G, 811H and 811J, that are provided as integral parts of the multichannel 1A Data Station arrangement. These units also provide the attendant controls used in the operation of the system.

**EIA Standard RS-232B Interface Between Data Processing Terminal Equipment and Data Communication Equipment.

3. TRANSMISSION CONSIDERATIONS

The degree of start-stop distortion+ encountered on 1A Data Station channels operating over a 3002 channel is a function of channel length, the number of voiceband transmission links in tandem, and facility impairments. The inherent degree of start-stop distortion of a pair of 1A Data Station channel terminals (excluding facility) is less than 5 percent. With a 10 dB ratio of the narrowband signal power to white noise bandlimited to 3200 Hertz, the amount of start-stop distortion is less than 15 percent. The 1A Data Station channels are relatively insensitive to facility impairments such as envelope delay distortion. They may be, however, sensitive to phase jitter (especially 75-baud channels) and impulse noise. The frequency response characteristic of the 3002 channel normally limits the number of data channels which can be derived from a 3002 channel as shown in Table A.

It is expected that the start-stop data distortion introduced by the 1A Data Station channel operating over a 3002 channel will usually be less than 15 percent; however, occasional distortion peaks considerably greater than 15 percent may occur. Therefore, it is recommended that the net margin+ of the receiving data terminal minus the gross start-stop distortion + at the transmitting terminal be equal to or greater than 25 percent.

The signal propagation time through a pair of 1A Data Station channel terminals, excluding the propagation time of the facility, is approximately 15 milliseconds for 150-baud channels and approximately 23 milliseconds for 75-baud channels.

+For definitions of degree of start-stop distortion, net margin, and gross start-stop distortion, references should be made to:

> EIA Standard RS-363 Standard for Specifying Signal Quality for Transmitting and Receiving Data Processing Terminal Equipments Using Serial Transmission at Interface with Non-Synchronous Data Communication Equipment.

4. INTERFACE DESCRIPTION

4.1 General

A derived 1A Data Station channel can be equipped with one of three types of station interface arrangements —

1. Voltage per EIA Standard RS-232B
2. 20-mA neutral current, 3-wire
3. 62.5-mA (20-mA optional) neutral current, 2-wire

The choice of interface is made at the time of customer order. The station interfaces chosen for the channels derived from a voiceband facility may be mixed; i.e., same channels may employ the voltage interface while others utilize the current interface. A standard 25-pin connector is used as the interface exit and entry point to the channel terminal and a separate 25-pin connector is provided for each derived channel. The customer's data terminal equipment should be equipped with a cable terminated in a 25-pin plug. In the case of the 2-wire current interface, an arrangement is also available in which a single 50-pin connector is used as the interface point to all of the derived channels. For this arrangement, the wire-pairs from each of the customer's data terminals (up to 16 terminals) should be terminated in a single 50-pin plug.

In order to maintain a reliable connection, the number of times the connectors are opened should not exceed 75. For this reason, the connectors should not be used as a patch field.

4.2 EIA RS-232 Type Serial Data Interface

The EIA voltage interface conforms with the specifications given in EIA Standard RS-232B. A brief summary of the electrical characteristics of the EIA specification follows.

All signals generated by the 1A Data Station channel have a magnitude in the 5 to 25-volt range when measured across a load of 3000 ohms or greater. The receiving circuit of a 1A Data Station channel will accept customer signals, measured at the input terminal with respect to signal ground, with a magnitude in the 3 to 25-volt range. In accordance with EIA

specifications, the customer's terminal equipment is expected to generate signals with a magnitude of at least 5 volts. The negative voltages are considered "OFF" or "marking," and the positive voltages are considered "ON" or "spacing." During normal operation, the input impedances of all 1A Data Station circuits which accept signals from the customer's equipment have DC resistances of at least 3000 ohms but not more than 7000 ohms and an effective shunt capacitance of 2500 picofarads or less. When a test feature is activated (see Section 7), some interface leads are open-circuited in order to permit testing of the channel equipment up to the interface. For more specific details, the EIA standard itself should be consulted.

4.3 Functional Description of Voltage Interface Circuits

The 11 interchange leads which are provided for connection to the customer's terminal equipment are described in this section. Operation of these leads when a test feature is activated is described in Section 7.

a. AA — Protective Ground: Electrically bonded to equipment frame and the AC power service ground.

b. AB — Signal Ground: Provides a common reference potential for all interface circuits except circuit AA. May optionally be connected to protective ground by a removable strap.

   Because many of the derived channels may utilize the same power supply and the same equipment cabinet, connection of the AB circuit to the AA circuit in any one channel interface will have the effect of connecting these two leads together in the interfaces of all those channels that share a common power supply. If the customer's terminal equipment is not connected to the 25-pin connector a marking signal will be transmitted.

c. BA — Transmitted Data: The BA circuit is designed to accept serial data from the customer's terminal equipment. Signals applied by the customer terminal equipment on circuit BA will be transmitted except when circuit CF (Data Carrier Detector) is in the OFF condition and the carrier squelch option is employed.

d. BB — Received Data: The BB circuit is designed to deliver serial data to the customer's terminal equipment. Received signals are applied to circuit BB except when circuit CF is in the OFF condition. When circuit CF is OFF, circuit BB is clamped either mark hold or space hold according to the option chosen by the customer.

   A local copy option can provide local copy on circuit BB of the data presented by the customer terminal equipment on circuit BA. When providing local copy, the channel terminal will continue to pass received spacing signals (i.e., breaks) over circuit BB. Local copy is not inhibited when circuit CF is OFF.

e. CA — Request-to-Send: A strapping option is provided that permits the CA circuit to be connected directly to the CB (Clear-to-Send) circuit provided circuit CB is not strapped to circuit CC. Otherwise, circuit CA is an open circuit. In either case, any information on circuit CA is not utilized by the 1A Data Station equipment.

f. CB — Clear-to-Send: Strapping options are provided to permit this circuit to be connected directly to either the CA circuit or the CC circuit, or to be left as an open circuit. The CA-CB loop option is provided to satisfy those existing terminal equipments that expect a Clear-to-Send indication in response to a Request-to-Send signal. The CB-CC strapping option is provided to multiple the control functions associated with the CC circuit onto the CB circuit for those terminal equipments that expect such

control information on the Clear-to-Send circuit.

g. CC — Data Set Ready:* This circuit is held in the ON condition whenever power is applied to the channel terminal. An option is available to turn circuit CC OFF whenever circuit CF is turned OFF.

h. CD — Data Terminal Ready: This circuit is not used. Preferably the customer's terminal equipment should not connect anything to this circuit. However, if a connection must be made to the CD circuit, it must be arranged to never assume the OFF condition. An OFF condition on circuit CD would cause circuit BB to be clamped mark hold or space hold depending on the option chosen.

i. CF — Data Carrier Detector: The CF circuit indicates to the customer's terminal equipment the presence or absence of a suitable incoming carrier in the 1A Data Station channel. When the received carrier level drops from the initial line-up level by 12 dB or more for 90 to 300 milliseconds, circuit CF assumes the OFF condition. The resumption of acceptable carrier for 20 to 500 milliseconds will cause the CF circuit to reassume the ON condition. Circuit CF will also assume the OFF condition if a system alarm due to high power or a poor signal to noise ratio is detected (see Section 6 — Alarm Features and Indications).

The detection of a loss-of-carrier condition will also cause circuit BB to be clamped either mark or hold or space hold according to the option chosen by the customer. A second option is available which will cause circuit CC to be held OFF when circuit CF is OFF. With a separate option, the output of the channel modulator can be squelched when circuit CF is OFF so that the loss-of-carrier condition is reflected back to the distant 1A Data Station equipment. This option should only be elected at one end of the channel, generally at the noncontrol station of the service arrangement.

j. +P — Positive power: For Telephone Company use only.

k. -P — Negative power: For Telephone Company use only.

* Circuit CC is a fail-safe lead; i.e., it will turn OFF if the power fails.

Pin assignments are as follows:

Pin Number	Circuit	Designation
1	AA	Protective Ground
2	BA	Transmitted Data
3	BB	Received Data
4	CA	Request-to-Send
5	CB	Clear-to-Send
6	CC	Data Set Ready
7	AB	Signal Ground
8	CF	Data Carrier Detector
9	+P	Data Set Test
10	-P	Data Set Test
11-19	—	
20	CD	Data Terminal Ready
21-25	—	

4.4 20-mA Neutral Current 3-Wire Interface

The 3-wire current interface provides separate 20 mA loops for both the send and receive circuits to the customer's terminal equipment. This interface may be selected only for data transmission speeds up to 75 bauds (110 bauds require the use of 150 baud channels). Circuit CF, identical with the corresponding EIA interface circuit, is also provided.

Figure 2 illustrates the separate send and receive loops provided by 3 leads in the interface. The 1A Data Station provides the power for the loops and if the impedances specified below are met, marking current in the loops should be 20 +2.5-mA. No loop current adjustments are necessary. Polarity is such that current will flow through the customer-provided equipment from pin 2 (BA) to pin 10 and from pin 3 (BB) to pin 10.

