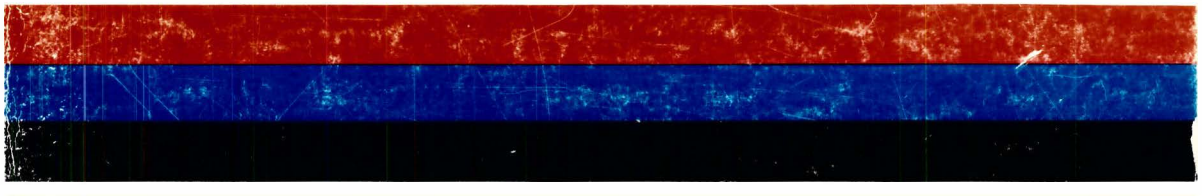
Data Services Reference Handbook

Data Sets-Installation and Maintenance

VOLUME II



AT&T
Information Systems



325-093

SEPTEMBER 1983

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Data Services

Reference Handbook

Volume II

Printed in U.S.A.

PREFACE

Objective

The objective of the Data Services Reference Handbook is to furnish the Telephone Company craft employee with a practical field manual comprised of information pertaining to the description, installation, and maintenance of voice bandwidth data sets and associated data auxiliary apparatus.

Plan of Text

In general, the Bell System Practices (BSPs) have been edited and condensed to offer a wide spectrum of information that would not be possible to include in a handbook in the unedited format. In addition, option and interface tables have been excerpted from descriptive sections when necessary and added to provide complete installation information.

Contents

The Data Services Reference Handbook consists of sixteen parts, divided into five volumes. Parts 1 and 2, covering data sets 100- and 200-types, are placed in Volume I. Parts 3 through 6, covering data sets 407-type, transaction telephone, Digital Data System, data auxiliary equipment, and ADTS testing, are placed in Volume II. Parts 7 and 8 covering general data apparatus and general trade products are placed in Volume III. Parts 9 through 14 covering ***registered*** interfaces, data jacks and mountings, data sets, data stations, and data auxiliary sets, are placed in Volume IV. Parts 15 and 16 covering DATAPHONE®/II Service and DIMENSION®/System 85 data service units are placed in Volume V.

The BSPs are arranged in each part in order of material content rather than by number. This type of presentation is necessary to allow an item to be presented in a subjective manner rather than to be restricted by the 9-digit numbers. For information not contained in this manual, refer to standard BSP files.

As an aid to usability, shown above the 9-digit number of each BSP is an abbreviated description of the apparatus covered in the practice (for example, DS 108D, DS 201C Sta, DAS 828D, etc.), plus a hyphenated number. This number shows the part number and the order in which the practice is placed in the part. (For example, 3-1 is the first practice in Part 3.) Where it is known that a BSP will be added to the manual in a later revision, a number has been skipped to save space for the practice. The page number of each page in the BSP is retained at the bottom of the page for cross-reference purposes.

DATA SERVICES REFERENCE HANDBOOK

Comments concerning content, usability, and adequacy of this manual will be welcomed. This sheet may be removed and mailed directly to the Bell System Practices Organization. This sheet is not to be used for ordering manuals.

Specific comments on particular BSPs should be forwarded by means of Form E-3973.

Mail to:

Bell System
Data Design Organization
Department 3114
2400 Reynolda Road
Winston-Salem, N. C. 27106

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407-TYPE MULTIPLE DATA STATION

DESCRIPTION

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1. GENERAL

1.01 This section provides information on the 407A- and 407B-type multiple data station optioned for either an Electronic Industries Association (EIA) voltage or a contact equivalent customer interface. The 407-type multiple data station performs functions similar to data set 403D-type multiple data station.

1.02 This section is reissued to add coverage on data set 407B. Since changes are extensive throughout the section, revision arrows have been omitted.

1.03 A 407A-type multiple data station, shown in Fig. 1, consists of the following units:

- Data set (DS) 407A
- 41-type data mounting (houses a maximum of eight DSs 407A) equipped with:
  - 101A power unit.
  - P3BJ power cord (one supplied ***only*** with the 41B1 and 41B2 data mountings). This power cord enables interconnection to other power units.
  - KS-14532-L16 power cord (one supplied ***only*** with the 41A1 and 41A2 data mountings). This 10-foot power cord is used for connection to the customer-provided ac power outlet.
  - 46A1 data unit (one supplied ***only*** with 41A1 or 41A2 data mountings).
  - 47A1 data unit (one supplied ***only*** with 41A1 or 41A2 data mountings).
- An appropriate housing such as a KS-20018-L11A or -L12A.

1.04 A 407B-type multiple data station is similar to the 407A-type shown in Fig. 1, but uses DS 407Bs, and only 41A2 and 41B2 data mountings.

Note: The KS-20018-L11A cabinet will hold 24 DS 407As, but only 16 DS 407Bs, due to thermal limitations.

1.05 The 407-type multiple data station is used primarily for Digital Inquiry Voice Answer-Back (DIVA) systems. These systems may be used in such applications as credit checking or retrieving

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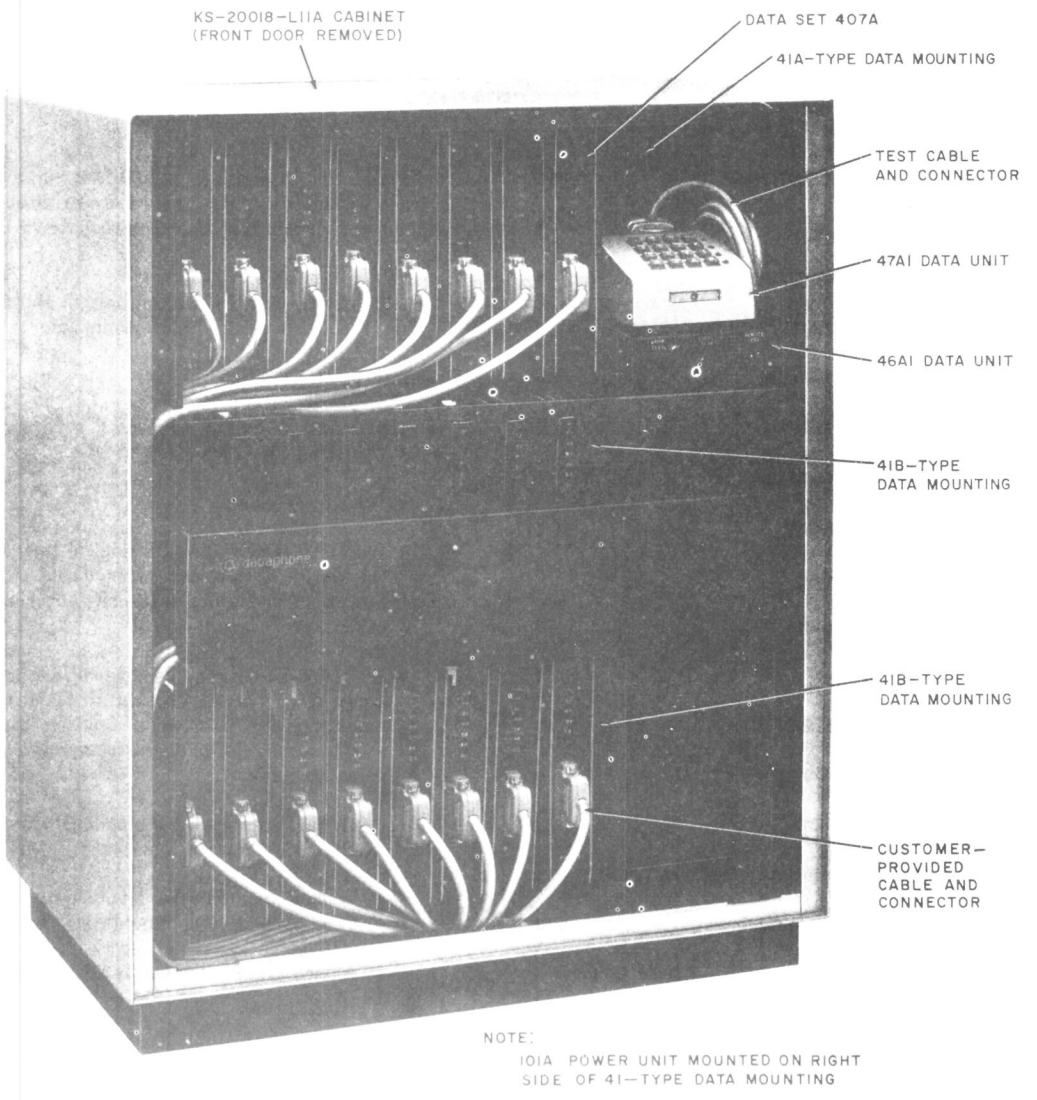


Fig. 1—407A-Type Multiple Data Station Mounted in a KS-20018-L11A Cabinet—Typical

information from a customer-provided computer. Using a Touch-Tone® telephone dial or TRANSACTION* telephone as the input device, a customer may call the computer and receive a voice or tone answer over the telephone handset. This answer may consist of machine-generated or prerecorded phrases. These phrases are under control of a customer-provided computer equipped with an audio response unit.

