PRIVATE LINE DATA SETS 2024, 2048, AND 2096

DESCRIPTION AND OPERATION

STAND ALONE—MULTIPLE

"DATAPHONE®" II SERVICE

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1. GENERAL

1.01   This section contains the physical and functional description and operating procedure for DATAPHONE® II service data sets (DSs) 2024A, 2048A, 2048C, and 2096A (Fig. 1).

1.02   Whenever this section is reissued, the reason for reissue will be contained in this paragraph.

1.03   The DATAPHONE II service private line data sets may be used with the following auxiliary apparatus or diagnostic equipment:

• Data auxiliary set (DAS) 829-type to provide a standard termination and switched network backup for 4-wire private lines with data only or alternate data/voice.

• 2100A-L1 data control unit (DCU) diagnostic console (DC) used as part of the network diagnostic system (NDS).

• 2200A-L1 DCU network controller (NC) used as part of the NDS.
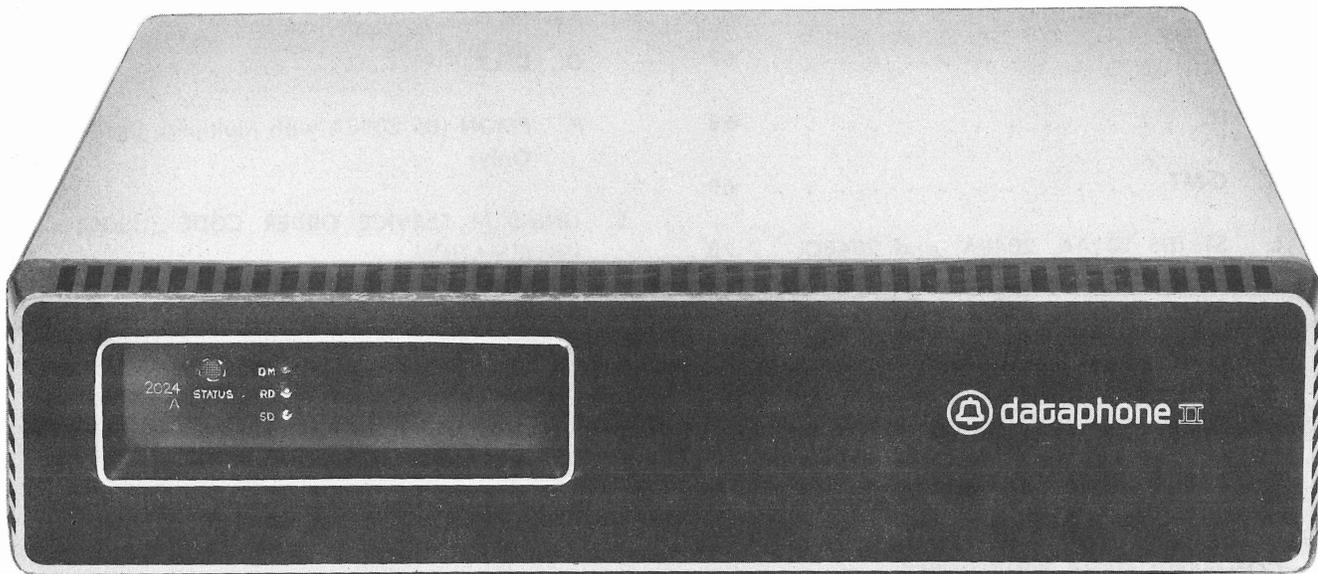
Fig. 1—Example of DATAPHONE II Service Data Set (Stand Alone)

1.04 The following is a technical specification summary of elements common to all DATAPHONE II service private line data sets:

Customer Interface Voltages: Per Electronic Industries Association (EIA) interface specification RS-449 and electrical characteristic specification RS-423

Control Channel Interface Voltages: Per EIA electrical characteristic specification RS-423

Diagnostic Channel Interface Voltages: Per EIA electrical characteristic specification RS-423

Output Power Level: 0 dBm (±1 dB)

Input Level: -16 ±7 dBm

Line Impedance: 600 ohms

Transmitter Timing: Internal or external

Operating Mode: Duplex

Power Requirements: 105 to 129 volts, 80 watts maximum, at 57 to 63 Hz

Ambient Temperature Range: +40 to +120°F

Relative Humidity Range: 5 to 95 percent, noncondensing

Data Terminal Equipment (DTE): Must be equipped with an interface cord terminated with a plug meeting the requirements of EIA standard RS-449. If the plug is a 25-pin RS-232C interface connector a KS-21253, L7 adapter will be required.

DS 2024A

1.05 Data set 2024A is a synchronous, serial, binary transmitter-receiver that operates over 4-wire telephone facilities. Data set 2024A is designed for private line service only. A similar data set (designated DS 2024B) is designed for use over switched-network facilities.

1.06 Data set 2024A is line signal compatible with DS 201B, 201C (private line versions), and other DS 2024A data sets.

1.07 The following is a technical specification summary of DS 2024A (elements common to all DATAPHONE II service private line data sets are above):

- *Modulation:* Differential 4-phase shift keying (PSK)

- *Data Rate:* 2400 bps

- *Line Requirements:* 4-wire private line basic 3002-type channel.

DS 2048A AND 2048C

1.08 Data set 2048A and 2048C are synchronous, serial, binary transmitter-receivers that operate at 4800 bps over 4-wire telephone facilities. Data sets 2048A and 2048C are designed for private line service only. A similar data set (designated 2048B) is designed for use over switched-network facilities. Data set 2048C has a shorter receiver start-up interval than DS 2048A and is therefore referred to as a "quick start-up" data set. Data set 2048C is a special data set used at the control station of a multipoint circuit when the tributary DS 2048As are *optioned* for quick start-up. The DS 2048C can be optioned to operate as a DS 2048A (control data set only).

1.09 Data set 2048A is line signal compatible with DS 208A and other DS 2048A data sets. Data set 2048C is line signal compatible with DS 2048A and with DS 208A when option E1 is not installed in DS 2048C.

1.10 The following is a technical specification summary of DS 2048A and 2048C (elements common to all DATAPHONE II service private line data sets are above):

- *Modulation:* 8-phase shift keying

- *Data Rate:* 4800 bps

- *Line Requirements:* Basic 3002-type channel.

DS 2096A

1.11 Data set 2096A is a synchronous, serial, binary transmitter-receiver that operates at 9600 bps over 4-wire telephone facilities. Data set 2096A is designed for private line service only.

1.12 Data set 2096A is line signal compatible with DS 2096A only. The DS 2096A cannot be used with DS 209A.

1.13 The following is a technical specification summary of DS 2096A (elements common to all DATAPHONE II service private line data sets are above):

- *Modulation:* Quadrature amplitude modulation (QAM)

- *Data Rate:* 9600 bps with multiplexing

- *Line Requirements:* Basic 3002-type channel with high performance data conditioning (D1-type); no C-type conditioning required.

1.14 The DS 2096A contains a multiplexing capability which provides data channels in multiples of 2400 bps up to 9600 bps as follows:

- One 9600-bps channel

- One 7200-bps and one 2400-bps channel (72/24)

- Two 4800-bps channels (48/48)

- One 4800-bps channel and two 2400-bps channels (48/24/24)

- Four 2400-bps channels (24/24/24/24).

The default channel speeds for use on degraded telephone facility are as follows:

- One 4800-bps channel

- Two 2400-bps channels (24/24)

These channels can interface with DTE or can be extended with DATAPHONE II service DS 2024A, 2024B, 2048A, 2048B, 2048C, or 2096A. These channels can also be extended with new-family data sets: DS 201-type, 208-type, and 209-type but without diagnostic capabilities.

1.15 When DS 2096A is used in a multiplex system, idle (unused) ports are permitted to be unterminated. For example, a point-to-point multiplexing system operating with four 2400 bps channels may use only three of the available channels, while the fourth channel is idle and unterminated.

2. PHYSICAL DESCRIPTION

A. Data Mountings

2.01 Any of the private line data sets can be used individually in a stand-alone arrangement or grouped together in a multiple arrangement. When used as a stand alone, the data set is installed in a 63A1 data mounting. When used in a multiple arrangement, the data sets are installed in a 64A1 data mounting. The 63A1 data mounting (Fig. 2) measures 15 1/2 inches wide, 13 inches deep and 4 1/4 inches high and weighs 14 1/2 pounds without data set and 21 pounds with a data set installed.

2.02 The 63A1 data mounting can house any one of the data set types with a maximum power dissipation of 80 watts. The 63A1 data mounting is equipped with plastic covers on front and rear, a fan, a transformer, and a backplane printed wiring board assembly. The fan is used to remove heat from the data mounting and the transformer is used to convert the incoming 117 Vac to 18 Vac (on each side of a center-tapped transformer) for use by the data set. The ac power cord is connected to the bottom of the data set. A spare fuse is located near the ac input receptacle. The rear of the data mounting (Fig. 3) contains five

connectors and a dual in-line package (DIP) switch as described below:

- *CIU/DBU Connector (50-pin female)*—Provides connection to channel interface unit (DAS 829-type) or dial backup unit equipment.

- *CC-IN (Male) and CC-OUT (Female) Connectors (10-pins each)*—Provide control channel connections to a network controller, diagnostic console or another 63A1 data mounting for diagnostic purposes.

- *DC-IN (Male) and DC-OUT (Female) Connectors (9-pins each)*—Used at extended locations to provide diagnostic channel connections between data sets.

- *DIP Switch (8 position)*—Provides the means for assigning data set local address.

2.03 The 64A1 data mounting (Fig. 4) measures 19 or 23 inches wide, 15.4 inches deep and 14 inches high and weighs 52 pounds equipped with a 290A1 power unit without data sets installed. The 64A1 data mounting can house up to eight data sets with a mixture of any of the private line data set types being allowed. The maximum power dissipation of a 64A1 data mounting fully loaded is approximately 600 watts. The mounting is equipped with brackets on each side allowing it to be mounted in 19- or 23-inch relay racks or cabinets. A maximum of four 64A1 data mountings can be installed in a KS-20018,L15 cabinet. In addition to housing a maximum of eight data sets, the mounting also houses a common circuit board. A 290A1 power unit is mounted on the side of the 64A1 data mounting in a 23-inch rack and above or below the data mounting in a 19-inch rack. Mounting the power unit in a 19-inch rack requires the following three items (each ordered separately): A mounting plate (comcode 842989451), a data set power extension cord (comcode 842989469), and a fan power extension cord (comcode 842989477). The 290A1 power unit supplies 36 Vac power through a fuse, transformer, and backplane buss to data sets in positions 1, 3, 5, and 7, and through another fuse, transformer, and backplane buss to data sets in positions 2, 4, 6, and 8. Located in the bottom of the mounting are three fans that are used to remove heat from the mounting. The fans are also powered by the 290A1 power unit through a separately fused 117 Vac outlet. The
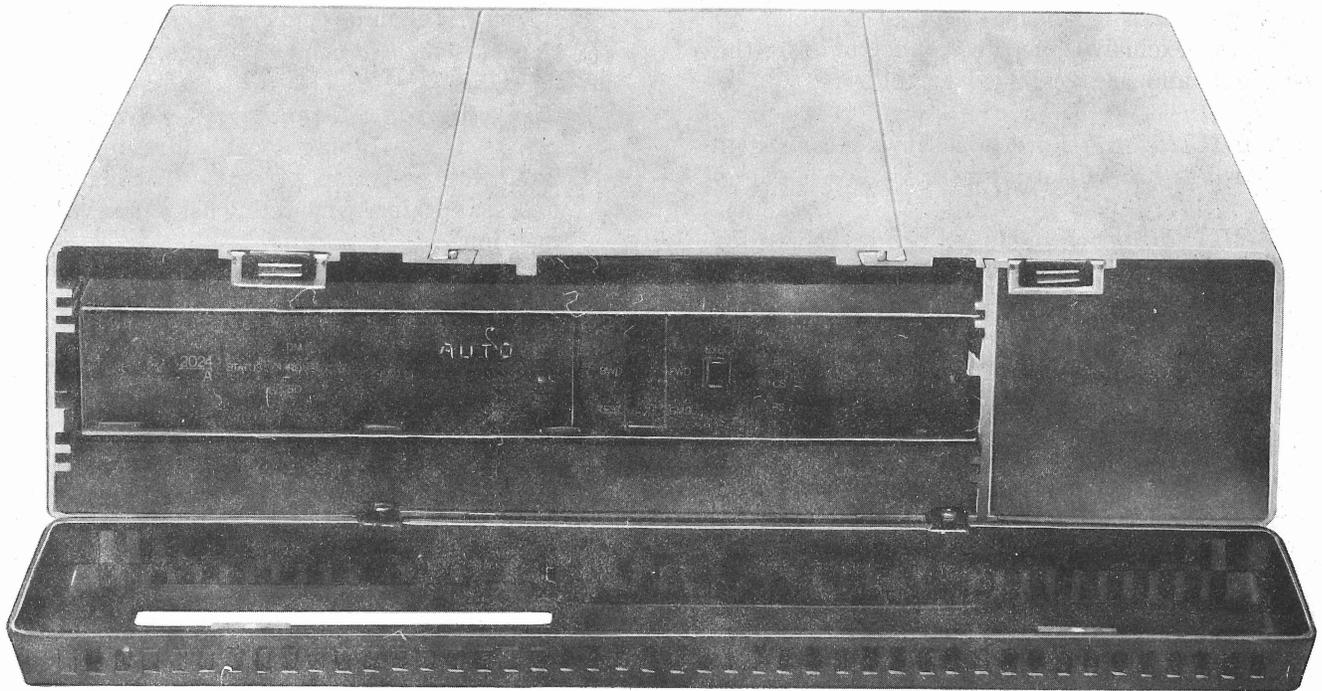
Fig. 2—63A1 Data Mounting With DATAPHONE II Service Data Set Installed

DIAGNOSTIC CHANNEL CONNECTORS

LOCAL ADDRESS SWITCH

E1A CUSTOMER CONNECTORS (2 & 4) (PART OF DATA SET MODULE 2096A)

E1A CUSTOMER CONNECTORS (1 & 3) (PART OF DATA SET MODULE 2096A)

CIU/DBU CONNECTOR

CONTROL CHANNEL CONNECTORS
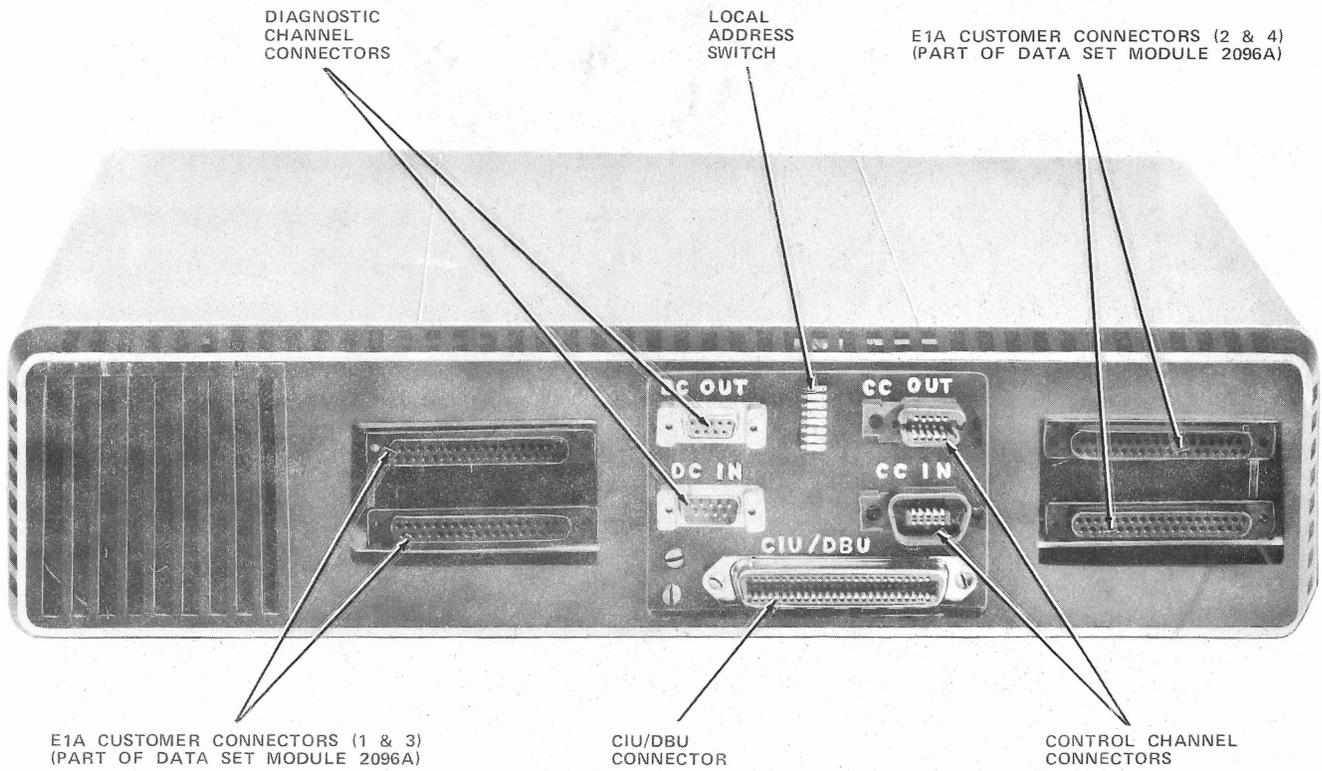
Fig. 3—63A1 Data Mounting Rear View

rear of the data mounting (Fig. 5) contains 20 connectors, exclusive of the connector for the power unit, and are described as follows:

- **DBU (50-pin female)**—Provides connection to dial back up equipment.

- **CIU (50-pin female)**—Provides connection to channel interface units (DAS 829-types).

- **CC-IN (Male) and CC-OUT (Female) Connectors (10 pins each)**—Provide connections to a diagnostic console network controller, or another 64A1 data mounting for diagnostic purposes.

- **DC-IN (Male) and DC-OUT (Female) Connectors (9 pins each)**—One pair required per data set (16 total) to provide

diagnostic channel connections for diagnostic purposes on extended networks.

- **DIP Switch (5-position)**—Provides the means for assigning local address for the mounting or group of sets. The data set address within the mounting has a preassigned position.

- **Alarm Circuit Screw Terminals**—A pair of screw terminals located on the common circuit board next to CC-OUT give a contact closure when the alarm circuit is activated indicating loss of status.

2.04 The front of the mounting is equipped with a panel that is hinged at the bottom and covers approximately the lower one-half of the data set faceplates when raised. The panel must

BATTERY SWITCH
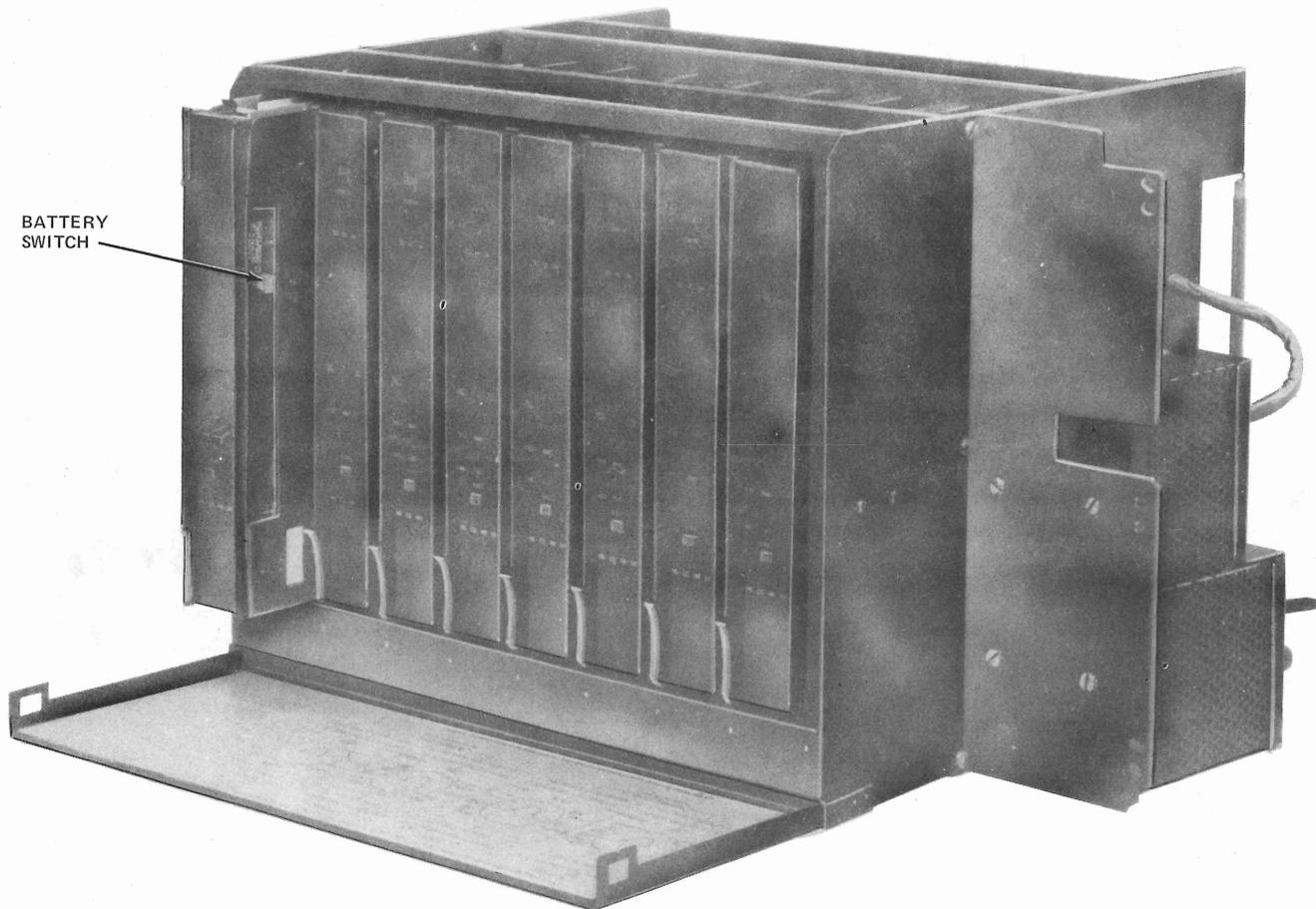
Fig. 4—64A1 Data Mounting (Shown With Panel Lowered)
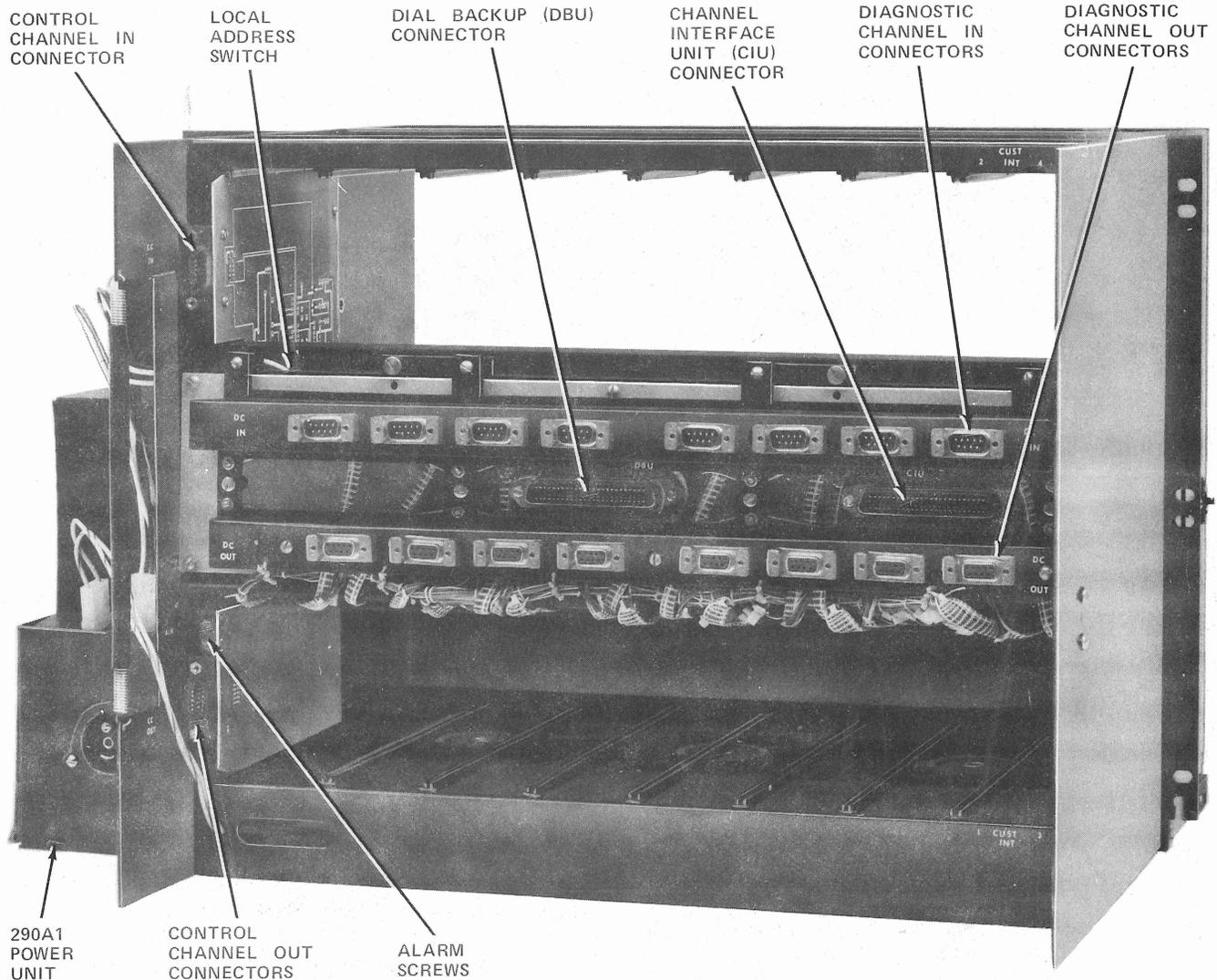
Fig. 5—64A1 Data Mounting Rear View

be lowered (Fig. 4) when installing and removing data sets and when gaining access to the switches on the data set faceplates. A write-on plastic strip is included on the panel to note line and circuit numbers.

B. Data Sets

2.05 Each private line data set is composed of two printed circuit boards with protective cold plates attached to a single faceplate as shown in Fig. 6. The overall dimensions of each data set circuit board assembly are 2 inches wide, 12 1/2 inches long and 11 1/2 inches high. Each assembly weighs approximately 4 1/2 pounds.

2.06 Each data set contains, in addition to other components, a battery and two (DS 2024A, 2048A, and 2048C) or five (DS 2096A) switches.