The send and receive loops provided may be used to drive short distances of in-house circuitry that are not exposed to lightning potentials. The send loop may have in series with it a maximum of 500 ohms and up to one-half henry of inductance. This will permit a receiver to be placed in series with the send loop for monitoring purposes provided the combined resistance of the loop and receiver does not exceed 500 ohms. The receive loop also is limited to a maximum resistance of 500 ohms and one-half henry of inductance for 20-mA operation. The receivers may be selector magnet drivers, line relays, or equivalent devices meeting the impedance requirements and designed to detect 20-mA of current as a mark signal and no current as a space signal. The receiving circuitry should be isolated from ground and should not impress foreign voltages in excess of one-half volt. Noninductive impedances are preferred as they cause less send contact deterioration.

To insure proper operation of the channel terminal, it is recommended that the contact closures provided by the customer's terminal equipment have the following characteristics: isolated from ground (leakage >1 megohm), less than one-half volt of foreign potential, less than 5 ohms resistance (excluding loop resistance) when contact is closed, more than 1 megohm resistance when contact is open. The send contacts or their electrical equivalent should be capable of repeatedly making and breaking a nominal 20 milliamperes and capable of withstanding an open circuit voltage up to 25 volts DC. A closed send contact (20 mA current) is detected as a mark signal and an open send contact (zero current) is detected as a space signal.

4.5 Functional Description of 20-mA, 3-Wire, Current Interface Circuits

The seven interchange leads which provide connection to the customer's terminal equipment are described in this section. Operation of these leads when a test feature is activated is described in Section 7.

a. AA — Protective Ground: Electrically bonded to the equipment frame and the AC power service ground.

b. AB — Signal Ground: Provides a common reference potential for circuit CF and the positive and negative power supply potentials. May be connected to protective ground by a removable strap.

   Because many of the derived channels may utilize the same power supply and the same equipment cabinet, connection of the AB circuit to the AA circuit in any one channel interface will have the effect of connecting these two leads together in the interfaces of all those channels that share a common power supply.

c. BA — Transmitted Data: The Send loop is connected through the send contact of the customer's terminal equipment to the -P lead. Signals presented by the customer's terminal will be transmitted except when circuit CF is in the OFF condition if the carrier squelch option is employed. If the customer's terminal equipment is not connected to the 25-pin connector associated with a current interface channel terminal, a spacing signal will be transmitted, except when the receive-only option is in use, in which case a marking signal will be transmitted.

d. BB — Received Data: The Receive loop is connected through the receiver of the customer's terminal equipment to the —P lead. Received signals are delivered to the receive loop except when circuit CF is in the OFF condition. When circuit CF is OFF, the Receive loop is held either marking or spacing according to the option chosen by the customer. A local copy option can provide local copy on the receive loop of data presented by the customer's terminal equipment on the send loop. When providing local copy, the channel terminal will continue to pass receive spacing signals (e.g., breaks) over circuit BB. Local copy is not inhibited when circuit CF is OFF.

e. CF — Data Carrier Detector: The CF circuit indicates to the customer's terminal equipment the presence or absence of a suitable incoming carrier in the 1A Data Station channel. When the received carrier level drops from the initial lineup level by 12 dB or more for 90 to 300 milliseconds, circuit CF assumes the OFF condition. The resumption of acceptable carrier for 20 to 500 milliseconds will cause the CF circuit to reassume the ON condition. Circuit CF will also assume the OFF condition if a system alarm due to high signal power or a poor signal to noise ratio is detected (see Section 6 — Alarm Features and Indications).

   The detection of a loss-of-carrier condition also causes the Receive loop to be clamped either marking (20 mA of current) or spacing (no current) according to the option chosen by the customer. Loop current is maintained in the send loop if the send contact in the customer's terminal equipment is closed. An option is available so that the output of the channel modulator can be squelched whenever circuit CF is OFF so that the loss-of-carrier condition is reflected back to the distant 1A Data Station equipment. This option should only be elected at one end of the channel, generally at the noncontrol station of the service arrangement.

f. +P — Positive power: For Telephone Company use only.

g. -P — Negative power: Common lead for the Send and Receive loops described above.

   The circuits appearing on pin numbers 2, 3, and 10 (as indicated below) present a full duplex interface for the data terminal equipment; the Send loop is connected between pins 2 and 10, while the Receive loop is connected between pins 3 and 10. As noted previously, an option is available that provides for local copy of transmitted data.

Pin assignments are as follows:

Pin Number	Circuit	Designation
1	AA	Protective Ground
2	BA	Transmitted Data
3	BB	Received Data
4-6	—	
7	AB	Signal Ground
8	CF	Data Carrier Detector
9	+P	Data Set Test
10	—P	(See description)
11-25	—	

4.6 62.5-mA (20-mA Optional) Neutral Current 2-Wire Interface, Half-Duplex

The 2-wire current interface is for use with terminal equipment requiring a 2-wire, 62.5-mA or, optionally, a 20-mA neutral current. No loop current adjustments are required. This interface may be selected only for data transmission speeds up to 75 bauds (110 bauds require the use of 150 baud channels). The interface connector to the customer's terminal equipment is either a 25-pin connector or a 50-pin connector depending on the arrangement selected. Figure 2A illustrates the send/receive loop provided by 2 leads in the interface.

The 2-wire loop provided may be used to drive short distances of in-house circuitry that are not exposed to lightning potentials. The loop may have in series with it a maximum of 300 ohms and up to one-half henry of inductance for 62.5 mA operation and a maximum resistance of 500 ohms and up to one-half henry of inductance for 20-mA operation. The receivers may be selector magnet drivers, line relays, or equivalent devices meeting the impedance requirements and designed to detect 62.5/20-mA of current as a mark signal and no current as a space signal. The receiving circuitry should be isolated from ground and should not impress foreign voltages in excess of one-half volt. Noninductive impedances are preferred as they cause less send contact deterioration.

To insure proper operation of the channel terminal, it is recommended that the contact closures provided by the customer's terminal equipment have the following characteristics: isolated from ground (leakage >1 megohm),

less than one-half volt of foreign potential, less than 5 ohms resistance (excluding loop resistance) when contact is closed, more than 1 megohm resistance when contact is open. The send contacts or their electrical equivalent should be capable of repeatedly making and breaking a nominal 62.5 milliamperes and capable of withstanding an open circuit voltage up to 25 volts DC. A close send contact (62.5/20 mA current) is detected as a mark signal and an open send contact (zero current) is detected as a space signal.

4.7 Functional Description of 62.5/20-mA, 2-Wire Interface, Half-Duplex Circuits

A. Interface Provided By 25-Pin Connector

The seven interchange leads which provide connection to the customer's terminal equipment via a 25-pin connector are described in this section. Operation of these leads when a test feature is activated is described in Section 7.

a. AA — Protective Ground: Electrically bonded to the equipment frame and the AC power service ground.

b. AB — Signal Ground: Provides a common reference potential for circuit CF and the positive and negative power supply potentials. May be connected to protective ground by a removable strap.

   Because many of the derived channels may utilize the same power supply and the same equipment cabinet, connection of the AB circuit to the AA circuit in any one channel interface will have the effect of connecting these two leads together in the interfaces of all those channels that share a common power supply.

c. BA — Transmitted Data: Circuit BA is connected through both the send contact and the receiver of the customer's terminal equipment to the BB circuit. Signals presented by the customer's terminal will be transmitted except when circuit CF is in the OFF condition if the carrier squelch option is employed.

d. BB — Received Data: Circuit BB is connected through the receiver and send contract of the customer's terminal equipment to the BA circuit. Received signals are delivered to the send/receive loop except when circuit CF is in the OFF condition. When circuit CF is OFF, the Receive Circuit is held either marking or spacing according to the option chosen by the customer.

e. CF — Data Carrier Detector: The CF circuit (not provided in the 50-pin connector interface) indicates to the customer's terminal equipment the presence or absence of a suitable incoming carrier in the 1A Data Station channel. When the received carrier level drops from the initial lineup level by 12 dB or more for 90 to 300 milliseconds, circuit CF assumes the OFF condition. The resumption of acceptable carrier for 20 to 500 milliseconds will cause the CF circuit to reassume the ON condition. Circuit CF will also assume the OFF condition if a system alarm due to high signal power or a poor signal to noise ratio is detected (see Section 6 — Alarm Features and Indications).

   The detection of a loss-of-carrier condition also causes the Receive/Send loop to be clamped either marking (62.5/20-mA of current) or spacing (no current) according to the option chosen by the customer. Loop current is maintained if the send contact in the customer's terminal equipment is closed. An option is available so that the output of the channel modulator can be squelched whenever circuit CF is OFF so that the loss-of-carrier condition is reflected back to the distant 1A Data Station equipment. This option should only be elected at one end of the channel, generally at the noncontrol station of the service arrangement

f. +P — Positive power: For Telephone Company use only.

g. -P — Negative power: For Telephone Company use only.