1.06 To operate with the Transaction telephone, a DS 407A-L1A or DS 407B-L1 must be used. The DS 407-L1A uses a JU1B line control and

*Trademark of AT&TCo

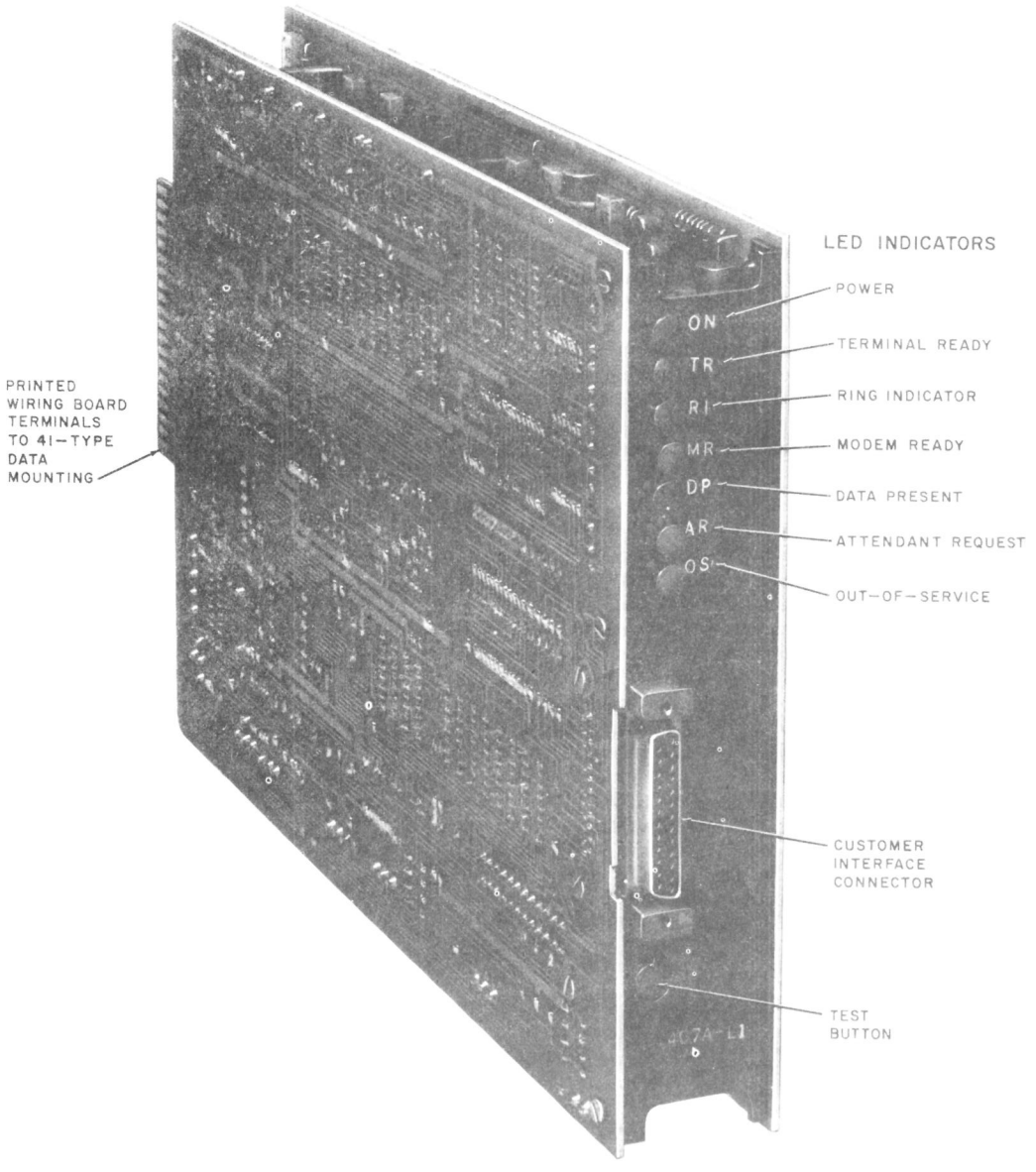


Fig. 2—Data Set 407A-L1 or -L1A

interface board or a factory-modified JU1 board changed per X-18107.

1.07 Data set 407-type is a low-speed, parallel receiver that detects two-out-of-eight multifrequency signals generated by a Touch-Tone-type telephone. The data set receives data from either the 2-wire switched telecommunications network or an unconditioned private line facility. The data set provides a two-way voice channel as well as full-time remote control. The remote control feature enables the data set to receive Touch-Tone signals in the presence of outgoing voice or tone answer-back. The data set has the capability of generating a 2025-Hz answer-back tone. Status light emitting diodes (LEDs), as shown in Fig. 2 and 3, are provided on the front panel of DS 407-type to indicate the state of various functions and customer interface signals.

1.08 The 41-type data mounting will accommodate up to eight data sets 407A or 407B. The 41A-type data mounting contains the 101A power unit, one 46A1 data unit, and one 47A1 data unit. The 41B-type data mounting is the same as the 41A-type data mounting but does ***not*** contain the 46A1 and 47A1 data units (test unit). The 41A-type data mountings may be used to accommodate the first eight DS 407s and the 46A1 and 47A1 data units. When additional DS 407s are used, one 41B-type data mounting is used for each eight additional data sets. The 41A1 and 41B1 data mountings are rated Manufacture Discontinued (MD) and are replaced by the 41A2 and 41B2 data mountings, respectively. The DS 407A uses either 41A1 or 41A2 interchangeably, and likewise the 41B1 and 41B2. ***DS 407B uses only 41A2 and 41B2 data mountings.***

1.09 The 46A1 data unit (Fig. 1) provided with the 41A-type data mounting enables local or remote testing of any data set 407-type in the cabinet.

1.10 The 47A1 data unit also provided with the 41A-type data mounting enables local testing by a telephone company (telco) employee or customer of any data set housed in the cabinet.

1.11 The 407-type multiple data station may be housed in a KS-20018-L11A or -L12A cabinet, or equivalent, or any mounting rack that will accept the 23-inch 41-type data mounting. Only one 41A1 or 41A2 data mounting will be mounted in each cabinet to house the first eight data sets. Additional data sets will be housed in the 41B1 or 41B2 data mountings, as required.

1.12 The 407-type multiple data station is compatible with a 565HK-type telephone set or a Call Director®. These units provide TALK and return to DATA functions as well as normal telephone set functions if required. The 407-type multiple data station is also compatible with the 2B automatic call distributor (ACD).

2. PHYSICAL DESCRIPTION

2.01 The 407-type multiple data station will operate in an ambient temperature range from 40 to 120°F. The relative humidity operating ranges for the data station are as follows:

- Between 40 to 75°F, the humidity may vary from 20 to 95 percent.
- At 100°F the humidity range is 20 to 70 percent.
- At 120°F the humidity range is 20 to 40 percent.

Data Set 407A-L1

2.02 Data set 407A-L1 (Fig. 2) consists of two printed wiring circuit packs (CPs) (JU1 and JU2) mounted together in sandwich fashion. A KS-19087-type 25-pin connector is located on the front of the data set and provides the interface with customer-provided terminal equipment. Printed CP terminals are also located on the rear of the data set which enables the data set to plug into the 41-type data mounting. The data set is 8 inches high, 12.1 inches deep, 1.45 inches wide, and weighs approximately 2-3/4 pounds. The data sets require power sources of +12 volts, −12 volts, and +5 volts. DS 407A-L1 can be updated to DS 407A-L1A by factory modification of JU1 per X-18107.

Data Set 407A-L1A

2.03 Data set 407A-L1A (Fig. 2) consists of two printed wiring CPs (JU1B and JU2) similar to DS 407A-L1. Dimensionally, DS 407A-L1A is the same as DS 407A-L1, and the power source

