

**ATTACHMENT 1
SECTION 312-110-904 LL**

**Bell System Data Communications
TECHNICAL REFERENCE**

**150 Baud Private Line Channels
Interface Specification**

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ENGINEERING DIRECTOR - DATA COMMUNICATIONS



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150 BAUD PRIVATE LINE CHANNELS

Interface Specification

Preliminary

1. DESCRIPTION

1.1 General

1.11 The purpose of this specification is to define the interface of the 150 Baud Private Line Channel as presented to customer-provided terminals (CPT).

150 Baud Service is different in nature than familiar voiceband private line and DDD networks. It (150 Baud Service) will consist of AC or DC terminal links interconnected by networks of narrow band tandem link transmission facilities. These private line channels are half or full duplex and will carry serial binary data at signalling speeds up to 150 bauds. There will be no overall end-to-end supervision (knowledge of circuit continuity) and the interface to business machines will be EIA Standard RS-232B type. The send and receive data leads of this interface will be compatible with existing private line services although the supervisory leads may not function exactly the same. The meaning of this is clarified in detail in the lead-by-lead description of the interface that follows.

Although the type of local loop facilities and equipment arrangement provided by the Telephone Company will be subject to local conditions, the interface to the CPT will perform in essentially the same manner.

1.2 Physical

1.21 One basic transmission equipment arrangement consists of Data Set 108- or 109-type together with a suitable control device such as the 820 D1 Data Auxiliary Set for single station arrangements or an 820E DAS for multiple set arrangements.

An 820 D Data Auxiliary Set is required with each Data Set 108- or 109-type for private line service at single station installations. The 820 D1 provides the housing, power, and interface connector for the data set and performs additional operating functions as described in paragraph 2.21. Figure 4 is a photograph of this unit. For multiple data set installations, the above functions are performed in an 820E DAS, illustrated in Figure 6, which may be mounted in either a relay rack or a multiple data set cabinet as shown in Figure 7.

Two basic transmission systems are used with these first arrangements; one system uses a-c transmission and the other low

current d-c transmission. The a-c system (Data Set 108-type) will permit half-duplex (HDX) and full-duplex (FDX) operation over-all loop lengths whereas the d-c system (Data Set 109-type) is designed for HDX operation for those stations normally within the local exchange area of a hubbing office or for short-haul station-to-station circuits (maximum loop of 2000 ohms and 1.0 uf).

1.22 A second basic transmission equipment arrangement is interim in nature and consists of an 816-type Data Auxiliary Set plus a 130-type teletypewriter subscriber set arranged for 150 baud channel use. The 816 Data Auxiliary Set acts to convert the signals of the 130-type TTY subscriber set to the signals specified by EIA Specification RS-232B. In addition to conversion of the send and receive data signals, the 816 units provide the other control signals required for operation with the CPT's. The 816 units may be operated on a half-duplex or on a full-duplex basis.

The 816 Data Auxiliary Set is packaged either in an 816A single unit housing (see Figure 4) or in an 816B multiple unit housing for up to 10 units (see Figure 5), depending on the number of 150 baud channel terminations provided.

1.23 The general term "PL data set" will be used in this document hereafter to designate all of the complete transmission equipment arrangements described in paragraphs 1.21 and 1.22.

1.3 Power Requirements

1.31 The customer must provide a receptacle supplying continuous 115 volt, 60 Hz a-c power. The regulated power supplies provided in the PL data set will work properly over a frequency deviation of ± 0.45 Hz and a voltage range of 105 to 129 volts. The PL data set is equipped with a demountable, 10-foot long gray cord equipped with a U- bladeground type plug. The power receptacle provided must accept such a plug and supply a valid ground to the ground pin. It is preferred to have this ground the same as the one used by the CPT.

The power consumption of either the 108-type or 109-type data set equipment arrangements will be less than 15 watts. The 130-type subset + 816 Data Auxiliary Set arrangement draws about 70 watts.

1.4 Environment

1.41 The PL data set will operate properly over an ambient room temperature range of 40° to 120° F and over a relative humidity range of 20 per cent to 95 per cent.

2. INTERFACE - ELECTRICAL

2.1 General

2.1.1 Interface Connector

The CPT equipment should be equipped with a cable terminating in a Cinch or Cannon DB-19604-432 plug mounted in a Cinch DB-51226-1 hood assembly.

Normally the cable should not exceed 50 feet in length.

A detailed discussion of the characteristics of the interface connector is found in:

Bell System Data Communications
Technical Reference
Data Set
Interface Connectors

which is available from

Engineering Director - Data Communications
American Telephone and Telegraph Company
195 Broadway
New York, New York 10007

2.1.2 Pin Assignments in the interface connector are shown in Table A and in Figure 3.

Table A

ALLOCATION OF PINS AT THE CUSTOMER INTERFACE

<u>Pin Number</u>	<u>Circuit</u>	<u>Description</u>
1	AA	Protective Ground
2	BA	Transmitted Data
3	BB	Receive 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	(Telephone Co. use only)	Data Set Test (+P)
10	(Telephone Co. use only)	Data Set Test (-P)
12	CX	Local Mode (Note 1)
11, 13 to 25	Not used in this application	

Note 1: Not used in the 130 Subset + 816 DAS arrangement.