The battery is nickel/cadmium and provides power to the volatile memory in the data set to prevent loss of data set options and network addresses when power is lost or removed from the data set. One of the switches on each data set is a 2-position rocker DIP switch that connects the battery to the data set circuitry (Fig. 4). This switch is turned on when the data set is installed. When this switch is on the battery can be charged and power can be provided to the volatile memory when power is lost or removed. The remaining switch or switches is a DIP switch used to set the rise time option (fast or slow) for the data set interface(s).

2.07 The data set faceplates (Fig. 7, 8, and 9) contain an alphanumeric display and certain switches and indicators with the number of indicators being different for each type of data set (DS 2024A,
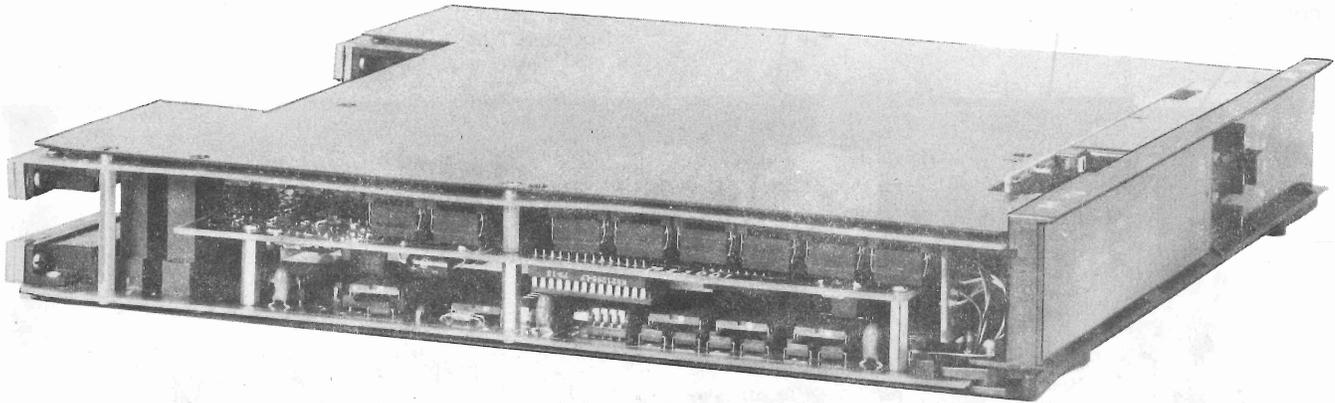
Fig. 6—DATAPHONE II Service Data Set (Typical)

2048-type or 2096A). The faceplate of each data set contains three paddle switches, a pushbutton, an alphanumeric display, and either 10 (2024A), 11 (2048-type) or 20 (2096A) light-emitting diode (LED) indicators, and can be arranged by reversing the labels and rotating the display for either stand-alone or multiple mounting (Fig. 10). The designations adjacent to the indicators identify the functions being monitored. The indicators and their functions are as follows:

- **STATUS:** This set of two large LEDs indicates system (data sets and connecting facilities) status as determined by the real-time diagnostic system. This system continually checks both control and tributary data sets and indicates the status of both on the control data set front panel and of the tributary on its front panel. When the **green** STATUS lamp is on the system is operating properly. A **red** STATUS indication means the real-time diagnostic unit has detected one (or more) of five faults. The fault (or faults) that were detected are displayed on the alphanumeric display for at least 15 seconds (Fig. 11). If more than one fault exists each is displayed for approximately five seconds. The faults checked by the real-time diagnostic unit and the display abbreviations used when each is detected are shown in Table A. These faults are described in Part 3, Functional Description.

- **SD (Send Data):** This yellow LED reflects the state of the EIA SD lead. The

LED is lighted when SD is in a spacing (positive) condition.

- **RD (Receive Data):** This yellow LED lights when the RD lead is in a spacing (positive) condition.

- **DM (Data Mode):** This yellow LED lights when the DM lead is **on** (positive) indicating the data set is in the data mode. Among other things this indicates the data set is connected to a data channel.

- **Alphanumeric Display (unlabeled):** This display is four characters, with each character consisting of 16 LED segments. It is capable of displaying alphabetic, numeric, and special (such as check mark or asterisk) characters. The alphanumeric display automatically indicates faults revealed by the real-time diagnostic systems and indicates test and command information as described in Part 3, Functional Description.

- **TEST COND (Test Condition):** The **on** condition of this red LED indicates the data set is performing a test. In a test of a tributary data set initiated by a control data set the TEST COND LED will light on each data set. The tributary data set LED will light as soon as it enters the test mode. The control data set LED will light when it receives confirmation via the diagnostic (secondary) channel that the tributary is in the test mode. The tributary data set LED will extinguish when the data
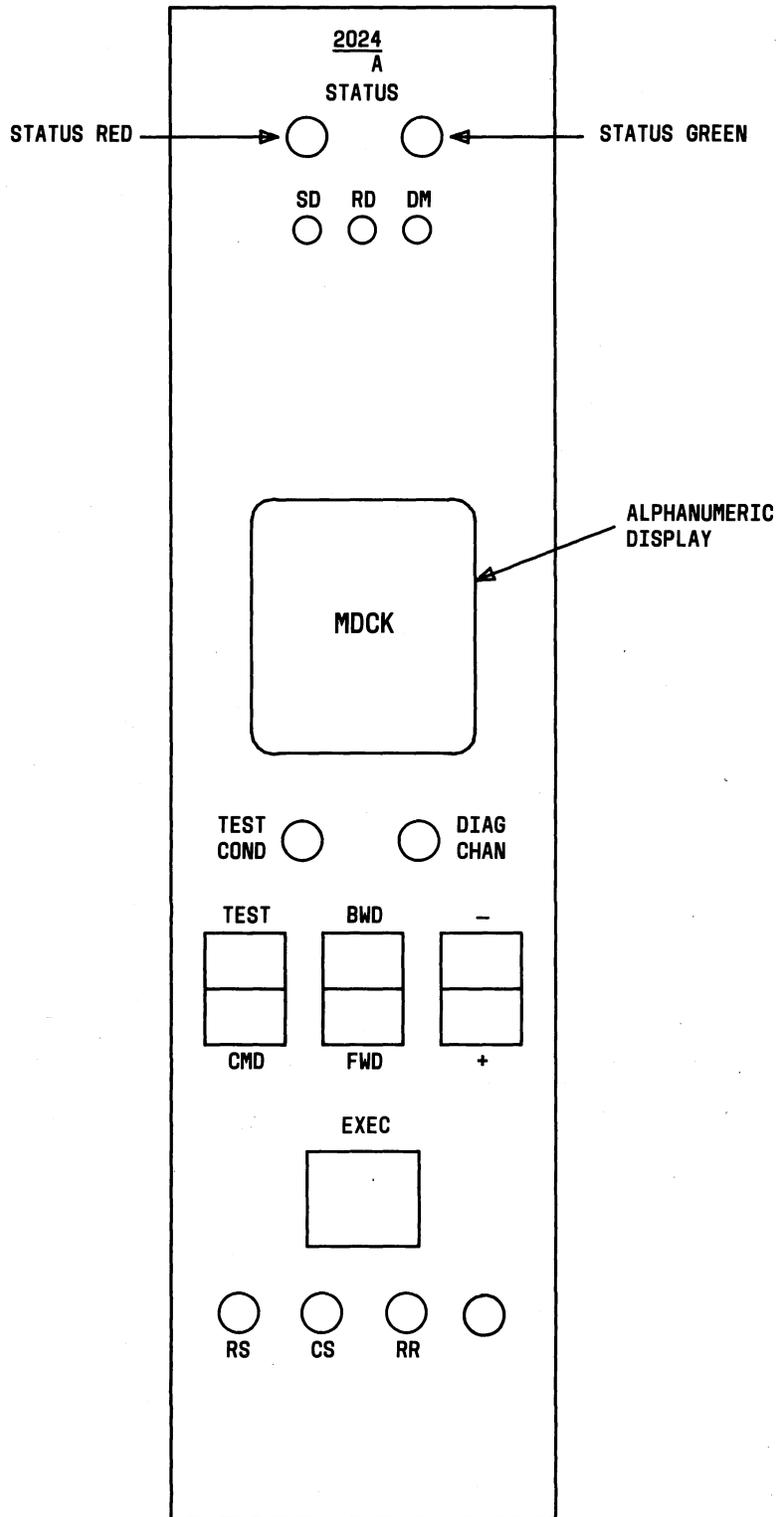
Fig. 7—DS 2024A Front Panel (Private Line Data Set)
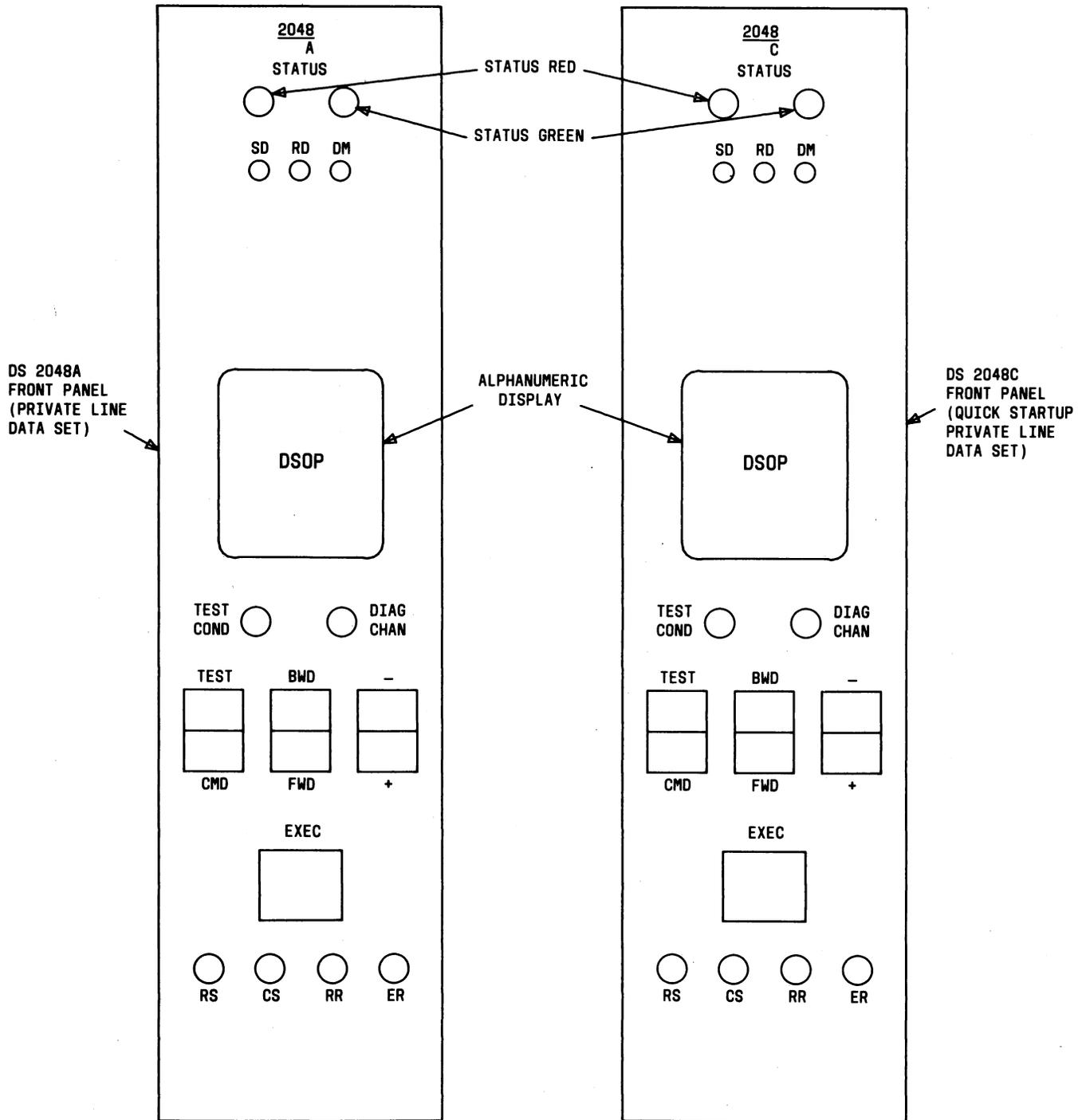
Fig. 8—DS 2048A and 2048C Front Panels
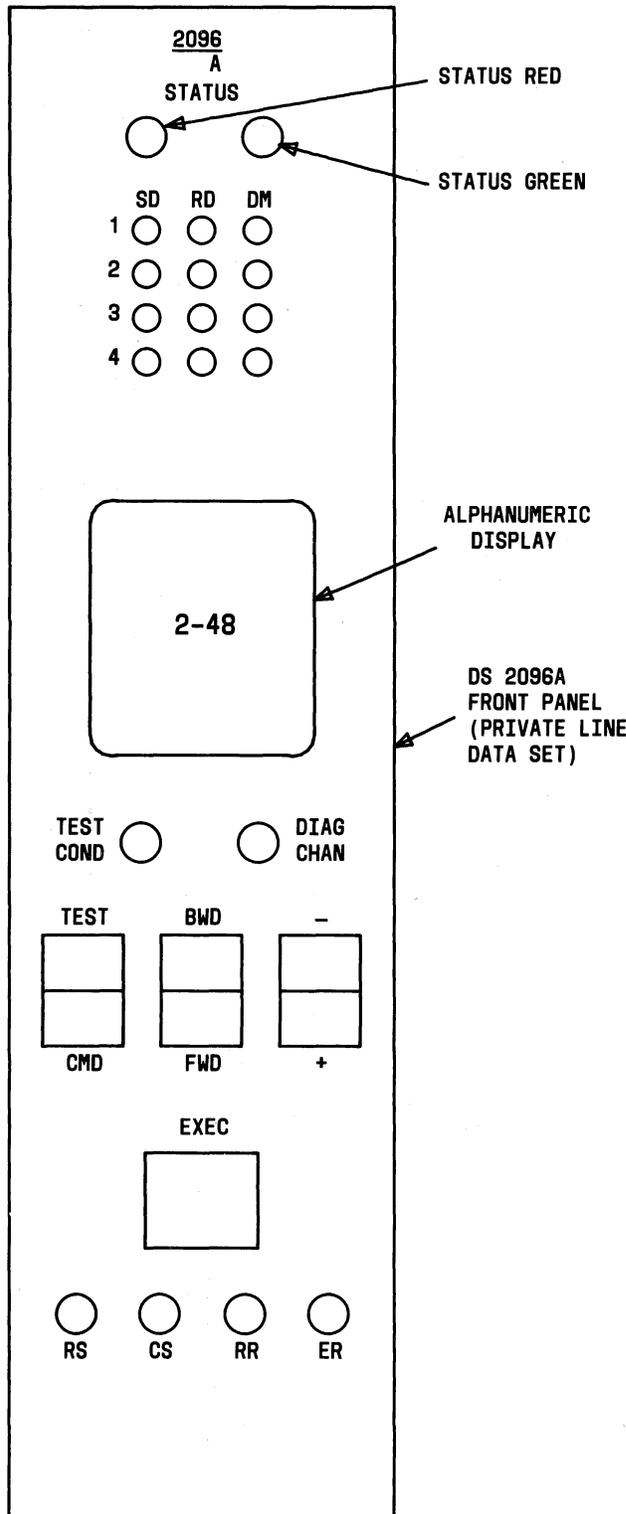
Fig. 9—DS 2096A Front Panel

set leaves the test mode and the control data set LED extinguishes upon confirmation of same. The TEST COND LED also lights whenever a test is initiated by the DTE through the customer interface connection.

- *DIAG CHAN (Diagnostic Channel):* This green LED lights for approximately 100 ms whenever a message is transmitted or received on the diagnostic (secondary) channel.

- *RS (Request to Send):* This yellow LED lights when the RS input lead from the DTE is *on* (positive).

- *CS (Clear to Send):* This yellow LED lights when the CS output lead to the DTE is *on* (positive).

- *RR (Receiver Ready):* This yellow LED lights when the RR lead is *on* (positive) indicating carrier is being received.

- *ER (Equalizer Retrain):* This yellow LED indicates the status of the adaptive equalizer circuit on DS 2048- and 2096-type. This indicator lights when the data set is retraining. This is nonfunctional and unlabeled on DS 2024A.

2.08 Four switches, accessible on a stand-alone data set by rotating the magnetically-latched front cover downward and on a multiple-mounted data set by rotating the mechanically-latched front cover downward, are provided to operate and test the data set. These switches, their types, and their functions are as follows.

- *TEST/CMD (Test/Command):* This is a three-locking position paddle-switch which during normal data set operation will be in the center or normal (unlabeled) position. In TEST this switch selects the test menu (Table B) stored in the data set. In CMD the command menu (Table C) stored in the data set is selected.

- *BWD/FWD (Backward/Forward):* This is a three-position nonlocking paddle-switch which during normal data set operation will be in the center or normal (unlabeled) return position. Both BWD and FWD positions are momentary-contact and are used to proceed
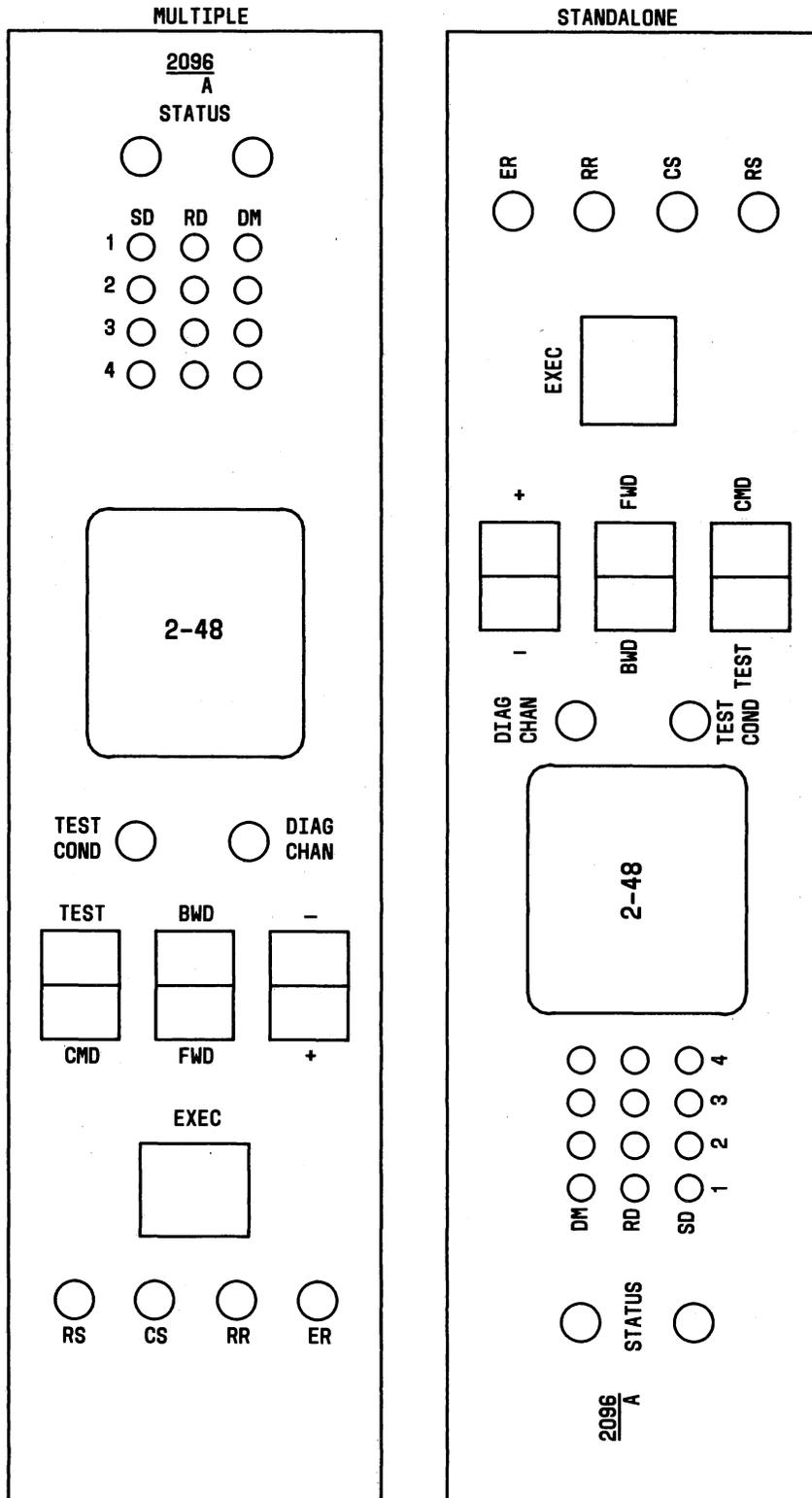
Fig. 10—Example of Multiple and Stand-Alone Data Set Front Panel Arrangements

RED STATUS
LED LIGHTED

DETECTED FAULT DISPLAYED
ON ALPHANUMERIC DISPLAY
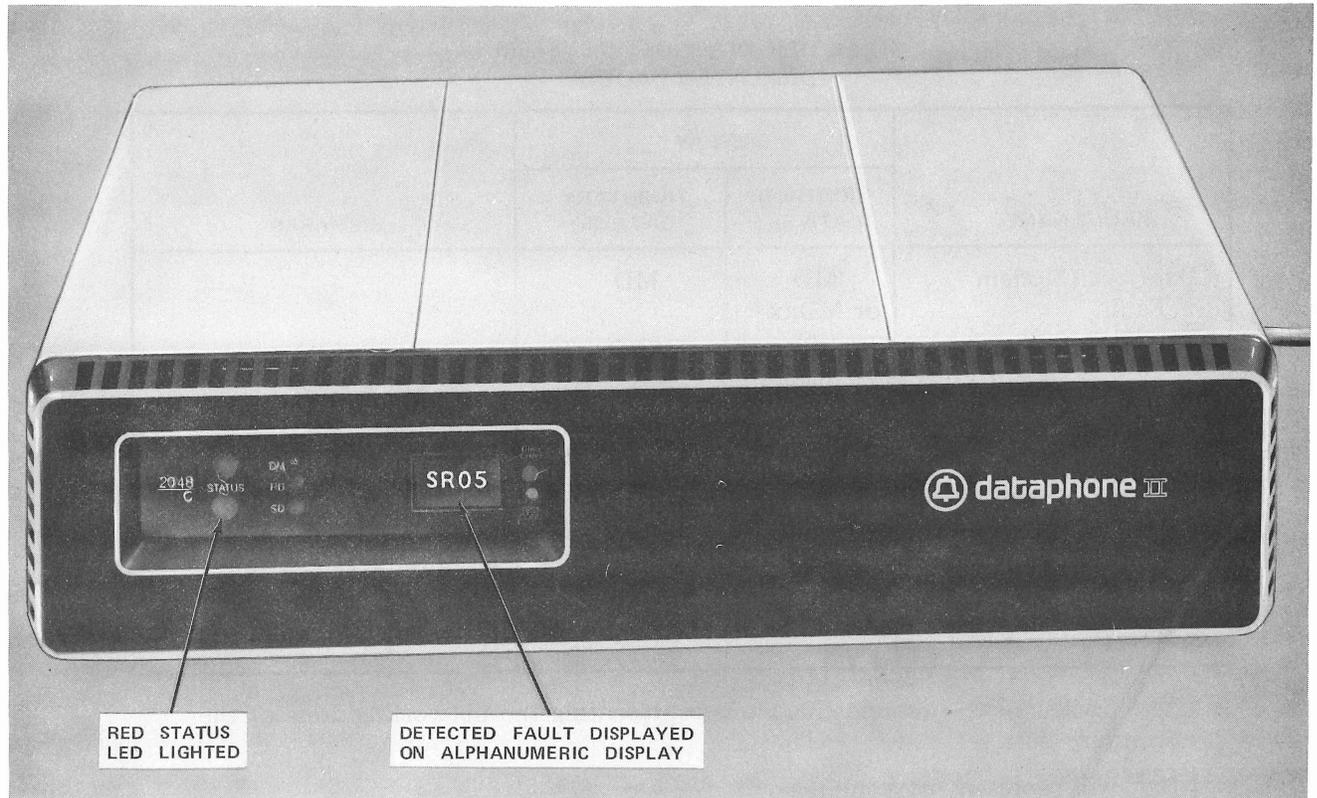
Fig. 11—Data Set Front Panel Showing Red Status and Fault Condition

through the test or command menu in either the backward or forward direction.

- **-/+ *(Minus Sign/Plus Sign):*** This is a three-position nonlocking paddle-switch which during normal data set operation will be in the center or normal (unlabeled) return position. Both - and + positions are momentary-contact and are used to proceed either forward (+) or backward (-) through a list (such as options or addresses) when TEST or CMD is selected.

- ***EXEC (Execute):*** This momentary-contact pushbutton switch is used to execute the test or command function indicated on the alphanumeric display.

3. FUNCTIONAL DESCRIPTION

3.01 This part contains information on DATAPHONE II service data sets. Included in this part is a simplified block diagram and descriptions of the block diagram, real-time diagnostic system faults, test menu, command menu, and options.

A. General

3.02 Figure 12 contains a simplified block diagram of the major functions of a DATAPHONE II service data set. The data set functions can be considered in two parts: The **main channel** made up of the customer interface, main data set control circuits, primary transmitter, and primary receiver. The **diagnostic channel** made up of the control channel and diagnostic channel interfaces, diagnostic channel control, diagnostic channel transmitter, and diagnostic channel receiver.

3.03 In addition to the two major functional parts above, the DATAPHONE II service data set contains the following parts:

- A front panel containing control switches and alphanumeric display

TABLE A

REAL TIME DIAGNOSTIC SYSTEM
DISPLAYED FAULTS

| | DISPLAY | | |
FAULT NAME	CONTROL DATA SET	TRIBUTARY DATA SET	REMARKS
Data Set (Modem Fault	MD or MDxx*	MD	
Facility	FA or FAxx*	FA	
Streaming Terminal	SRxx*	SR	
No Response	NRxx*	(none)	
Port X	PRTx†	(none)	Fault in extended network off port X (DS 2096A)
Port 1	PRT1	(none)	Fault in extended network (DS 2024A or 2048A)

* "xx" will be two numeric characters representing the network address of the tributary data set.

† "x" will represent port number.

- Circuitry providing option memory protection in case of a power failure

- Channel interface circuits that are shared by the main and diagnostic channels

- Power supply circuitry.

B. Main Channel

3.04 Customer equipment connects to the data set on the customer interface (CUST INT) connector. In the DS 2096A four CUST INT connectors provide for up to four channels of multiplexing.

3.05 The main channel *transmitter* accepts serial binary data from the DTE in synchronism with positive transitions of the clock provided either by the data set or by the DTE. The transmitter groups this data and encodes it according to the modulation scheme of the individual data set and in a form suitable for transmission on the telephone line.

3.06 The main channel *receiver* accepts the transmitted signal from the telephone line, demodulates the analog signal to recover serial data and bit timing, and delivers the data and timing to the DTE through the customer interface.

3.07 The main channel *control circuitry* performs four major functions:

- General data set management: Data set initialization, execution of commands initiated at the data set front panel and storage of such things as poll and option lists.