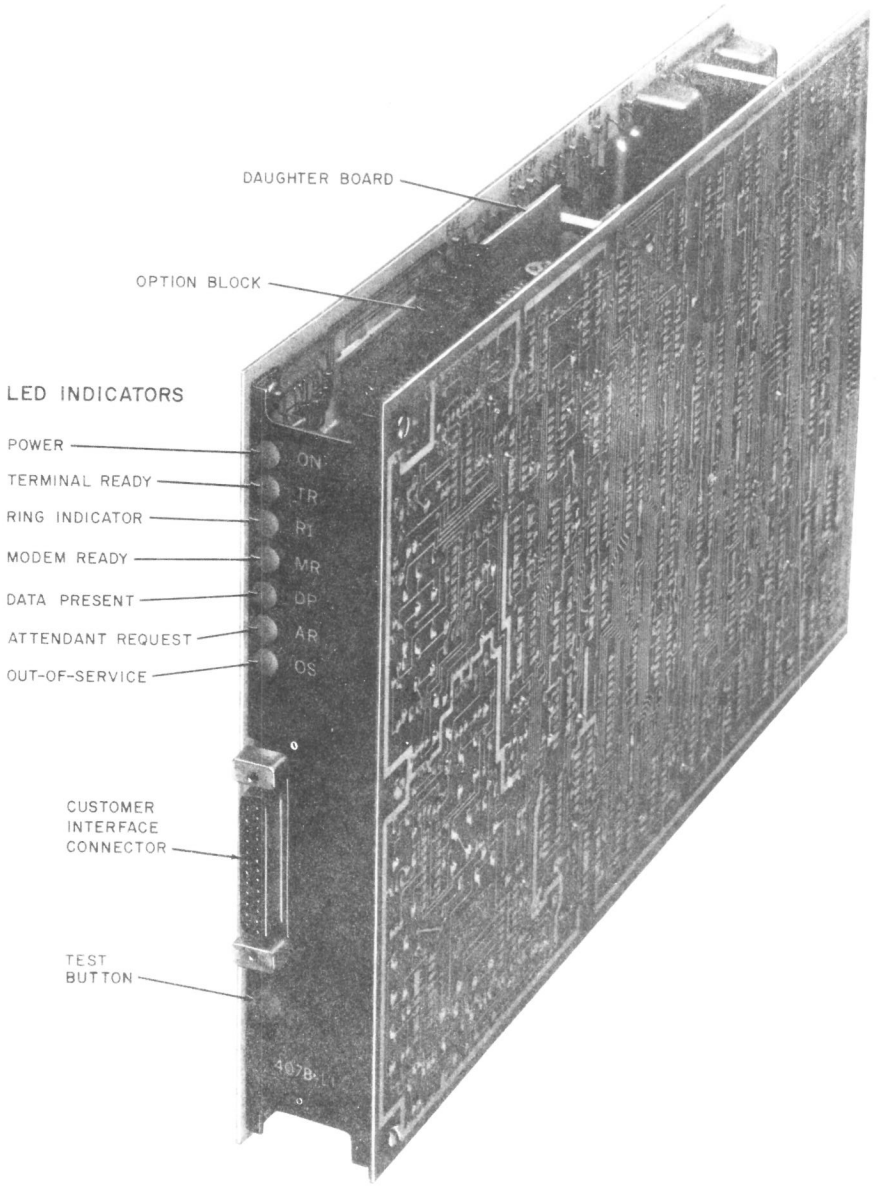


Fig. 3—Data Set 407B

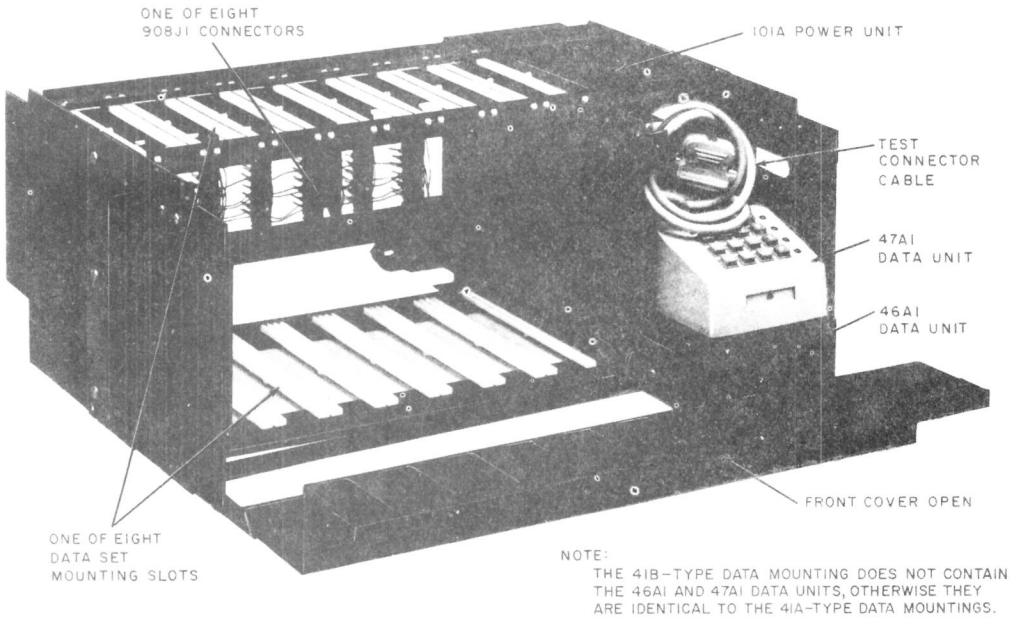


Fig. 4—41A-Type Data Mounting With Front Cover Open

requirements are the same. A 25-pin interface connector is located on the front of the set.

Data Set 407B

2.04 Data set 407B (Fig. 3) consists of two CPs (JU2 and JU3) similar to DS 407A-L1A, with a daughter board CM1 (circuit module) as part of JU3. Dimensionally, the DS 407B is the same as DS 407A, and the set weighs 3 pounds. The power source requirements are the same as DS 407A. A 25-pin interface connector is located on the front of the set.

41-Type Data Mountings

2.05 The 41A data mounting (Fig. 4) contains a test unit and is approximately 23 inches wide, 8.67 inches high, and 16.5 inches deep. It mounts on a 23-inch rack and weighs approximately 42 pounds. The 41A1 and 41A2 data mountings are supplied with a KS-14532-L16 power cord. The 41B1 and 41B2 data mountings have the same phsycial dimensions as the 41A1 and 41A2 data mountings and weigh approximately 38 pounds. The 41B1 and 41B2 data mountings are supplied with a P3BJ power cord. The P3BJ power cord consists of a Hubbel Twist-lock receptacle and a three-prong male plug. The 41B1 and 41B2 do ***not*** contain test units.

2.06 The 41-type data mountings are provided with eight 908J1 connectors, two KS-16672-L3 50-pin connectors, and one 101A power unit. All four data mountings provide a locking strip across the front of the mountings to ensure the data sets remain properly connected in the nest. A pack of spare option plugs (for data set 407-type) is also provided with the data mountings. The 41-type data mountings are also provided with a removable cover. Decals are attached to the inside of this front cover. One decal provides data set number location as well as computer port assignment for each data set in the 41-type data mounting. This decal appears on all 41-type data mountings. A second decal is located on 41A1 data mountings to

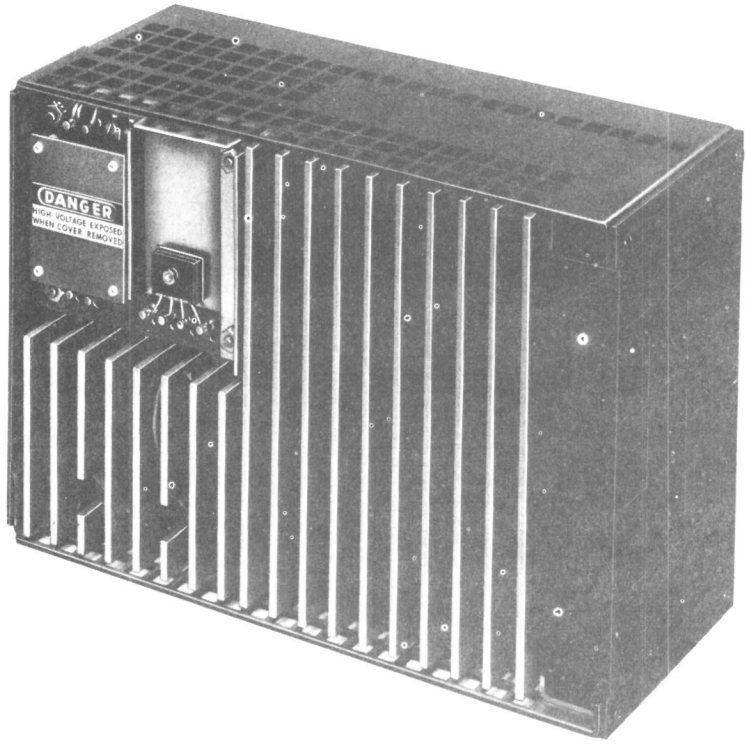


Fig. 5—101A Power Unit

provide local test information. This same decal, plus a third decal is located on 41A2 data mountings to provide local test information. Backplane wiring is also provided with the data mountings.

2.07 A 25D connector cable equipped with one KS-16689-L3 plug is used to make the necessary line facility connections per four data sets. The KS-16689-L3 plug is connected to the left (J4) or right (J3) KS-16672-L3 connector on the rear of the 41-type data mounting. In addition, connector J4 on the 41A1 or 41A2 data mounting also holds the tip and ring pair of the service line used in remote testing. A 5-foot long test connector cable is provided with 41A1 and 41A2 data mountings to facilitate testing of any data set in the cabinet.

101A Power Unit

2.08 The dc voltages are supplied to the data sets via the data mounting by the 101A power unit (Fig. 5.) The 101A power unit is mounted on the right side of the data mounting and weighs 20 pounds. If more than one data mounting is required, the 101A power units are interconnected (via P3BJ power cords) with the bottom power unit supplying the external power connection via the KS-14532-L16 power cord.

46A1 Data Unit

2.09 The 46A1 data unit (Fig. 1) is approximately 5.2 inches wide, 2 inches high, 4.2 inches deep, and weighs 1.5 pounds. This data unit