2.2 PL Data Set - EIA Interface

2.21 General

All interface circuits between a CPT and the PL data set (Figure 3) should be designed to meet the EIA Standard RS-232B.

2.22 Functional Description

A description of the required operation of the interchange leads and the signals appearing on each are as follows:

- Pin 1) AA - Protective Ground: Electrically bonded to the machine or equipment frame and a-c power service ground.
- Pin 2) BA - Transmitted Data: The BA circuit is designed to accept serial data from the CPT. The PL data set sends a marking signal to the line facility when the EIA connector is removed or when the CPT power is OFF.
- Pin 3) BB - Received Data: The BB circuit is designed to deliver serial binary data to the CPT.
- Pin 4) CA - Request to Send: The CA circuit is directly strapped to the Clear to Send (CB) circuit.
- Pin 5) CB - Clear to Send: The CB circuit is directly strapped to the Request to Send (CA) circuit.
- Pin 6) CC - Data Set Ready: The CC circuit presents an ON signal at all times except for the following conditions:
 - a) When the power to the PL data set is off.
 - b) When the PL data set is in either a test mode or local mode.
- Pin 7) AB - Signal Ground: Establishes the common reference potential for all interchange circuits except circuit AA.
- Pin 8) CF - Data Carrier Detector: The CF circuit delivers an ON signal to the CPT when the Data Set 108 or 130 Sub Set is receiving carrier or Data Set 109 is receiving line current and an OFF when received carrier is not detected by the Data Set 108 or 130 Sub Set or line current is not detected by the Data Set 109.
- Pin 12) CX - Local Mode: The PL data set is placed in the local mode as described below by an ON signal on the CX circuit.

The local mode will not be initiated from an open circuit condition caused when the CPT power is OFF or when the EIA connector is removed.

2.3 PL Data Set - Additional Functions

In addition to providing the above interfaces, the PL data set provides the functions described below.

2.31 Local Copy

When used for HDX service, the PL data set provides local copy on the BB circuit of data sent on the BA circuit. When receiving local copy, the PL data set passes received spacing signals (breaks) over the BB circuit to the CPT. There is an installer's option on the PL Data Sets to disable local copy if it is not desired.

2.32 Test Mode

2.321 As an aid in determining whether trouble is located in the local AC terminal link including the PL data set or in the CPT, a Test Mode is provided on the Data Set 108 and the 130 Subset arrangements. This mode permits checking both the send and receive transmission path from the serving test center on a loop-back basis. Since the Data Set 109 is a 2-wire half duplex d-c set, no loop-back test mode is available.

2.322 When the PL data set is placed in the test mode by operation of a key, it acts as follows. Where differences exist between the data set and 130 Subset arrangements, these are indicated.

1. Connects the BB circuit (Received Data) to the BA circuit (Transmitted Data) in the PL data set.
2. (a) Data Set 108 Arrangement - Opens BA circuit on the data set from the BA circuit of the CPT.
(b) 130 Subset Arrangement - Opens the BA circuit on the data set from the BA circuit of the CPT and in addition terminates BA toward the CPT in 3K ohms.
3. (a) Data Set 108 Arrangement - An installer's option is available to either hold a steady marking condition on BB or to allow data to be received on BB.
(b) 130 Subset Arrangement - A steady marking condition appears on BB.
4. Holds CA (Request to Send) open.
5. Holds CB and CC circuits (Clear to Send and Data Set Ready) OFF towards the CPT.
6. Lights the test lamp.

7. (a) Data Set 108 Arrangement - Disable local mode if operated.
(b) 130 Subset Arrangement - No action since no local mode available.
8. Disables HDX local copy option.
9. (a) 108 Data Set Arrangement - Permits loss of received carrier to squelch transmitted carrier.
(b) 130 Sub Set Arrangement - CF (Data Carrier Detector) circuit held on.

A second operation of the test mode key releases the PL data set from this mode.

A test lamp is provided on the PL data set to indicate when the PL data set is in the test mode as initiated by the above method. An arrangement is provided to allow the use of an external indicator lamp as an installer's option when the PL data set is not in view of the attendant.

2.33 Local Mode

In order to permit the CPT to be tested through the EIA interface interconnection on a local basis, the 108 and 109 PL data set arrangements provide a local mode of operation. This test feature is activated by an ON signal on the CX circuit (Local Mode) except when the PL data set is in the test mode. When activated, the local mode circuit acts as follows:

- 1) Delivers local copy of data placed on the BA circuit to the BB circuit.
- 2) Clamps the transmitted data lead marking to the line.
- 3) Opens the received data path of the data set to the BB circuit.
- 4) Holds the CC circuit OFF toward the CPT.

The local mode is released by an OFF signal on the CX circuit.

2.34 Received Carrier Detector Option

An installer's option is provided in the 108 PL data set arrangement which will allow an OFF on the Carrier Detector lead to squelch outgoing carrier over the Send Carrier Control lead. This arrangement can be used to notify the test center that the station has lost carrier. In the Test Mode, this action is always provided.

3. TRANSMISSION CHARACTERISTICS OF CHANNEL

3.1 Distortion

3.1.1 Definition - Telegraph Distortion

Each start-stop data character is composed of several elements; a single unit start element which is always a space, 5, 6 or 7 single unit information elements and sometimes a single unit parity element which may be mark or space, and a stop element which is always a mark and is one unit or longer in length. A typical 8-level character is illustrated in Figure 1, for example purposes.