- Start-up procedures.

- Management of background diagnostic to monitor modem (data set) performance status (MPS).

- Management of tests initiated at the data set front panel.

TABLE B

DATA SET TEST MENU

TEST NAME	DISPLAY		REMARKS
	CONTROL DATA SET	TRIBUTARY DATA SET	
Port	PORT	PORT	DS 2096A Only
Automatic Network Test	AUTO	(N/A)	
Modem Test	MT	MT	Timed
Digital Test	DT	DT*	Tests
End-to-End Test	EE	EE*	
Transmit Loss Test	TRMT*	TRMT*	
Receive Loss Test	RCV*	RCV*	Nontimed
1004 Hz Tone Test	1004*	1004*	Tests
Local Loopback Test	LL*	LL*	
Digital Loopback Test	DL*	DL*	
Continuous Modem Test	C-MT*	C-MT*	
Self Test	ST*	ST*	
Receive Signal Level Test	RSL	RSL	
Receive Signal Quality Test	RSQ	RSQ	Parameter Tests
Lamp Test	LAMP	LAMP	Hardware Test
Abort All Tests	ABT	ABT	

* Applicable in maintenance mode only. Refer to Part 4, Operation.

C. Diagnostic Channel

3.08 The diagnostic channel transmits and receives data set diagnostic information. The diagnostic channel uses three interfaces:

- *Analog Facility Interface*—The local data set communicates with the far end data sets through the diagnostic channel transmitter and receiver. These units modulate and demodulate data using frequency shift keying. These data are frequency division multiplexed onto the same analog facility as the primary data stream.

- *Control Channel Interface:* The local data set communicates with DCDs through this interface.

TABLE C

DATA SET COMMAND MENU

TEST NAME	DISPLAY		REMARKS
	CONTROL DATA SET	TRIBUTARY DATA SET	
Modem Check	MDCK	(N/A)	
Disable	DSAB	DSAB	
Maintenance Mode	MTCE	MTCE	
Display Options	DSOP	DSOP	
Clear Options	CLOP*	CLOP*	
Change Options	CHOP*	CHOP*	
Change Multiplexer Options	CHMX*	CHMX*	DS 2096A Only
Add Poll List	(N/A)	ADPL*	
Port Select	PORT	PORT	DS 2096A Only
Display Poll List	DSPL	DSPL†*	
Acquire Poll List	AQPL*	AQPL†*	
Change Poll List	CHPL*	CHPL†*	
Display Software Version	DSSV*	DSSV*	
Display Network Address	DSNA	DSNA	
Change Network Address	CHNA*	CHNA*	
Display Local Address	DSLA	DSLA	

* Applicable to tributary data sets in maintenance mode only.

† Available to outboard tributary and backbone tributary data sets (option G2 and G4).

- **Diagnostic Channel Interface:** The local data set communicates with other colocated extended service data sets through this interface.

D. Data Mountings

3.09 The two data mountings are designated stand alone (63A1) and multiple (64A1). Each provides:

- **Control Channel Interface Connectors:** Connectors designated CC-IN and CC-OUT and associated EIA circuitry.

- **Diagnostic Channel Interface Connectors:** Connectors designated DC-IN and DC-OUT.

- **Channel Interface Unit and Dial Backup Unit Connectors:** Designated CIU/DBU (one connector) in the 63A1 data mounting or CIU and DBU (two connectors) in the 64A1 data mounting. These provide line facility connections, data auxiliary set control, and dial backup circuitry.

- **AC Power:** Low-voltage ac power is provided for the data set power circuits.
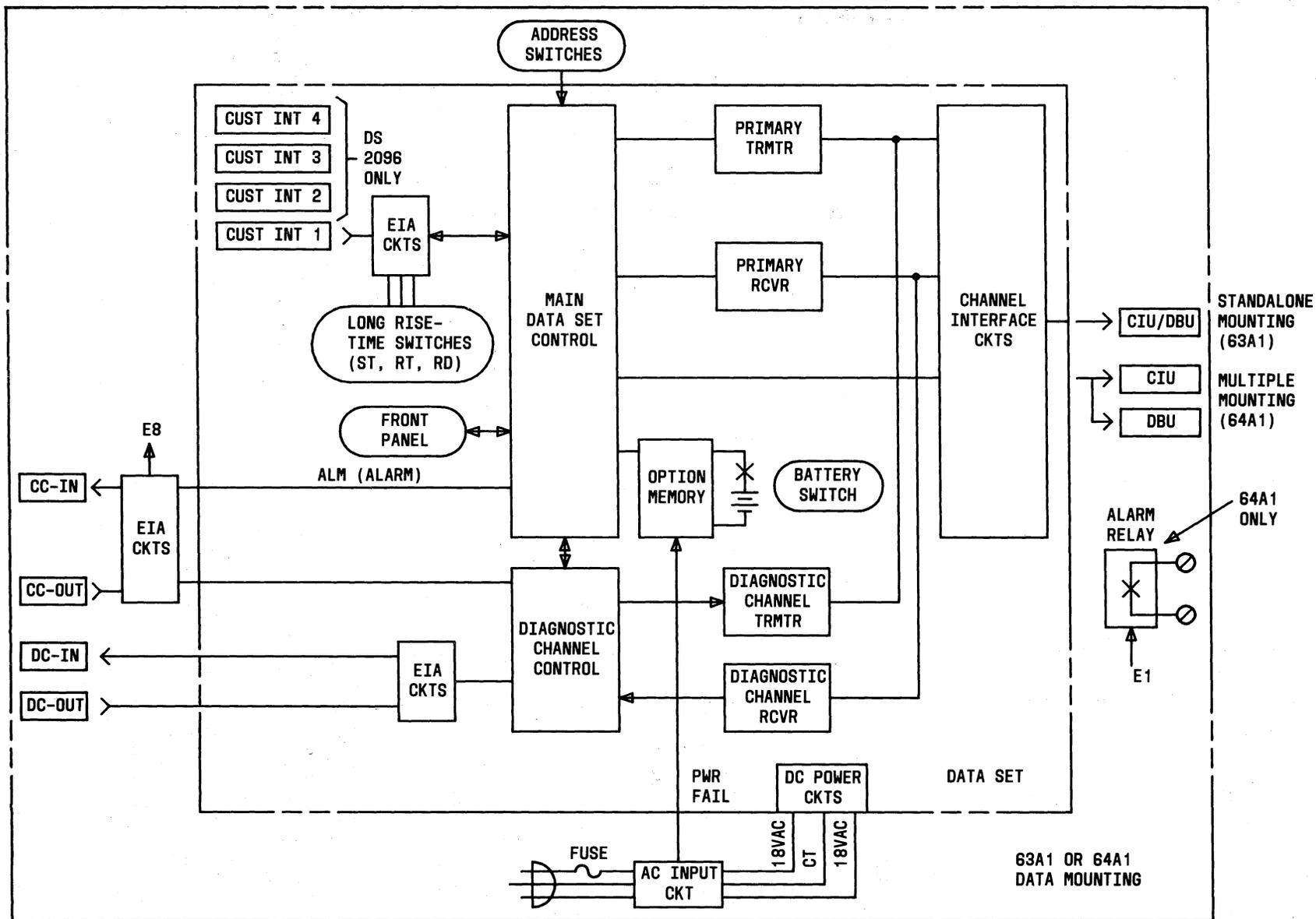
Fig. 12—DATAPHONE II Service Data Set General Simplified Block Diagram

3.10 The 64A1 data mounting also provides an alarm relay contact that is operated whenever any data set in the data mounting has a STATUS-red condition. This alarm condition is passed to other data sets and/or DCDs via the CC-IN interface.

E. Interface

3.11 All interface connectors for DATAPHONE II service private line data sets are accessible at the rear of the data set. Each interface connection is described in the following paragraphs.

Customer Interface

3.12 The customer interface is accessible through the 37-pin customer interface connector (DS 2024 or 2048) or connectors (DS 2096) at the rear of the data set. The connector pin numbers and the corresponding EIA circuit name and EIA circuit mnemonic are shown in Table D. The customer interface connector and leads conform to the requirements of EIA Standards RS-449 and RS-423. A comparison of EIA Standards RS-449 and RS-232C circuit names and mnemonics is given in Table E. A detailed description of the customer interface leads is contained in the following paragraphs.

3.13 Figure 13 shows the customer interface circuits. All drivers and terminators are provided in all data sets even if they are not used in a particular type of data set (such as DS 2024A). The switches shown on circuits ST, RT, and RD are provided to increase the rise time of the waveform thereby allowing greater cable lengths.

3.14 The RS-449 interface allows greater distances (up to 4000 feet) between the data set and the DTE than is allowed using the RS-232C interface. This increase in distance is made possible by increasing the duration of the rise time of the EIA signals generated and by sending the rapidly changing signals over twisted pairs. Each data set is equipped with rise time options that determine the duration of the rise time of the EIA signals, thus determining the maximum allowable distance between the data set and DTE. As shown in Table F the rise time options are different for RS-232C and RS-449. Refer to the option table for option definitions.

3.15 *Signaling Rate Indicator (SI):* This circuit is used only in DS 2096A. An *on*

condition of this lead indicates the data set is operating at 9600 bps. An off condition of this lead indicates the data set is operating at 4800 bps.

3.16 *Send Data (SD):* Mark and space signals generated by the DTE are delivered to the data set on this lead. The data set samples the signals on this lead during the negative transition of the send timing (ST) signal or the clock signal provided by the DTE for externally timed data sets. The DTE must be arranged to transmit data on this lead only when an *on* condition is present on both the clear-to-send (CS) and data mode (DM) leads.

3.17 *Send Timing (ST):* For internally timed data sets, signals on this lead are used to provide the DTE with signal element timing information for the send data (SD) lead. The ST signal is present at all times when power is applied to the data set. The first signal element of the SD signal should be presented by the DTE on the positive (*off* to *on*) transition of ST which coincides with the *off* to *on* transition of the clear-to-send (CS) signal. (The clear-to-send signal turning *on* coincides with a positive transition of ST.) Send data is sampled by the data set on negative transitions of ST. The ST lead provides a timing signal which is phase-locked to the terminal timing (TT) signal for data sets timed externally by the DTE.

3.18 *Receive Data (RD):* Mark and space signals generated by the data set in response to data signals received from the distant-end data set are delivered to the DTE on this lead. The data signals are clocked to the DTE and the DTE is timed to sample the data during the negative transitions of the receive timing (RT) signals. An *off* condition on the receiver ready (RR) lead causes the received data lead to be clamped in the mark condition.

3.19 *Request-to-Send (RS):* With switched carrier operation, an *on* condition on this lead is an indication to the data set transmitter of the intent of the DTE to transmit data. After turning *on* this lead, the DTE should wait for an *on* condition on the clear to send (CS) lead before starting transmission. When the RS lead is turned *off* at the end of a message, the data set transmitter remains on about 2 ms to allow the last bits of data to clear the transmitter. With continuous

TABLE D

CUSTOMER INTERFACE CONNECTOR

PIN NO.	EIA CIRCUIT MNEMONIC (RS-449)	EIA CIRCUIT NAME (RS-449)	APPLIES TO DATA SET:			
			2024A	2048A	2048C	2096A
2	SI	Signaling Rate Indicator				✓
4, 22	SD	Send Data	✓	✓	✓	✓
5, 23	ST	Send Timing	✓	✓	✓	✓
6, 24	RD	Receive Data	✓	✓	✓	✓
7, 25	RS	Request-to-Send	✓	✓	✓	✓
8, 26	RT	Receive Timing	✓	✓	✓	✓
9, 27	CS	Clear-to-Send	✓	✓	✓	✓
10	LL	Local Loopback	✓	✓	✓	✓
11, 29	DM	Data Mode	✓	✓	✓	✓
12, 30	TR	Terminal Ready				✓
13, 31	RR	Receiver Ready	✓	✓	✓	✓
14	RL	Remote Loopback	✓	✓		✓
15	IC	Incoming Call				✓
16	SR	Signaling Rate Selector				✓
17, 35	TT	Terminal Timing	✓	✓	✓	✓
18	TM	Test Mode	✓	✓	✓	✓
19	SG	Signal Ground	✓	✓	✓	✓
20	RC	Receive Common	✓	✓	✓	✓
28	IS	Terminal-in-Service				✓
32	SS	Select Standby		✓	✓	✓
33	SQ	Signal Quality		✓	✓	✓
36	SB	Standby Indicator	✓	✓	✓	✓
37	SC	Send Common	✓	✓	✓	✓

TABLE E

COMPARISON OF RS-449 TO RS-232C

RS-449			RS-232C		
PIN NO.	MNEMONIC	NAME	PIN NO.	MNEMONIC	NAME
2	SI	Signaling Rate Indicator	23	CI	Data Sig Rate Sel
4, 22	SD	Send Data	2	BA	Transmitted Data
5, 23	ST	Send Timing	15	DB	Trmtr Sig Element Timing
6, 24	RD	Receive Data	3	BB	Received Data
7, 25	RS	Request to Send	4	CA	Request to Send
8, 26	RT	Receive Timing	17	DD	Rcvr Sig Element Timing
9, 27	CS	Clear to Send	5	CB	Clear to Send
10	LL	Local Loopback			
11, 29	DM	Data Mode	6	CC	Data Set Ready
12, 30	TR	Terminal Ready	20	CD	Data Terminal Ready
13, 31	RR	Receiver Ready	8	CF	Received Line Sig Detector
14	RL	Remote Loopback			
15	IC	Incoming Call	22	CE	Ring Indicator
16	SF/SR*	Select Freq/Signaling Rate Sel	23	CH	Data Sig Rate Sel
17, 35	TT	Terminal Timing	24	DA	Trmtr Sig Element Timing
18	TM	Test Mode			
19	SG	Signal Ground	7	AB	Signal Ground
20	RC	Receive Common			
28	IS	Terminal In Service			
32	SS	Select Standby			
33	SQ	Signal Quality	21	CG	Signal Quality Detector
34	NS	New Signal			
36	SB	Standby Indicator			
37	SC	Send Common			

* These circuits share pin no. 16

carrier operation, the transmitter is kept on at all times. The user may choose, however, to use the RS lead to control timing functions in the CPE that require the CS lead **on** condition. In this case, the data set provides a delay of 8 ms between an **on** condition of RS and an on condition of CS.

3.20 Receive Timing (RT): The square-wave signal on this lead at the nominal rate is used to provide the DTE with receiver timing information. The transition from **on** to **off** indicates the center of each signal element (bit) on the receive data (RD) lead. The RT signal is provided when the receiver ready (RR) lead is **on.** If RR should go **off,** RT is clamped to the **off** condition.

3.21 Clear-to-Send (CS): Signals on this lead are generated by the data set to indicate

TABLE F

ALLOWABLE DISTANCE BETWEEN DATA SETS AND DTE

DATA SET	RISE TIME OPTION SETTING	RS-449 MAXIMUM DISTANCE IN FEET*	RS-232C MAXIMUM DISTANCE IN FEET
DS 2024A	RS-232C (SA) RS-449 (LA)	— 4000	50 —
DS 2048-type	RS-232C (SA) RS-449 (LA)	— 4000	50 —
DS 2096A	RS-232C† RS-449‡	— 2700	50 —

* These figures assume that signals generated by the DTE have transition times permitting these distances.

† For RS-232C the options to be used are: SA for port 1, SB for port 2, SC for port 3, and SD for port 4.

‡ For RS-449 the option to be used are: LA for port 1, LB for port 2, LC for port 3, LD for port 4.

Fig. 13—EIA Customer Interface Circuits

whether or not the data set is ready to transmit data. In switched carrier operation, CS is turned *on* in response to an *on* condition of the request-to-send (RS) lead from the DTE. This delay allows the distant data set to get into synchronization. The *on* condition of the CS lead is an indication to the DTE that signals presented on the send data (SD) lead will be transmitted to the communications channel. The *off* condition of this lead is an indication to the DTE that it should not transfer data on the SD lead. The *off* condition of CS will be maintained as long as RS is *off.* The CS turns *off* when the RS is turned *off* so that another message can be initiated by turning RS *on* again. In continuous carrier switched RS operation, the data set provides a delay of 8 ms.

3.22 *Local Loopback (LL):* Signals on this lead are generated by the DTE and permit the customer to turn *on* test mode (TM) through the customer interface.

3.23 *Data Mode (DM):* Signals on this lead are generated by the data set to indicate to the DTE whether or not the data set is in the data mode. The *on* condition of this lead indicates that the local data set is capable of transmitting and receiving data signals and is not in the test mode or talk mode (if the data set is arranged for alternate voice service). The *on* condition of this lead alone should not be interpreted to mean

that a communication channel has been established to a distant data station or should not be used to determine the status of any remote DTE. This lead is used in conjunction with request-to-send and clear-to-send leads when data is being transmitted.

3.24 *Terminal Ready (TR):* The *on* condition of this lead prepares the data set to be

connected to the communication channel and maintains the connection established by internal or external means. The *off* condition of this lead removes the data set from the communication channel following completion of data transfer.

3.25 Receiver Ready (RR): The *on* condition of this lead indicates that the data carrier signal has been received for 5 ms (15 ms in DS 2096A) or more. This lead will go *off* if the line signal disappears for more than 5 ms (or more than 1 second if option E2 is employed) due to the end of transmission or to a transmission line interruption. This *off* condition causes the receive data (RD) lead to be clamped to the mark condition and the receive timing (RT) lead to be clamped to the *on* condition.

3.26 Remote Loopback (RL): The *on* condition of this lead causes the local data set to transmit a signal to a remote data set to enable a remote loopback condition. The *off* condition of RL causes the local data set to signal a remote data set to release from a remote loopback condition.

3.27 Incoming Call (IC): This circuit is used only in DS 2096A to allow dial-in extension service. The *on* condition of this lead indicates an incoming call (ringing) signal is being received by the data set. This lead is *off* during the off segment of the ringing cycle and at all times when ringing is not being received.

3.28 Signaling Rate Selector (SR): The use of this circuit is optional in DS 2096A. If used, the *on* condition of this lead selects 9600 bps and the *off* condition selects 4800 bps.

3.29 Terminal Timing (TT): For externally timed data sets, this lead is used by the DTE to provide bit rate timing to the transmitter. The *on* to *off* transition of this lead indicates the center of each signal element on the send data (SD) lead. The send timing (ST) lead is phase-locked to this signal. Signals should be available on this lead whenever the data set is in service.

3.30 Test Mode (TM): The *on* condition of this lead indicates to the DTE that the data set is in a test condition. Test mode is turned on when a test is initiated, either by a diagnostic control device (DCD), control data set, locally at

the data set front panel, or through the customer interface.

3.31 Signal Ground (SG): This lead connects circuit ground of the data set to circuit ground of the DTE to provide a common ground reference potential.

3.32 Receive Common (RC): This interface lead is connected to the *data set* circuit ground and provides the DTE with a reference potential for interchange circuit receivers.

3.33 Terminal In Service (IS): This circuit is used only in DS 2096A to allow dial-in extension service. The *on* condition of this lead indicates that the DTE is in service and permits calls to be connected to the switched network data set at the extended location (ie, to be answered). The *off* condition of this lead indicates that the DTE is not in service (eg, in a test condition not involving the data set) and does not permit incoming calls to be connected to the switched network data set at the extended location.

3.34 Select Standby (SS): This circuit is used in all DATAPHONE II service private line data sets to select normal or dial backup telephone facilities. The *off* condition of this lead selects the normal telephone facility. The *on* condition of this lead selects the dial backup telephone facility.

3.35 Signal Quality (SQ): The condition of this circuit is an indication of the probability of an error existing in the received signal. The *on* condition of this lead indicates low probability of an error and the *off* condition indicates high probability. (Not used in DS 2024A.)

3.36 Standby Indicator (SB): This circuit is used in all DATAPHONE II service private line data sets to indicate whether the data set is conditioned to operate over normal or dial backup telephone facilities. The *off* condition of this lead indicates the data set is conditioned to operate over the normal telephone facility. The *on* condition of this lead indicates the data set is conditioned to operate over the dial backup telephone facility.

3.37 Send Common (SC): This interface lead is connected to the *DTE* circuit ground and provides the *data set* with a reference potential for interchange circuit receivers.

Line Facility Interface—Stand-Alone Data Sets

3.38 The line facility interface is accessible through the 50-pin female connector at the rear of the data set labeled CIU/DBU. The connector pin numbers and the corresponding lead designations are shown in Table G. Figure 14 shows the line facility circuits. A description of these leads is contained in the following paragraphs.

3.39 *Data Tip (DT), Data Ring (DR), Data Tip 1 (DT1), and Data Ring 1 (DR1):* These are the receive and transmit leads of the 4-wire telephone facility.

3.40 *Line Status Indicators (TEK5 and TEK6):* These leads are used by a channel interface unit (CIU) DAS 829-type or equivalent to provide an indication to the DTE (on the DM lead) when the data set is in the loopback mode and not available for use.

3.41 *Dial Backup Unit 1 Through Dial Backup Unit 4 (DBU1-4):* These leads provide the means to use the switched message network to provide a substitute channel for a private line channel experiencing difficulty.

Line Facility Interface—Multiple Data Set Mounting

3.42 The line facility interface is accessible through the two 50-pin female connectors at the rear of the multiple mounting labeled CIU and DBU (Fig. 5). The connector pin numbers, corresponding lead designations and data set position served are shown in Tables H and I for the CIU and DBU connectors respectively. Figure 14 shows the line facility circuits. A description of these leads is contained in the following paragraphs.

3.43 *Data Tip (DT), Data Ring (DR), Data Tip 1 (DT1), and Data Ring 1 (DR1):* These are the receive and transmit leads of the 4-wire telephone facility.

3.44 *Line Status Indicators (TEK5 and TEK6):* These leads are used by a channel interface unit (CIU) DAS 829-type or equivalent to provide an indication to the DTE (on the DM lead) when the data set is in the loopback mode and not available for use.

3.45 *Dial Backup Unit 1 Through Dial Backup Unit 4 (DBU1-4):* These leads provide the means to use the switched message network to provide a substitute channel for a private line channel experiencing difficulty.

Control Channel Interface

3.46 The control channel interface is a 1200 bps daisy-chain arrangement permitting diagnostic and control signals to flow from DCDs downstream to all data mountings at the same location. This interface also provides a common alarm for the mountings. Figure 15 shows the control channel interface circuits.

Note: The term "daisy-chain" refers to a serial connection of devices, each having a special pair of ports (designated *in* and *out*) for this purpose. Intermediate devices use both ports whereas a device at either end of the connection uses only one of the ports.

TABLE G

STAND-ALONE DATA SET CHANNEL INTERFACE
UNIT/DIAL BACKUP UNIT (CIU/DBU) CONNECTOR

PIN NO.	LEAD DESIGNATION	FUNCTIONS
1,26	DBU1, DBU2	Dial Backup Unit 1, 2
3,28	TEK6, TEK5	Line Status Indicator
4,29	DR1, DT1	Transmit Pair
5,30	DR, DT	Receive Pair
6,31	DBU3, 4	Dial Backup Unit 3, 4

Fig. 14—Line Facility Circuits

LEAD DESIG-NATION	STANDALONE MOUNTING (63A1)	MULTIPLE MOUNTING (64A1) LINE NUMBER							
		1	2	3	4	5	6	7	8
	CIU/DBU	CIU							
DR1	4	2	5	8	11	14	17	20	23
DT1	29	27	30	33	36	39	42	45	48
DR	5	1	4	7	10	13	16	19	22
DT	30	26	29	32	35	38	41	44	47
TEK6	3	3	6	9	12	15	18	21	24
TEK5	28	28	31	34	37	40	43	46	49
		DBU							
DBU1	1	1	2	3	4	5	6	7	8
DBU2	26	26	27	28	29	30	31	32	33
DBU3	6	17	18	19	20	21	22	23	24
DBU4	31	42	43	44	45	46	47	48	49
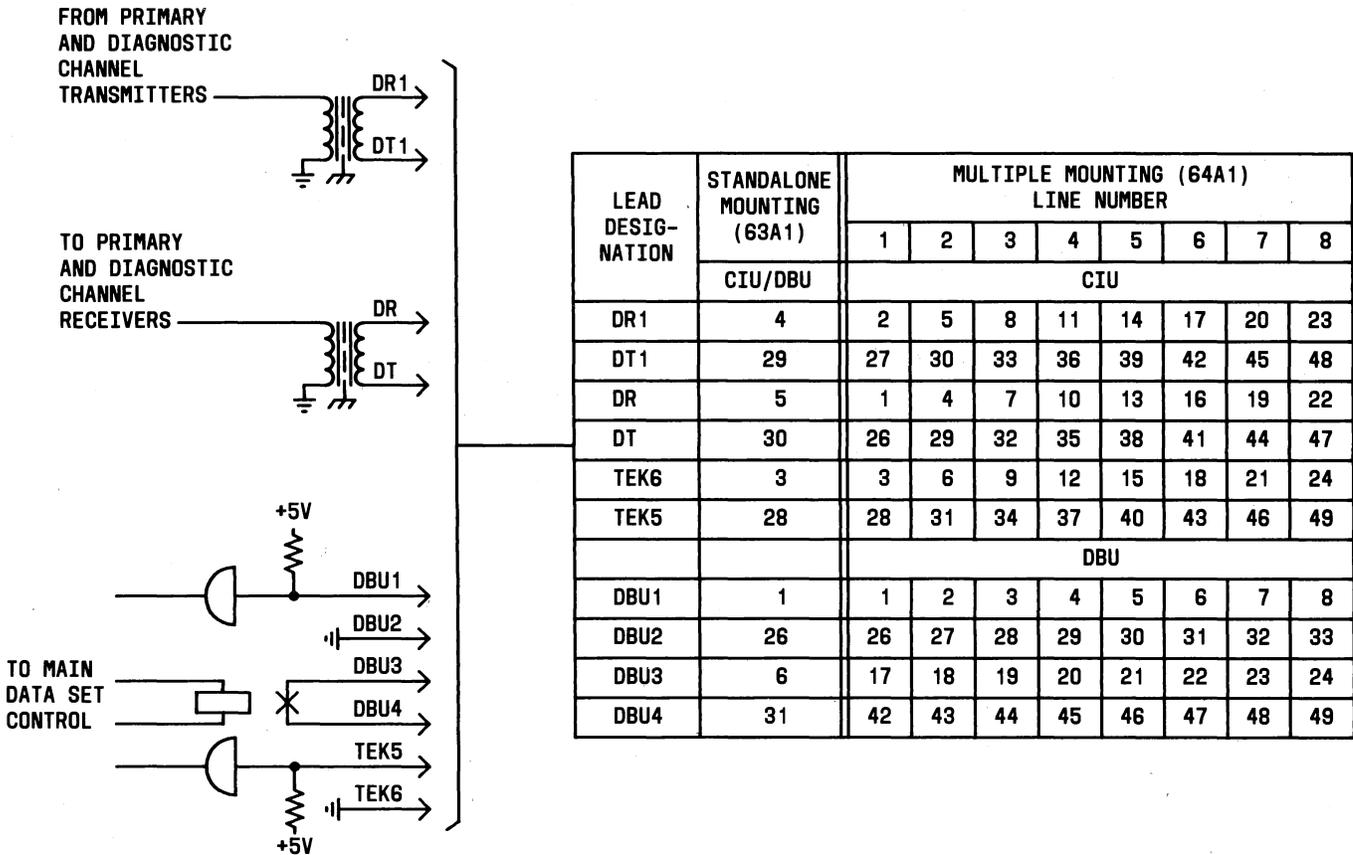
3.47 The control channel interface can also provide a common access point for remotely located DCDs via DS 202T (private line DATAPHONE II service data sets) or DS 212AR (switched network DATAPHONE II service data sets) when no local DCD is provided. If no DCD is provided either locally or remotely the connection to this interface is omitted.