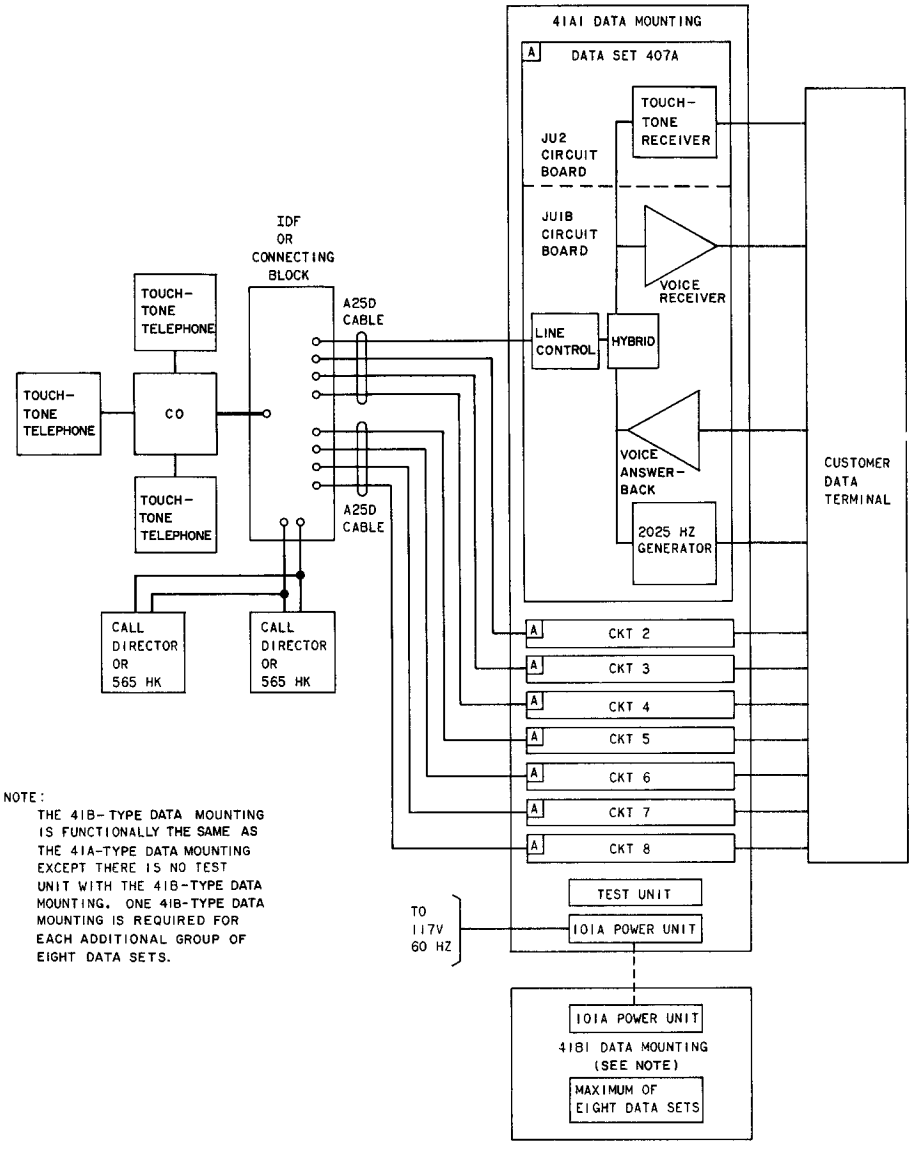


Fig. 6—Functional Block Diagram—407A-Type Multiple Data Station Arrangement—Typical

contains a LOCAL-REMOTE test switch, test indication LEDs, and a LAMP TEST switch for testing all LEDs in the cabinet.

47A1 Data Unit

2.10 The 47A1 data unit (Fig. 1) is approximately 4.5 inches wide, 2.5 inches high, 4.5 inches deep, and weighs 1.5 pounds. This data unit is a modified 16-button Touch-Tone dial. The data unit contains LEDs across the top and down the right side of the dial.

Cabinets

2.11 The 407-type multiple data station may be housed in one of two KS-20018-type cabinets. The front panel of each cabinet is tinted plastic, while the back panel is perforated metal. The cabinet exteriors are textured aluminum with a clear finish. The cabinets and physical characteristics are as follows:

- KS-20018-L11A cabinet can house one 41A1 or 41A2 and up to two 41B1 or 41B2 data mountings with a maximum of twenty-four DS 407As or sixteen DS 407Bs. The cabinet is approximaely 24 inches wide, 30 inches high, 19 inches deep, and weighs 31 pounds.

- KS-20018-L12A cabinet can house one 41A1 or 41A2 data mounting with a maximum of eight data sets. The cabinet is approximately 24 inches wide, 17 inches high, 19 inches deep, and weighs 22 pounds.

Stations requiring more data sets that can be accommodated in the KS-20018-L11A cabinet can be served by using multiple cabinets. Interconnection between cabinets must be made at time of installation.

3. FUNCTIONAL DESCRIPTION

3.01 The 407-type multiple data station provides a maximum of eight interface connections between the data sets and customer-provided terminals per data mounting. Two line facility interface connectors per data mounting are also provided. Each of the line facility connectors provide the necessary interface to connect four data sets to the telephone network. The telephone network connections are made via an intermediate distribution frame (IDF) or connecting block, as required. A functional block diagram is shown in Fig. 6.

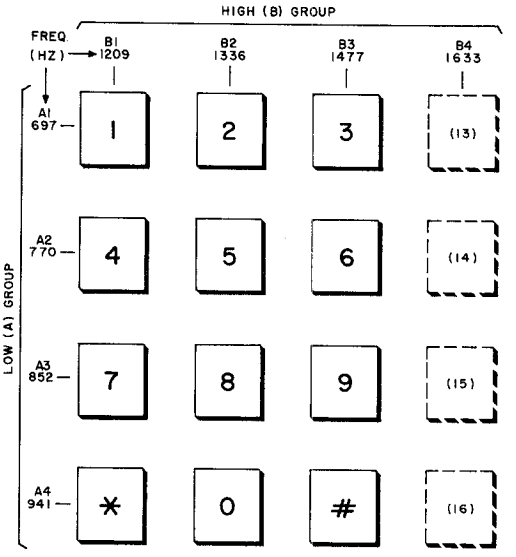


Fig. 7—Touch-Tone Dial Frequency Assignments

Data Set 407A

3.02 Data sets 407A-L1 and -L1A are functionally, as well as physically, divided into two halves; a line control and interface CP (JU1 or JU1B) and a receiver CP (JU2).

3.03 The JU1 or JU1B CP provides the interface between the telephone lines and the data set. This CP is also the interface between the data set and customer-provided terminal via the KS-19087-type 25-pin connector. An impedance match of 600 ohms (private line) or 900 ohms direct distance dialing [(DDD) line] is provided by the data set via the JU1 or JU1B CP. The JU1 or JU1B CP provides the following additional functions:

- Automatic answer.

- Normal voice telephone service with an associated key telephone set, if required.

- Two-way voice channel.
- Return to data.
- Tone answer-back (2025 Hz) (see note).
- Local and remote test capability.
- Indicator LEDs.
- Call referral.
- Automatic Call Distributor (ACD) interface.

Note: DS 407A-L1A (using a JU1B or modified JU1) has a tighter tolerance on answer-tone duration than DS 407A-L1.

3.04 The hybrid network located on JU1 or JU1B CP allows detection of valid data signals in the presence of near-end signals such as voice answer-back or tone answer-back. (Full-time remote control).

3.05 The JU2 CP is the receiver portion of the data set and accepts a two-out-of-eight Touch-Tone transmission code. The transmission code consists of two groups of frequencies, a low group and a high group, each containing four frequencies. These frequencies are grouped and designated as shown in Fig. 7.

3.06 The receiver detects the Touch-Tone signals at a maximum rate of ten characters per second. A character consists of one frequency from each group shown in Fig. 7. Therefore, the two-out-of-eight code provides 16 different frequency pairs (characters). Data set 407-type recognizes all of these characters.

3.07 Seven status LEDs are provided on the front of data sets 407A-L1 and -L1A as shown in Fig. 2. The LED names and functions are defined as follows:

- The "ON" LED indicates that power is applied to the data set.
- The terminal ready (TR) LED indicates the status of the data terminal ready signal from the customer interface.
- The ring indicator (RI) LED indicates that ringing is being applied to the data set.
- The modem ready (MR) LED indicates the status of data set ready signal to the customer interface. This LED comes ON 3 seconds after ringing is tripped, if the station is in the Data mode and TR is ON. Once it comes ON, it stays ON until termination of the call, whether the line is in the Talk or the Data mode.
- The data present (DP) LED indicates the status of the data present signal to the customer interface. This signal (DP LED ON) indicates that the data set is receiving data.
- The attendant request (AR) LED indicates the status of attendant request signal from the customer interface.
- The out-of-service LED indicates that the data set has been placed out of service.

3.08 The data set has the capability of giving an out-of-service indication to the connecting data facility under any of the following conditions:

- Out-of-service customer interface lead is placed in the ON state by the customer terminal.
- The data set is under test.
- Power is lost to the data set.
- The data set is not plugged into the nest correctly or has been removed from the nest.
- The connector to the customer terminal is not plugged in correctly and the EIA interface option is used.

3.09 The data set detects ringing current on its associated line circuit and generates a ring indicator (RI) signal on the customer interface. If the customer terminal is ready to accept the call (DTR is turned on), the line control circuit will answer the call automatically and then sense DC loop current. A 2025-Hz answer tone is then transmitted for about 1.5 seconds to the calling station, indicating the call has been answered. The DSR lead is turned ON indicating the data set is connected to the line. During a call, the line control circuit will indicate line and data set status

TABLE A

DATA SET 407-TYPE OPTIONS

OPTION	SELECTION	DESIG	AVAILABLE IN
Type of Operation	Switched Network	A*	Both 407A and 407B
	Private Line	B	
Used With ACD	No	C*	Both 407A and 407B
	Yes	D	
Answer Back Level	-3 dBm	E	Both 407A and 407B
	-7 dBm	F	
	-12 dBm	G*	
Customer Interface	EIA	H*	Both 407A and 407B
	Contact Equivalent	J	
Terminal Initiated Referral	Always	K	407B Only
	During Computer Down Only	L*	
OS Controlled by DTR	No	M*	407B Only
	Yes	N	
Computer Down Detection	Switch Only	AA	407B Only
	All DTR Off Only	BB	
	Switch or All DTR Off	CC	
	Not Used	DD	
Out-of-Service Wiring	Tip-Ring Short	EE	Both 407A and 407B
	Third Wire Ground	FF	
	Separate Pair Short	GG	
Grounding	Frame Ground Connected to Signal Ground	HH*	Both 407A and 407B
	Frame Ground and Signal Ground Not Connected	JJ	

* Factory Furnished Option.

by means of a lamp indication on the associated Call Director or 565HK-type telephone station as follows:

- In the ***Idle*** mode the lamp is OFF.
- In the ***Data*** mode the lamp is ON.
- In the ***Data*** mode, when the attendent request lead is ON, the lamp flashes.
- In the ***Talk*** Mode the lamp is ON.
- In the ***Out-of-Service*** mode the lamp is ON.