Telegraph distortion is the measure of the displacement of any mark-to-space or space-to-mark transition from its proper location. The reference point used when measuring telegraph distortion is the initial mark-to-space transition of each character which occurs at the beginning of each start element. The slicing level for all measurements is at about the 50% point on the rising and falling waveforms.

Referring to Figures 1 and 2, transitions measured at the slicing level should occur at integral multiples of t_e from the start transition for no distortion. If a transition occurs at a time Δt earlier or later than this time, the distortion is:

$$\text{Per Cent Distortion} = \frac{\Delta t \times 100}{t_e}$$

For example, refer to Figure 2 and let us examine the distortion of information element No. 3 which is in the space condition. Assume the nominal element length $t_e = 10$ milliseconds and that $\Delta t_2 = 1$ millisecond and that $\Delta t_3 = 2$ milliseconds.

$$\begin{aligned} \text{Peak Distortion} &= \frac{\Delta t \text{ max.}}{t_e} \times 100 = \frac{2}{10} \times 100 = 20\% \\ \text{Per Character} & \end{aligned}$$

Thus, although the element is 30 per cent shorter than its nominal length, its telegraph distortion, as defined, is 20 per cent.

3.1.2 Distortion Objectives at Interface

The long term objectives of 150 Baud Service will be met if the CPT delivers no more than 5% telegraph distortion to the PL data set and if the CPT is capable of processing received signals with up to 40% telegraph distortion. CPT's that do not meet these performance objectives must be handled by special engineering. It is expected that as the state of the art improves, future objectives may be changed to 3 and 45%, respectively.

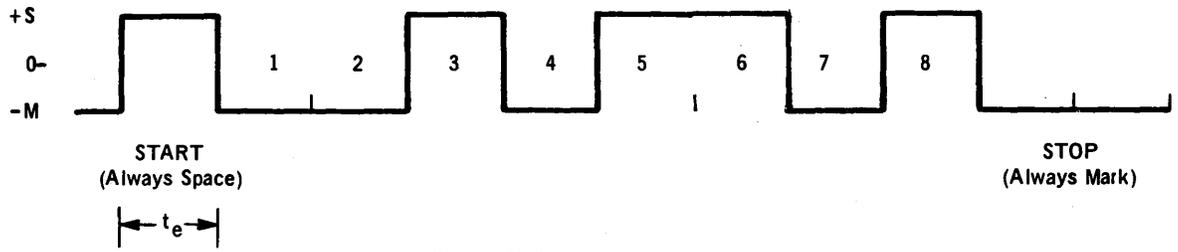
3.2 Turn-around Time

3.21 Near-end Turn-around

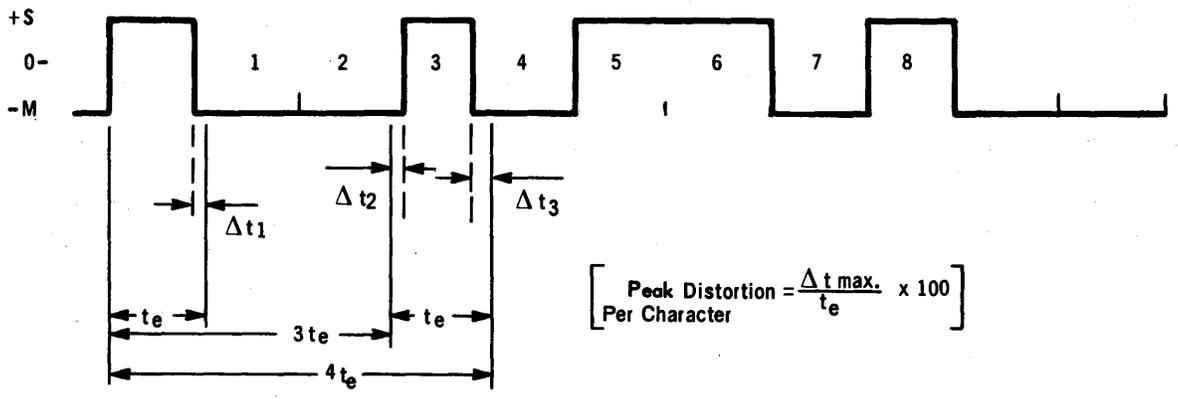
The local turn-around time of the circuit is essentially zero. However, the CPT should not turn around until the receipt of the entire stop pulse of the last character.

3.22 Far-end Turn-around

Far-end turn-around time is a function of the complexity and length of the circuit, including the number of modems and regenerative repeaters required. An allowance of 500 milliseconds round trip transmission delay should suffice for most circuits. However, if turn-around time is critical to the CPT operating procedure, it is recommended that the specific case be discussed with the Telephone Company.