3.48 The control channel interface consists of a 10-pin male connector (CC-IN) and a 10-pin female connector (CC-OUT) shown in Fig. 3 and 5. The connector pin numbers and the corresponding lead designations and functions are shown in Table J for CC-IN and Table K for CC-OUT.

Diagnostic Channel Interface

3.49 The diagnostic channel interface is a low-speed daisy-chain arrangement extending the diagnostic signals through an extended service site.

3.50 The diagnostic channel interface consists of a 9-pin male connector (DC-IN) and a 9-pin female connector (DC-OUT) shown in Fig. 3 and 5. The connector pin numbers and the corresponding lead designations and functions are shown in Table L for DC-IN and Table M for DC-OUT. Figure 15 shows the diagnostic channel interface circuits.

F. Real-Time Diagnostic System Faults

3.51 The DATAPHONE II service diagnostic system detects and displays some system malfunctions automatically (Table A). This basic diagnostic function is contained in the DATAPHONE II service data sets. The DC and the NC enhance this diagnostic capability found in the data sets. The individual faults indicated by the real-time diagnostic system are described below.

TABLE H

MULTIPLE MOUNTING CHANNEL
INTERFACE UNIT (CIU) CONNECTOR

PIN NO.	LEAD DESIGNATIONS	DATA SET POSITION NO.	FUNCTIONS
1,26	DR, DT	1	Receive Pair
2,27	DR1, DT1	1	Transmit Pair
3,28	TEK6, TEK5	1	Line Status Indicator
4,29	DR, DT	2	Receive Pair
5,30	DR1, DT1	2	Transmit Pair
6,31	TEK6,TEK5	2	Line Status Indicator
7,32	DR, DT	3	Receive Pair
8,33	DR1, DT1	3	Transmit Pair
9,34	TEK6, TEK5	3	Line Status Indicator
10,35	DR, DT	4	Receive Pair
11,36	DR1, DT1	4	Transmit Pair
12,37	TEK6, TEK5	4	Line Status Indicator
13,38	DR, DT	5	Receive Pair
14,39	DR1, DT1	5	Transmit Pair
15,40	TEK6, TEK5	5	Line Status Indicator
16,41	DR, DT	6	Receive Pair
17,42	DR1, DT1	6	Transmit Pair
18,43	TEK6, TEK5	6	Line Status Indicator
19,44	DR, DT	7	Receive Pair
20,45	DR1, DT1	7	Transmit Pair
21,46	TEK6, TEK5	7	Line Status Indicator
22,47	DR, DT	8	Receive Pair
23,48	DR1, DT1	8	Transmit Pair
24,49	TEK6, TEK5	8	Line Status Indicator

Data Set (Modem) Fault (MD)

3.52 This alphanumeric display indication (Fig. 16) denotes a failure in a data set. This display will indicate a fault in either a control or a tributary data set. In the case of a data set failure in a tributary data set the problem is reported to both the local (tributary) data set and to the associated control data set.

Facility (FA)

3.53 This alphanumeric display indication (Fig. 17) denotes either the receive signal quality or receive signal level are out of specifications. This fault indication will indicate a failure in either a control or a tributary data set. In the case of a facility failure in a tributary data set the problem is reported to both the local (tributary) data set and to the associated control data set.

Streaming Terminal (SR)

3.54 This alphanumeric display indication (Fig. 11) denotes a data terminal having interface lead request-to-send (RS) in a constant **on** state. This fault indication will indicate a failure in a tributary data set and report the failure to both the tributary data set and the associated control data set.

No Response (NR)

3.55 This alphanumeric display indication appears when a control data set is unable to elicit a response from a tributary data set after five attempts on the diagnostic channel.

Port *X* (PRTx)

3.56 This alphanumeric display indication is used on DS 2024, 2048, and 2096 in extended

TABLE I

MULTIPLE MOUNTING DIAL BACKUP
UNIT (DBU) CONNECTOR

PIN NO.	LEAD DESIGNATIONS	DATA SET POSTION NO.
1, 26		1
2, 27		2
3, 28		3
4, 29	DBU1, DBU2	4
5, 30		5
6, 31		6
7, 32		7
8, 33		8
17, 42		1
18, 43		2
19, 44		3
20, 45	DBU3, DBU4	4
21, 46		5
22, 47		6
23, 48		7
24, 49		8

service network. PRT1, PRT2, PRT3, or PRT4 indicates to a control data set operator that the circuit of the port specified on the DS 2096 has a fault.

G. Test Menu

3.57 The private line data sets provide a number of tests on both control and, in most cases, tributary data sets which are to be performed by the customer or a telephone company (telco) employee. In addition, several tests are provided for tributary data sets which may be performed by telco employees only. For DS 2096A the first "test" displayed is Port (PORT). This is not a test but is intended to remind the operator that any test selected will go through port 1 unless changed. Each of the other tests listed in the test menu (Table B) is described below.

Automatic Network Test (AUTO)

3.58 This test (Fig. 18) is available only on control data sets. It is designed to provide the operator with a way to quickly ascertain the status of the data sets and facilities of the network. The control data set generates a message and transmits it on the primary channel to each tributary data

set on its poll list. The tributary data set receives the message, checks it for errors, (multipoint tributaries) starts up, and transmits a good copy back to the control data set. (This message also contains an error indication if one was generated by the original transmission.) The control data set checks the new message for errors and records this information. This exchange of messages is accomplished for each tributary data set on the control data set's poll list and then repeated 50 times. If two or more transmissions result in errors the alphanumeric display indicates FAIL followed by the total number of failures along with the network address of the first 10 faulty tributaries. Otherwise, PASS is displayed with AUTO. Each acronym is displayed for 2 seconds.

3.59 The AUTO test checks the control data set and tributary data set, transmitter and receiver, and the telephone facility connecting them. It also checks the start-up of multipoint tributary data sets.

Modem Test (MT)

3.60 This test checks the transmitter, receiver, and the start-up capability of the data set under test. Modem test can be initiated by a control data set on itself or on any tributary on its poll list. A tributary data set can run MT on itself only.

3.61 Modem test (Fig. 19) involves start-up and transmission of a message 100 times. The data set is internally disconnected from the telephone facility interface and the transmitter output is connected to the receiver input through an attenuator (analog loopback). If one error is detected in the 100 transmissions the alphanumeric display will indicate FAIL alternating with "MT--" (for a control data set) or "MTxx" (for a tributary data set) where "xx" is the network address of the data set. If no errors are detected PASS will be indicated alternating with the test abbreviation (MT) and data set identification.

Digital Test (DT)

3.62 This test checks the control data set and tributary data set transmitter and receiver and the telephone facility connecting them.

3.63 Digital test (Fig. 20) is performed between the control and a selected tributary data
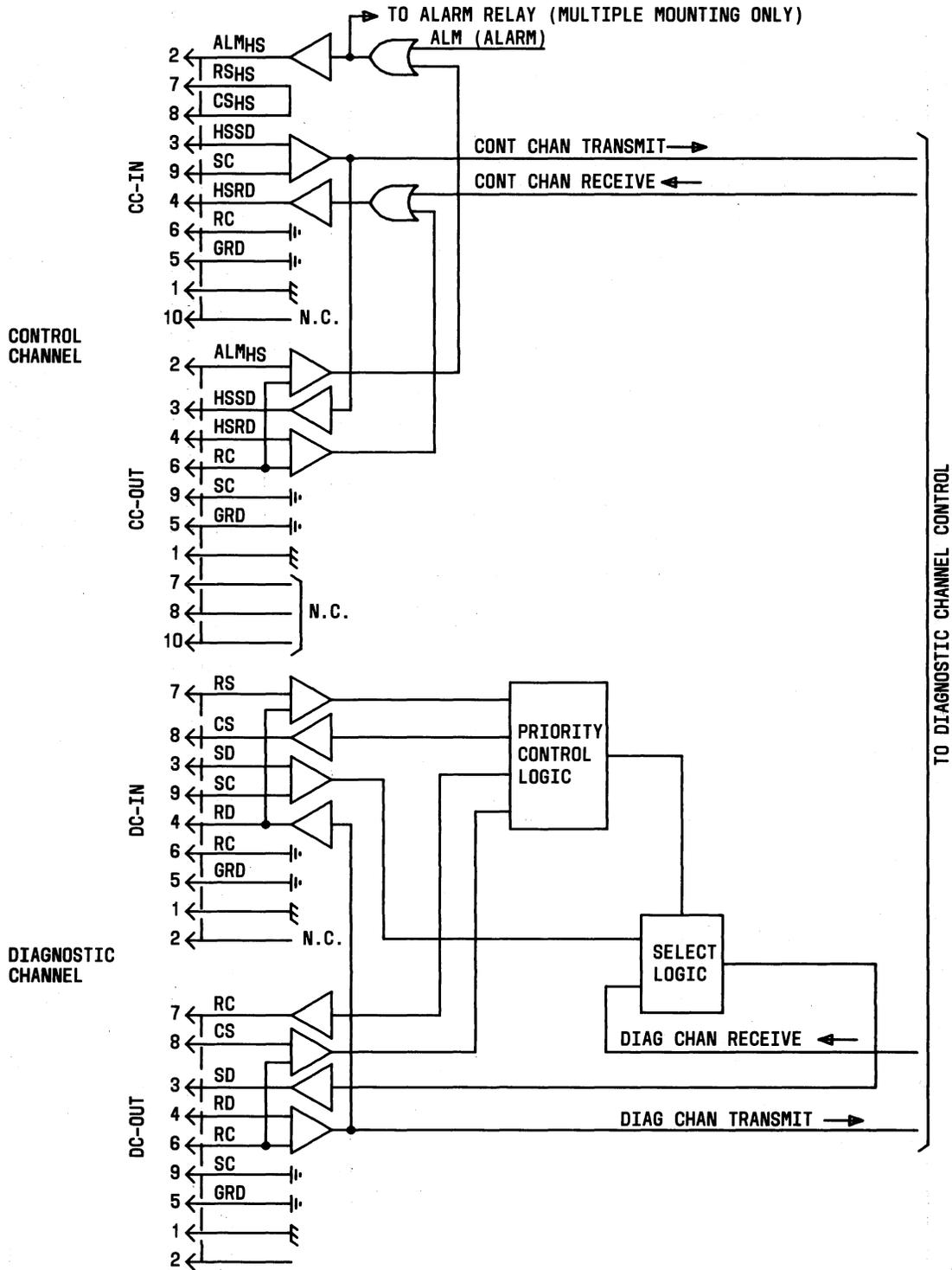
Fig. 15—Control Channel and Diagnostic Channel Interface Circuits

TABLE J

CONTROL CHANNEL INTERFACE — IN (CC-IN)

PIN NO.	LEAD DESIGNATION*	FUNCTION
1	FG	Frame Ground
2	ALM_{HS}	Alarm Circuit
3	HSSD	Send Data
4	HSRD	Receive Data
5	GRD	Circuit Ground
6	RC	Receive Common
7	RS_{HS}	Request-to-Send
8	CS_{HS}	Clear-to-Send
9	SC	Send Common

* "HS" in any lead designation stands for "high-speed".

TABLE K

CONTROL CHANNEL INTERFACE — OUT (CC-OUT)

PIN NO.	LEAD DESIGNATION*	FUNCTION
1	FG	Frame Ground
2	ALM_{HS}	Alarm Circuit
3	HSSD	Send Data
4	HSRD	Receive Data
5	GRD	Circuit Ground
6	RC	Receive Common
9	SC	Send Common

* "HS" in any lead designation stands for "high speed".

set. The control data set transmits a 511-bit pseudorandom word on the primary channel for 10, 20, or 40 seconds. This word is received by the tributary data set where it is looped from the receiver output to the transmitter input and retransmitted. This word is received by the control data set and compared to the original. Upon completion of the test the alphanumeric display will display PASS or FAIL alternating with DTxx (where "xx" is the network address of the tributary data set).

3.64 Telco employees can condition a tributary data set to request that a control data set

TABLE L

DIAGNOSTIC CHANNEL INTERFACE – IN (DC-IN)

PIN NO.	LEAD DESIGNATION*	FUNCTION
1	FG	Frame Ground
3	SD	Send Data
4	RD	Receive Data
5	GRD	Circuit Ground
6	RC	Receive Common
7	RS	Request-to-Send
8	CS	Clear-to-Send
9	SC	Send Common

* Some documents may contain lead designation with a suffix "I" (e g , SD/I) which stands for "in".

TABLE M

DIAGNOSTIC CHANNEL INTERFACE – OUT (DC-OUT)

PIN NO.	LEAD DESIGNATION*	FUNCTION
1	FG	Frame Ground
3	SD	Send Data
4	RD	Receive Data
5	GRD	Circuit Ground
6	RC	Receive Common
7	RS	Request-to-Send
8	CS	Clear-to-Send
9	SC	Send Common

* Some documents may contain lead designations with a suffix "O" (eg, SD/O) which stands for "out".
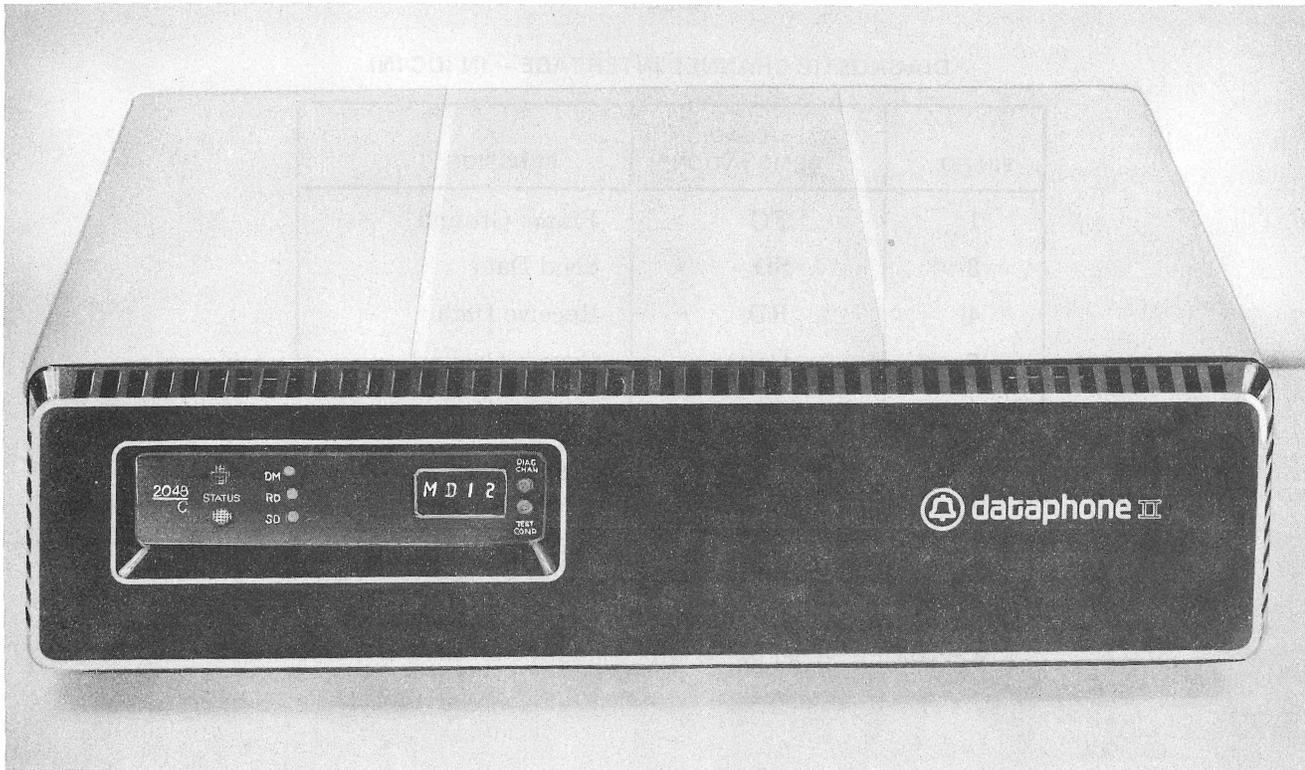
Fig. 16—Data Set (Modem) Fault Display

perform DT on it by placing the tributary data set in the maintenance mode (MTCE). When performing the test in this manner, the results are displayed on the tributary data set front panel.

End-to-End Test (EE)

3.65 This test is similar to automatic network test described above except that it actually tabulates the number of transmissions in each direction that contain errors. It checks the transmitter, receiver, and telephone facility of each data set.

3.66 This test (Fig. 21) is performed between the control and a selected tributary data set. The control data set generates a message and transmits it on the primary channel to the selected tributary data set. The tributary data set receives the message, checks it for errors, and transmits a good copy back to the control data set. (This message also contains an error indication if one was generated by the original transmission.) The control data set checks the new message for errors and records this information.

3.67 The exchange of messages is performed 100 times. Each error is counted by the control data set and displayed upon completion of the test. The displays are "xxEI" (where "xx" are the number of errors and "EI" is "errors inbound") alternating with "xxEO" (where "xx" is the number of errors and "EO" is "errors outbound") together with "EExx" where "xx" is the address of the tributary data set.

3.68 Telco employees can condition a tributary data set to request a control data set to perform EE on it by placing the tributary data set in the maintenance mode (MTCE). When performing the test in this manner, error counting is done in the control data set and sent via the diagnostic channel to the tributary data set where displays are on the tributary data set front panel.

Transmit Loss Test (TRMT)

3.69 This test (Fig. 22) can only be performed on data sets in the maintenance mode of operation. The TRMT is designed to measure the

Fig. 17—Facility Fault Display

1004 Hz loss of the primary channel in the *outbound* direction from the testing data set.

3.70 When TRMT is initiated the testing data set will signal a far-end DATAPHONE II service data set on the diagnostic channel to prepare to measure the receive level of the 1004 Hz tone (transmitted at 0 dBm ±1 dB for 5 seconds) it will be sent on the primary channel. The far-end data set measures the level and transmits the result back to the testing data set on the diagnostic channel.

3.71 The testing data set will display the result as follows:

- "xxDB" where "xx" represents the received signal level in negative dBm.

- "xxDB" where *flashing* "xx" represents the received signal level in positive dBm.

This received level measurement is accurate to ±1 dB. The overall accuracy of the test is ±2 dB

(±1 dB on the transmission and ±1 dB on the received level measurement). The measurement quantity will alternate with "TRxx" if the testing data set is a control or "TRMT" if the testing data set is a tributary.

Receive Loss Test (RCV)

3.72 This test (Fig. 23) can only be performed on data sets in the maintenance mode of operation. The RCV is designed to measure the 1004 Hz loss of the primary channel in the *inbound* direction to the testing data set.

3.73 When RCV is initiated the testing data set will signal a far-end data set (this must be a DATAPHONE II service data set) on the diagnostic channel to transmit a 1004 Hz tone at 0 dBm ±1 dB for 5 seconds on the primary channel. The testing data set will measure the received level and display the result.
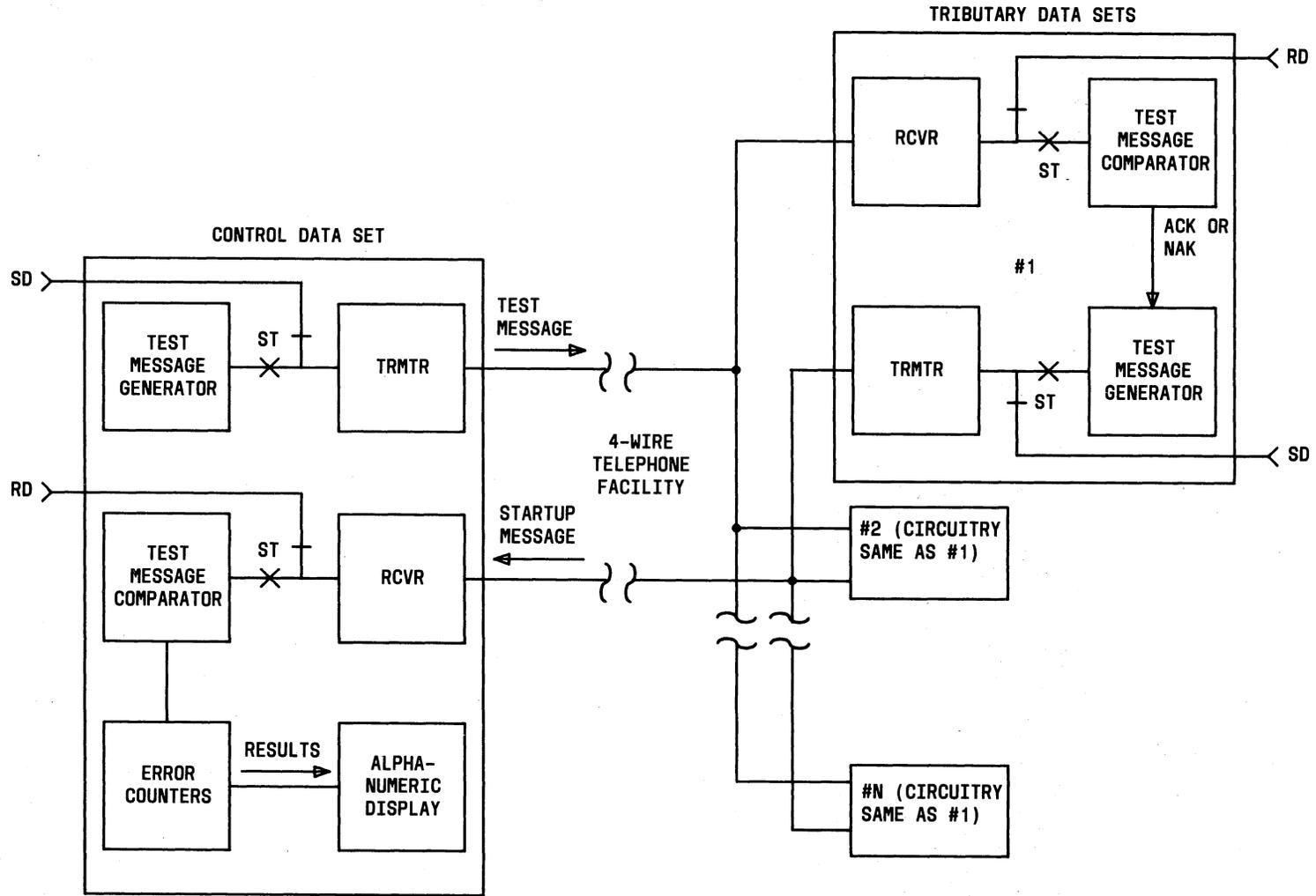
Fig. 18—Automatic Network Test
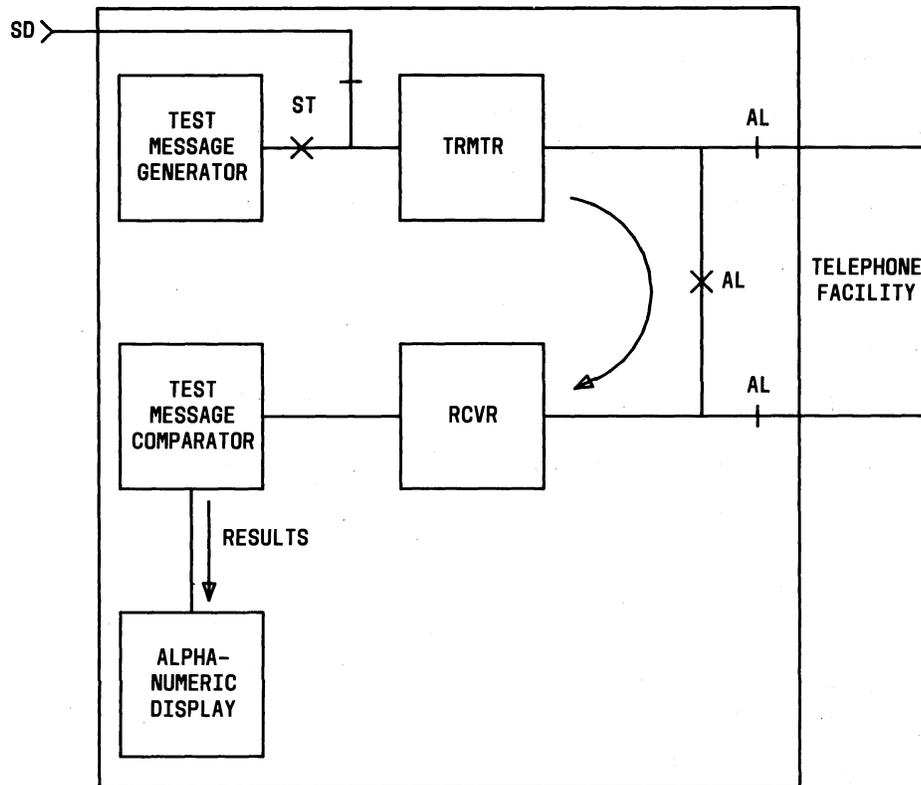
Fig. 19—Modem Test or Continuous Modem Test

3.74 The testing data set will display the result as follows:

- "xxDB" where "xx" represents the received signal level in negative dBm.

- "xxDB" where *flashing* "xx" represents the received signal level in positive dBm.

This received signal level measurement is accurate to ±1 dB. The overall accuracy of the test is ±2 dB (±1 dB on the transmission and ±1 dB on the received level measurement). The measurement quantity will alternate with "RCxx" if the testing data set is a control or "RCV" if the testing data set is a tributary.

1004 Hz Tone Test (1004)

3.75 This test (Fig. 24) can only be performed on data sets in the maintenance mode of operation. The 1004 causes the data set to continuously transmit a 1004 Hz tone at 0 dBm ±1 dB on the primary channel.

3.76 The purpose of this test is to allow a telco employee at a far-end location to measure the received signal level by some means. The level could be measured by another DATAPHONE II service data set by selecting the receive signal level (RSL) test.

Local Loopback Test (LL)

3.77 This test is used by a telco employee wishing to perform tests on a control or tributary data set using external test equipment or DTE.

3.78 In test LL (Fig. 25) the output of the transmitter is looped to the input of the receiver through an attenuator. The data set is internally disconnected from the telephone facility interface.