The call is terminated when the loop current is interrupted during a call after the automatic answering sequence is over. The call is also disconnected by the following means:

- TALK mode—attendant hangs up
- DATA mode—DTR ***off***
- ACD—DTR ***off.***

Data Set 407B

3.10 Data set 407B (Fig. 2) performs all the functions of DS 407A; and also provides the following three additional features:

- Terminal-initiated referral capability
- Remote call termination
- Limited call-handling capability when customer-provided equipment is out of service.

The DS 407B is also functionally and physically divided into two halves; a line control and interface (JU3) and a receiver (JU2). The additional functions listed above are provided by a daughter board which is part of JU3 CP; the JU2 CP provides the same functions for both data sets.

3.11 When DS 407B is optioned for "terminal initiated referral—always," the calling terminal may request an attendant any time (computer "up" or "down") by sending the "attendant request" signal (* *).

3.12 In addition to the features described above, when the 407B data station goes into "computer down" mode, the data sets answer incoming calls, generate a 3.5-second answer tone to indicate "computer down" to the calling terminal and can respond to an "attendant request" signal (* *) from a terminal. A 15-second time-out feature is provided so that calls that do not get referred are promptly terminated.

3.13 Data set 407B responds to the Touch-Tone sequence * # * (star, number sign, star) by momentarily turning off data terminal ready (DTR) regardless of the status of the DTR lead at the customer interface. This causes the data set to terminate the call.

3.14 Out of service may be controlled by DTR by option.

OPTION AND INTERFACE INFORMATION

Data Sets 407A and 407B

3.15 On DS 407A-type, option strapping is provided by means of two-pronged plugs which fit into numbered jacks on the JU1-type CP. On DS 407B the same options are funished as part of JU3 CP. Additional options required when DS 407B is used with a Transaction telephone are provided by rectangular jacks which fit over prongs on a lettered option block on the daughter board (CM1) which is part of JU3. Options for DS 407-type are listed in Table A.

Customer Interface Information

3.16 Interface pin numbers, lead designations, abbreviations, and functions for data set 407-type are shown in Table B. Twenty-three of the twenty-five leads on the customer interface connector are assigned. The two unassigned leads are spares.

41-Type Data Mounting

3.17 The 41-type data mounting is a multiple apparatus housing which will accommodate a maximum of eight data sets. Connectors J3 and J4 on the 41-type data mounting provide interconnection from the eight mounting slots to the telephone network via an IDF or connecting block. The 908J1 connectors (eight per mounting) accept data set 407-type.

TABLE B

CUSTOMER INTERFACE LEAD FUNCTIONS

PIN NO.	LEAD DESIGNATION	ABBREVIATION	FUNCTION
1	Frame Ground	FG	Common to ac power service ground.
2	Voice Receive A	VRA	Provides one-half of a 600Ω balanced pair for line signals being passed to the customer.
3 4 5 6	A1 Data A2 Data A3 Data A4 Data	A1 A2 A3 A4	Low group outputs from data set when a valid Touch-Tone character is present.
7	Spare	—	Not used.
8	Voice Receive B	VRB	Provides one-half of a 600Ω balanced pair for line signals being passed to the customer.
9 10 11 12	B1 Data B2 Data B3 Data B4 Data	B1 B2 B3 B4	High group outputs from data set when a valid Touch-Tone character is present.
13	Spare	—	Not used.
14	Ring Indicator	RI	An ON condition on this lead indicates that ringing signal is being received.
15	Attendant Request	AR	An ON condition on this lead (data set in data mode) indicates that an attendant is requested on the line.
16	Data Present	DP	An ON condition on this lead indicates that the data set is receiving a valid Touch-Tone signal. This lead is considered a data lead and therefore an ON condition is a negative voltage.
17 18	Voice Answer-Back A Voice Answer-Back B	VAA VAB	Provides a 600Ω balanced pair for answer-back signal from customer to data set.
19	Data Mode	DM	An ON condition on this lead and the DSR lead (pin 23) indicates the data set is in the data mode. An OFF condition on the DM lead and an ON condition on the DSR lead indicates the data set is in the talk mode.

TABLE B (Cont)

CUSTOMER INTERFACE LEAD FUNCTIONS

PIN NO.	LEAD DESIGNATION	ABBREVIATION	FUNCTION
20	Tone Answer-Back	TAB	An ON condition on this lead causes the data set to disable the voice answer-back port and generate an answer-back tone (2025 Hz).
21	Data Receive	DR	An ON condition *must* be placed on this lead (by the customer) to connect the Touch-Tone receiver to the telco line. This enables the data set to receive data.
22	Data Terminal Ready	DTR	An ON condition on this lead prepares the data set to be connected to the telco line. In DS 407B, the out-of-service function can be optionally controlled by the DTR lead. When that option (N) is selected, the OS lead has no effect and the set is out of service when DTR is off.
23	Data Set Ready	DSR	An ON condition on this lead indicates the data set is *either* in the data mode and ready to receive data, transmit answer-back signals, or both, depending on the condition of the DR lead (Pin 21), or is in the talk mode (DM lead Pin 19 is OFF).
24	Signal Ground	SG	This conductor establishes the common ground for signals referenced to it and is optionally connected to frame ground via a strap located on the power unit.
25	Out of Service	OS	An ON condition on this lead makes the data set appear busy to incoming calls. When an ACD is employed, this lead is placed in the OFF condition at all times. In DS 407B, the out-of-service function can be optionally controlled by the DTR lead. When that option (N) is selected, the OS lead has no effect and the set is out of service when DTR is off.

3.18 Each of the 41A1 (MD), 41A2, 41B1 (MD), and 41B2 data mountings are equipped with one 101A power unit. The 101A power unit supplies power to a maximum of eight data sets. Separate outputs on the power unit provide +12 volts, −12 volts, and +5 volts filtered dc power for each data set in the 41-type mounting. The power unit is powered from a 117-volt 60-Hz three-wire (with ground) source.

3.19 The single test unit in the 41A1 or 41A2 data mounting provides both local and remote

testing capabilities for all the data sets within a single cabinet.

Test Unit—46A1 and 47A1 Data Units

3.20 When a data set is placed under test (local or remote), the customer interface cable is removed from the data set and the test cable from the 46A1 data unit (CA1) is connected directly to the data set interface connector. An extension of this 25-pin test connector automatically operates the TEST switch located on the front of the data set. When the data set is placed in the test mode, the following functions occur:

- Data set is transferred from its associated line to a test line.
- The local test start (LTS) and remote test release (RTR) leads of the set under test are connected to the test circuit.
- The interface leads are placed in the contact equivalent option.
- If an ACD is used for voice access and call distribution, the data terminal ready indication to the ACD is disabled. This makes the data set under test appear busy to the ACD.
- The incoming line is made busy so no calls will be directed to the data set under test.

3.21 The 46A1 data unit provides local, remote, and LED testing of up to 24 of the 407-type data sets in a multiple data station. The LOCAL-REMOTE test switch is operated to REMOTE TEST, thereby placing the data set in the remote test mode. In the remote test mode, the data set under test is connected to a service line and then called from a remote data test center. When the LAMP TEST switch is depressed, the status LEDs on the data sets and test unit should light. This test feature checks that all LEDs are in working condition.

3.22 The 47A1 data unit provides means for local testing of up to 24 data sets by the customer or telco employee, by operating the LOCAL-REMOTE test switch on the 46A1 data unit to LOCAL TEST. When a Touch-Tone button on the 47A1 data unit is depressed and held, the two LEDs representing the horizontal and vertical coordinates of the depressed button will flash at a steady rate. This test enables the customer or telco employee to obtain a rapid check of a data set.

4. REFERENCES

4.01 The following documents pertain to the 407-type multiple data station.

SD & CD 1D240-01 Data System Station—407-Type Data Station

SD & CD 1D241-01 Power Unit 101A

SECTION	TITLE
314-811-100	1A Transaction Telephone Test Line Station—Description
476-270-203	2B Automatic Call Distributing System—Cabling and Cross Connects
581-235-101	2B Automatic Call Distributor—General Description Information
590-004-109	Data Set 407-Type Multiple Data Station—Reference Guide
590-100-132	46A1 Data Unit—Identification
590-100-133	47A1 Data Unit—Identification
590-102-132	41-Type Data Mounting—Identification
594-030-100	Data Set 407-Type—Identification
594-800-101	407-Type Multiple Data Station Using 2B Automatic Call Distributor—Description
594-800-200	407-Type Multiple Data Station—Installation and Connections
594-800-300	407-Type Multiple Data Station—Maintenance

SECTION	TITLE	SECTION	TITLE
594-800-500	407-Type Multiple Data Station—Test Procedures	668-104-540	Data Test Center 904A- and 904C-Types—407-Type Multiple Data Station—Loop-Back Test
594-800-501	407-Type Multiple Data Station Using 2B Automatic Call Distributor—Test Procedures		

407-TYPE MULTIPLE DATA STATION INSTALLATION AND CONNECTIONS

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Option Descriptions 2
4. CUSTOMER INTERFACE INFORMATION . 4
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1. GENERAL

1.01 This section provides installation and connection procedures to be followed when installing the 407A- and 407B-type multiple data stations. Installation information is also provided on the Call Director®, 565HK-type telephone set, and 2B automatic call distributor (ACD) associated with the data station. Information concerning the associated business machine, data terminal equipment, or related services is ***not*** included.