Typical Undistorted Eight Level
Telegraph Start-Stop Signal
Figure 1



$$\left[\text{Peak Distortion} = \frac{\Delta t \text{ max.}}{t_e} \times 100 \right]$$

Per Character

Distorted Eight Level
Telegraph Start-Stop Signal
Figure 2

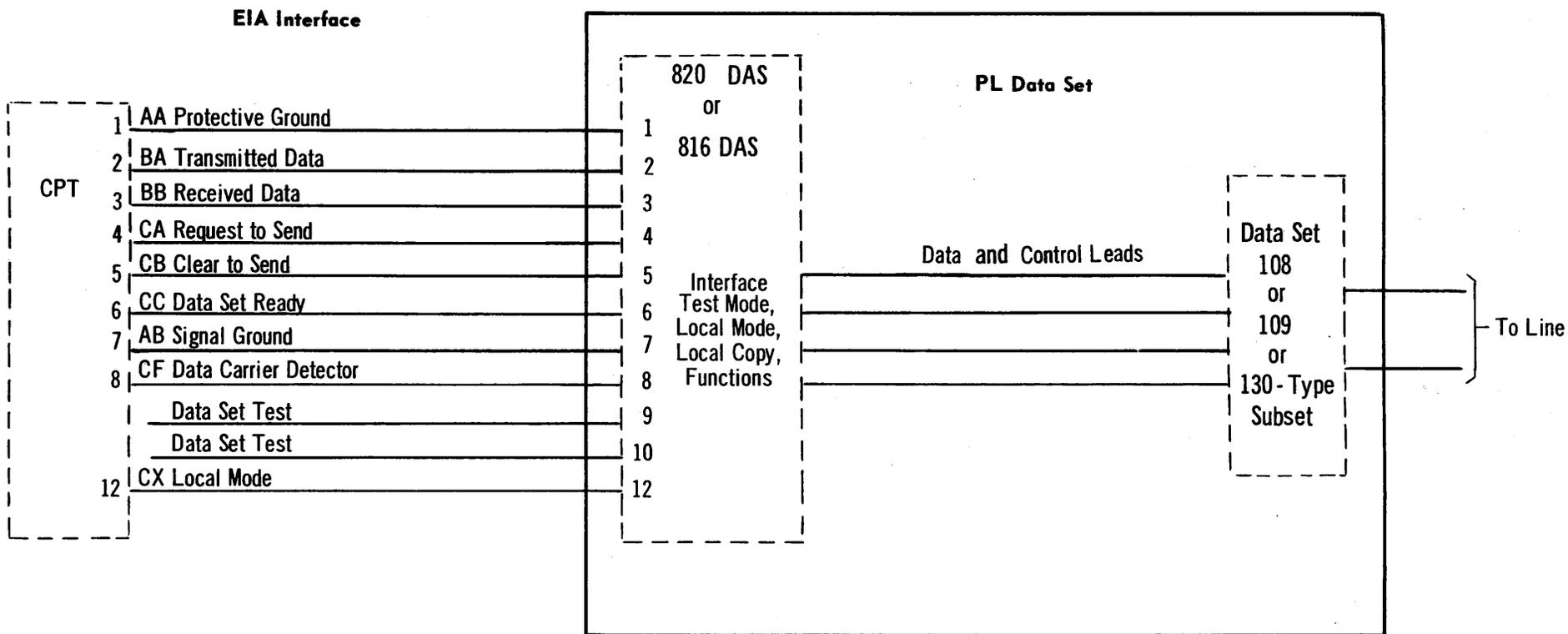


FIGURE 3
PL DATA SET INTERFACE

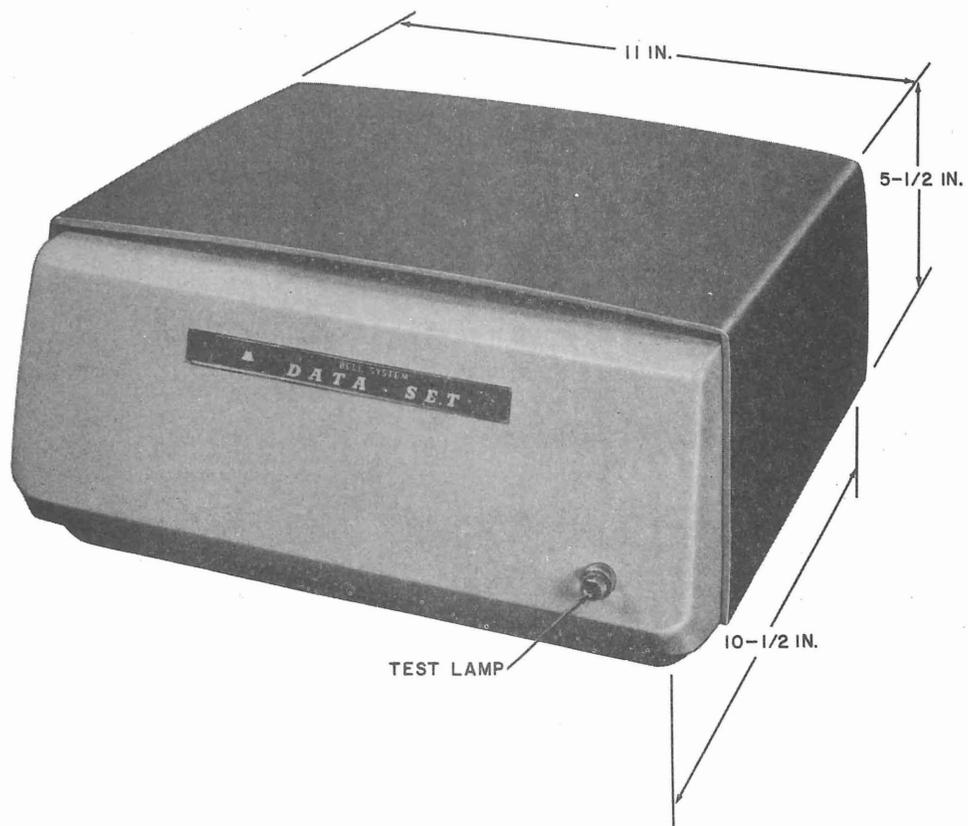


FIGURE 4
816A DATA AUXILIARY SET
(Normally Mounted Vertically)
or
DATA SET 108 - Type
with 820D DAS
or
DATA SET 109 - Type
with 820D DAS