Digital Loopback Test (DL)

3.79 This test is used by a telco employee wishing to perform tests from a data set to which external test equipment is connected to the data

CONTROL DATA SET

TRIBUTARY DATA SET
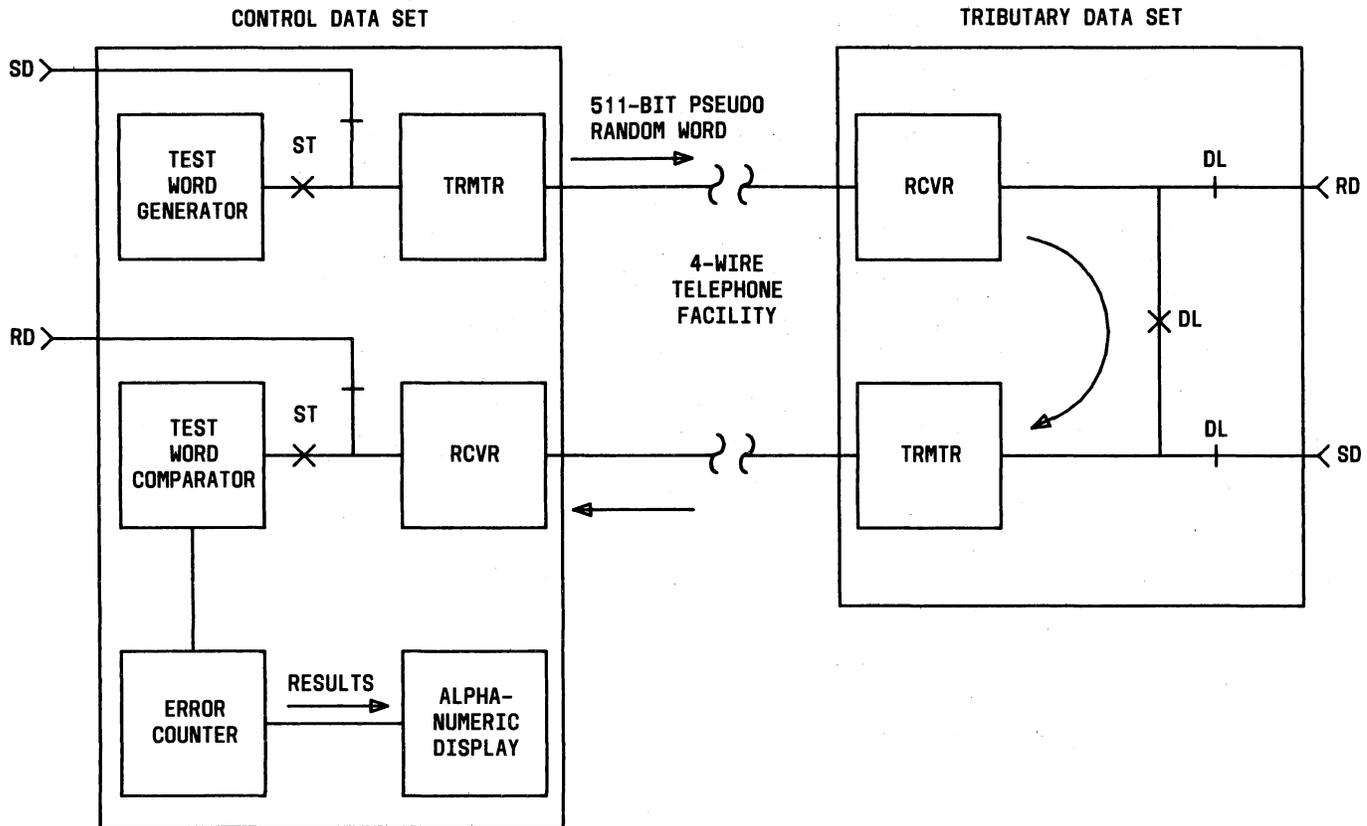
Fig. 20—Digital Test

set in DC. In test DL (Fig. 26) the output of the receiver is looped to the input of the transmitter. The data set is internally disconnected from the customer interface. Control channel and diagnostic channel operation are not affected.

Continuous Modem Test (C-MT)

3.80 This test (Fig. 19) checks an individual control or tributary data set transmitter and receiver. When the test is initiated the data set-generated test message is looped back from the transmitter output to the receiver input through an internal attenuator. The received data is then checked against the original message. Upon completion of the test the alphanumeric display will display PASS or FAIL alternating with C-MT. As soon as one passed test is completed another begins. If the test fails it is not rerun and FAIL is displayed.

Self Test (ST)

3.81 This test (Fig. 27) is intended to allow DATAPHONE II service data sets to perform digital loopback tests with DS 201 and 208. To perform ST the DS 201 or 208 DL or ST switch is depressed and ST is initiated at the DATAPHONE II service data set.

3.82 When the test is initiated the control data set begins transmitting a 15-bit pseudorandom or steady marking word to the tributary DS 201 or 208. With the DS 201 or 208 in DL this word is received by the tributary data set where it is looped from the receiver output to the transmitter input and retransmitted. This word is received by the control data set and compared to the original. The error count will be displayed at the control data set as "xxST" and updated continuously.

3.83 With the DS 201 or 208 in ST the test is conducted like an end-to-end self test with

CONTROL DATA SET   TRIBUTARY DATA SET
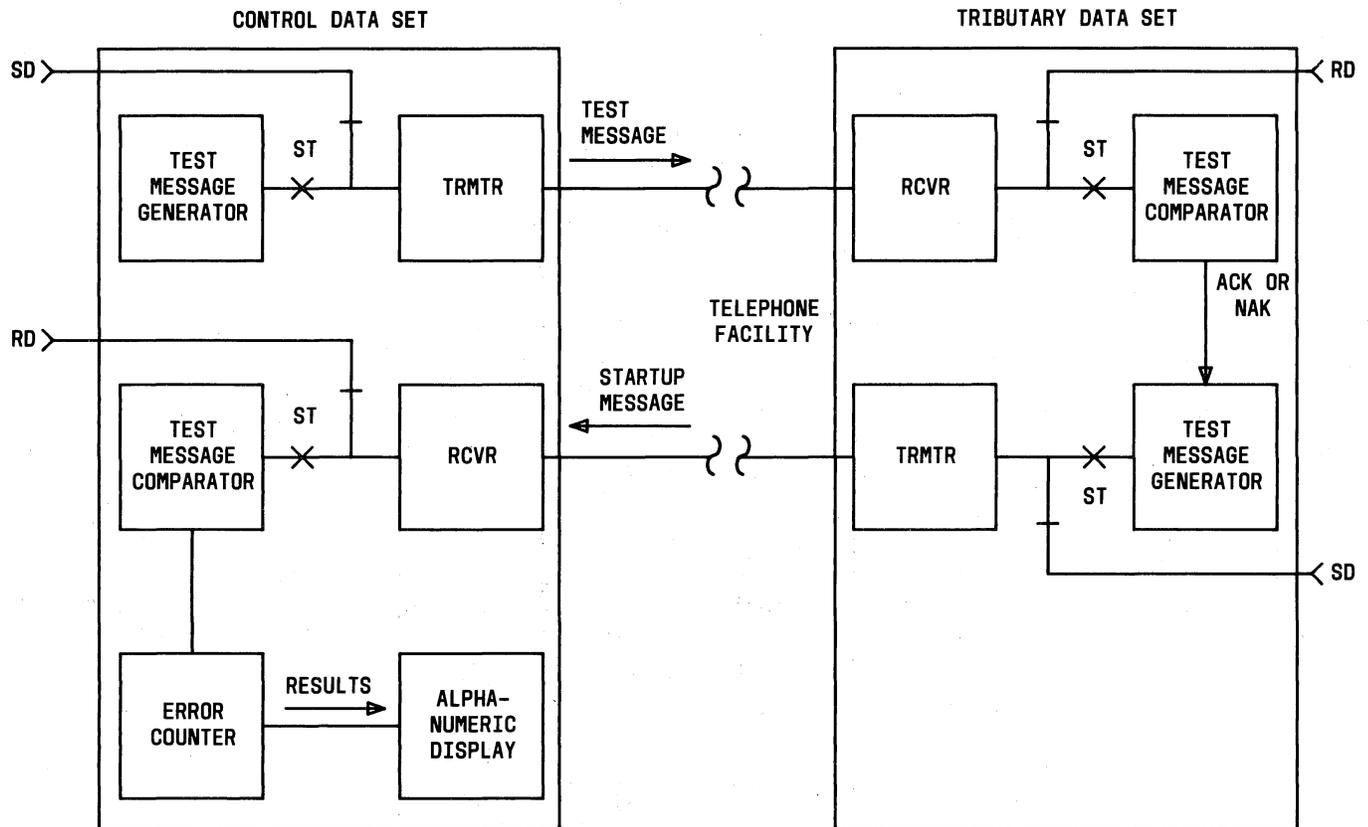
Fig. 21—End-to-End Test

the test word being generated and transmitted at each end.

Receive Signal Level Test (RSL)

3.84 This test calls for a measure of the receive signal level to a data set. This test can be performed by a control or tributary data set on itself or by a control data set on a tributary. The result is displayed as "RSL" alternating with "xxDB". The display "xxDB" represents the receive signal level measured in negative dBm. (When a control data set tests a tributary data set the "xxDB" display alternates with "SLxx".)

Receive Signal Quality Test (RSQ)

3.85 This test is very similar to RSL above with the following differences: the result figure will be a number from 0 to 9 (displayed without "DB") and will alternate with "SQxx" or "RSQ-".

Lamp Test (LAMP)

3.86 This test checks all front panel LEDs, including the segments of each character of the alphanumeric display. Depressing EXEC causes all LEDs to be driven on for as long as EXEC is depressed.

Abort All Tests (ABT)

3.87 This command is included in the test menu because it affects only test operation. When initiated, this command terminates any test in progress in the local data set. In addition, if the local data set is a control, tests in progress at all the associated tributary data sets will be terminated also.

H.   Command Menu

3.88 The DATAPHONE II service data sets provide a large number of commands for use by telco employees and, in some cases, customers.

TESTING DATA SET

FAR-END DATAPHONE II
DATA SET

Fig. 22—Transmit Loss Test

TESTING DATA SET

FAR-END DATAPHONE II
DATA SET

SD >

ALPHANUMERIC
DISPLAY

TRMTR

RCVR

< RD

RESULT

4-WIRE
TELEPHONE
FACILITY

LEVEL
MEASURING
CIRCUITRY

ST

RCVR

TRMTR

ST

TONE
GENERATOR

1004 Hz
TONE

RD >

< SD
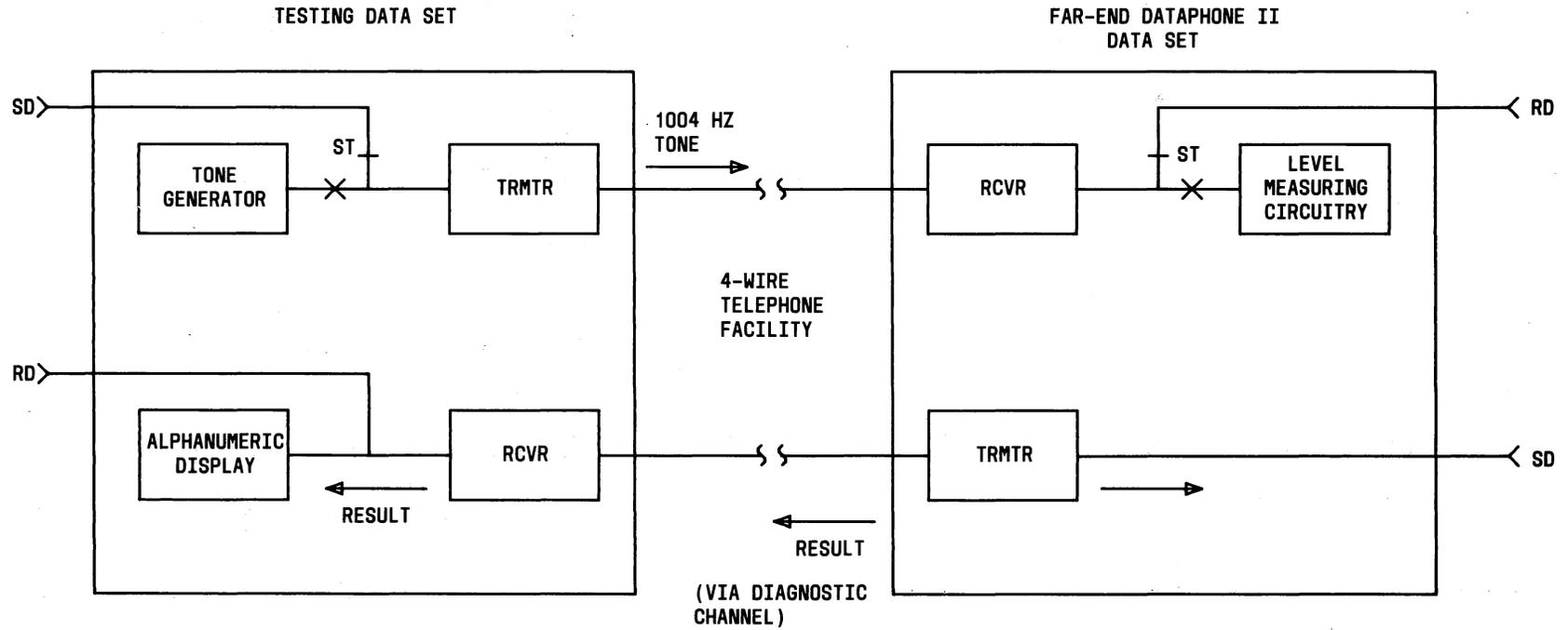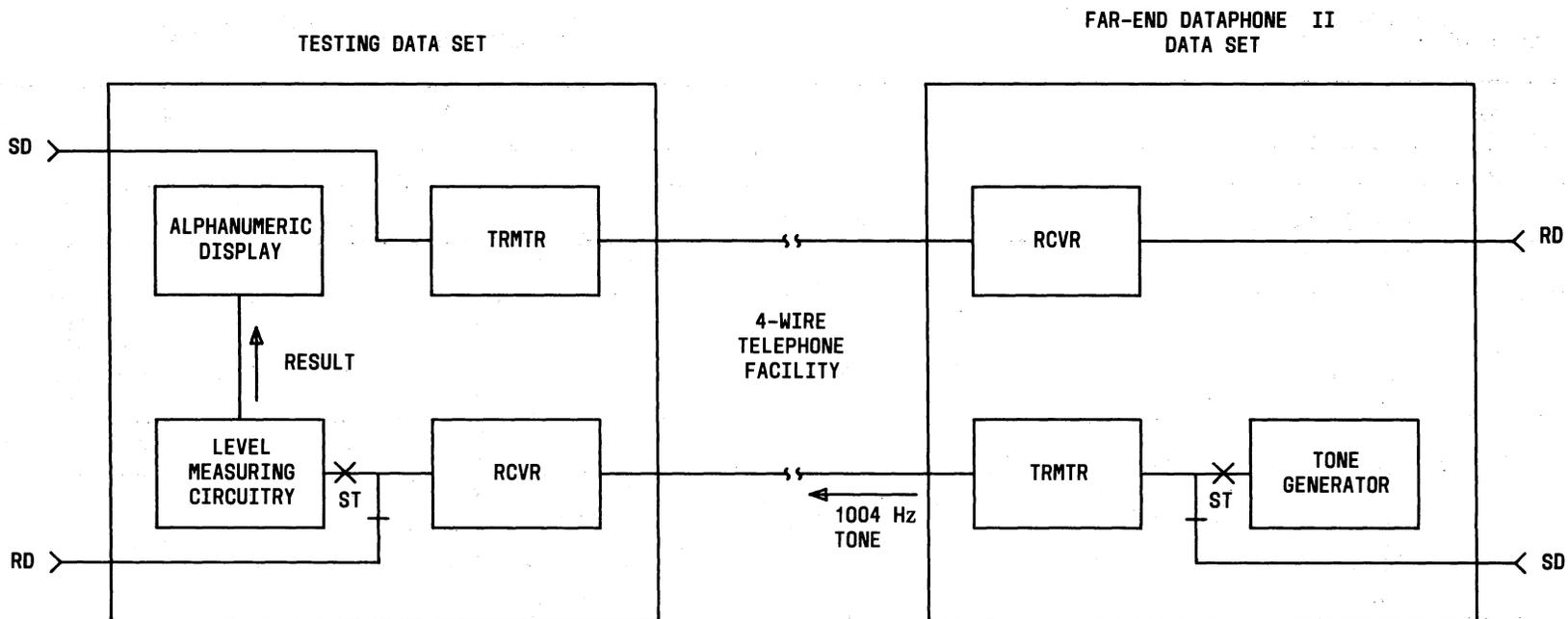
Fig. 23—Receive Loss Test

TESTING DATA SET
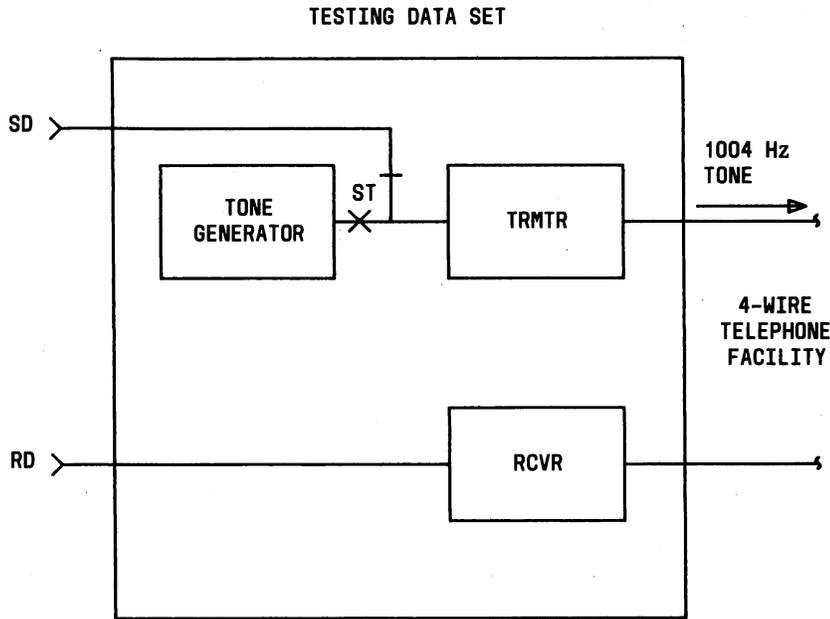
Fig. 24—1004 Hz Test Tone
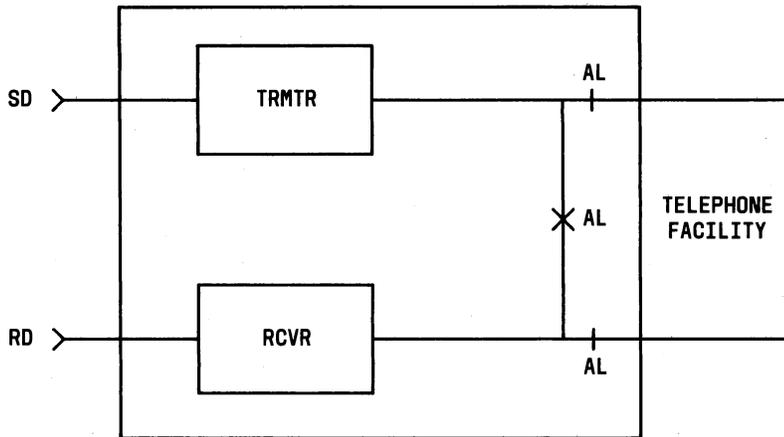
Fig. 25—Local Loopback Test

These commands are divided into two categories: mode commands and change commands.

3.89 Mode commands are those that permit an operator to display or change the operating mode of a data set. Refer to Table C for a list of these commands.

3.90 Change commands are those that permit an operator to display and change features such as options or addresses. These commands also are shown in Table C.

3.91 Each command in the command menu is described below.

Modem Check (MDCK)

3.92 This command permits the operator of a control data set to quickly survey the network for tributary data sets which are in an
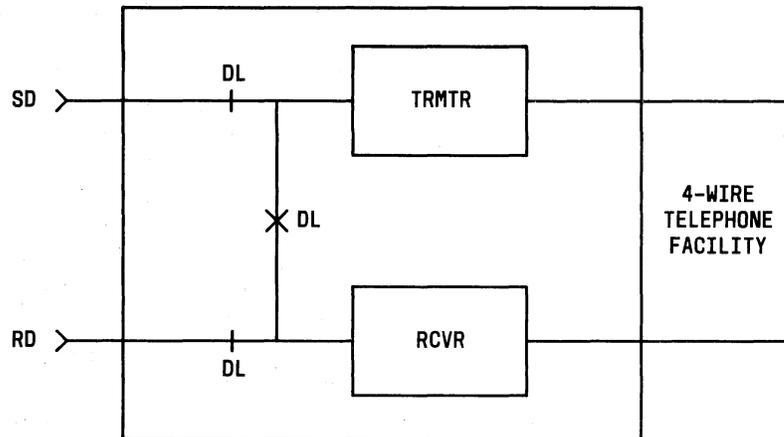
Fig. 26—Digital Loopback Test

"off-line" condition (ie, disabled, in maintenance mode, or in a test mode). Any data set not displayed as "DSxx" (disabled), "MCxx" (maintenance mode), or "TSxx" (test mode), where "xx" is the network address, is "on-line".

Disable (DSAB)

3.93 This command makes it possible for a control data set operator to disable the control data set or any tributary data set. A tributary data set operator can disable only the tributary data set. When disabled, the data set transmitter is internally disconnected from the network by looping its output to the receiver input through an attenuator. In this condition the CS (clear-to-send) and DM (data mode) customer interface leads are held *off.*

3.94 The operator is locally advised of a disabled data set when the TEST/CMD switch is in the normal position by the alphanumeric display flashing "DSAB". A tributary data set that is disabled advises the control data set of this mode each time it is polled by sending that message over the diagnostic channel. No fault condition will be indicated since disable is a mode of operation.

3.95 When the DSAB command is choosen (with the TEST/CMD switch in CMD) a tributary data set alphanumeric display will indicate DS/O for an *enabled* and DS/I for a *disabled* data set. A control data set will indicate a check mark by the pseudo address of itself or the network address of any tributary that is *disabled.*

3.96 Certain tests can be performed on a data set while it is disabled. These are: modem test (MT), local loopback test (LL), continuous modem test (C-MT), received signal level test (RSL), and received signal quality test (RSQ). During LL customer interface leads CS and DM will be turned *on* to allow the telco employee to carry out external testing. The disable command is used to both disable and enable the data set.

Maintenance (MTCE)

3.97 This command enables a telco employee to place a control or tributary data set in the maintenance mode.

3.98 A control or tributary data set in the maintenance mode has enhanced test and command menus. These may be used to test the data set before it is placed in a multipoint network or to test the data set after a trouble report.

3.99 The telco employee is locally advised of a data set in the maintenance mode when the TEST/CMD switch is in the normal position by the alphanumeric display flashing "MTCE". A tributary data set that is in the maintenance mode advises the control data set of this mode each time it is polled by sending that message over the diagnostic channel. No fault condition will be indicated since maintenance is a mode of operation.

3.100 A tributary data set is enabled by the maintenance mode to perform certain additional tests (refer to Table B) with its control
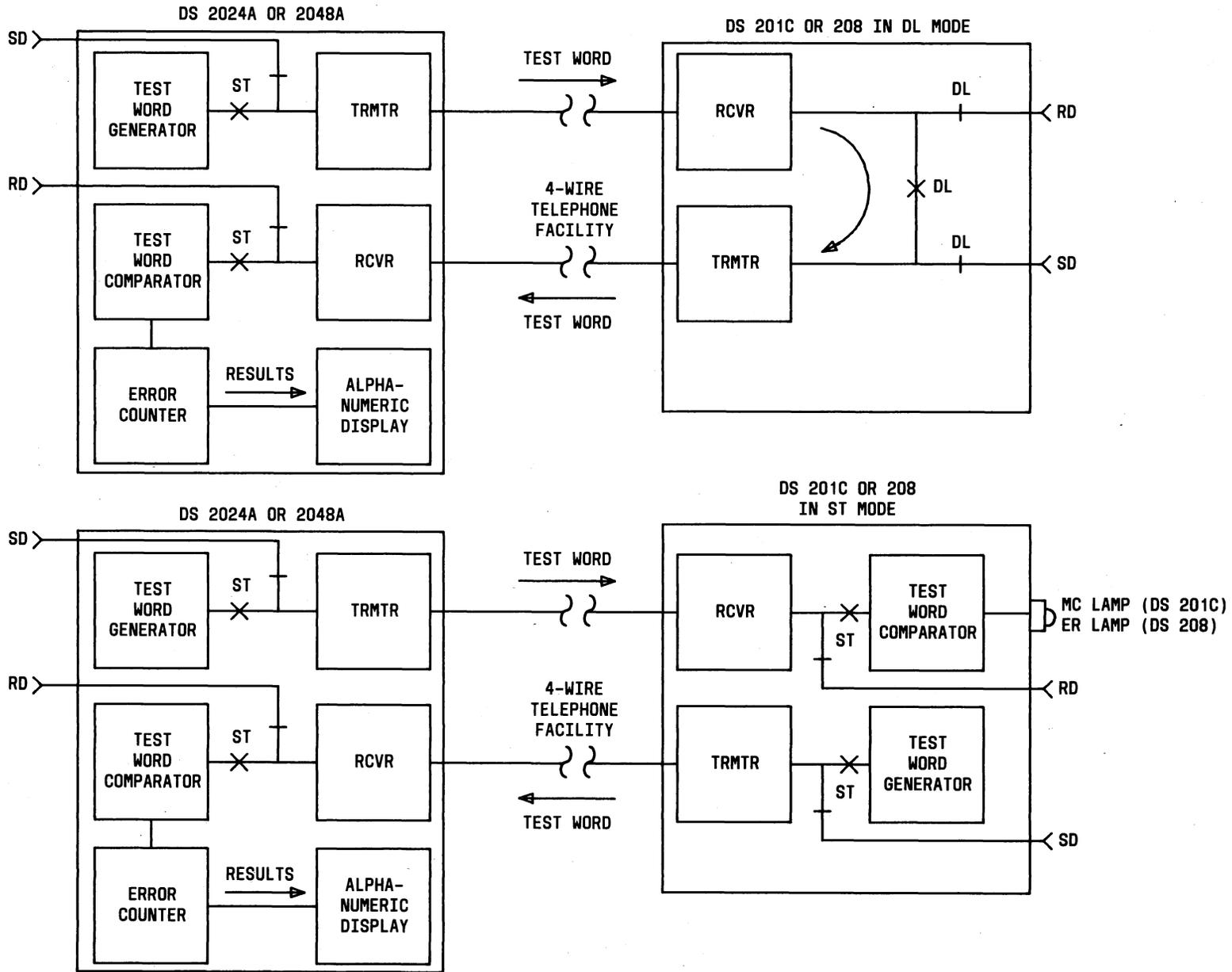
Fig. 27—Self Test

data set over the primary channel. A control data set is also enabled to perform additional tests while in the maintenance mode (refer to Table B).