Pin assignments for the 2-wire 25-pin connector are as follows and are the same as those for the 3-wire current interface except that the customer should not connect to circuit No. 10 in the 2-wire case.

Pin Number	Circuit	Designation
1	AA	Protective Ground
2	BA	Transmitted Data
3	BB	Received Data
4-6	—	
7	AB	Signal Ground
8	CF	Data Carrier Detector
9	+P	Data Set Test
10	-P	Data Set Test
11-25	—	

B. Interface Provided By 50-Pin Connector

In arrangements having a 50-pin connector as the interface point, a single 50-pin connector accommodates the wire-pair from up to 16 of the customer's terminals. The following two circuits only, are provided to each of the customer's terminals.

a. BA — Transmitted Data: Circuit BA is connected through both the send contact and the receiver of the customer's terminal equipment to the BB circuit. Signals presented by the customer's terminal will be transmitted except when a carrier fail condition occurs on the channel and the carrier squelch option is employed.

b. BB — Received Data: Circuit BB is connected through the receiver and send contact of the customer's terminal equipment to the BA circuit. Received signals are delivered to the receive loop except when a carrier fail condition occurs on the channel and the mark or space hold option is employed in which case the receive circuit is held marking or spacing.

Pin assignments for the 50-pin connector are as follows:

Pin Number	Circuit	Designation
1	BB1	Received Data
2	BB2	Received Data
3	BB3	Received Data
.	.	.
.	.	.
.	.	.
16	BB16	Received Data
17-25	—	
26	BA1	Transmitted Data
27	BA2	Transmitted Data
.	.	.
.	.	.
.	.	.
41	BA16	Transmitted Data
42-50	—	

5. PHYSICAL CHARACTERISTICS

The 1A Data Station multichannel arrangement is modular in design, consisting of data mountings, plug-in circuit packs, and Data Auxiliary Sets 811G, 811H and 811J. The number of such units required for a given installation will depend on the number of data channels being derived by the 1A Data Station equipment. For installations requiring ten channels or less, the cabinet illustrated in Figure 3 is employed. The outside dimensions of this cabinet are 30 inches high by 24 inches wide by 17 inches deep. Its weight (total occupancy) is approximately 145 pounds. Figures 4 and 5 indicate the placement of the circuit packs and data auxiliary sets required for a typical installation. For installations exceeding ten channels, a larger cabinet, as illustrated in Figure 7 is usually used. This larger cabinet has dimensions of 72 inches high by 34 inches wide by 30.5 inches deep, and can house enough 1A Data Station equipment to derive up to 24 data channels. Assuming total occupancy, the weight of this larger cabinet installation is approximately 700 pounds.

The customer must provide a receptacle supplying continuous 117-volt, 60 Hz AC power. The power receptacle must accept a plug equipped with a U-blade ground and supply a valid ground to the ground pin. It is preferred to

have this ground the same as the one used by the customer-provided terminal. Approximately 7.5 watts of 117v ±10 percent, 60 Hz ±5 percent AC power are required per derived data channel, with a maximum of 75 watts for the small cabinet arrangement and a maximum of 260 watts for the large cabinet arrangement.

The 1A Data Station will operate in an ambient temperature between 40 and 120° F and relative humidity between 20 and 95 percent.

6. ALARM FEATURES AND INDICATIONS

A variety of alarm features and indications are provided with the 1A Data Station arrangement to aid the customer in determining the state of the channelizing equipment and in identifying and isolating most trouble conditions without requiring assistance from the Telephone Company. These alarms also affect the operation of the derived data channels as viewed by the customer. This section, therefore, describes the various alarm features provided and relates their function to the general operation of the derived data channels.

There are two levels of alarms — major and minor. A major (system) alarm is one that indicates that all derived channels in a system are probably inoperative. A minor (channel) alarm is one that indicates that a fault exists in one or more channels in a system, but not in all channels. Major alarm circuitry is provided that functions by simultaneously monitoring two derived channels, 75 baud or 150 baud, within a given system, looking for both excessive changes in signal level and poor signal-to-noise (S/N) ratios. A drop of 12 dB or an increase of 10 dB from the initial lineup level in either or both monitored channels will be detected. In addition, a ratio of the narrowband signal power to the total voice channel noise power (S/N) of approximately -2 dB or less for a 75 baud channel, or approximately +3 dB or less for a 150 baud channel, in either or both monitored channels will be detected. (The above S/N thresholds occur when the noise power density is flat across the frequency band, i.e., white noise.) This alarm circuitry also utilizes loss-of-carrier indications from each channel, as well as operational indications from both the positive and negative power supplies used in the system.

A major alarm condition is caused by (1) high power, low power, or excessive noise being detected in both monitored channels, or (2) the failure of either the positive or the negative power supply. A minor alarm condition is caused by (1) high power, low power, or excessive noise being detected in either, but not both, monitored channels, (2) a carrier fail condition in one or more, but not all, of the derived channels, (3) the removal of any circuitry associated with the monitored channels, or (4) the removal of any circuitry associated with the major alarm feature.

Visual alarm indications are provided on the exterior of the 1A Data Station cabinet and on the appropriate Data Auxiliary Set 811G, 811H or 811J within the cabinet. Data Auxiliary Set 811J provides major alarm indications for up to two systems. As shown in Figure 3, three indicator lamps are located on top of the 1A Data Station cabinet. These lamps (ALARM, TEST, and PILOT) are intended to monitor the state of all the equipment located within the cabinet. The ALARM lamp (red) lights for both major and minor alarms. The TEST lamp (green) lights when any key is operated to an off-normal position. This lamp is intended to be a reminder to restore all keys before attempting to put a system or channel into service. The PILOT lamp (white) monitors power within the cabinet and is normally ON. Should any power supply fail, the PILOT lamp will be extinguished. Figure 8 illustrates the visual alarms that are located on the Data Auxiliary Sets 811G and 811H within the cabinet. A major ALARM lamp, provided on the Data Auxiliary Set 811G or 811J, lights only for major alarms associated with that system. The individual channel CARRIER FAIL lamps, provided on both the Data Auxiliary Sets 811G and 811H, light to indicate low power in that channel. Although individual carrier fail lamps are not provided on the Data Auxiliary Set 811J, the carrier fail lamps provided on each channel terminal's Receive Interface circuit pack are visible and would light to indicate low power in that channel.

The CARRIER FAIL lamps do not necessarily follow the CF circuits in the station interface. The channel CF lead is turned OFF whenever a channel is taken out of service due to low power, high power, or a poor signal to noise

ratio whereas the channel CARRIER FAIL lamp is illuminated only whenever a channel is taken out of service due to a low power condition. This distinction simplifies the determination of the cause of a trouble condition.

Alarm conditions do affect the interface operation of the derived data channels. Major alarms caused by high power or a poor signal to noise ratio affect all of the derived channels in a system. A major or a minor alarm due to low power affects only those channels associated with the alarm condition. An alarm causes the following action to take place in each affected channel.

1. The CF circuit, where provided, turns OFF.
2. The BB circuit is clamped marking or spacing, depending on the option chosen.
3. Optionally, for the EIA interface, circuit CC can be clamped in the OFF condition.
4. Optionally, the output of the channel modulator can be squelched. (Should only be implemented at one end of the channel, generally the noncontrol end.)

If the alarm is due to a low signal power condition, the CARRIER FAIL lamp is lighted also.

In addition to the above interface and visual indications, one set of contact for each type of alarm, major and minor, is made accessible to the customer at a screw terminal strip. These transfer contacts are early-break-make (i.e., they break before they make) and have maximum current capacity of 500 milliamperes (DC or AC rms) and an open circuit voltage limit of 50 volts (DC or AC rms). Figure 9 illustrates the logical configuration of these contacts. (In the nonalarm state, continuity exists between terminals 4 and 5 and between terminals 1 and 3.) Consequently, additional visual or audible alarm indications can then be employed by the customer in a manner that best suits his needs. If remote alarms are wanted, consult the local Telephone Company. All alarms provided by the 1A Data Station equipment are of the nonlocking type.

7. MAINTENANCE CONSIDERATIONS

The use of general major and minor alarms, along with individual channel alarms (as explained above), should permit localizing a trouble to a cabinet and then to a particular system or channel in an orderly fashion for maintenance purposes. In addition to these alarms, certain other features and capabilities have been incorporated into the design of 1A Data Station equipment to further facilitate fault location and maintenance of the service. These include a voiceband loop around, a baseband loop around per channel, and a channel check test set. Figures 6 and 8 illustrate the control switch and lamp panel provided on the data auxiliary sets for the 25- and 50-pin connector arrangements, respectively.