1.02 This section is reissued to add information on data set (DS) 407B. Since this is a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 The DS 407-type multiple data station consists of data sets 407-type, 41-type data mounting(s) (eight data sets per data mounting), and an appropriate cabinet. The 41A1, 41A2, 41B1, and 41B2 data mountings contain a 101A power unit, but only the 41A1 and 41A2 contain test units. One 101A power unit may supply power to one data mounting or a maximum of eight data sets. The test unit consists of the 46A1 and 47A1 data units. The DS 407-type multiple data station sets are receivers of Touch-Tone® signals used primarily in Digital Inquiry Voice Answer-Back (DIVA) systems.

1.04 The 407-type multiple data station may be housed in a KS-20018-L11A or -L12A cabinet, or equivalent, or any mounting rack arrangement that will accept the 23-inch, 41-type data mounting. Each KS-20018-type cabinet listed above may house the following number of 41-type data mountings and data sets.

- KS-20018-L11A cabinet can house one 41A1 or 41A2 and up to two 41B1 or 41B2 data mountings with a maximum of twenty-four data sets 407A or sixteen 407B. (Heat dissipation reduces the number of DS 407Bs that can be mounted in a given cabinet).

- KS-20018-L12A cabinet can house one 41A1 or 41A2 data mounting with a maximum of eight DS 407A or DS 407B.

Larger installations require multiple KS-20018-L11A cabinets.

1.05 Plugs and cables for connecting the customer-provided terminals (CPTs) to the data sets are provided by the customer and should not exceed 50 feet in length. The cables for connecting the multiple data station to the transmission facilities must be terminated at the data mounting end in a 50-pin connector, such as the one on the A25D-type connector cable.



Some installations may require that a 5-foot M25A-61 cord, or equivalent, be supplied with the 407-type multiple data station. These cords can serve as extension cords for connections to customer interface cords external to the cabinet. The M25A-61 cord, or equivalent, is required when the customer interface cords have a bending radius greater than 4 inches. Refer to Section 594-800-150 for customer interface connector and cable requirements.

NOTICE

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1.06 The multiple data station may be installed in any location that is convenient for the customer within 50 feet of the CPT. It is desirable to mount the station adjacent to or within view of the customers audio response unit (ARU). This will allow visual monitoring of the status lamps on the DS 407s while operating or testing the ARU. Verify that the location selected by the customer for the installation is adequate for maintenance and that the customer-provided ac power outlet is ***not*** controlled by a switch. The ac power outlet must be within 10 feet of the equipment cabinet or mounting rack arrangement.

1.07 Reference directions (left, right, front, or rear) on the data mounting are in respect to facing the apparatus.

1.08 When test or demonstration calls are made, refer to the section entitled Crediting Charges on Test Calls (010-250-001) for the proper procedure for crediting charges.

1.09 Ensure that the data loops have been tested and meet requirements outlined in the section entitled Data System—Dataphone® Service on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines (314-205-501) or Voice Bandwidth Private Line Data Circuits—Tests and Requirements (314-410-500).

1.10 Data sets and data units found to be defective should be returned to a Western Electric Company distributing house for repair. Sets should be tagged to indicate the nature of the trouble.

2. SPECIAL TOOLS

2.01 In addition to the standard installation tools, installation of the data mountings and data sets will require the following special tools:

- KS-19053-L1 screwdriver, or equivalent
- Screw starter, Kedman Co. No. 1736, or equivalent.

3. OPTIONS

DS 407A and DS 407B

3.01 Options for DS 407-type multiple data station vary with application. Options are installed on the JU1 or JU1B circuit packs by means of small 2-pronged plugs which fit into numbered jacks on both DS 407A and DS 407B. Additional options on DS 407B are made by means of small rectangular jacks which fit over lettered prongs on the option block of the circuit module (daughter board). Installation of options should be made in accordance with the service order or the circuit layout record card. There are no options associated with the data units. ***Install options in DS 407A or DS 407B as applicable before installing the data sets in the data mounting.*** Options which apply to DS 407-type are illustrated in Fig. 1 and 2, and are listed in Table A.

Station Options

3.02 Nine options are made external to the data set (AA through JJ, Table A). Seven of these options are made on the connector block or intermediate distribution frame; two are made on the power supply.

Option Descriptions

3.03 The following describes both the data set and the data station options:

(a) ***Option A***—This option (factory-furnished) provides switched telecommunications network operation with a line impedance of 900 ohms.

(b) ***Option B***—This option provides private line (PL) operation with a line impedance of 600 ohms. When this option is installed, the line control circuit of the data set is bypassed and the data set is placed on line via the data terminal ready (DTR) customer interface lead.

(c) ***Option C***—This option (factory-furnished) is provided when there is ***not*** an automatic call distributor (ACD) associated with the data system.

(d) ***Option D***—This option is provided when an ACD ***is*** associated with the data system.

(e) ***Option E***—This option provides 0-dB attenuation of the data set answer-back signal and allows a maximum signal level of −3 dBm out of the data set.

(f) ***Option F***—This option provides 4-dB attenuation of the data set answer-back signal and allows

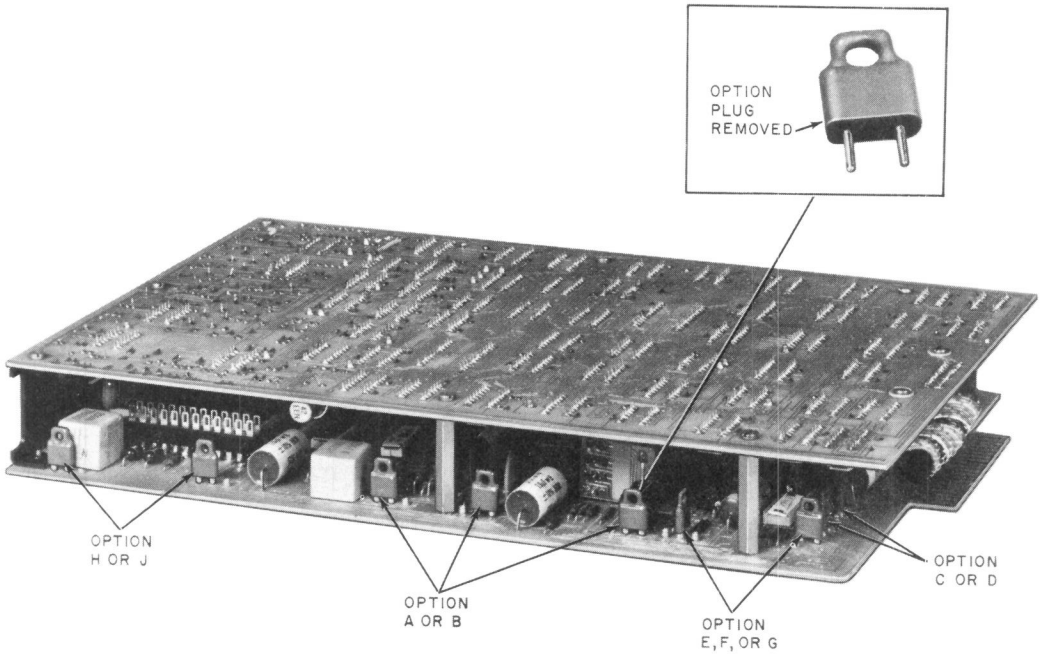


Fig. 1—Data Sets 407A and 407B—Option Plug Locations

a maximum answer-back signal level of −7 dBm out of the data set.

(g) ***Option G***—This option (factory-furnished) provides 9-dB attenuation of the data set answer-back signal and allows a maximum signal level of −12 dBm out of the data set.

(h) ***Option H***—This option (factory-furnished) provides an Electronic Industries Association (EIA) voltage interface (RS-232-C).

(i) ***Option J***—This option provides a contact ***equivalent*** interface.

(j) ***Option K***—(DS 407B only) With this option, the calling terminal is always able to initiate referral to an attendant by sending the Touch-Tone sequence ∗∗.

(k) ***Option L***—(DS 407B only) With this option, the terminal can initiate referral to an attendant only during "computer down" mode.

(l) ***Option M***—(DS 407B only) This option provides out of service controlled by the OS interface lead.

(m) ***Option N***—(DS 407B only) This option provides out of service controlled by DTR lead.

(n) ***Option AA***—(DS 407B only) This option provides for "computer-down" detection by means of a customer-actuated switch.

(o) ***Option BB***—(DS 407B only) This option provides for "computer down" detection by means of all DTR leads being in the OFF condition simultaneously.