3.101 A tributary data set in the maintenance mode is able to use the acquire poll list (AQPL) command to direct the control data set (via the diagnostic channel) to acquire the network address of the tributary data set. This places the tributary data set on the control data set poll list without the necessity of action being taken locally at the control data set location.

3.102 This command both places the data set in the maintenance mode (MC/I) and removes it from the maintenance mode (MC/O).

Display Options (DSOP)

3.103 This command permits the operator to observe the options installed in a data set. These options will be displayed in sequence on the alphanumeric display by executing the command and operating the -/+ switch.

Clear Options (CLOP)

3.104 This command clears all previously installed options. After execution of this command the data set is automatically placed in the change options (CHOP) command to install options.

If the operator exits the CHOP command without taking any action (ie, installating any options) a default option set is automatically installed.

Change Options (CHOP)

3.105 This command adds and deletes options. All available options will be displayed in alphanumeric sequence on the alphanumeric display. All options currently installed will be indicated by a check mark ($\checkmark$) opposite the alphanumeric designation (eg, "A2 $\checkmark$").

Change Multiplexer Mode (CHMX)

3.106 This command selects the multiplexer configuration of DS 2096A. The following optional configurations are provided:

- One 9600-bps channel (1-96)

- One 7200-bps and one 2400-bps channel (72/24)

- Two 4800-bps channels (48/48)

- One 4800-bps channel and two 2400-bps channels (48/24/24)

- Four 2400-bps channels (24/24/24/24)

The default channel speeds for use on degraded telephone facility are as follows:

- One 4800-bps channel (1-48)

- Two 2400-bps channels (24/24)

Add Poll List (ADPL)

3.107 This command enables a poll list in tributary data sets for use in the maintenance mode.

Acquire Poll List (AQPL)

3.108 This command causes the control or backbone tributary data set to poll every possible network address. (The maximum length of the poll list will be optional.) Each network address for which it receives a response will be added to the list.

The AQPL command is time-consuming. To add known addresses the change poll list command (below) may be used.

Display Poll List (DSPL)

3.109 This command permits the operator to determine which network addresses are on the poll list. These addresses are displayed in sequence on the alphanumeric display.

Change Poll List (CHPL)

3.110 This command enables the operator to manually add or delete network addresses from the poll list. As with options, the network addresses currently on the poll list, are displayed with a check mark ($\checkmark$) opposite the numeric display.

Display Software Version (DSSV)

3.111 This command enables the operator to determine the software version being used in the data set.

Display Network Address (DSNA)

3.112 This command allows the operator to display the local data set network address. The display contains the abbreviation NA and a 2-digit address.

Change Network Address (CHNA)

3.113 This command permits the operator to change the network address of the local data set.

Display Local Address (DSLA)

3.114 This command enables the operator to check the data set local address. This address cannot be changed from the front panel. The display contains the abbreviation LA alternating with a 3-digit address.

Port Monitor (PMON)

3.115 This command applies to DS 2096A only and is used to make the front panel RS and CS indicators indicate activity on ports 2, 3, or 4. These LEDs indicate activity on the last port selected.

I. Options

3.116 The private line data sets are provided with a number of options which must be installed prior to placing the data set in service. The options for private line data sets are contained in eleven categories with each category having up to eight options. These categories are designated by characters from A to K with each option within a category being designated by a number from 1 to 8.

3.117 Options are installed using the set of option commands described previously. Operating procedures necessary for setting options are found in Part 4, Operation.

3.118 The options are stored in a volatile memory. Once the options have been stored, they are retained even during power outages by the battery backup to the memory power. Whenever the data set has power applied to it after having been totally without power (ie, no ac power and the battery is discharged or switched out), *the default options designated in Table N will be automatically loaded from a permanent memory into the volatile memory.* The installer should verify that the options called for on the service order are installed. The options available with private line data sets are shown in Table N and are described below.

Category A Options—Service Offerings

3.119 The category A options are circuit configuration options for point-to-point or multipoint circuits. The category G options, which are described later, are circuit configuration options for extended circuits and multiplexer circuits. These category A and G options define the role of the data set in the network.

3.120 The category A options describe to the diagnostic circuitry whether the data set is a diagnostic channel control or tributary data set. Control data sets use the diagnostic channel to poll and select the tributary data sets directly connected to their analog circuits. Control data sets use the channel both to gather information on the status of the tributaries and to direct commands to them from the control data set front panel. The control data sets have complete test and command menus. Tributary data sets can transmit on the diagnostic channel only in response to a poll or selection from a control data set and they have limited test and command menus.

3.121 Category A and G options are mutually exclusive; ie, only a single Category A *or* G option is to be installed.

3.122 *Point-to-Point Control (A1):* This option enables a point-to-point control data set with full test and command menus. This data set can then identify its tributary data set(s) and display system status on the front panel. This application is illustrated in Fig. 28.

3.123 *Point-to-Point Tributary or Extended Point-to-Point Tributary (A2):* This data set responds to polls from the control data set above. Restricted test and command menus

TABLE N

DATA SET OPTIONS

OPTION DESIG.	OPTION NAME	APPLIES TO DATA SET				REMARKS
		2024A	2048A	2048C	2096A	
A1	Category A—Service Offerings Point-to-Point Control	✓	✓		✓	Mutually Exclusive with Cat. G options Below
A2	Point-to-Point Tributary or Extended Point-to-Point Tributary	✓	✓		*	
A3	Multipoint Control	✓	✓	*		
A4	Multipoint Tributary or Extended Multipoint Tributary	*	*		‡	
B1	Category B—Timing Control Internal Timing	*	*	*	*	Mutually Exclusive
B2	Slaved Timing	✓	✓		✓	
B3	External Timing - Port 1	✓	✓	✓	✓	
B4	External Timing - Port 2				✓	
B5	External Timing - Port 3				✓	
B6	External Timing - Port 4				✓	
C1	Category C—Carrier Control Continuous Carrier, Switched RS - Port 1	✓	✓	✓	✓	Mutually Exclusive
C2	Continuous Carrier, Switched RS - Port 2				✓	
C3	Continuous Carrier, Switched RS - Port 3				✓	
C4	Continuous Carrier, Switched RS - Port 4				✓	
C5	Continuous Carrier, Continuous RS	✓	✓	*	*	
C6	Switched Carrier, Switched RS All Ports	*	*	✓	✓	
D1	Category D—Interface Control DM off in Analog Loop	✓	✓	✓	✓	
D2	Received Data Not Clamped in Modem Test	✓	✓	✓	✓	
D3	Signaling Rate Selector (SR) Used				✓	
D4	Antistream Timer - 3 seconds	✓	✓		✓	
D5	Antistream Timer - 9 seconds	✓	✓		✓	
D6	Antistream Timer - 27 seconds	✓	✓		✓	
D7	Data Auxiliary Set or TEK Leads Not Used †	✓	✓	✓	✓	
D8	Disable Receive Signal Quality for Facility Health Monitor	✓	✓	✓	✓	

TABLE N (Contd)

DATA SET OPTIONS

OPTION DESIG.	OPTION NAME	APPLIES TO DATA SET				REMARKS
		2024A	2048A	2048C	2096A	
E1	Category E —Miscellaneous Options Quick Start-Up		✔	✔		
E2	One-second Holdover Out	*	*		✔	
E3	Transmit Soft Turn-Off	✔	✔	✔		
E4	Receive Soft Turn-Off	✔	✔	✔		
E5	Maximum Address - 16	✔	✔	✔	✔	
E6	Maximum Address - 32	✔	✔	✔	✔	
E7	Disable Secondary Channel	✔	✔	✔	✔	
E8	Disable Receive Signal Level for Facility Health Monitor	✔	✔	✔	✔	
F5	Category F—DDD Options DM-TR Interlock In				✔	
F6	Terminal-In-Service (IS) Used				✔	
G1	Category G—Additional Service Offerings Double Extension Outboard Control	✔	✔		✔	
G2	Double Extension Outboard Tributary or M:1 Mux Tributary	✔	✔		✔	
G3	Double Extension Backbone Control or M:1 Mux Control	✔	✔		✔	
G4	Backbone Tributary or 1:M Mux Tributary	✔	✔		✔	
G5	Extended Point-to-Point Control or 1:M Mux Control	✔	✔		✔	
G6	Extended Multipoint Control or 1:M Mux Multipoint Control	✔	✔	✔		
H1	Category H—Elastic Stores Elastic Store In- Port 1				✔	
H2	Elastic Store In - Port 2				✔	
H3	Elastic Store In - Port 3				✔	
H4	Elastic Store In - Port 4				✔	

TABLE N (Contd)

DATA SET OPTIONS

OPTION DESIG.	OPTION NAME	APPLIES TO DATA SET				REMARKS
		2024A	2048A	2048C	2096A	
I1	Category I—Independent Receiver Ready Operation Independent Rcvr Ready Operation - Port 1				✔	
I2	Independent Rcvr Ready Operation - Port 2				✔	
I3	Independent Rcvr Ready Operation - Port 3				✔	
I4	Independent Rcvr Ready Operation - Port 4				✔	
J1	Category J—Interface Control for Port Identification Extended Service Addressing - Port 1	✔	✔	✔	✔	
J2	Extended Service Addressing - Port 2				✔	
J3	Extended Service Addressing - Port 3				✔	
J4	Extended Service Addressing - Port 4				✔	
K1	Category K—DDD Interface Telemetry Dial-In Extension Telemetry - Port 1				✔	
K2	Dial-In Extension Telemetry - Port 2				✔	
K3	Dial-In Extension Telemetry - Port 3				✔	
K4	Dial-In Extension Telemetry - Port 4				✔	
K5	DS 201, 208 Operation at Dial-In Ext - Port 1				✔	
K6	DS 201, 208 Operation at Dial-In Ext - Port 2				✔	
K7	DS 201, 208 Operation at Dial-In Ext - Port 3				✔	
K8	DS 201, 208 Operation at Dial-In Ext- Port 4				✔	
LA	Interface Rise Time Options ¶ RS-449 Rise Time - Port 1	✔	✔	✔	✔	
LB	RS-449 Rise Time - Port 2				✔	
LC	RS-449 Rise Time - Port 3				✔	
LD	RS-449 Rise Time - Port 4				✔	
SA	RS-232 Rise Time - Port 1	§	§	§	§	
SB	RS-232 Rise Time - Port 2				§	
SC	RS-232 Rise Time - Port 3				§	
SD	RS-232 Rise Time - Port 4				§	

✔ Available option.

* Default option, and available option.

† Provided only when TEK leads or 829-type ACUs are not present.

‡ Appears in option list but is not used.

§ Factory installed option.

¶ Installed and removed by rise time switch(s).

are enabled and only local testing is allowed. Refer to Fig. 28.

3.124 *Multipoint Control (A3):* Similar to option A1 above. This data set will have one or more tributary data sets and will be enabled to acquire a poll list. Refer to Fig. 29 and 30.

3.125 *Multipoint Tributary or Extended Multipoint Tributary (A4):* Similar to option A2 above. Refer to Fig. 29 and 30.

CONTROL
DATA SET

TRIBUTARY
DATA SET

TO
DTE — 4-WIRE PRIVATE LINE
FACILITY — TO
DTE

OPTION A1   OPTION A2
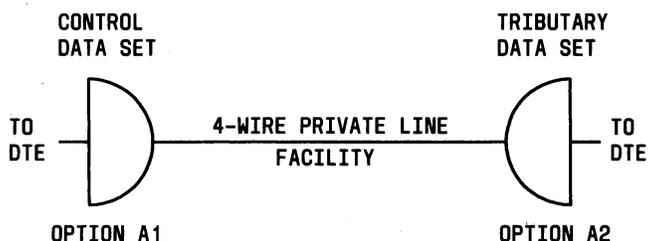
Fig. 28—Example of Category A Point-to-Point Service Options

CONTROL
DATA SET

TRIBUTARY
DATA SET

TO
DTE — 4-WIRE PRIVATE LINE
FACILITY — TO
DTE

OPTION A3   OPTION A4

TO
DTE
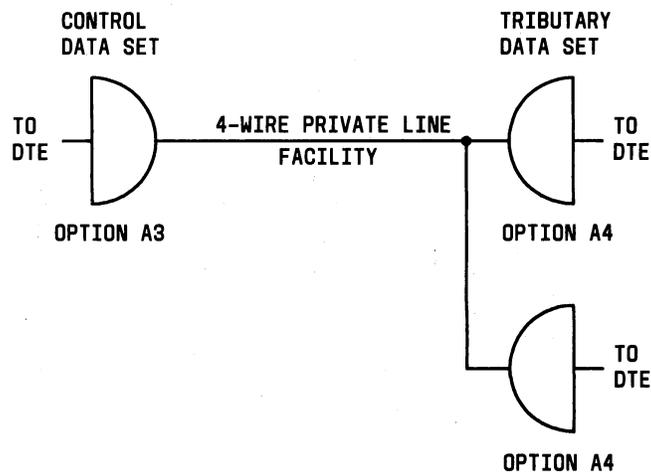
OPTION A4

Fig. 29—Example of Category A Multipoint Service Option

CONTROL
DATA SET   TRIBUTARY
DATA SET

TO
DTE — DS
2048C — 4-WIRE PRIVATE
LINE FACILITY — TO
DTE

OPTION A3 AND E1   OPTION A4 AND E1

TO
DTE
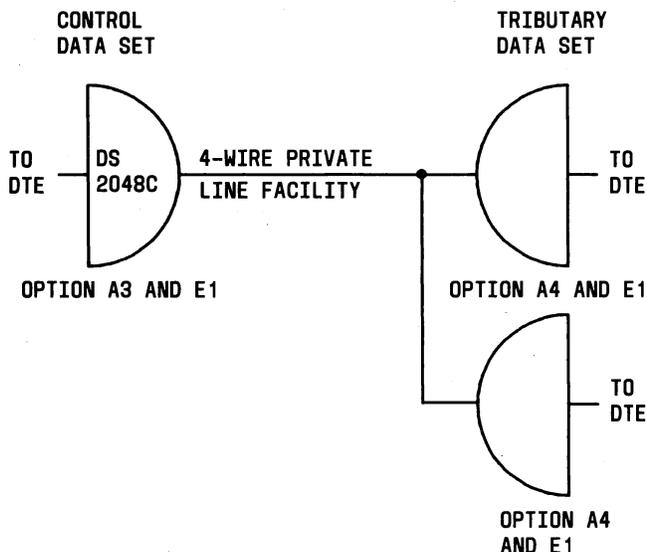
OPTION A4
AND E1

Fig. 30—Example of Category A and E Quick Start-up Multipoint Service Options

Category B Options—Timing Control

3.126 These options determine the source of data set timing; either internal, slaved, or external.

3.127 *Internal Timing (B1):* With this option installed, data set timing is derived from the internal master oscillator. This option will be used in most cases. Exceptions are extended service offerings and where the DTE supplies a clock frequency.

3.128 *Slaved Timing (B2):* This option is used in extended service to keep all system data sets at the same frequency as the control data set. With this option installed, data set transmit symbol timing is phase-locked to data set recovered receiver timing.

3.129 *External Timing (B3) (Port 1 on DS 2096A):* Used where the DTE supplies a clock frequency. Data set timing is phase-locked to the DTE clock on customer interface lead TT. On DS 2096A this option enables TT on port 1 only.

3.130 *External Timing-Ports 2 through 4 (B4 through B6 Respectively) (DS 2096A Only):* These options enable TT on the port selected. Options B3 through B6 are mutually exclusive.

Category C Options—Carrier Control

3.131 This set of options determines the state of the carrier and customer interface lead RS.

3.132 *Continuous Carrier, Switched RS (C1) (Port 1 on DS 2096A):* This option maintains carrier on continuously as in option C5 but there is an 8 ms delay between RS *on* and CS *on.* When RS goes *off,* CS goes *off.* In DS 2096A this option applies to port 1. In DS 2024A, 2048A, or 2048C options C1, C5, and C6 are mutually exclusive. In DS 2096A option C6 may be chosen *or* C5 combined with any or all of C1 through C4 may be chosen.

3.133 *Continuous Carrier, Switched RS—Ports 2 through 4 (C2 through C4 Respectively) (DS 2096A Only):* These options enable continuous carrier *on* and switched RS for the port designated. If *any* of options C1 through C4 are installed carrier is held *on* and RS is held *on* for those ports not specifically optioned for switched RS.

3.134 *Continuous Carrier, Continuous RS (C5):* This option maintains the transmit line signal on continuously (except for retrain sequences in DS 2048A and 2096A). The data set maintains RS *on* internally. (In DS 2096A all RS signals are held *on* except for those ports optioned for switched RS by options C1 through C4.)

3.135 *Switched Carrier, Switched RS (C6) (Includes All Ports of DS 2096A):* This option places the transmitter line signal under the control of customer interface signal RS (from the DTE). When RS is *on* the carrier will turn *on* and a start-sequence transmitted. At the end of that sequence CS will turn *on.* Carrier and CS will remain *on* as long as RS is *on.*

Category D Options—Interface Control

3.136 This option category determines how certain customer interface (and, in the case of

option D7, channel interface) leads or situations are treated.

3.137 *DM Off in Analog Loopback (D1):* When installed, this option turns customer interface lead DM *off* when the data set is placed in an analog loopback test mode.

3.138 *RD Not Clamped In Self-Test Mode (D2):* In a self-test mode this option allows the test word on customer interface lead RD to be monitored. This in turn allows verification of proper start-up during a dynamic self test. In DS 2096A all RD leads are unclamped when this option is installed.

3.139 *SR Used (D3):* Enables the SR interface leads on ports 1 and 2 of the DS 2096A, to allow customer interface control of the data set line speed. Since speed changes at a control set are telemetered to its tributaries, but the converse is not true, it is recommended that this option be installed only in control sets. The speed may be switched from the normal 9600 bps to 4800 bps.

3.140 *Antistream Timer (3, 9, or 27 Seconds—D4, D5, or D6 Respectively):* This option prevents a streaming DTE from interfering with a multipoint circuit. When installed in multipoint tributary data sets this option turns *off* carrier after RS has been *on* for the specified time (3, 9, or 27 seconds). Carrier will be restored if the streaming condition is corrected.

3.141 *Data Auxiliary Set or TEK Leads Not Used (D7):* When a DAS 829-type CIU is not part of a station arrangement this option should be installed. This option disables the TEK5 and TEK6 leads of the channel interface.

3.142 *Disable Receive Signal Quality for Facility Health Monitor (D8):* Disables the signal quality input to the facility status monitor in both switched and continuous carrier operation.

Category E Options—Miscellaneous

3.143 *Quick Start-up (E1) (DS 2048A or 2048C Only):* Installed in a multipoint tributary data set this option causes it to send an abbreviated start sequence (quick start-up). When requested by the control data set over the diagnostic channel the data set will send a long start (normal poll) sequence. A DS 2048C *without* this option

acts like a DS 2048A multipoint control data set. With option E1 installed a DS 2048C acts, as its coding expresses, with quick start-up sequences. Thus, when a mixture of new-family (DS 208A) data sets and DATAPHONE II service (DS 2048A) data sets are in a network they can all be served. When all tributary data stations have DATAPHONE II service data sets with option E1 installed, the quick start-up option can be placed in the control quick start-up data set and the network is converted to quick start-up. Refer to Fig. 30.

3.144 *One-Second Holdover Out (E2):* This option (when *not* installed) causes the data set receiver to bridge signal interruptions of up to 1 second. When line signal disappears, the equalizer, timing recovery, and automatic gain control are inhibited for 1 second or until the line signal reappears. During this time customer interface lead RR is held *on*. Option E2 is recommended for private line services which expect a switched carrier input to the receiver.

3.145 *Transmit Soft Turn-Off (E3) and Receive Soft Turn-Off (E4):* The purpose of soft turn-off is to eliminate the spurious data which is passed to the user at the end of a transmission. In a normal turn-off the RR circuit remains on, and therefore data is unclamped, for several milliseconds after line signal is lost. The noise entering the receiver is demodulated and passed to the customer as data until RR goes OFF and clamps RD. The E3 option causes the transmitter line signal to be held on, with send data clamped to mark, for several milliseconds after RS goes OFF. In the receiver, if the E4 option is installed, the data is passed through a shift register long enough to delay it such that the user data and some of the marks are passed to the user before RR clamps RD at the end of transmission. The spurious data remains in the register and is therefore not passed to the user. This option is not implemented in the DS 2096A.

> *WARNING: Do not install option E4 in the receiving data set unless option E3 is installed in the transmitting data set as service interruption may result.*

3.146 *Maximum Address 16 (E5) and Maximum Address 32 (E6):* Each of these options place an upper limit (16 or 32) on the largest network address in the data set poll list. This will minimize the time spent by a control data set during the AQPL command. With neither of these options installed the maximum network address size is 84.

3.147 *Disable Secondary Channel (E7):* This option is employed where a mixture of new-family and DATAPHONE II service data sets is necessary. Because the diagnostic channel operation might adversely affect the new-family data set operation it is disabled until all DATAPHONE II service data sets are installed.

3.148 *Disable Receive Signal Level for Facility Health Monitor (E8):* Disables the signal level input to the facility health monitor.

Category F Options—Direct Distance Dialing (DDD)

3.149 This category of options is primarily intended for use in DDD data sets. These options are used in private line applications only in a DS 2096A backbone control (option G3) in a network with dial-in extensions.

3.150 *DM-TR Interlock On (F5):* This option requires the DTE to respond to DM going *off* at the end of a remotely terminated call by turning TR *off*. If TR does not respond the extended data set will not answer a new incoming call. During the time between DM *off* and TR *off* the extended data set will be in the make-busy mode if the IS used option (F6) is installed. If the IS used option is not installed, the set will simply not answer calls during that interval. This interlock is a security feature which ensures that the central processing unit (CPU) is aware that a new call is on the line.

3.151 *IS Used (F6):* As is the case with F5 above this option finds limited application in private line data sets. This option is used on the same data sets as F5 and in conjunction with it (although F5 can be installed without F6.) When used, option F6 enables the terminal in service (IS) lead. With IS *off* then the extended data set will be in the make-busy mode.

Category G Options—Additional Service Offerings

3.152 The category G options are service offering options for extended services and multiplexer or concentrator networks. These options, like the

category A options, define the role of the data set in the network.

3.153 Extended service circuits have either two or three cascaded diagnostic channel (and data) links, each with two category G options associated with it, one for the control data set and one for the tributary data set. The diagnostic channel is extended between these links via the diagnostic channel daisy-chain. The main DS 2096A link is called the backbone. The extensions from it are called either extended or outboard. These are distinguished by the direction of diagnostic channel message flow. These messages flow from control to tributary over the analog circuit and from tributary to control over the daisy-chain between colocated sets. In an outboard link such messages flow from the outboard control set, which may have a DCD associated with it, toward the backbone link (ie, the outboard control set is the highest point in the diagnostic hierarchy). In the extended link, such messages flow outward from the backbone link, through the extended control data set, to the extended tributary data set (ie, the extended tributary set is the lowest point in the diagnostic hierarchy).

3.154 The usual single-ended extended service circuit would have a backbone link and an extended link, with diagnostic control being at the backbone control data set. A doubly-extended

circuit may have an outboard link on one side of the backbone and an extended link at the other side, with diagnostic control being at the outboard control data set.

3.155 Concentrator or multiplexer circuits are characterized as many-to-one (M:1) or one-to-many (1:M), where the 1 refers to the high-speed data set and the M refers to the lower-speed sets. An M:1 circuit has a number (M) of low-speed tributaries daisy-chained to 1 high-speed control set, with messages flowing from the tributaries to the control data set. A 1:M circuit has 1 high-speed tributary daisy-chained to a number (M) of low-speed control data sets, with messages flowing from the tributary to the control data sets.

3.156 *Double Extension Outboard Control (G1):* This is the control data set (at the CPU) for a doubly-extended service (Fig. 31). It communicates with an outboard tributary (G2) data set and is similar to a point-to-point control data set. System status is monitored and displayed by this data set.

3.157 *Double Extension Outboard Tributary or Many-to-One (M:1) Multiplex Tributary (G2):* This option, when installed along with one or more of the J1 through J4 options, is used in doubly-extended services as the
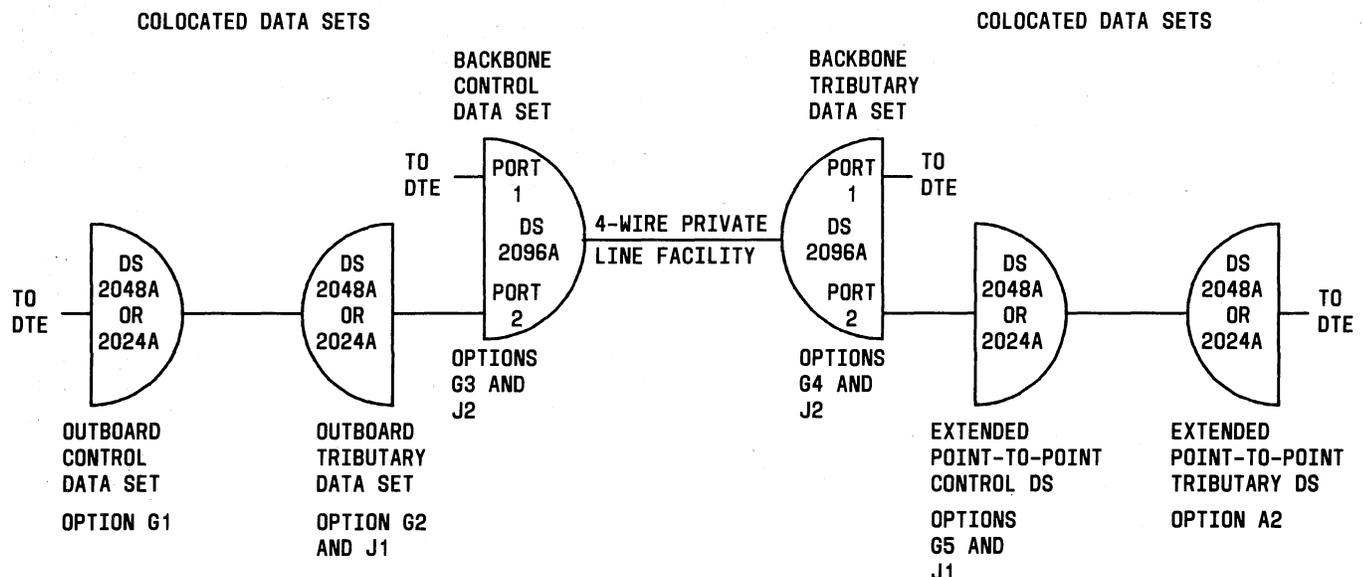
Fig. 31—Example of Category G and J Doubly-Extended Service Options

tributary data set on a point-to-point circuit with an outboard control data set (G1). Refer to Fig. 31 for an illustration of this service. When no J1 through J4 options are installed this option will identify a tributary data set as a concentrator or multiplexer.