Data System – 816B Data Aux. Set
Mtd. in KS-19643 Cabinet
Front View
(19" Deep)

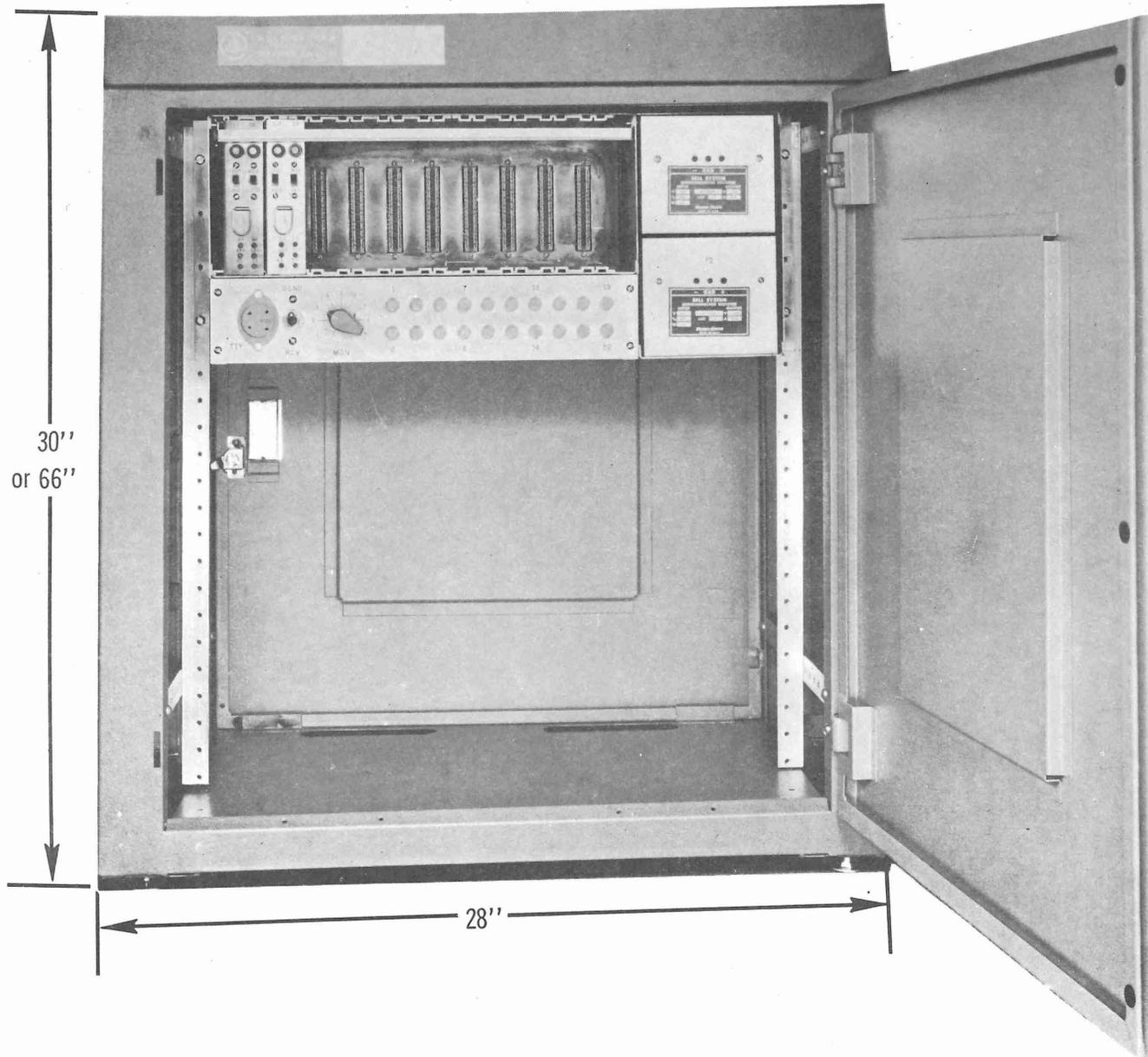


FIGURE 5a

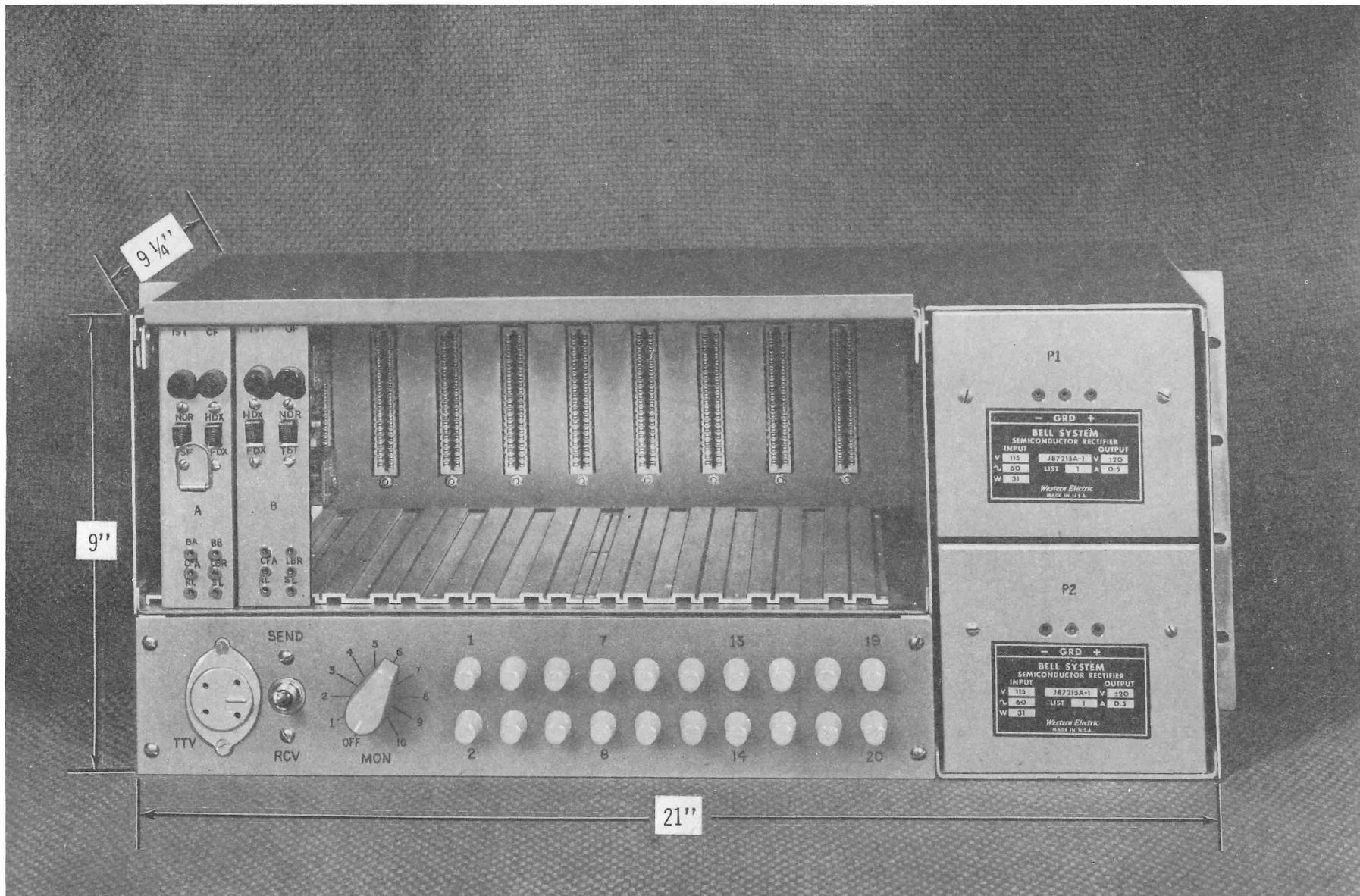


FIGURE 5b