The voiceband loop around feature permits a check of the integrity of a 4-wire facility from the Telephone Company central office. Operation of the VOICE BAND LOOP AROUND switch on the data auxiliary set connects the send pair to the receive pair in a 4-wire facility, thereby enabling the serving central office to make both AC and DC loop-around continuity tests on the voice facility. This test feature will not permit loop-around testing between 1A Data Stations and therefore should only be operated at the request of the Telephone Company. Operation of this switch will take out of service all derived channels associated with the system.

Operation of the VOICE BAND LOOP AROUND switch disables the alarm features so that removal of the line from the 1A Data Station equipment will not cause a major alarm. However, the CARRIER FAIL lamp associated with each channel in the system is lighted. The interface leads of each channel will be clamped as described for alarms in Section 6 except that circuit CC will be OFF regardless of the related option chosen for the alarm condition. Since operation of the VOICE BAND LOOP AROUND switch is a test condition, the green TEST lamp on the top of the cabinet is lighted.

The baseband loop around feature permits end-to-end testing of derived channels from one 1A Data Station location. Because the loop-back takes place just prior to the interface, this

feature provides a thorough check of the derived channel equipment as data signals are sent and received. Operation of the appropriate switches for a baseband loop around test (1) causes the channel to electrically disengage from the customer's terminal equipment, (2) connects the received data lead to the send data lead at the baseband level for the loop back function, and (3) lights the TEST lamp to indicate that a switch is in an off-normal position. The customer at the far end of the channel can then send data and receive the same data looped back, thereby verifying whether or not the channel is capable of sustaining acceptable data transmission. Since the test circuitry is shared among the channels of a system, only one channel of a system can be tested at a given time.

For EIA interface channel terminals, the following conditions exist when the channel is in the baseband loop around mode.

a. Circuit BA is open-circuited and ignored.

b. Circuit BB is open-circuited or, optionally, is left alone so as to permit receipt of copy during the test mode.

c. Circuit CC is clamped OFF.

d. Circuit CF remains operational.

For 3-wire current-interface channel terminals, the following conditions exist when the channel is in a baseband loop around mode.

a. 20-mA of current is maintained in the send loop, if the send contact in the customer's equipment is closed, so that a local monitoring receiver in series with the send loop would receive marking current.

b. Circuit BB is open-circuited or, optionally, is left alone so as to permit receipt of copy during the test mode.

c. Circuit CF remains operational.

For 2-wire current interface channel terminals, the following conditions exist when the channel is in a baseband loop around mode.

a. 62.5/20-mA of current is maintained in the send/receive loop if the send contact in the customer's equipment is closed.

b. Circuit CF, where provided, remains operational.

A simple data transmission channel check test set has been incorporated into the design of the 1A Data Station multichannel equipment so that, in the case of an apparent channel failure, it will be possible for the user to determine if it is necessary to request that the Telephone Company dispatch a repairman to fix the equipment or if he should call in the service organization for the customer owned equipment. This can be a very important feature from the customer's viewpoint since Telephone Company testing and maintenance of 1A Data Station equipment will generally require release of the entire voiceband facility, thereby affecting other channels as well as the one in question. The channel check test set may also be used by Telephone Company personnel during the initial lineup of the channels. The following paragraphs briefly outline the salient features of the channel check test set and describe how it can be utilized by the customer to check out any one of the derived channels without interrupting the operation of the other channels.

In essence, the channel check test circuitry consists of a signal generator and a signal detector. The signal generator, by the use of bipolar signals, is capable of keying the channel modulators in a number of ways which may be selected by a switch located on the Data Auxiliary Set. The signal detector drives a meter that indicates the data transmission capability of the data channel.

By manual control at both ends of a 1A Data Station channel, the customer can verify that undistorted data can be transmitted and received within prescribed distortion limits. Operation of the appropriate switches provided at each end of the channel will cause an undistorted dotting (alternate mark and space signals) signal to be transmitted. At the distant end the channel check receiver will detect the dotting signal and will indicate via the meter the quality of the received signal. If the channel is in good alignment the meter reading will be in the green region. If, however, the received signal is sufficiently distorted, then the meter reading will be in the red region. This test can be performed independently in both directions, and can also

be used in conjunction with the baseband loop around at one station to permit a loop-around channel check to be made.

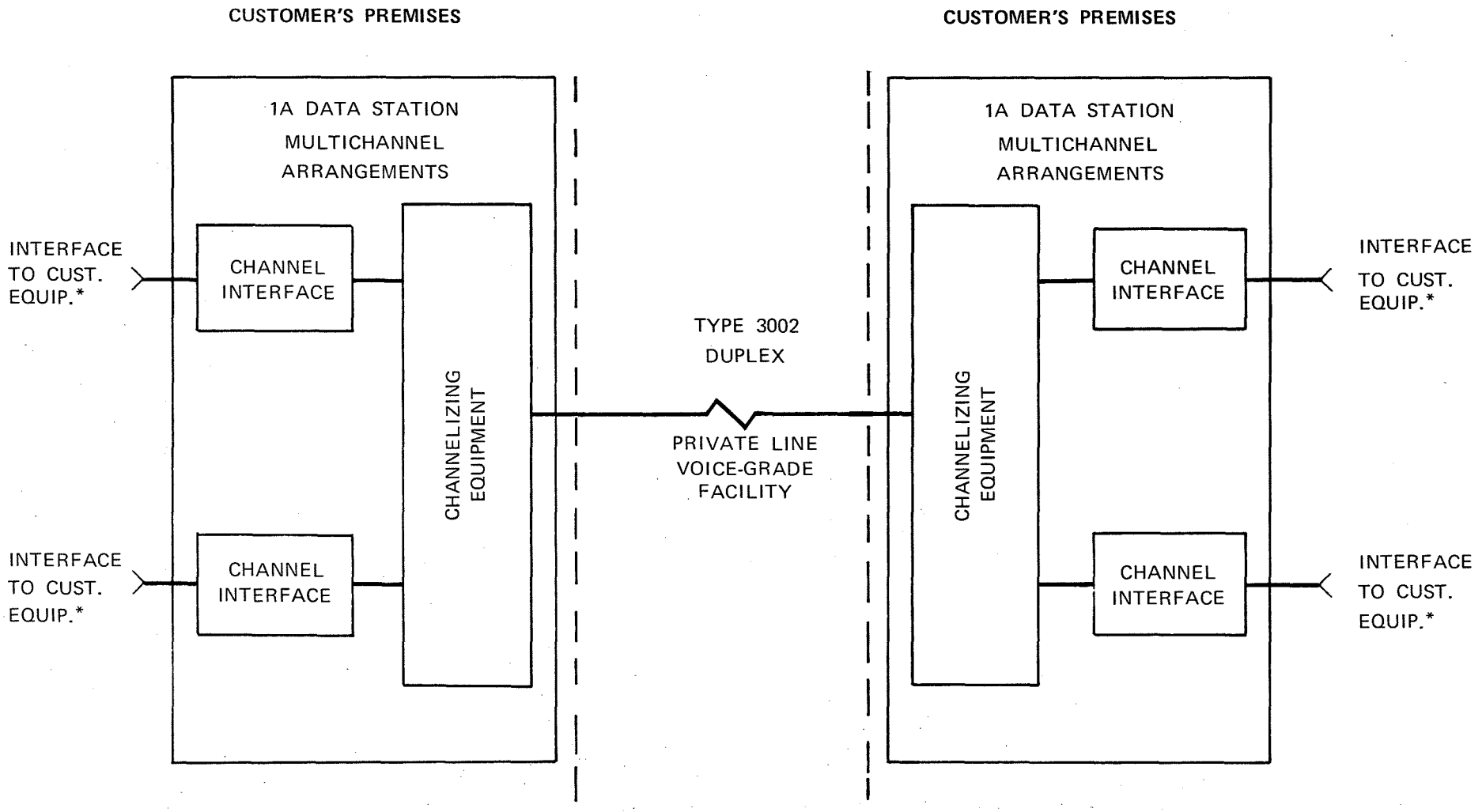
The measurement afforded by this test, while quite accurate (within ± 3 percent of the meter reading), should not be construed as a true measure of a channel's performance. The use of a dotting signal permits only a measure of the bias in the channel. Typically the characteristic distortion may raise this reading as much as 5 or 10 percent depending on the total amount of distortion from the customer's equipment at the input to the channel. Hence, the use of this test should be primarily to see if undistorted data can be transmitted and received without the meter reading entering the red region of the scale. The channel check circuitry is based upon measurements on a dotting signal and is not suitable for measuring the distortion of data signals generated by customer-provided equipment.

Additional switch positions are provided for use by Telephone Company personnel during the initial lineup procedures. Although these positions are accessible to the customer, it is not expected that he will utilize them in the course of checking out the operation of a derived channel.

8. SUMMARY OF OPTIONS

The following is a summary of the various options for each derived channel in a 2-point channelizing service. This summary does not include those options which will be determined by the Telephone Company (frequency assignments, transmit levels, etc.).