3.158 *Double Extension Backbone Control or Many-to-One (M:1) Multiplex Control (G3):* This option is intended for the backbone control data set (a DS 2096A) of an extended service (Fig. 32). The control backbone data set DDU polls the tributary backbone data set (also a DS 2096A). The diagnostic channel is shared over four primary channels. All tests and commands are allowed. When used with colocated data sets for doubly-extended service (Fig. 31), one or more J1 through J4 options (extended service addressing) should be installed. When they are installed, the system status will be reported upstream to the outboard control data set. Refer also to Fig. 33. This option is also used in the control data set for an M:1 multiplexer or concentrator circuit (Fig. 31).

3.159 *Backbone Tributary or One-to-Many (1:M) Multiplex Tributary (G4):* This is the tributary backbone DS 2096A for extended service (Fig. 32). The data set responds to polls from the control data set and polls its colocated sets. Messages are sent upstream to the backbone control data set. The diagnostic channel is shared over four primary channels. The test and command menus are limited to prevent service disrupting tests. Those ports which are extended must have one of the J1 through J4 options installed. When no category J options are installed, this option defines a control data set for a 1:M multiplexer or concentrator circuit (Fig. 34).

3.160 *Extended Point-to-Point Control or One-to-Many (1:M) Multiplex Control (G5):* This data set is similar to a point-to-point control data set (option A1). It stores a poll list of its connected tributaries and polls them for status, which is reported upstream to the backbone control data set. The front panel operation allows all tests and commands. The DDU uses an identification interface, which requires one of the J1 through J4 options. When no J options are installed this option will identify a control data set at a concentrator or multiplexer. Refer to Fig. 31 through 34.

3.161 *Extended Multipoint or One-to-Many (1:M) Multiplexer Multipoint Control (G6):* Similar to G5 above but with no retrain feature enabled in DS 2048A or 2096A. Installed in the colocated control data set for an extended multipoint network. Refer to Fig. 32.

Category H Options—Elastic Stores

3.162 *Elastic Store In (H1) Only DS 2096A):* This option enables the elastic store associated with the SD lead. The elastic store is used in extended service to buffer phase differences between the data on the RD lead of a colocated lower speed data set and the clock on the data set ST lead. (Use of the store requires that a clock be present on interface lead TT to clock the data into the store. Normally, the colocated set's receive timing will be connected there.)

3.163 *Elastic Store In—Ports 2 through 4 (H2 Through H4 Respectively):* Same as H1 above on other ports of DS 2096A.

Category I Options—Independent Receiver Ready Operation

3.164 The category I options control the independent receiver ready feature on a per port basis. They are required in dial-in extension circuits and may also be used in systems with extended multipoint circuits and in point-to-point DS 2096A with multiplexing. The options cause each multiplex channel to appear to have an independent RR (receiver ready) circuit in the receiver which responds to an independent RS circuit in the corresponding transmitter.

3.165 For dial-in extension circuits the options are to be installed in both the backbone control and the backbone tributary data sets. In extended multipoint circuits, the option should be installed in the backbone control data set only. In point-to-point multiplexed applications, the options may be installed at either end or at both ends of the circuit.

3.166 When the independent receiver ready operation feature is used, the customer data sequence must not contain more than 23 consecutive marks. If it does, improper operation of RR will result. Independent receiver ready

COLOCATED DATA SETS REMOTE SITE

```
                          EXTENDED                    EXTENDED
                          POINT-TO-POINT              POINT-TO-POINT
                          CONTROL DATA SET            TRIBUTARY DATA SET
   BACKBONE      BACKBONE
   CONTROL       TRIBUTARY
   DATA SET      DATA SET
```
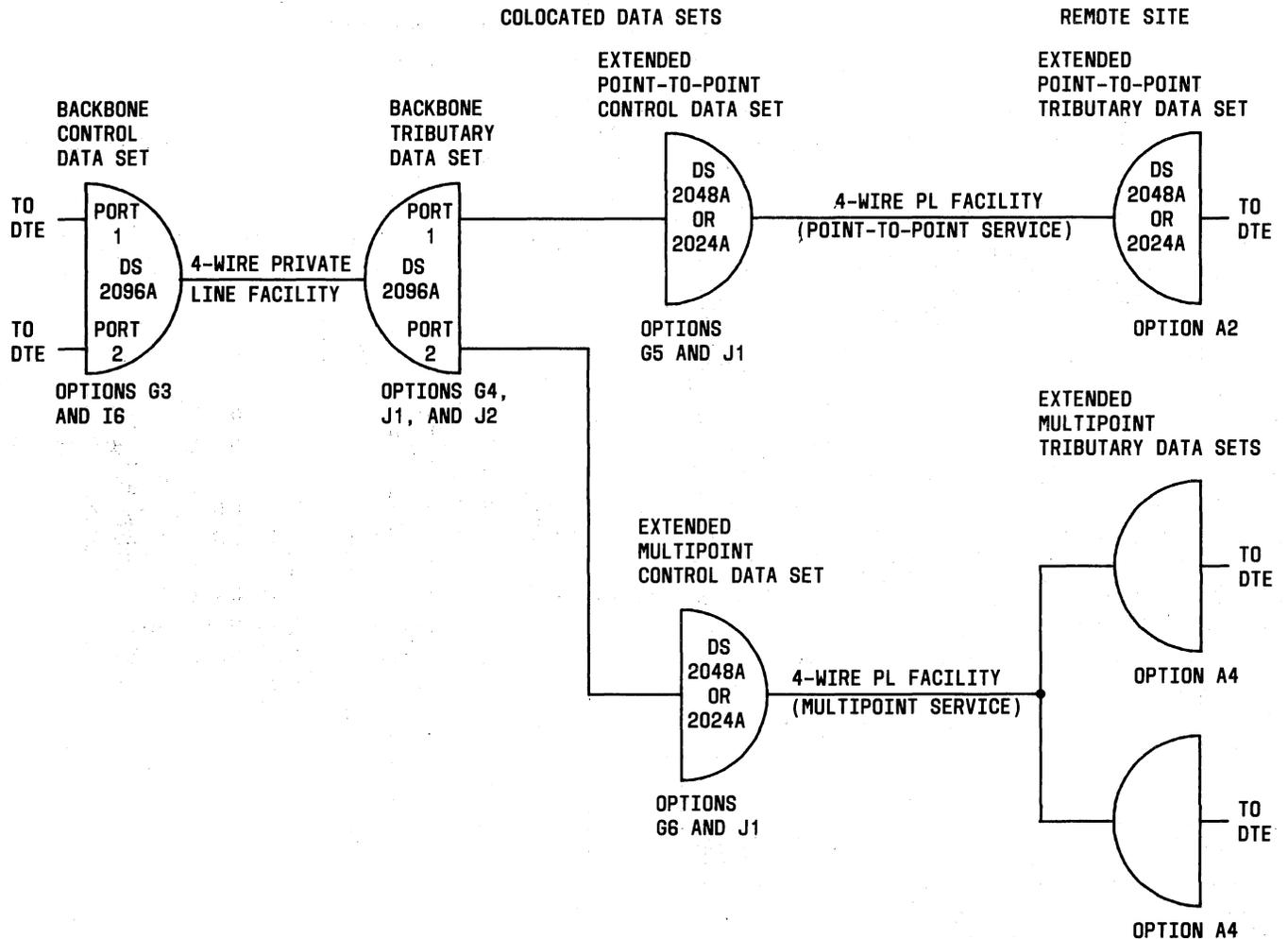
Fig. 32—Example of Category A, G, I, and J Extended Service Options

operation is not to be used in doubly-extended DS 2096A networks.

3.167 The category I options are listed below:

- *Independent Receiver Ready Operation—Port 1 (I1)*

- *Independent Receiver Ready Operation—Port 2 (I2)*

- *Independent Receiver Ready Operation—Port 3 (I3)*

- *Independent Receiver Ready Operation—Port 4 (I4)*

Category J Options—Interface Control for Port Identification

3.168 *Extended Service Addressing—Port 1 (J1):* Applies to DS 2024A, 2048A and 2096A port 1. Options J2 through J4 apply to DS 2096A ports 2 through 4, respectively.

3.169 Installation of the J options are required in extended service whenever data sets are colocated with the backbone DS 2096As and the diagnostic channel is to be extended via the daisy chain. In a single-ended extended circuit, they are required in both the backbone tributary and in the extended control data sets. In a doubly extended circuit they are required in those sets as well as in the outboard tributary and in the backbone control. These options provide addressing capabilities

COLOCATED DATA SETS
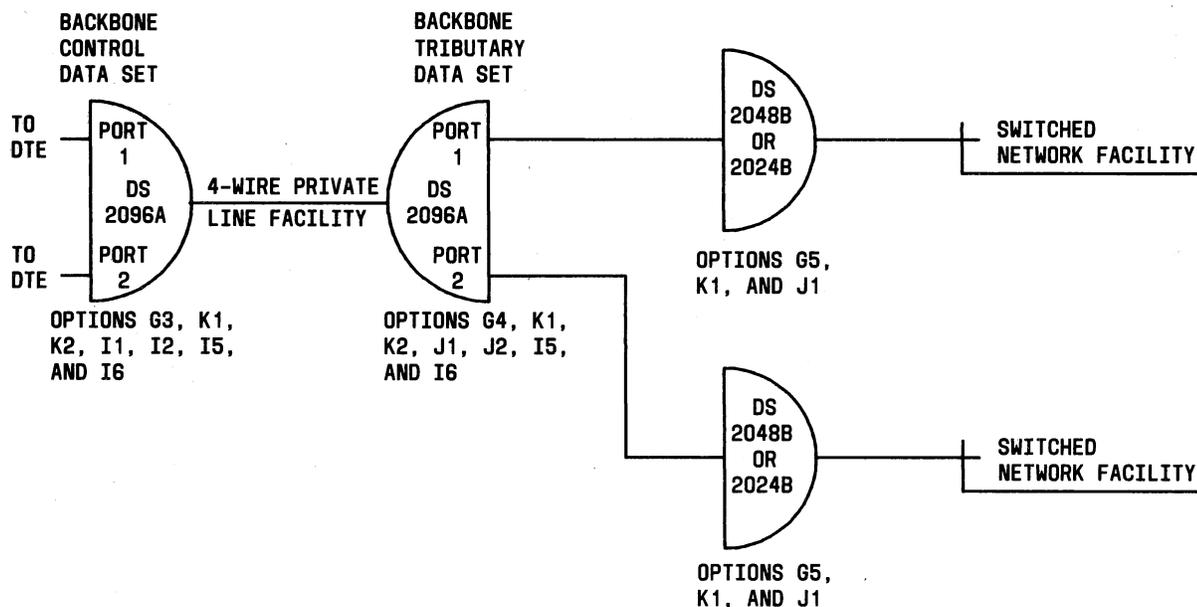
Fig. 33—Example of Category G, I, J, and K Dial-In Extension Service Options

on the diagnostic channel between colocated data sets. The options redefine the RS-449 interface leads SR (signaling rate selector) and SI (signaling rate indicator) for addressing of information that appears on the local diagnostic channel daisy chain. These two leads are cross-connected, using the M28A cord, between the colocated data sets and are used to associate (identify) this information with the appropriate colocated set and port of the DS 2096A.

Category K Options—DDD Interface Telemetry

3.170   *Dial-In Extension Telemetry—Port 1 (K1):* Applies to DS 2096A port 1. Options K2 through K4 apply to DS 2096A ports 2 through 4, respectively.

3.171   These options are used in the DS 2096A backbone control data set (option G3), in the backbone tributary DS 2096A (option G4) and in the extended DDD control DS 2024B or 2048B (defined as a DDD set with option K1 installed) dial-in extension service. The effect of these options is to give the appearance of a DDD interface at the DS 2096A backbone control data set, even though the DDD data set is located at the colocated

site. Dial-in extensions are not allowed in doubly-extended DS 2096A services.

3.172   To accomplish this, the collocated DDD set interface is connected to the backbone tributary DS 2096A (option G4) interface by a special cord (M28A) which cross-connects the DDD data set IS, IC, DM, and TR leads to the IC, IS, TR, and DS interface leads of the tributary DS 2096A. At each data set, the K1 through K4 options invoke a set of rules which allows the control functions DM and IC of the DDD set to be remoted to the control DS 2096A interface and allows the TR function from the control DS 2096A to be remoted to the DDD data set. The transition to the data mode of the control set and the DDD set are synchronized. The backbone control DS 2096A transmitter circuitry for independent carrier operation is enabled.

3.173   This IS lead is another part of the extended DDD interface. The state of the IS interface lead on each port of the backbone control data set is sent via the secondary channel to the corresponding port of the backbone tributary data set at the extended site. The data set there is conditioned by the option to accept an IS indication from the

```
OUTBOARD        M:1 MUX                                           1:M MUX      TRIBUTARY
CONTROL         TRIBUTARY                                         CONTROL      POINT-TO-POINT
DATA SETS       DATA SETS                                         DATA SETS    DATA SETS


   OPTION G1       OPTION G2                                       OPTION G5    OPTION A2


                              M:1 MUX       1:M MUX
                              CONTROL       TRIBUTARY
                              DATA SET      DATA SET

              CUSTOMER                                   CUSTOMER
              PROVIDED                                   PROVIDED
              MANY-TO-ONE         4-WIRE PL              ONE-TO-MANY
              MULTIPLEXER         FACILITY               MULTIPLEXER

              (M:1 MUX)                                  (1:M MUX)
                              OPTION G3     OPTION G4


                         NOTE:
                            ALL DATA SETS MAY
                            BE DS 2024A OR
   OPTION G1       OPTION G2      DS 2048A              OPTION G5    OPTION A2
```

Fig. 34—Example of Category A and G Multiplexer Service Options

secondary channel and use it to control the IC interface driver, which is cross-connected to the IS lead of the DDD set.

3.174   DS 201 or 208 Operation at Dial-In Extension—Ports 1 Through 4 (K5 Through K8, Respectively): These options are used in dial-in extension services when data sets calling in to the extended DDD control data set include both DATAPHONE II service and new-family data sets. The K5 through K8 options are to be installed in the backbone control data set (option G3) and the emulate 20x operation (DDD data sets only) option F7 is to be installed in the extended DDD control data set (option K1). Together these options allow a mixed calling universe for this service.

3.175   The K5 through K8 options do the following in the extended service control data set:

● Cause the RS-CS time to be either 50 or 150 ms, if the multiplex option causes the port speed to be 4800 or 2400 respectively.

● Cause the time from the beginning of answer to DM *on* to be 3.1 seconds.

4.   OPERATION

4.01   This part contains procedures for carrying out data set operations from the front panel of DATAPHONE II service data sets.

4.02   The DATAPHONE II service data set front panel; its associated indicators and controls;

and the control circuitry contained within each data set permit the operator to test and command the local and tributary data sets.

4.03 The following paragraphs contain procedures for exercising the test menu and command menu of DATAPHONE II service data sets.

GENERAL INFORMATION FOR EXERCISING THE TEST MENU AND COMMAND MENU

4.04 Both the test menu and the command menu (Tables B and C) are stored in the data set in continuous fashion (Fig. 35). That is, the operator can go in either a forward or a backward direction from any point in either repertoire with equal effectiveness.

4.05 To illustrate this consider the first test in the test menu. (The first test is the test whose acronym or abbreviation appears in the alphanumeric display when the TEST/CMD switch is first placed in the TEST position.) This test is adjacent to the *second* test in the *forward*

direction and the *last* test in the *backward* direction.

4.06 This method of storing and providing access to lists of data also applies to such things as option lists and poll lists.

4.07 When exercising tests and commands on DATAPHONE II service data sets it is good practice (as it is with any procedure) to first read through the entire procedure before proceeding with the test or command.

ALPHANUMERIC DISPLAY

4.08 As described in Part 3, Functional Description, the alphanumeric display is the main indicator of data set results. The precedence of indications of the alphanumeric display are shown in Table O. Table O shows which indication will be displayed when more than one of the conditions exists simultaneously.

4.09 In the following test procedures and command procedures certain symbols associated with
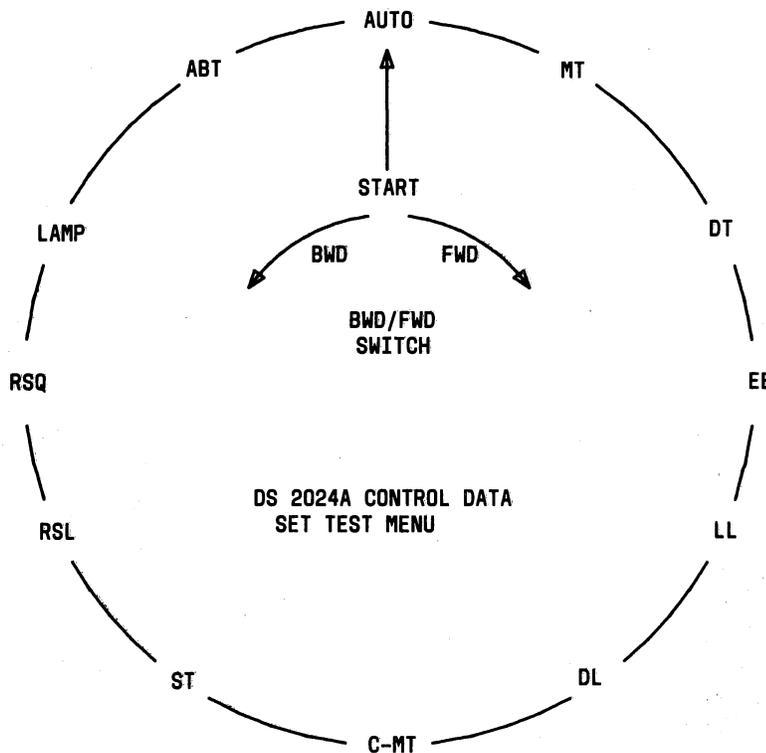
Fig. 35—Example of List Storage in Data Set

TABLE O

ALPHANUMERIC DISPLAY INDICATION
PRECEDENCE WITH TEST/CMD SWITCH
IN NORMAL POSITION

INDICATION PRECEDENCE	TYPE OF INDICATION	DS 2024A, 2048A, AND 2048C EXAMPLE	DS 2096A EXAMPLE
First	Mode	MTCE*	MTCE*
Second	Test	LL	LL
Third	Real-Time Diagnostic Fault	MD	MD
Fourth	Normal	Blank	1 - 96 (Multiplex Configuration)

* Flashing at about 3 times per second.

the alphanumeric display require explanation. They are:

- "xx" Used to represent unknown numerals.

- "--" Used to represent the pseudo address for the control data set.

- "bb" Used to represent blank characters in the display.

- "**" (flashing) Used to indicate that the -/+ (minus/plus) switch must be used to supply additional information.

- "✔" Used to indicate a choice that has been designated.

CONTENTION IN TESTING

4.10 When an operator at a DC, NC, or control data set attempts to initiate testing on a control or tributary data set (in the case of a DC or NC) or a tributary data set (in the case of a control data set) that is already undergoing a

self-induced test the DCD or control data set will be unable to override the test in progress.

4.11 It is not possible for any device initiating a test to override the test in progress of any other device.

4.12 Table P contains the machine response displayed by the control data set attempting to initiate testing on a tributary data set in various contention situations.

TEST MENU PROCEDURES

4.13 *Apparatus:* No equipment or tools are required to perform these test procedures.

4.14 Unless otherwise noted all actions and verifications are made at the local data set front panel.

A. PORT (DS 2096A Port Number)

4.15 This is not a test but does appear as part of the test menu of DS 2096A. To select a port other than number one use the following procedure:

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT.

STEP   ACTION   VERIFICATION

TABLE P

CONTROL DATA SET CONTENTION
SITUATION RESPONSES

SITUATION	ALPHANUMERIC DISPLAY INDICATION
Tributary Data Set Under Self-Induced Test	BUSY
Tributary Data Set Under Test by DCD	BUSY
Tributary Data Set Fails to Respond or Responds Incorrectly	ERRb* (Error)
Control Data Set or DCD Aborts Tributary Data Set Test While in Progress	ABTD (Aborted)

    * "b" represents blank character.

2   Depress EXEC.   Alphanumeric display indicates PT** with ** flashing.

3   Operate and hold -/+ switch in either - or + until alphanumeric display displays desired port.   Alphanumeric display indicates desired port.

4   Depress EXEC.   A check mark will appear to the left of the port number (as ✔bbx).

B. AUTO (Control Data Sets Only)

DS 2096

1   Place TEST/CMD switch in TEST.   Alphanumeric display indicates PORT.

2   Place BWD/FWD switch to FWD momentarily. Alphanumeric display indicates AUTO.

3   Depress EXEC.   Alphanumeric display (AUTO) flashes.

                       TEST COND LED lights then extinguishes.

STEP	ACTION	VERIFICATION
		Alphanumeric display indicates PASS alternating with AUTO or, if failures occurred, FAIL and xxbb (total number of failures detected) alternating with ATxx (where "xx" is the network address of the failed data set) for each of up to 10 failed locations.
4	Place TEST/CMD switch in normal position.	Alphanumeric display indicates MUX configuration.

DS 2024A, 2048A, or 2048C

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in TEST.	Alphanumeric display indicates AUTO.
2	Depress EXEC.	Alphanumeric display (AUTO) flashes.
		TEST COND LED lights then extinguishes.
		Alphanumeric display indicates PASS alternating with AUTO or, if failure occurred, FAIL and xxbb (total number of failures detected) alternating with ATxx (where "xx" is the network address of the failed data set) for each of up to 10 failed locations.
3	Place TEST/CMD switch in normal position.	Alphanumeric display blanks.

C. MT

Control Data Set

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or AUTO.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTbb.	Alphanumeric display indicates MT.
3	Depress EXEC.	Alphanumeric display indicates MT** with ** flashing.
4	Operate and hold –/+ switch to + until the network or pseudo address of the data set desired is displayed.	Alphanumeric display first indicates MT-- (where "--" is a pseudo address for the control data set) then MTxx (where "xx" is the network address of a tributary data set).
5	Depress EXEC.	Alphanumeric display flashes MTxx.
		TEST COND LED lights then extinguishes.
		Alphanumeric display indicates PASS or FAIL alternating with MTxx.
6	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

STEP	ACTION	VERIFICATION

Tributary Data Set

1	Place TEST/CMD switch in TEST.	Alphanumeric display indicates MT.
2	Depress EXEC.	Alphanumeric display flashes MTbb (where "bb" are blank characters.) TEST COND LED lights then extinguishes. Alphanumeric display indicates PASS or FAIL alternating with MTbb.
3	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

D. DT

Control Data Set

1	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or AUTO.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates DTbb.	Alphanumeric display indicates DTbb (where "bb" indicates blank characters).
3	Depress EXEC.	Alphanumeric display flashes DT**.
4	Operate and hold –/+ switch to + until the network address of the desired data set is displayed.	Alphanumeric display indicates DTxx (where "xx" is the network address).
5	Depress EXEC.	Alphanumeric display (DTxx) flashes. TEST COND LED lights then extinguishes. Alphanumeric display indicates PASS or FAIL alternating with DTxx.
6	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

Tributary Data Set

Note: This test is accomplished by the *control data set.* The digital loopback actually occurs at the *tributary data set.*

1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates DSAB.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.

STEP	ACTION	VERIFICATION
4	Depress EXEC.	Display changes to MC/I.
5	Place TEST/CMD switch in normal position.	Alphanumeric display flashes MTCE.
6	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or MTbb (where "bb" indicates blank characters).
7	Operate and hold –/+ switch in + until alphanumeric display indicates DTbb.	Alphanumeric display indicates DTbb.
8	Depress EXEC.	Alphanumeric display (DTbb) flashes.
		TEST COND LED lights then extinguishes.
		Alphanumeric display indicates PASS or FAIL.
9	Place TEST/CMD switch in CMD.	Alphanumeric display indicates DSAB.
10	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
11	Depress EXEC.	Alphanumeric display indicates MC/I.
12	Depress EXEC.	Display changes to MC/O.
13	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

E. EE

Control Data Set

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or AUTO.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates EEbb.	Alphanumeric display indicates EEbb (where "bb" indicates blank characters).
3	Depress EXEC.	Alphanumeric display indicates EE** with ** flashing.
4	Operate and hold –/+ switch to + until the network address of the desired data set is displayed.	Alphanumeric display indicates EExx (where "xx" is the network address).
5	Depress EXEC.	Alphanumeric display (EExx) flashes.
		TEST COND LED lights then extinguishes.
		Alphanumeric display indicates xxEI (the quantity of error inbound) alternating with xxEO (the quantity of errors outbound) alternating with EExx.

STEP	ACTION	VERIFICATION
6	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

Tributary Data Set

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates DSAB.
2	Operate BWD/FWD switch in FWD momentarily.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Place TEST/CMD switch in normal position.	Alphanumeric display flashes MTCE.
6	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or MTbb.
7	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates EEbb.	Alphanumeric display indicates EEbb.
8	Depress EXEC.	Alphanumeric display (EEbb) flashes. TEST COND LED lights then extinguishes. Alphanumeric display indicates xxEI (the quantity of errors inbound alternating with xxEO (the quantity of errors outbound) alternating with EE.
9	Place TEST/CMD switch in CMD.	Alphanumeric display indicates DSAB.
10	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
11	Depress EXEC.	Alphanumeric display indicates MC/I.
12	Depress EXEC.	Display changes to MC/O.
13	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

F. TRMT

Control Data Set

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.

STEP	ACTION	VERIFICATION
4	Depress EXEC.	Display changes to MC/I.
5	Place TEST/CMD switch in normal position.	Alphanumeric display flashes MTCE.
6	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or AUTO.
7	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates TRMT.	Alphanumeric display indicates TRMT.
8	Depress EXEC.	Alphanumeric display indicates TR** (with "**" flashing.
9	Operate and hold –/+ switch in + until the network address of the desired data set is displayed.	Alphanumeric display indicates TRxx (where "xx" is the network address).
10	Depress EXEC.	Alphanumeric display (TRxx) flashes. TEST COND LED lights then extinguishes. Alphanumeric display indicates xxDB (where "xx" indicates the quantity in negative dBm) alternating with TRxx.
11	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
12	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
13	Depress EXEC.	Alphanumeric display indicates MC/I.
14	Depress EXEC.	Display changes to MC/O.
15	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

Tributary Data Set

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates DSAB.
2	Place BWD/FWD switch to FWD momentarily.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Place TEST/CMD switch in normal position.	Alphanumeric display flashes MTCE.
6	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or MTbb.
7	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates TRMT.	Alphanumeric display indicates TRMT.