816B Data Aux. Set — Front View —
2 Units Inserted in Set

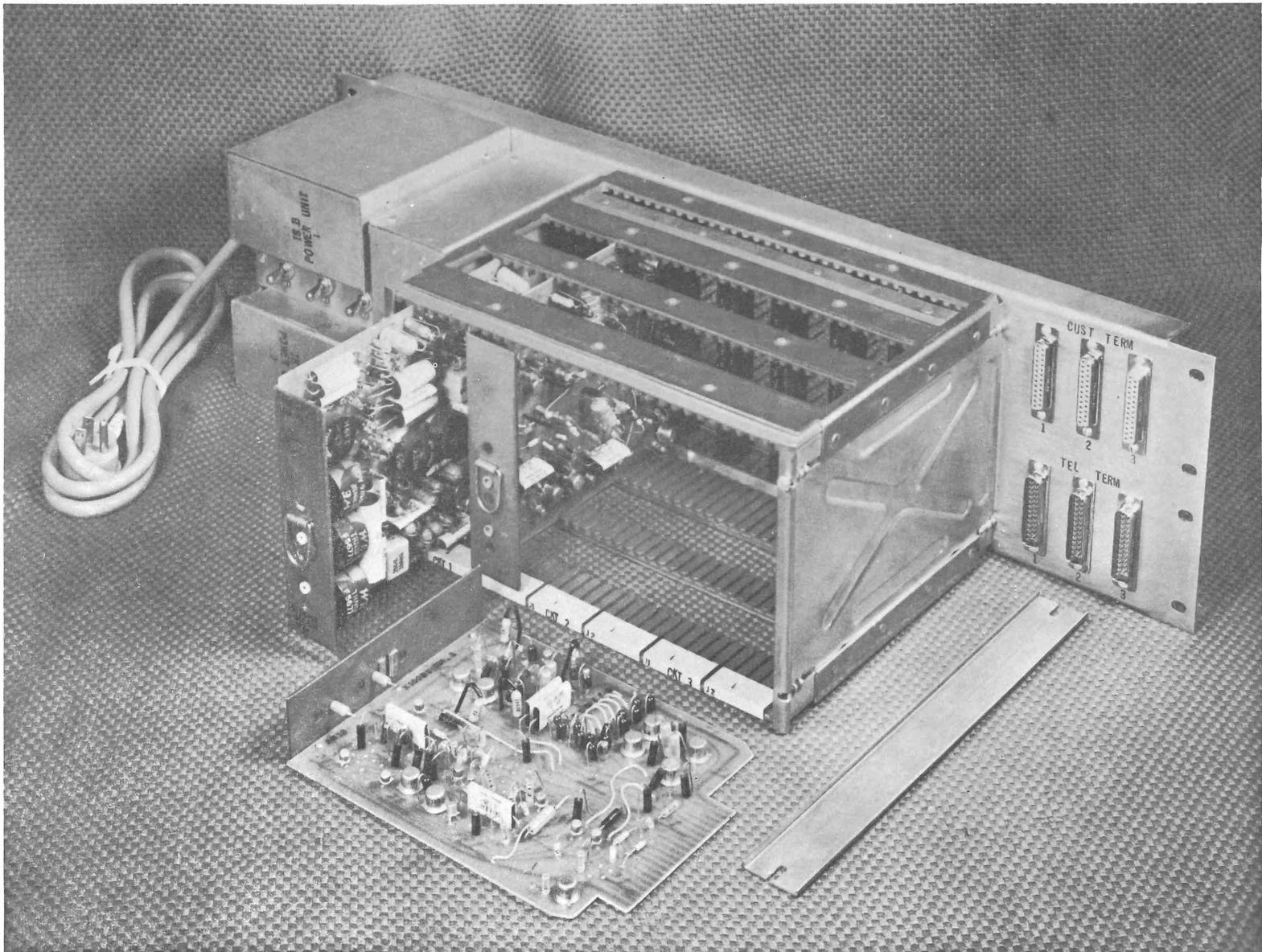


FIGURE 6

820E Data Aux. Set. – Front View

1 – 108 Data Set & Interface Card Installed in Set