1. Channel capable of operating 0 to 75 Bauds or 0 to 150 Bauds.
2. Three types of interfaces to customers' data terminal.
   a. Voltage per EIA standard RS-232B.
   b. 20-mA neutral current (3-wire). Up to 75 bauds only.
   c. 62.5- or 20-mA neutral current (2-wire). Up to 75 bauds only.
3. Local copy or no local copy with half-duplex operation.
4. Copy or no copy in TEST.
5. For EIA interface channels, one of three options can be established for circuits CA and CB.
   a. CA connected to CB for customer terminals arranged to receive Clear-to-Send in response to Request-to-Send. (No delay within 1A Data Station equipment.)
   b. CB strapped to follow CC for customer terminals arranged to monitor CB, and not CC. Circuit CA is an open circuit.
   c. Circuit CA and Circuit CB are open circuits.
6. BB clamped mark hold or space hold when CF turns OFF.
7. CC clamped OFF when CF turns OFF.
8. Squelch outgoing carrier upon loss of incoming carrier. (Should only be implemented at one end of a channel, generally the noncontrol end.)
9. An option is provided per system to connect circuit AA to circuit AB.



* INTERFACE OPTIONS AVAILABLE
- EIA
- 20-mA NEUTRAL CURRENT 3-WIRE
- 62.5/20-mA NEUTRAL CURRENT 2-WIRE

Figure 1 — Typical System Configuration for Two-Point Channelizing Service

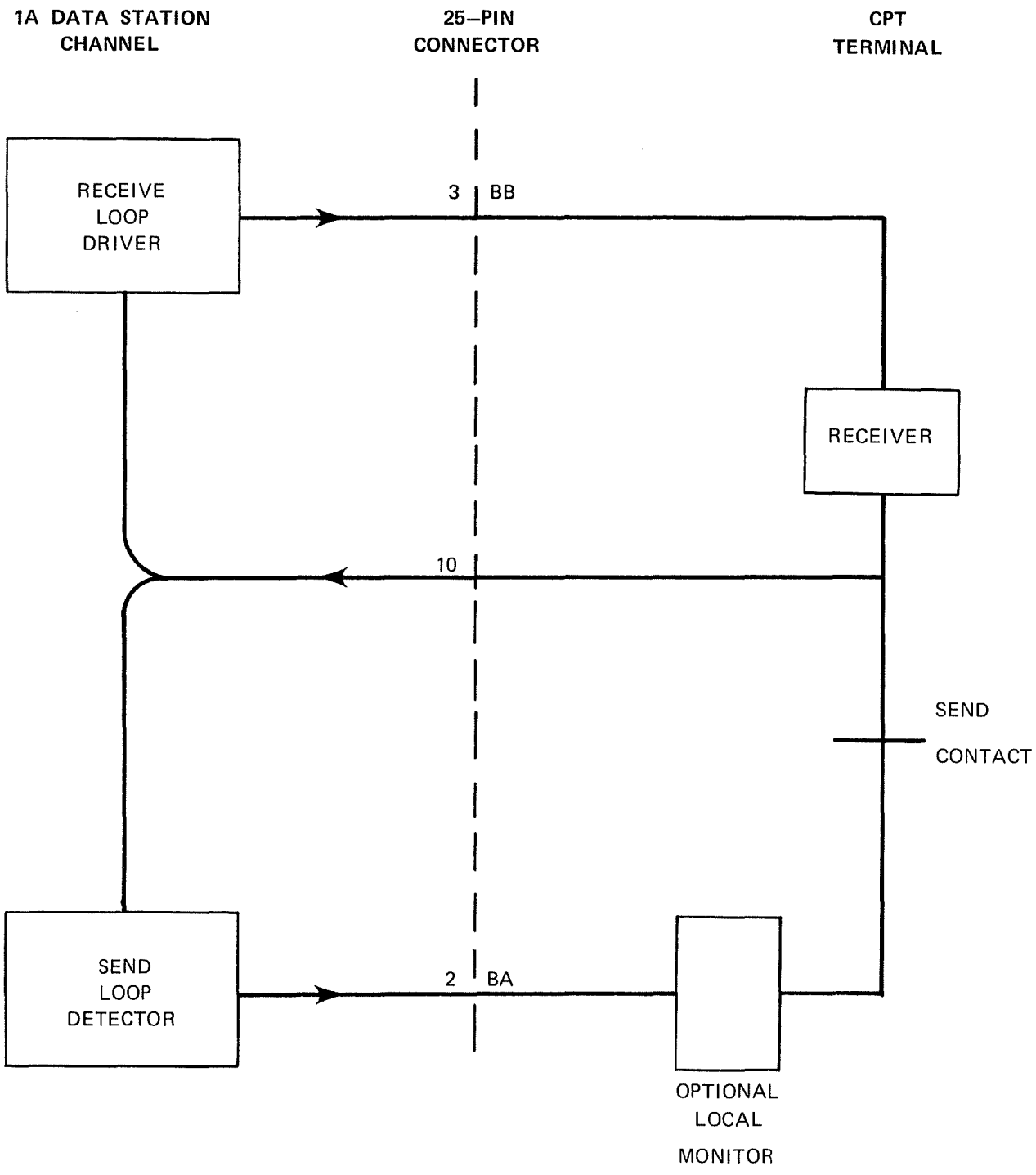


Figure 2 — 1A Data Station — Interconnection of Send and Receive Loops for 20-mA Neutral Current 3-Wire Interface

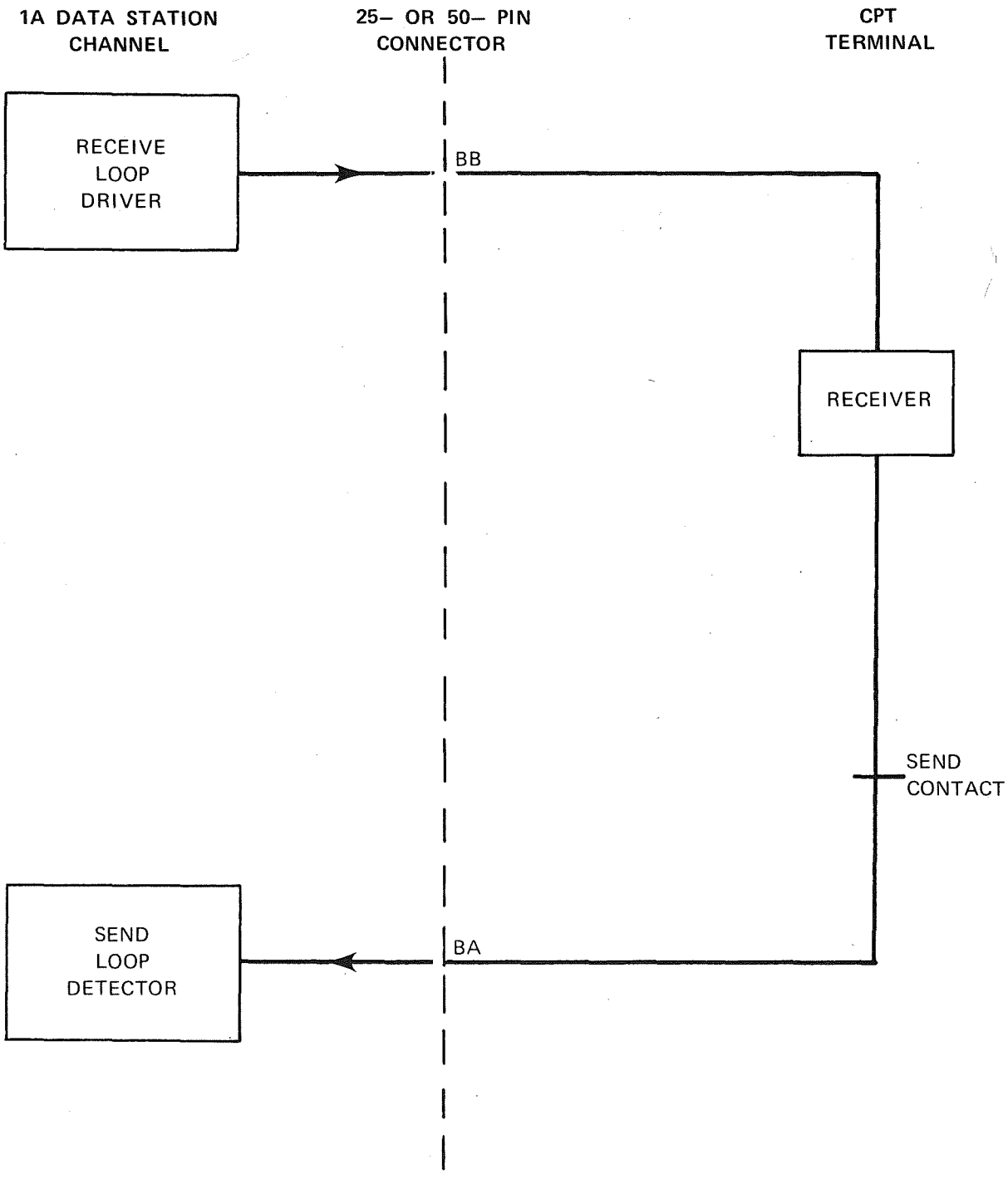


FIGURE 2A – 1A Data Station – Interconnection of Send and Receive Leads for 62.5-mA Neutral Current 2-Wire Interface