STEP	ACTION	VERIFICATION
8	Depress EXEC.	Alphanumeric display (TRMT) flashes. TEST COND LED lights then extinguishes.
		Alphanumeric display indicates xxDB (where "xx" indicates the quantity in negative dBm) alternating with TRMT.
9	Place TEST/CMD switch in CMD.	Alphanumeric display indicates DSAB.
10	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
11	Depress EXEC.	Alphanumeric display indicates MC/I.
12	Depress EXEC.	Display changes to MC/O.
13	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

G. RCV

Control Data Set

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Place TEST/CMD switch in normal position.	Alphanumeric display flashes MTCE.
6	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or AUTO.
7	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates RECb.	Alphanumeric display indicates RCVb.
8	Depress EXEC.	Alphanumeric display indicates RC** (with "**" flashing.
9	Operate and hold -/+ switch in + until the network address of the desired data set is displayed.	Alphanumeric display indicates RCxx (where "xx" is the network address).
10	Depress EXEC.	Alphanumeric display (RCxx) flashes. TEST COND LED lights then extinguishes.
		Alphanumeric display indicates xxBB (where "xx" indicates the quantity in negative dBm) alternating with RCxx.

STEP	ACTION	VERIFICATION
11	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
12	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
13	Depress EXEC.	Alphanumeric display indicates MC/I.
14	Depress EXEC.	Display changes to MC/O.
15	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

Tributary Data Set

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates DSAB.
2	Place BWD/FWD switch to FWD momentarily.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Place TEST/CMD switch in normal position.	Alphanumeric display flashes MTCE.
6	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or MTbb.
7	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates RCVb.	Alphanumeric display indicates RCVb.
8	Depress EXEC.	Alphanumeric display (RCVb) flashes. TEST COND LED lights then extinguishes. Alphanumeric display indicates xxDB (where "xx" indicates the quantity in negative dBm) alternating with RCVb.
9	Place TEST/CMD switch in CMD.	Alphanumeric display indicates DSAB.
10	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
11	Depress EXEC.	Alphanumeric display indicates MC/I.
12	Depress EXEC.	Display changes to MC/O.
13	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

STEP	ACTION	VERIFICATION

H. 1004

Control Data Set

1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Place TEST/CMD switch in normal position.	Alphanumeric display flashes MTCE.
6	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or AUTO.
7	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates 1004.	Alphanumeric display indicates 1004.
8	Depress EXEC.	Alphanumeric display flashes 1004.
	Note: The data set is now conditioned to be tested by a telco employee at a remote location.	
9	After testing is completed: Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
10	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
11	Depress EXEC.	Alphanumeric display indicates MC/I.
12	Depress EXEC.	Display changes to MC/O.
13	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

Tributary Data Set

1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates DSAB.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Place TEST/CMD switch in normal position.	Alphanumeric display flashes MTCE.

STEP	ACTION	VERIFICATION
6	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PRT1 or MTbb.
7	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicate 1004.	Alphanumeric display indicates 1004.
8	Depress EXEC.	Alphanumeric display flashes 1004.
	Note: The data set is now conditioned to be tested by a telco employee at a remote location.	
9	After testing is completed: Place TEST/CMD switch in CMD.	Alphanumeric display indicates DSAB.
10	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
11	Depress EXEC.	Alphanumeric display indicates MC/I.
12	Depress EXEC.	Display changes to MC/O.
13	Place TEST/CMD switch in normal position.	Alphanumeric display return to normal indication.

I. LL

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK or DSAB.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Place TEST/CMD switch in normal position.	Alphanumeric display flashes MTCE.
6	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT, AUTO, or MTbb.
7	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates LLbb.	Alphanumeric display indicates LLbb (where "bb" indicates blank characters).
8	Depress EXEC.	Alphanumeric display flashes LLbb.
	Note: The data set is now conditioned to be tested by external test equipment.	TEST COND LED lights.
9	After testing is completed: Place TEST/CMD switch in CMD.	TEST COND LED extinguishes.
		Alphanumeric display indicates MDCK or DSAB.

STEP	ACTION	VERIFICATION
10	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
11	Depress EXEC.	Alphanumeric display indicates MC/I.
12	Depress EXEC.	Display changes to MC/O.
13	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

J.   DL

Control Data Set

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Alphanumeric display changes to MC/I.
5	Place TEST/CMD switch in normal position.	Alphanumeric display flashes MTCE.
6	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or AUTO.
7	Operate and hold BWD/FWD switch to FWD until alphanumeric display indicates DLbb.	Alphanumeric display indicates DLbb (where "bb" indicates blank characters).
8	Depress EXEC.	Alphanumeric display DL** with ** flashing.
9	Operate and hold –/+ switch in + until pseudo address of the control (--) or network address of the tributary data set (00 to 63) to be placed under test appears in the alphanumeric display.	Alphanumeric display indicates DL-- or DLxx.
10	Depress EXEC.	Alphanumeric display flashes DL-- or DLxx. TEST COND LED lights.
11	When testing is complete place TEST/CMD switch in CMD.	TEST COND LED extinguishes. Alphanumeric display indicates DSAB.
12	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
13	Depress EXEC.	Alphanumeric display indicates MC/I.
14	Depress EXEC.	Display change to MC/O.

STEP	ACTION	VERIFICATION
15	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

Tributary Data Set

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Alphanumeric display changes to MC/I.
5	Place TEST/CMD switch in normal position.	Alphanumeric display flashes MTCE.
6	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or MT.
7	Operate and hold BWD/FWD switch to FWD until alphanumeric display indicates DLbb.	Alphanumeric display indicates DLbb (where "bb" indicates blank characters).
8	Depress EXEC.	Alphanumeric display flashes DLbb. TEST COND LED lights.
9	When testing is complete place TEST/CMD switch in CMD.	TEST COND LED extinguishes. Alphanumeric display indicates DSAB.
10	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
11	Depress EXEC.	Alphanumeric display indicates MC/I.
12	Depress EXEC.	Display changes to MC/O.
13	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

K. C-MT

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK or DSAB.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Place TEST/CMD switch in normal position.	Alphanumeric display flashes MTCE.

STEP	ACTION	VERIFICATION
6	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT, AUTO, or MT.
7	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates C-MT.	Alphanumeric display indicates C-MT.
8	Depress EXEC.	Alphanumeric display flashes C-MT.
	Note: This test will repeat and new results will be displayed until the operator takes action. If the test fails, no other tests will be run and the alphanumeric display will indicate FAIL.	TEST COND LED lights then extinguishes. Alphanumeric display indicates PASS or FAIL alternating with C-MT.
9	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK or DSAB.
10	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
11	Depress EXEC.	Alphanumeric display indicates MC/I.
12	Depress EXEC.	Display changes to MC/O.
13	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

L. ST (DS 2024A, 2048A, and 2048C)

1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Alphanumeric display changes to MC/I.
5	Place TEST/CMD switch in normal position.	Alphanumeric display flashes MTCE.
6	Place TEST/CMD switch in TEST.	Alphanumeric display indicates AUTO or MT.
7	Operate and hold BWD/FWD switch in BWD until alphanumeric display indicates STbb.	Alphanumeric display indicates STbb (where "bb" indicates blank characters).
8	Depress EXEC.	TEST COND LED lights. Alphanumeric display (STbb) flashes briefly after which it displays xxST. "xx" represents the error count and is updated continuously until the operator terminates or restarts (by depressing EXEC) the test or the error count

STEP	ACTION	VERIFICATION
		reaches 99. (The 99 will flash when more than 99 errors are counted.)
9	When testing is completed place TEST/CMD switch in CMD.	Alphanumeric display indicates DSAB.
10	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
11	Depress EXEC.	Alphanumeric display indicates MC/I.
12	Depress EXEC.	Display changes to MC/O.
13	Place TEST/CMD switch in normal position.	Alphanumeric display blanks.
		TEST COND LED extinguishes.

M. RSL

Control Data Set

1	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or AUTO.
2	Operate and hold BWD/FWD switch in BWD until alphanumeric display indicates RSLb.	Alphanumeric display indicates RSLb (where "b" indicates a blank character).
3	Depress EXEC.	Alphanumeric display indicates SL** with ** flashing.
4	Operate and hold –/+ switch in + until pseudo address of the control (--) or network address of the tributary data set (00 to 63) to be placed under test appears in the alphanumeric display.	Alphanumeric display indicates SL-- or SLxx.
5	Depress EXEC.	SLxx may flash for some period of time then alphanumeric display indicates xxDB (the quantity of receive signal level in negative dBm) alternating with SL_ or SLxx.
6	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

Tributary Data Set

1	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or MT.
2	Operate and hold BWD/FWD switch in BWD until alphanumeric display indicates RSLb.	Alphanumeric display indicates RSLb (where "b" indicates a blank character).

STEP	ACTION	VERIFICATION
3	Depress EXEC.	Alphanumeric display indicates RSLb alternating with xxDB (the quantity of receive signal level in negative dBm).
4	Place TEST/CMD switch in normal position.	Alphanumeric display blanks or (for DS 2096A) indicates MUX configuration.

N. RSQ

Control Data Set

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or AUTO.
2	Operate and hold BWD/FWD switch in BWD until alphanumeric display indicates RSQb.	Alphanumeric display indicates RSQb (where "b" indicates a block character).
3	Depress EXEC.	Alphanumeric display indicates SQ** with ** flashing.
4	Operate and hold -/+ switch in + until pseudo address of the control (--) or network address of the tributary data set (00 to 80) to be placed under test appears in the alphanumeric display.	Alphanumeric display indicates SQ-- or SQxx (possibly flashing).
5	Depress EXEC.	SQ_ or SQxx may flash then alphanumeric display indicates xxbb (a number from 0 to 9 representing receive signal quality) alternating with SQ-- or SQxx.
6	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

Tributary Data Set

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT or MT.
2	Operate and hold BWD/FWD switch in BWD until alphanumeric display indicates RSQb.	Alphanumeric display indicates RSQb (where "b" indicates a blank character).
3	Depress EXEC.	Alphanumeric display indicates RSQb alternating with xxbb (a number from 0 to 9 representing receive signal quality).
4	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

O. LAMP

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT, AUTO, or MT.

STEP	ACTION	VERIFICATION
2	Operate and hold BWD/FWD switch to BWD until alphanumeric display indicates LAMP.	Alphanumeric display indicates LAMP.
3	Depress EXEC.	All LEDs and all segments of the alphanumeric display light and remain lighted for approximately 5 seconds after EXEC is released then return to normal.
4	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

P. ABT

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in TEST.	Alphanumeric display indicates PORT, AUTO, or MT.
2	Operate BWD/FWD switch to BWD momentarily.	Alphanumeric display test indicates ABT.
3	Depress EXEC.	Alphanumeric display test indication changes to ABTD. TEST COND LED extinguishes.
4	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

COMMAND MENU PROCEDURES

4.16   Unless otherwise noted all actions and verifications are made at the local data set front panel.

STEP	ACTION	VERIFICATION

A. MDCK (Control Data Set Only)

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
2	Depress EXEC.	Alphanumeric display will indicate: DSxx for a tributary that is disabled, MCxx for a tributary in the maintenance mode, TSxx for a tributary in a test mode, for 5 seconds *or* MDCK will blank for 5 seconds then return if no tributaries are in the above modes.
3	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

B. DSAB

Control Data Set

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.

STEP	ACTION	VERIFICATION
2	Operate BWD/FWD switch in FWD momentarily.	Alphanumeric display indicates DSAB.
3	Depress EXEC.	Alphanumeric display indicates DS** with ** flashing.
4	Operate and hold –/+ switch in + until pseudo address of the control (--) or network address of the tributary (00 to 63) to be disabled or enabled appears in the alphanumeric display.	Alphanumeric display indicates bb-- or bbxx which represent enabled data sets or ✔b-- or ✔bxx which represent disabled data sets.
5	To enable a disabled data set or disable an enabled data set: Depress EXEC.	The check (✔) on the alphanumeric display appears and disappears as a data set is enabled (not checked) and disabled (checked).

The data set will not respond if EXEC is depressed more than once per second.

6	Place TEST/CMD switch in normal position.	Alphanumeric display flashes WAIT if control data set is disabled or returns to normal indication if data set is enabled.

Tributary Data Set

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates DSAB.
2	Depress EXEC.	Alphanumeric display indicates DS/O for a data set *not* disabled (enabled) and DS/I for a data set that is disabled.
3	To enable a disabled data set or disable an enabled data set: Depress EXEC.	DS/O becomes DS/I or DS/I becomes DS/O each time EXEC is depressed.

The data set will not respond if EXEC is depressed more than once per second.

4	Place TEST/CMD switch in normal position.	Alphanumeric display flashes DSAB if data set is disabled or return to normal indication if data set is enabled.

C. MTCE

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK or DSAB.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O for a data set that is *not* in MTCE or MC/I for a data set that is in MTCE.

STEP	ACTION	VERIFICATION
4	To change the state of the data set: Depress EXEC.	MC/O becomes MC/I or MC/I becomes MC/O each time EXEC is depressed.
	The data set will not respond if EXEC is depressed more than once per second.	
5	Place TEST/CMD switch in normal position.	Alphanumeric display flashes MTCE if the data set is in the maintenance mode or returns to normal if not in the maintenance mode.

D. DSOP

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK or DSAB.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates DSOP.	Alphanumeric display indicates DSOP.
3	Depress EXEC.	Alphanumeric display indicates OP** with ** flashing.
4	Operate and hold -/+ in + and the installed options will appear in order on the alphanumeric display.	Alphanumeric display indicates all ***installed*** options in sequence.
5	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

E. CLOP

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK or DSAB.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates CLOP.	Alphanumeric display indicates CLOP.
6	Depress EXEC ***twice*** at least one second apart.	Alphanumeric display blanks for approximately one second then indicates CH** with ** flashing.
7	To proceed through the ***available*** options: Operate and hold the -/+ switch in +.	Alphanumeric display indicates all available options in sequence (such as bbA1).
8	To install any available option: Release the -/+ switch.	Alphanumeric display indicates desired option (such as bbB2).

STEP	ACTION	VERIFICATION
9	Depress EXEC.	
	If this command is exited having no option installed the data set will automatically install a factory set.	Alphanumeric display changes to ✔bB2 to indicate the desired option is installed.
10	After all desired options are installed: Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
11	Depress EXEC.	Alphanumeric display indicates MC/I.
12	Depress EXEC.	Display changes to MC/O.
13	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

F. CHOP

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK or DSAB.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates CHOP.	Alphanumeric display indicates CHOP.
6	Depress EXEC.	Alphanumeric display indicates CH** with ** flashing.
7	To proceed through the *available* options: Operate and hold the -/+ switch in +.	Alphanumeric display indicates all available options in sequence (such as bbA1) with previously installed options shown (such as ✔bB2).
8	To install any available option: Release the -/+ switch.	Alphanumeric display indicates desired option (such as bbC3).
9	Depress EXEC.	Alphanumeric display changes to ✔bC3.
10	To remove any installed option: Release the -/+ switch at the desired option.	Alphanumeric display indicates desired option (such as ✔bC6).
11	Depress EXEC.	Alphanumeric display changes to bbC6.
12	After all desired options are installed: Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.

STEP	ACTION	VERIFICATION
13	Depress EXEC.	Alphanumeric display indicates MC/I.
14	Depress EXEC.	Display changes to MC/O.
15	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

G. CHMX (DS 2096A Only)

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK or DSAB.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Operate and hold BWD/FWD switch in BWD until alphanumeric display indicates CHMX.	Alphanumeric display indicates CHMX.
6	Depress EXEC.	Alphanumeric display indicates current configuration (1-96, 7224, 2-48, or 4-24 for 9600 bps line speed; 1-48 or 2-24 for 4800 bps line speed).
7	Operate and hold -/+ switch in + until the desired multiplex configuration is displayed.	Alphanumeric display indicates multiplex options in sequence.
8	Depress EXEC.	Desired configuration display blinks once indicating that the multiplex option has been installed.
9	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
10	Depress EXEC.	Alphanumeric display indicates MC/I.
11	Depress EXEC.	Display changes to MC/O.
12	Place TEST/CMD switch is normal position.	Alphanumeric display indicates multiplex configuration.

H. DSPL

Control Data Set

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
2	Operate and hold BWD/FWD switch in BWD until alphanumeric display indicates DSPL.	Alphanumeric display indicates DSPL.

STEP	ACTION	VERIFICATION
3	Depress EXEC.	Alphanumeric display indicates PL** with ** flashing.
4	Operate and hold -/+ switch in +.	Alphanumeric display indicates each poll list address in sequence.
5	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

Outboard Tributary and Backbone Tributary Data Sets

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK or DSAB.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Operate and hold BWD/FWD switch in BWD until alphanumeric display indicates DSPL.	Alphanumeric display indicates DSPL.
6	Depress EXEC.	Alphanumeric display indicates PL** with ** flashing.
7	Operate and hold -/+ switch in +.	Alphanumeric display indicates each poll list address in sequence.
8	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
9	Depress EXEC.	Alphanumeric display indicates MC/I.
10	Depress EXEC.	Display changes to MC/O.
11	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

I.   ADPL (Tributary Data Set Only)

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Alphanumeric display changes to MC/I.

STEP	ACTION	VERIFICATION
5	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates ADPL.	Alphanumeric display indicates ADPL.
6	Depress EXEC.	Alphanumeric display will indicate DONE alternating with ADPL.
7	Operate and hold BWD/FWD switch in BWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
8	Depress EXEC.	Alphanumeric display indicates MC/I.
9	Depress EXEC.	Display change to MC/O.
10	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

J. AQPL (Control or Outboard Tributary and Backbone Tributary Data Sets)

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK or DSAB.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates AQPL.	Alphanumeric display indicates AQPL.
6	Depress EXEC.	Alphanumeric display (AQPL) starts to flash and does so until the poll list is acquired at which time DONE is displayed alternating with AQPL for two seconds each.
7	Operate and hold BWD/FWD switch in BWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
8	Depress EXEC.	Alphanumeric display indicates MC/I.
9	Depress EXEC.	Display changes to MC/O.
10	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

K. CHPL (Control or Outboard Tributary and Backbone Tributary Data Sets)

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.

STEP	ACTION	VERIFICATION
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates CHPL.	Alphanumeric display indicates CHPL.
6	Depress EXEC.	Alphanumeric display indicates PL** with ** flashing.
7	Operate and hold -/+ switch in +.	Alphanumeric display indicates each poll list address in sequence with addresses currently on the list displayed as ✔bxx and those not on the list as bbxx.
8	Release -/+ switch at any address to be added to or deleted from the poll list.	Alphanumeric display indicates address to be added or deleted.
9	Depress EXEC.	Alphanumeric display indicates address has been added (✔bxx) or deleted (bbxx) from poll list.
10	Operate and hold BWD/FWD switch in BWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
11	Depress EXEC.	Alphanumeric display indicates MC/I.
12	Depress EXEC.	Display changes to MC/O.
13	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

L. DSSV

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK or DSAB.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates DSSV.	Alphanumeric display indicates DSSV. LED adjacent to -/+ switch lights.
6	Depress EXEC.	Alphanumeric display indicates SV** with ** flashing.

STEP	ACTION	VERIFICATION
7	Depress and hold -/+ switch.	Alphanumeric display indicates the software version as Ax.x (eg, A2.4) on all data sets alternating with Bx.x (eg, B2.2) on DS 2048 and 2096.
8	Release -/+ switch then operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
9	Depress EXEC.	Alphanumeric display indicates MC/I.
10	Depress EXEC.	Display changes to MC/O.
11	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

M. DSNA

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
2	Operate and hold BWD/FWD switch in BWD until alphanumeric display indicates DSNA.	Alphanumeric display indicates DSNA.
3	Depress EXEC.	Alphanumeric display indicates NAxx (where xx is the network address of the data set.
4	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

N. CHNA

STEP	ACTION	VERIFICATION
1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
2	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
3	Depress EXEC.	Alphanumeric display indicates MC/O.
4	Depress EXEC.	Display changes to MC/I.
5	Operate and hold BWD/FWD switch in BWD until alphanumeric display indicates CHNA.	Alphanumeric display indicates CHNA.
6	Depress EXEC.	Alphanumeric display indicates NA** with ** flashing.
7	Operate and hold -/+ switch in +.	Alphanumeric display indicates each possible network address in sequence.
8	When alphanumeric display indicates desired network address release -/+ switch.	Alphanumeric display indicates desired network address.

STEP	ACTION	VERIFICATION
9	Depress EXEC.	Alphanumeric display (NAxx) blinks once.
10	Operate and hold BWD/FWD switch in FWD until alphanumeric display indicates MTCE.	Alphanumeric display indicates MTCE.
11	Depress EXEC.	Alphanumeric display indicates MC/I.
12	Depress EXEC.	Display changes to MC/O.
13	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

O. DSLA

1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
2	Operate and hold BWD/FWD switch in BWD until alphanumeric display indicates DSLA.	Alphanumeric display indicates DSLA.
3	Depress EXEC.	Alphanumeric display indicates LAbb alternating with xxx (where xxx is the decimal number for the local address).
4	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

P. PMON (DS 2096A with Multiplex Option Only)

1	Place TEST/CMD switch in CMD.	Alphanumeric display indicates MDCK.
2	Operate and hold BWD/FWD switch in BWD until alphanumeric display indicates PMON.	Alphanumeric display indicates PMON.
3	Depress EXEC.	Alphanumeric display indicates PORT.
4	Operate and hold −/+ switch in + until desired port appears in alphanumeric display. *Note:* Only numbers of ports actually used will appear.	Alphanumeric display indicates port desired (PRTx).
5	Depress EXEC.	Alphanumeric display blinks once.
6	Place TEST/CMD switch in normal position.	Alphanumeric display returns to normal indication.

5. UNIFORM SERVICE ORDER CODE (USOC) INFORMATION

5.01 *USOC Structure:* The USOC structure for DATAPHONE II service consists of three basic elements. These elements are a 3-character USOC which identifies the hardware required for service, a 2-character *suffix* which identifies the customer application, and *fields* for designated information. All DATAPHONE II service data sets will use the same USOC, suffix, designated fields structure.

5.02 *USOC Hardware Designation:* A 3-character USOC has been assigned to each DATAPHONE II service offering. The USOC identifies hardware required to provide the service. Table Q lists the data set USOCs based on data rate, facility type, physical arrangement, telephone set requirement, and quick start-up operation for control data sets (eg, a 2400 bps multipoint service with stand-alone data sets bears the USOC "2EG").

5.03 *USOC Application Suffix:* The second part of the USOC structure is the application suffix. Table R lists customer applications and the assigned application suffix. The primary categories for applications are private line and extended service. The 2-character application suffix designates the typical data set options for each application type (refer to Section 592-040-220).

5.04 For the previous example of a 2400 bps multipoint service, the USOCs with application suffixes are: control data set 2EGCA, tributary data set 2EGDA.

5.05 *USOC Designated Information Fields:* This part of the USOC contains additional information for the service. Each designated information field is identified by a *field identifier (FID)*. The FIDs applicable to private line data sets are defined below.

FID Definitions

5.06 *Control Data Set (CDS):* Identifies a control data set that is connected to a DCD. For example: 2EGCA/DCA 015; 01; N/DSO A NONE—B NONE/*CDS*

5.07 *Customer Device Address (DCA):* Identifies the field containing the local address, network address, and port (if applicable) of a data set in that order. Where the port number is not applicable an N will be placed in the port block. Example of the use of DCA are: 2EGCA/*DCA 015; 01; N*/DSO A NONE—B NONE (DS 2024A) or 96VAA/*DCA 011; 01; 2*/DSO A NONE—B NONE (DS 2096A).

5.08 *Data Set Interface (DSI):* This field is intended for use at large installations to assist the installer in "cross referencing" one data set to another. For example a DS 2024A being referenced to a port on a DS 2096A where several DS 2096As are installed: 2EGCA/DCA 015; 01; N/DSO A NONE—B NONE/*DSI 011; 01; 2.*

5.09 *Data Set Options (DSO):* This field tells the installer which options (if any) to add to or delete from the data sets standard list (refer to Section 592-040-220). Two examples are: 2EGCA/015; 01; N/*DSO A B2 - D B1* (with options to be added and deleted) or 2EGCA/015;

TABLE Q

USOC CODES FOR DATAPHONE II SERVICE PRIVATE LINE DATA SETS

| USOC | DATA RATE (bps) | | | PHYSICAL ARRANGEMENT | | QUICK START-UP* |
	2400	4800	9600	STAND ALONE	MULTIPLE	
2EG++	✔			✔		
2EH++	✔				✔	
48J++		✔		✔		
48N++		✔			✔	
4QD++		✔		✔		✔
4QF++		✔			✔	✔
96V++			✔	✔		
96Y++			✔		✔	

* Pertains to quick start-up *control* data sets only.

TABLE R

USOC CUSTOMER APPLICATIONS AND SUFFIX TABLE

CONFIGURATION	APPLICATION SUFFIX
Private Line	
Point-to-Point	
Control	AA
Tributary	BA
Multipoint	
Control	CA
Tributary	DA
Control Quick Start-up	EA
Tributary Quick Start-up	FA
Extended Service	
Backbone	
Control	GA
Tributary	HA
Extended Data Sets	
Point-to-Point	
Control	AE
Tributary	BE
Multipoint	
Control	CE
Tributary	DE
Control Quick Start-up	EE
Tributary Quick Start-up	FE
Switched Network	
Colocated	JE
Remote	JA

01; N/ *DSO A NONE—D NONE* (with no options on the standard list to be changed).

5.10 *Multiple Data Mounting Address (MDA):* Indicates the address assigned to a private line multiple data mounting cabinet.

5.11 *Multiplex Configuration (MPC):* This field applies to DS 2096A only and indicates the multiplex configuration arrangement to be installed in the data set. For example: 96VAA/DCA 011; 01; 1/DSO A NONE—B NONE/ *MPC A.* The alphabetic codes assigned to MPC are:

- A—Port 1, 9600 bps

- B—Port 1, 7200 bps; port 2, 2400 bps

- C—Ports 1 and 2, 4800 bps

- D—Port 1, 4800 bps; ports 2 and 3, 2400 bps

- E—Ports 1, 2, 3, and 4, 2400 bps

- F—Port 1, 4800 bps

- G—Ports 1 and 2, 2400 bps

5.12 The USOC will be a continuous line entry in the service and equipment portion of the service order.

6. REFERENCES

6.01 Additional information concerning private line data sets and related equipment is contained in the following Bell System Practices:

SECTION	TITLE
592-031-100	Data Set 202T-Type—Transmitter-Receiver—Description and Operation
592-039-100	Data Set 212AR-L1A/2A—Description and Operation
592-040-220	Private Line Data Sets 2024, 2048, and 2096—Installation and Connections—Stand Alone-Multiple DATAPHONE® II Service
592-040-520	Private Line Data Sets 2024, 2048, and 2096—Test Procedures—Stand Alone-Multiple—DATAPHONE® II Service

SECTION	TITLE
592-101-100	2100A Data Control Unit (Diagnostic Console)—Description and Operation—DATAPHONE® II Service
592-101-200	2100A Data Control Unit (Diagnostic Console)—Installation and Connections—DATAPHONE® II Service
592-102-100	2200A Data Control Unit (Network Controller)—Description and Operation—DATAPHONE® II Service
592-102-200	2200A Data Control Unit (Network Controller)—Installation and Connections—DATAPHONE® II Service
598-082-100	Data Auxiliary Set 829-Type—Channel Interface Units—Voiceband Private Line Channels—Description