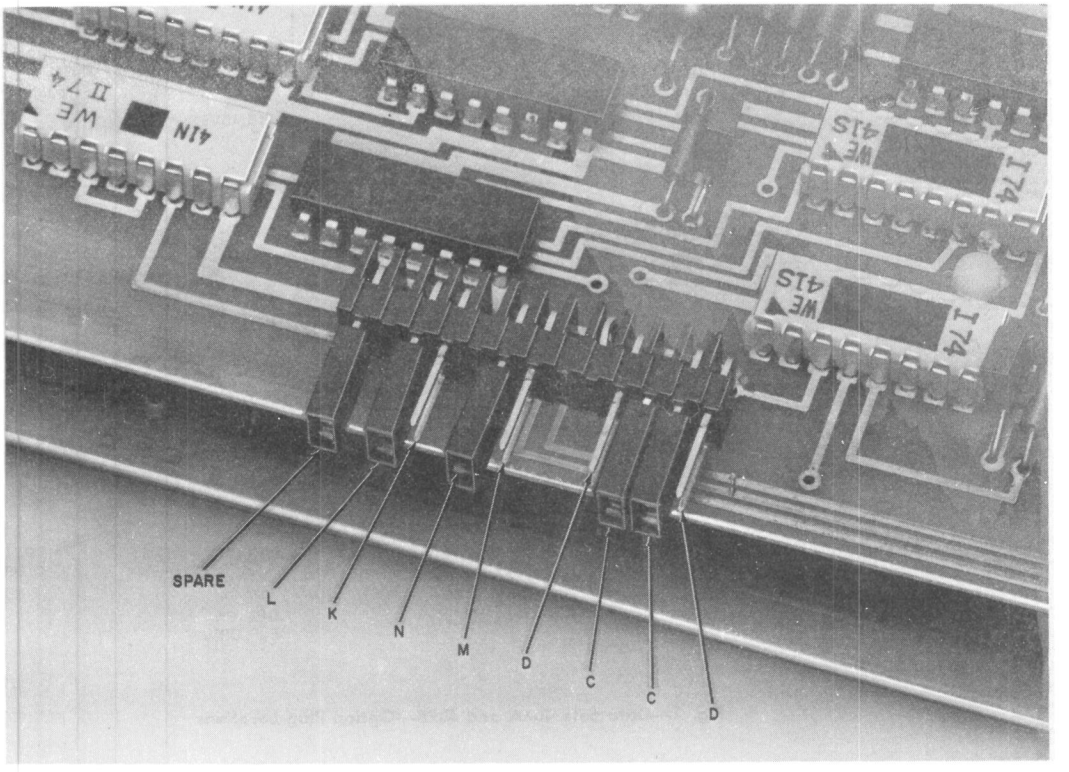


Fig. 2—Data Set 407B—Additional Option Jack Locations on CM1 (Daughter Board)

(p) ***Option CC***—(DS 407B only) This option provides for "computer down" detection either by customer-actuated switch or by all DTR leads being OFF.

(q) ***Option DD***—(DS 407B only) "Computer down" option not used.

(r) ***Option EE***—Out of service provided by tip-to-ring short.

(s) ***Option FF***—Out of service provided by third wire ground.

(t) ***Option GG***—Out of service provided by short on separate pair. Some electronic switching system (ESS) offices require this arrangement for out-of-service option.

(u) ***Option HH***—This option provides frame ground to signal ground connection. This is the option usually specified.

(v) ***Option JJ***—This option eliminates frame ground to signal ground connection.

4. CUSTOMER INTERFACE INFORMATION

4.01 Customer interface lead functions, abbreviations, and lead designations are given in Table B.

5. INSTALLATION AND CONNECTION PROCEDURE

5.01 The front cover of the 41-type data mounting is removable (by opening to a horizontal position and pulling forward). A decal is attached to the inside cover of each of the 41-type data

TABLE A

DATA SET 407-TYPE OPTIONS

OPTION	SELECTION	DESIG	STRAPPING				AVAILABLE IN
			ON LINE CONTROL AND INTERFACE BOARD	ON CM1	ON 101A POWER UNIT	ON CONNECTOR BLOCK	
Type of Operation	Switched Network (DDD)	A[1]	E34—E32, E37—E38 E42—E41	—	—	—	Both 407A and 407B
	Private Line	B	E34—E33, E37—E36 E42—E43	—	—	—	
Used With ACD	No	C[1]	E28—E26, E30—E29 [2]	C (Two Straps)[3]	—	—	Both 407A and 407B
	Yes	D	E28—E27, E30—E31[2]	D (Two Straps)[3]	—	—	
Answer Back Level	— 3 dBm	E	E54—E56, E60—E58	—	—	—	Both 407A and 407B
	— 7 dBm	F	E54—E53, E60—E59	—	—	—	
	—12 dBm	G[1]	E54—E55, E60—E61	—	—	—	
Customer Interface	EIA	H[1]	E49—E48, E51—E52	—	—	—	Both 407A and 407B
	Contact Equivalent	J	E49—E47, E51—E50	—	—	—	
Terminal Initiated Referral	Always	K	—	K	—	—	407B Only
	During Computer Down Only	L[1]	—	L	—	—	
OS Controlled by DTR	No	M[1]	—	M	—	—	407B Only
	Yes	N	—	N	—	—	
Computer Down Detection	Switch Only	AA	—	—	—	Per Fig. 7	407B Only
	All DTR Off Only	BB	—	—	—	Per Fig. 8	
	Switch or All DTR Off	CC	—	—	—	Per Fig. 9	
	Not Used	DD	—	—	—	Per Fig. 10	
Out-of-Service Wiring	Tip-Ring Short	EE	—	—	—	Per Fig. 6	Both 407A and 407B
	Third Wire Ground	FF	—	—	—		
	Separate Pair Short	GG	—	—	—		
Grounding	Frame Ground Connected to Signal Ground	HH[1]	—	—	E16-E17	—	Both 407A and 407B
	Frame Ground and Signal Ground Not Connected	JJ	—	—	E16-E17 Open	Per Fig. 4	

Notes:

1. Factory Furnished Option.
2. Applies to DS 407A and DS 407B.
3. Applies to DS 407B only.

TABLE B

CUSTOMER INTERFACE LEAD FUNCTIONS

PIN NO.	LEAD DESIGNATION	ABBREVIATION	FUNCTION
1	Frame Ground	FG	Common to ac power service ground.
2	Voice Receive A	VRA	Provides one-half of a 600Ω balanced pair for line signals being passed to the customer.
3 4 5 6	A1 Data A2 Data A3 Data A4 Data	A1 A2 A3 A4	Low group outputs from data set when a valid Touch-Tone character is present.
7	Spare	—	Not used.
8	Voice Receive B	VRB	Provides one-half of a 600Ω balanced pair for line signals being passed to the customer.
9 10 11 12	B1 Data B2 Data B3 Data B4 Data	B1 B2 B3 B4	High group outputs from data set when a valid Touch-Tone character is present.
13	Spare	—	Not used.
14	Ring Indicator	RI	An ON condition on this lead indicates that ringing signal is being received.
15	Attendant Request	AR	An ON condition on this lead (data set in data mode) indicates that an attendant is requested on the line.
16	Data Present	DP	An ON condition on this lead indicates that the data set is receiving a valid Touch-Tone signal. This lead is considered a data lead and therefore an ON condition is a negative voltage.
17 18	Voice Answer-Back A Voice Answer-Back B	VAA VAB	Provides a 600Ω balanced pair for answer-back signal from customer to data set.
19	Data Mode	DM	An ON condition on this lead and the DSR lead (pin 23) indicates the data set is in the data mode. An OFF condition on the DM lead and an ON condition on the DSR lead indicates the data set is in the talk mode.

TABLE B (Cont)

CUSTOMER INTERFACE LEAD FUNCTIONS

PIN NO.	LEAD DESIGNATION	ABBREVIATION	FUNCTION
20	Tone Answer-Back	TAB	An ON condition on this lead causes the data set to disable the voice answer-back port and generate an answer-back tone (2025 Hz).
21	Data Receive	DR	An ON condition *must* be placed on this lead (by the customer) to connect the Touch-Tone receiver to the telco line. This enables the data set to receive data.
22	Data Terminal Ready	DTR	An ON condition on this lead prepares the data set to be connected to the telco line. In DS 407B, the out-of-service function can be optionally controlled by the DTR lead. When that option (N) is selected, the OS lead has no effect and the set is out of service when DTR is off.
23	Data Set Ready	DSR	An ON condition on this lead indicates the data set is *either* in the data mode and ready to receive data, transmit answer-back signals, or both, depending on the condition of the DR lead (Pin 21), or is in the talk mode (DM lead Pin 19 is OFF).
24	Signal Ground	SG	This conductor establishes the common ground for signals referenced to it and is optionally connected to frame ground via a strap located on the power unit.
25	Out of Service	OS	An ON condition on this lead makes the data set appear busy to incoming calls. When an ACD is employed, this lead is placed in the OFF condition at all times. In DS 407B, the out-of-service function can be optionally controlled by the DTR lead. When that option (N) is selected, the OS lead has no effect and the set is out of service when DTR is off.

mountings, which provides the data set number location and computer port assignment for each data set in the data mounting. Another decal is attached to the inside cover of the 41A1 data mounting, which provides local test information. This decal, plus a third decal, is attached to the inside cover of the 41A2 data mounting to provide additional local test information.

5.02 ***Lettered Steps:*** A letter a, b, c, etc, added to a step number of this section indicates an action which may or may not be

required, depending on local conditions. The condition under which a lettered step or a series of lettered steps should be made is given in the PROCEDURE column, and all steps governed by the same condition are designated by the same letter within the procedure. Where a condition does not apply, all steps designated by that letter should be omitted.

5.03 The installation and connection procedure for the 407-type multiple data station is as follows:

STEP	PROCEDURE
	***Do not apply power to the cabinet or any of the related components of the data station until the complete station has been installed.***
1	Position the KS-20018-L11A or -L12A cabinet, or equivalent, near the customer-provided 60-Hz power outlet and the business machine interface cords as described in 1.06. ***Note:*** For ease of installation of the 41-type data mounting(s), the KS-20018-L11A and -L12A cabinets may be placed ***face up*** during installation.
2	Gain access to front of cabinet. ***Note:*** A bag of number 12 mounting screws and star washers are supplied with each 41-type data mounting. Frame ground is connected to the cabinet from the 41-type data mounting by the use of the star washers. Either 41A1 or 41A2 and 41B1 or 41B2 data mountings may be used with DS 407A; 41A2 and 41B2 data mountings must be used with DS 407B.
3	Verify that terminals E16 and E17 on 101A power unit are connected together (option HH) per Fig. 3. If the service order or circuit layout record card requires that signal ground ***not*** be connected to frame ground (optional JJ), remove the strap between E16 and E17 on 101A power unit per Fig. 3. Strap terminal 31 of 41-type data mounting(s) as shown in Fig. 4.
4	Remove the 101A power unit from the 41-type data mounting(s). (Power unit may be shipped loose.)
5	Remove front cover of each 41-type data mounting to be installed as required. ***Note:*** Removal of the power unit and front cover from the data mounting ensures easy installation of the data mounting within the cabinet.
6a	When installing a DS 407A data station in a KS-20018-L11A cabinet, install the mounting brackets (furnished with the 41-type data mounting) in the cabinet. The top of the bracket has the hole closest to the end. Mount the 41A1 or 41A2 data mounting in the top or center position as required.
6b	When installing a DS 407B data station in a KS-20018-L11A cabinet, do not use the mounting brackets. Mount the 41A2 data mounting in either the third, sixth, and ninth holes from the top or the third, sixth, and ninth holes from the bottom of the cabinet.
7a	Mount the 41B1 or 41B2 data mountings above and below the 41A1 or 41A2 data mounting as required for a DS 407A data station.