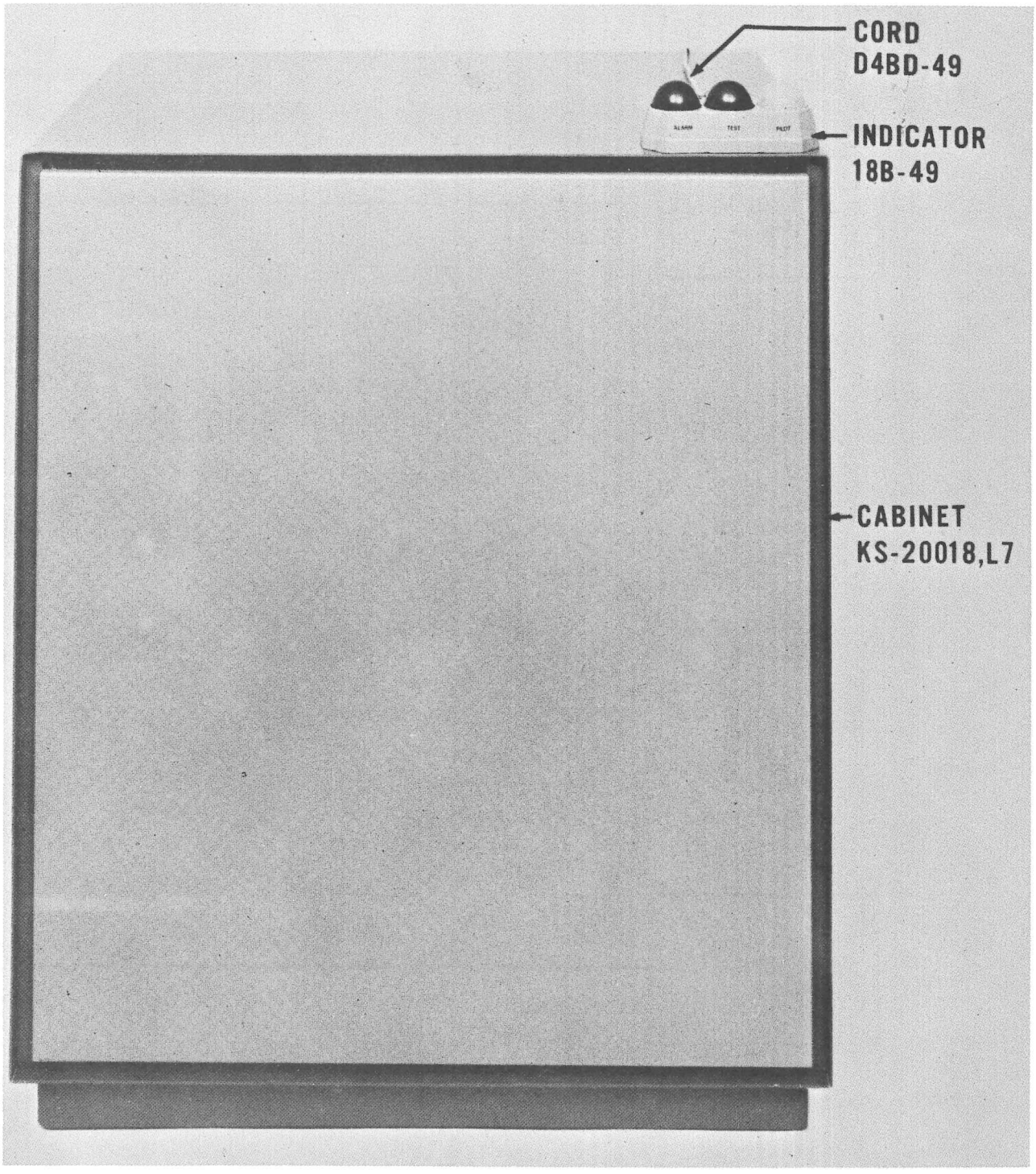


Figure 3 — 1A Data Station, Multichannel Arrangements — Small Cabinet Installation

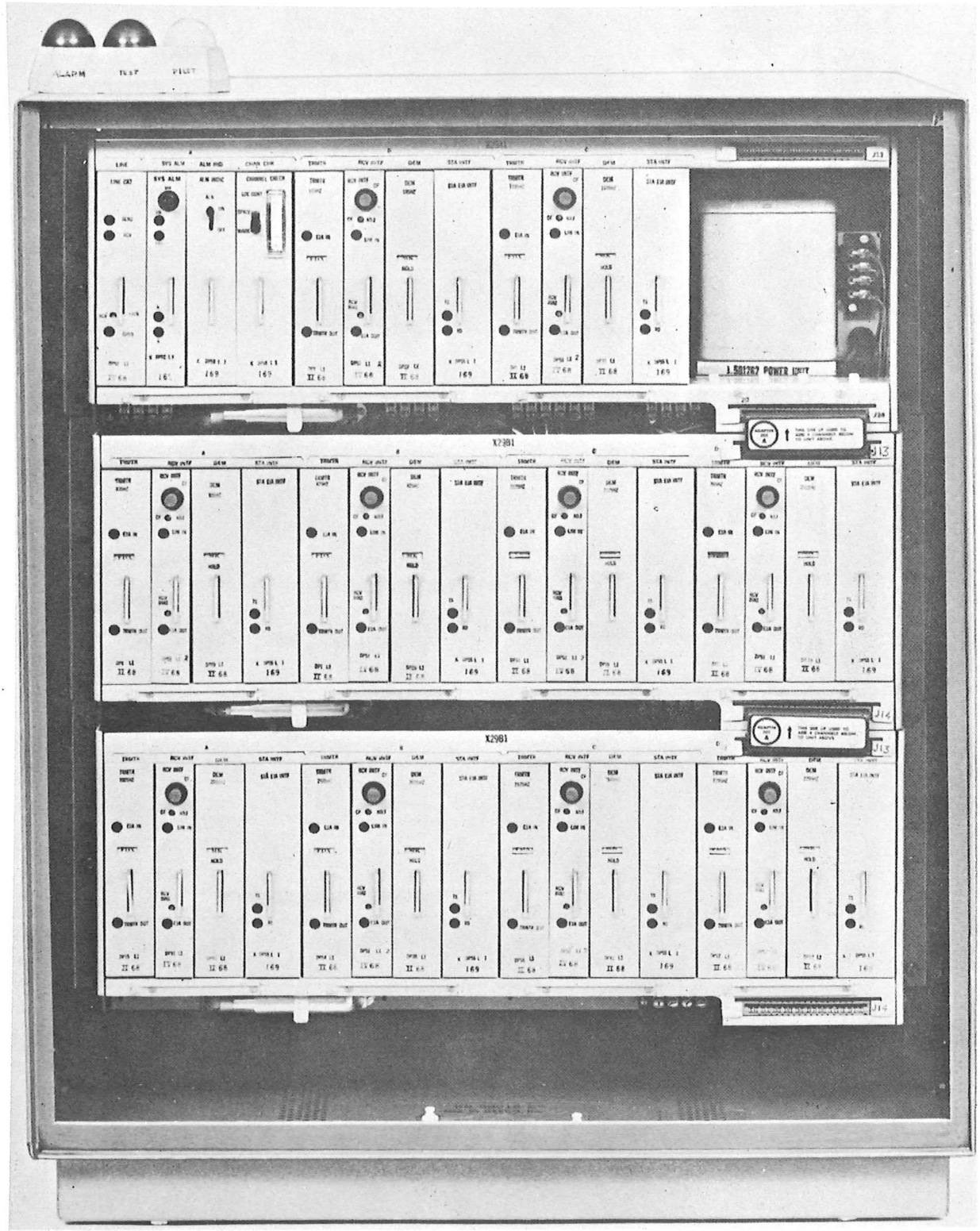


Figure 4 – 1A Data Station, Multichannel Arrangements – Channelizing Equipment Circuit Packs