1 – 109 Data Set displayed in front

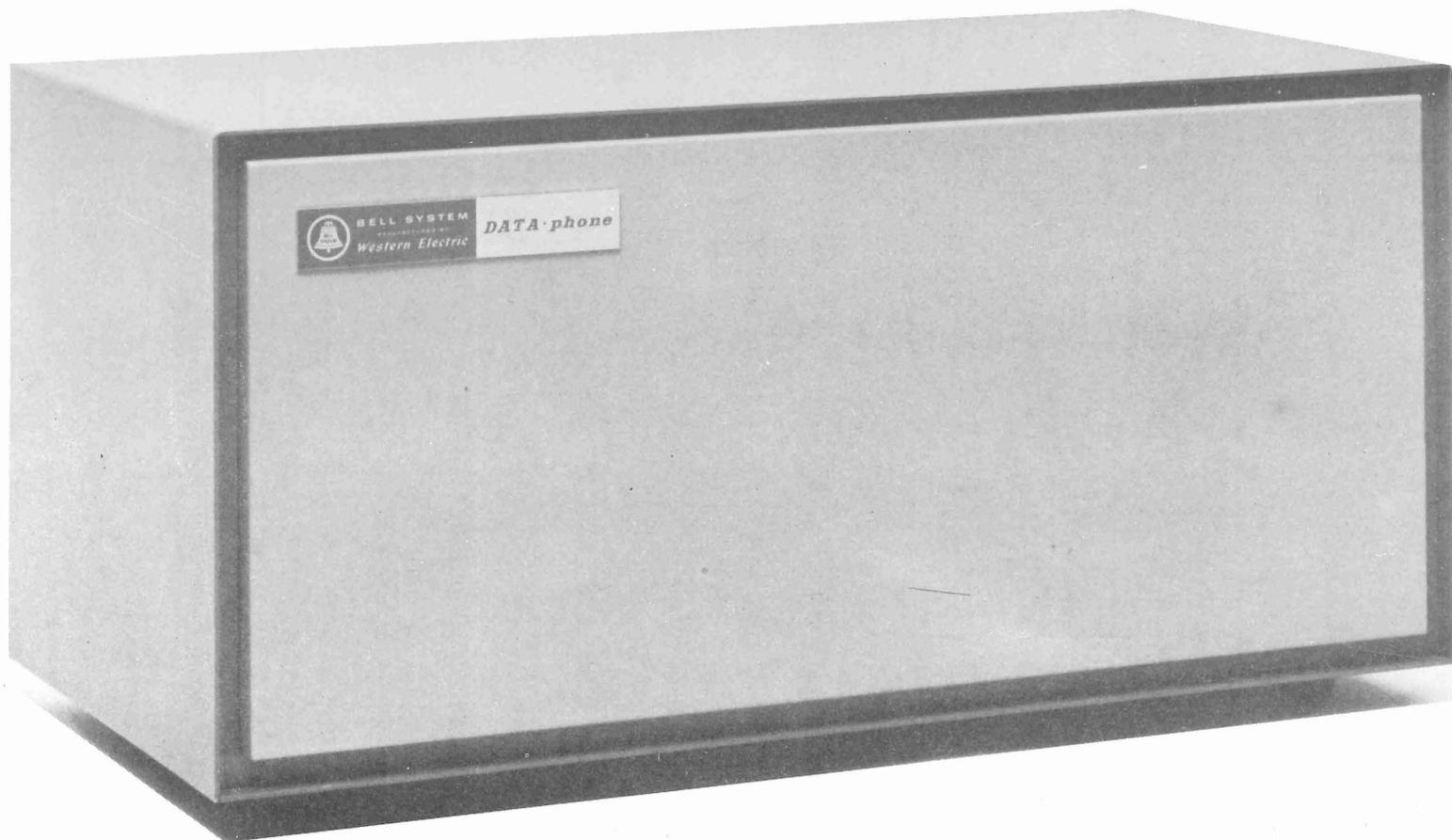


FIGURE 7A

Multiple Data Set Cabinet (KS 20018, List 1)

Contains 1-820E Data Aux. Set
(Similar Cabinets Available for
2, 3 or 4 - 820E Data Aux. Sets)

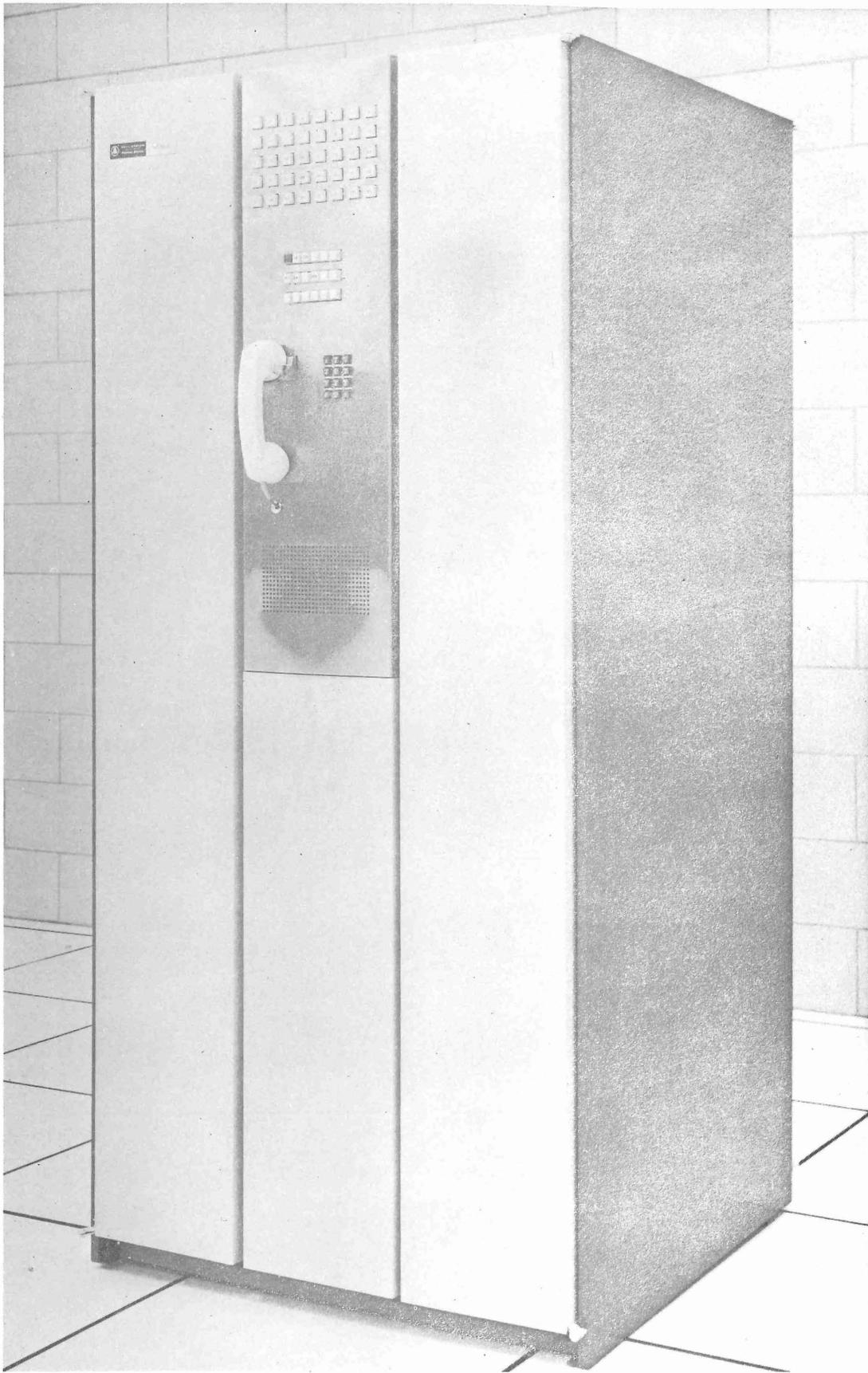


FIGURE 7B

Multiple Data Set Cabinet (KS 20093)

Contains Up to 16-820E Data Aux. Sets