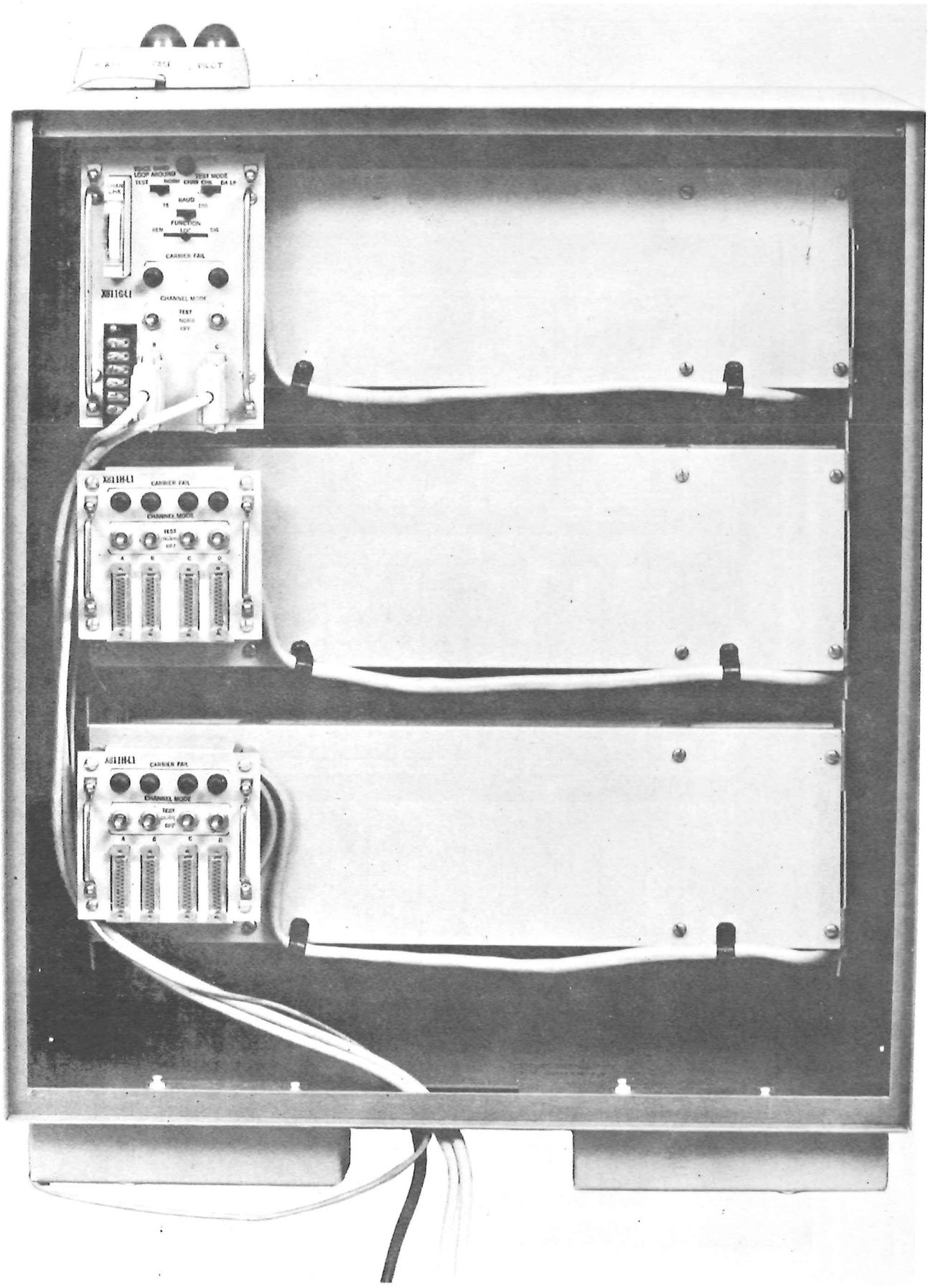


Figure 5 – 1A Data Station, Multichannel Arrangements –
Data Auxiliary Sets 811G & 811H

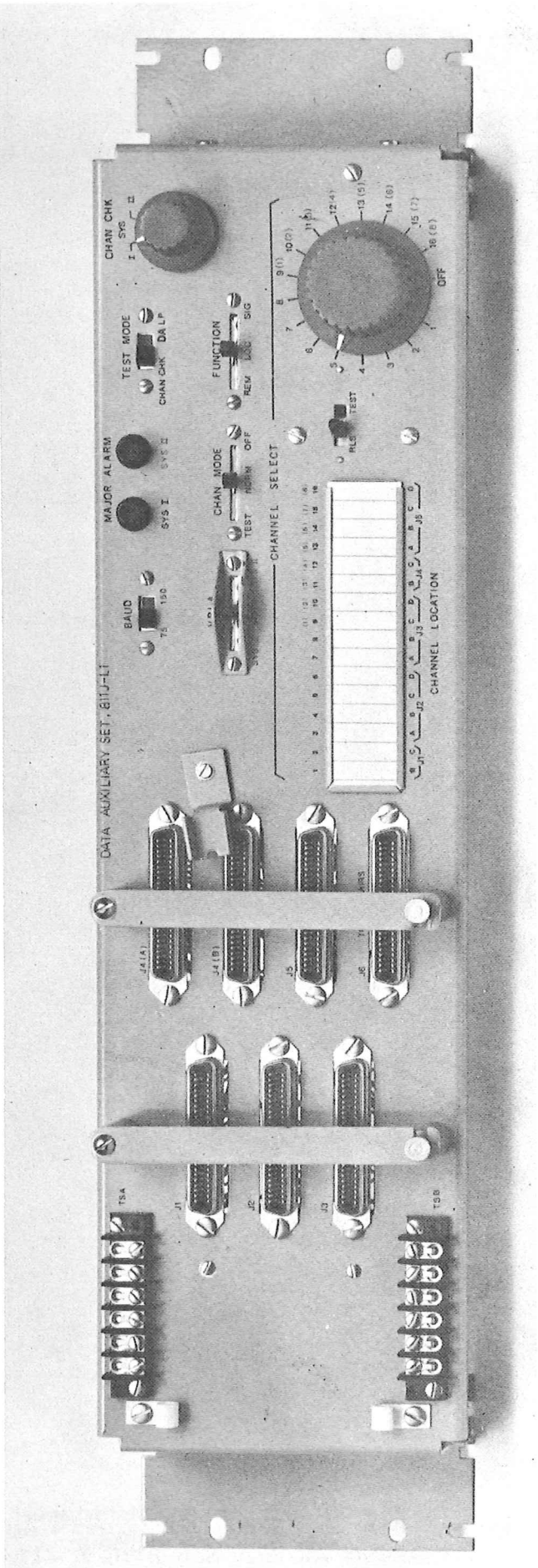


Figure 6 – Data Auxiliary Set 811J

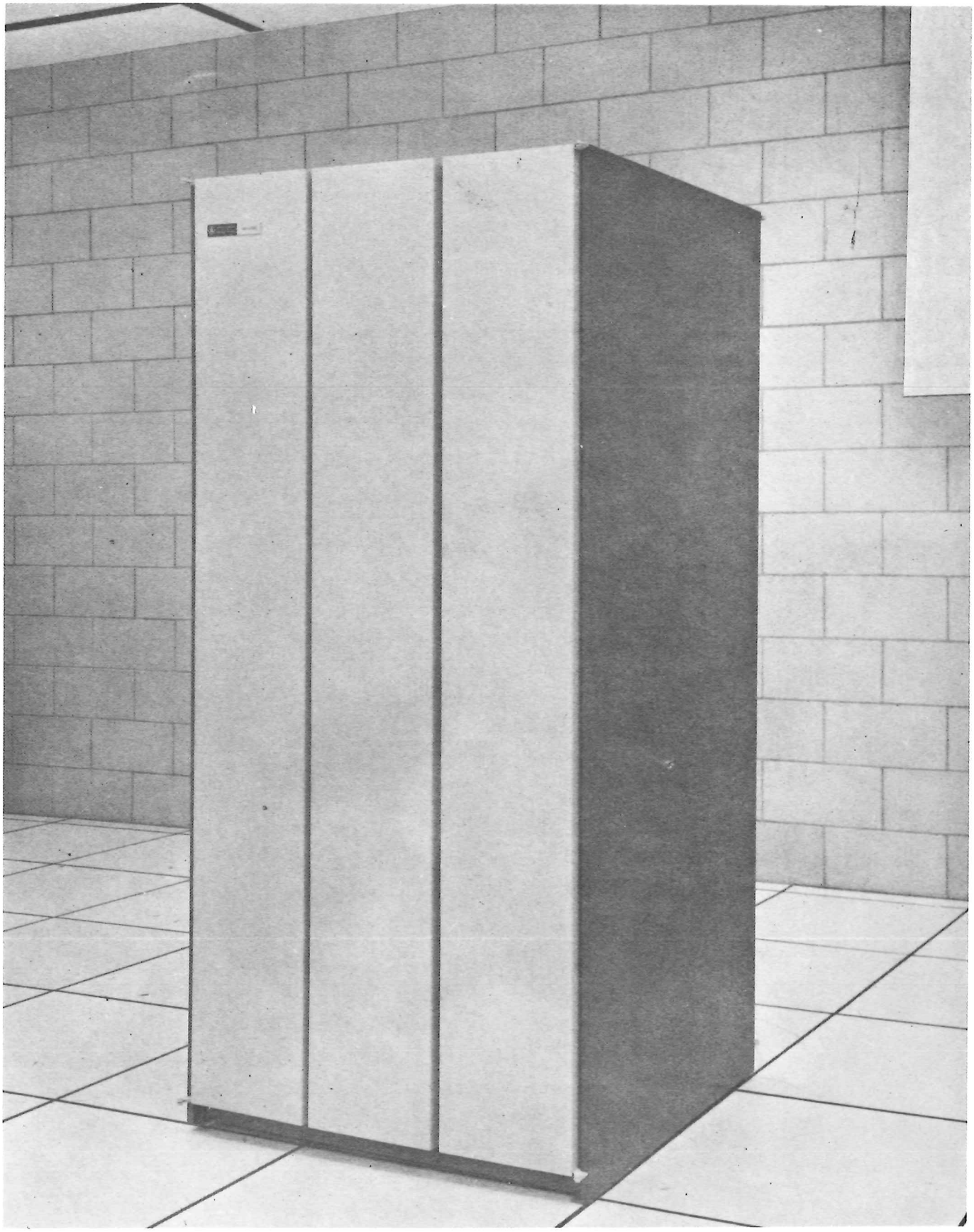


Figure 7 – 1A Data Station, Multichannel Arrangements – Large Cabinet Installation

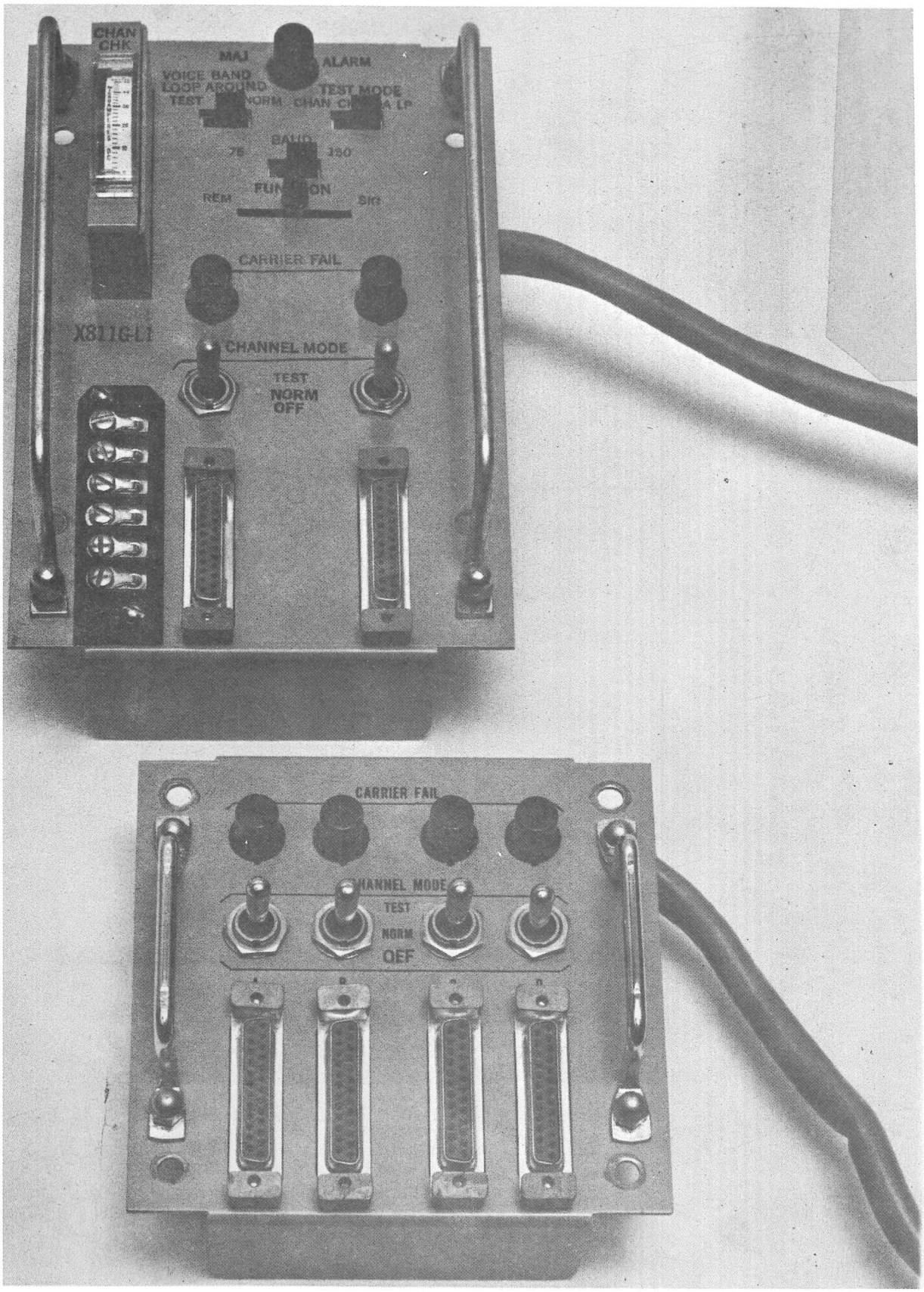


Figure 8 – Control Area of Data Auxiliary Sets 811G & 811H

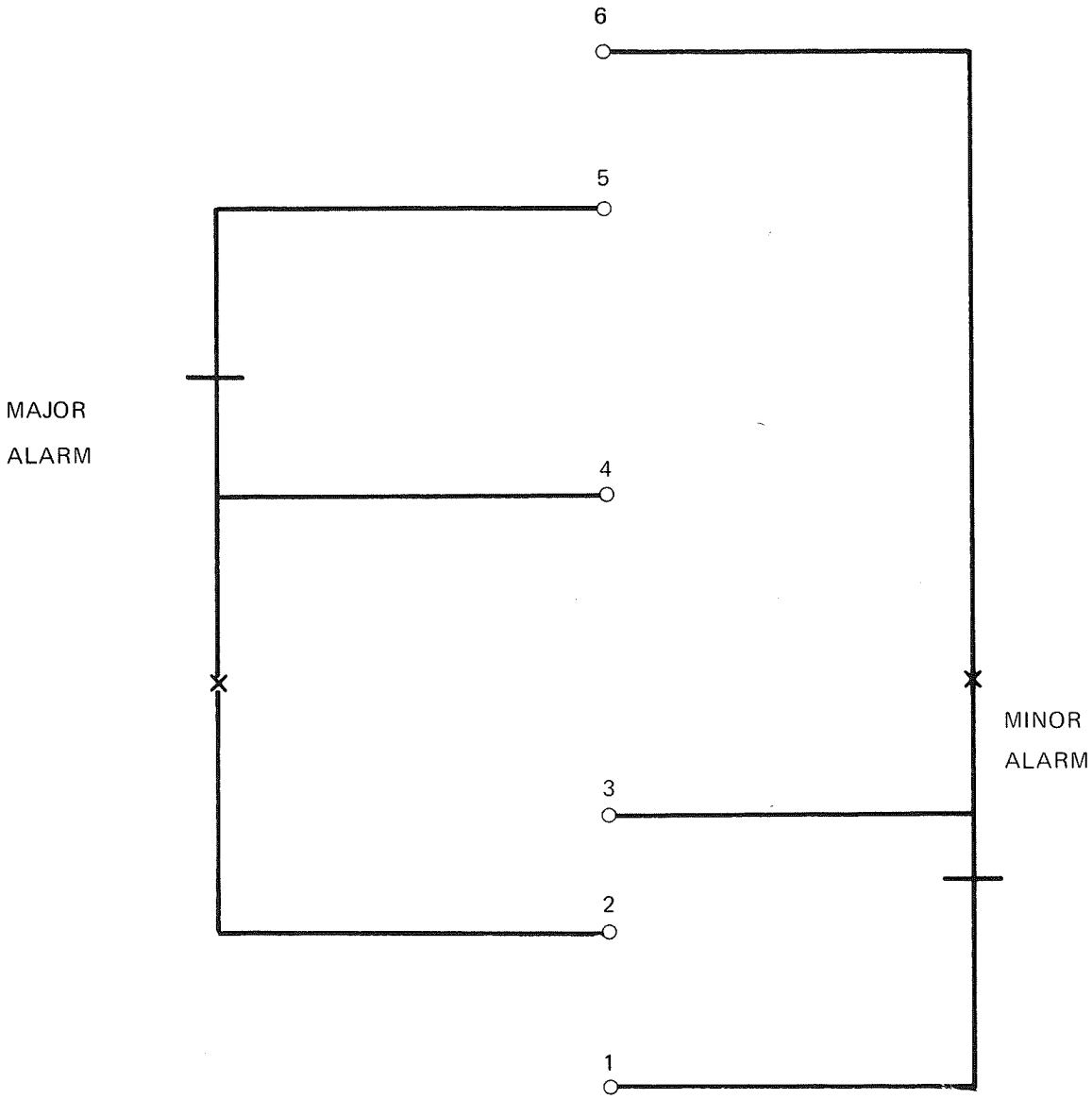


Figure 9 – Logical Configuration of Major and Minor Alarm Contacts on Terminal Strip on Data Auxiliary Set 811G.