STEP	PROCEDURE

7b Mount the 41B2 data mounting above or below the 41A2 data mounting as required for a DS 407B data station.

8a Connect the five wires from the 41B1 or 41B2 data mounting(s) to the 46A1 data unit (after removing 47A1 data unit) per Table C by removing two screws under the 46A1 data unit and sliding it forward. (The top of the 46A1 data unit hinges upward to provide access to the terminals.)

Note: In private line systems (option B), remove BL-W wire from screw terminal 35 on the 46A1 data unit and reconnect to screw terminal 25.

9b If a KS-20018-L12A cabinet is required—
Mount the 41A1 or 41A2 data mounting in the cabinet. (Only the 41A2 may be used in installing a DS 407B data station.)

10 Reinstall the 101A power unit(s) removed in Step 4 in their original location in the 41-type data mounting(s).

11a If a KS-20018-L11A cabinet is used—
Connect the KS-14532-L16 power cable (furnished with 41A-type data mounting) to the ac inlet located on the side of the 101A power unit mounted in the ***bottom*** 41B1 or 41B2 data mounting.

12a Interconnect all other 101A power units together using P3BJ power cables (furnished with the 41B-type data mountings).

13b If a KS-20018-L12A cabinet is used—
Connect the KS-14532-L16 power cable (furnished with 41A-type data mounting) to the ac inlet located on the side of the 101A power unit.

14 Verify that all pertinent data set options are properly installed per Table A and Fig. 1 and 2.

15 Insert each data set into the 41-type data mounting(s).

Note: Ensure that a good connection is made between the data set and the data mounting by using sufficient force when pushing the data set into position.

STEP	PROCEDURE
16	Insert the two telephone connector plugs (A25D connector cable equipped with KS-16689-L3 plug) into J3 and J4 located on the rear of each 41-type data mounting.
17	Route the A25D connector cables, as required, through the cabinet to the connecting block or intermediate distribution frame (IDF) and terminate per Table D.
18	Connect service line to connecting block or IDF.
19	Connect service line to pins 25 and 50 of the A25D connector cable going to J4 of the 41A1 or 41A2 data mounting as shown in Fig. 5. ***Note:*** For private line systems (option B), connect tip and ring pairs ***only*** per Table D. The remainder of the arrangement is connected per customer requirement.
20e	If a 2B ACD is specified on the service order or circuit layout record card— Proceed to Section 594-800-501.
21	Connect the central office telephone lines to the tip and ring pairs of the data sets at the connecting block or IDF per Table D.
22	Wire the out-of-service option (EE, FF, or GG) per service order or circuit layout record card in ***one of the three ways*** (shown in Fig. 6) for each data set in the 41-type data mounting. ***Note:*** The out-of-service option is only used in non-ACD switched network systems (data set options C and A, respectively).
23	Wire option AA, BB, CC, or DD as specified on the service order or circuit layout record card, in accordance with Fig. 7, 8, 9, or 10, as applicable.
24f	If a 565HK telephone set, or equivalent, or a Call Director is specified on the service order or circuit layout record card— Make connections per Table E from connecting block or IDF to Call Director or key telephone set. Refer to Fig. 11 for a functional wiring arrangement from data set number 1 to the Call Director or key telephone set. ***Note:*** Table E shows the connecting arrangement for the first four data sets to the Call Director or 565HK telephone set via the connecting block or IDF. Refer to the KEY SYSTEMS SERVICE MANUAL, volume one, or pertinent BSPs, for complete Call Director or 565HK telephone set, or equivalent, pin assignment.
25	Connect the power cord to a 117-volt 60-Hz ac outlet. ***Requirement:*** ON lamp of every data set should light, indicating proper power wiring.
26	Install front covers on 41-type data mounting(s) and perform the verification test per Section 594-800-500.

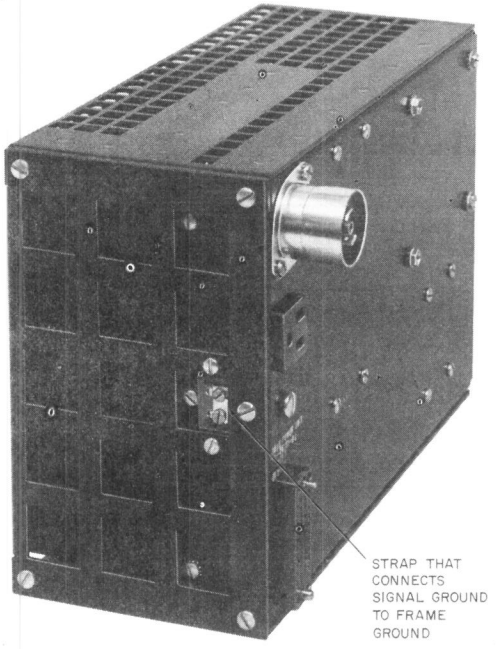


Fig. 3—Rear View of 101A Power Unit

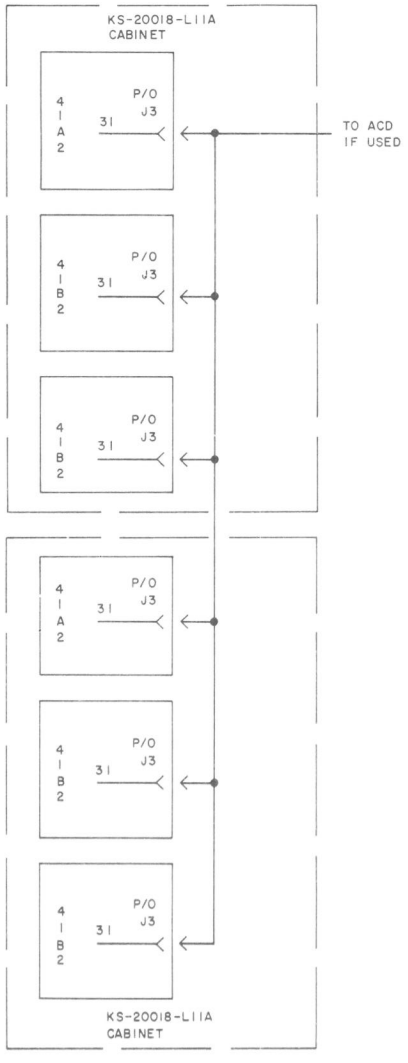


Fig. 4—Station Wiring When Frame Ground and Signal Ground Are Disconnected (Multiple Cabinets) (Option JJ)

TABLE C

41B1 OR 41B2 DATA MOUNTING
CONNECTIONS TO 46A1 DATA UNIT

41B1 DATA MOUNTING			46A1 DATA UNIT
DESIG	PIN NO.	COLOR CODE	SCREW TERMINAL
SLT	16	S	7, 8, or 9
SLR	19	G	10, 11, or 12
LTS	15	G-R	4, 5, or 6
LT	23	BR	1, 2, or 3
RTR	20	W	19, 20, or 21

Note: The 46A1 data unit may have to be removed from the 41A1 or 41A2 data mounting when the above connections are made from the 41B1 or 41B2 data mounting(s).

TABLE D

TELEPHONE INTERFACE FOR DATA SETS 407-TYPE MOUNTED IN THE 41-TYPE DATA MOUNTING

J3 CABLE PAIR ASSIGNMENT FOR DATA SETS (NOTE 1)				J4 CABLE PAIR ASSIGNMENT FOR DATA SETS (NOTE 2)				DESIGNATION	LEAD FUNCTION
1	2	3	4	5	6	7	8		
1 26	7 32	13 38	19 44	1 26	7 32	13 38	19 44	T R	Tip and ring pair
2 27	8 33	14 39	20 45	2 27	8 33	14 39	20 45	TT TR	Tip and ring pair to telephone set network
3	9	15	21	3	9	15	21	LAMP	Telephone set lamp control from data set
28	34	40	46	28	34	40	46	OSG	Ground for "third wire ground" out-of-service connection
4	10	16	22	4	10	16	22	A	"A" lead control from telephone set for Talk/Data control
29	35	41	47	29	35	41	47	DTRA	Data-terminal-ready control to ACD
5	11	17	23	5	11	17	23	ARA/OS1	Attendant request control to ACD/one lead of out-of-service pair (Note 3)
30	36	42	48	30	36	42	48	+12A/OS2	+12 volts to ACD/other lead of out-of-service pair (Note 3)
6 31	12 37	18 43	24 49	6 31	12 37	18 43	24 49	ST1 ST2	"Start" pair from ACD

Notes:

1. Data set 1 is mounted in the far left slot of the 41-type data mounting.
2. The service line pair, pins 25 and 50 (ring and tip, respectively), also appear on J4 of the 41A1 or 41A2 data mounting..
3. Lead function is determined by installer option. The out-of-service leads are ***not*** required for operation with an ACD. In this case the out-of-service function is accomplished by turning DTRA OFF.

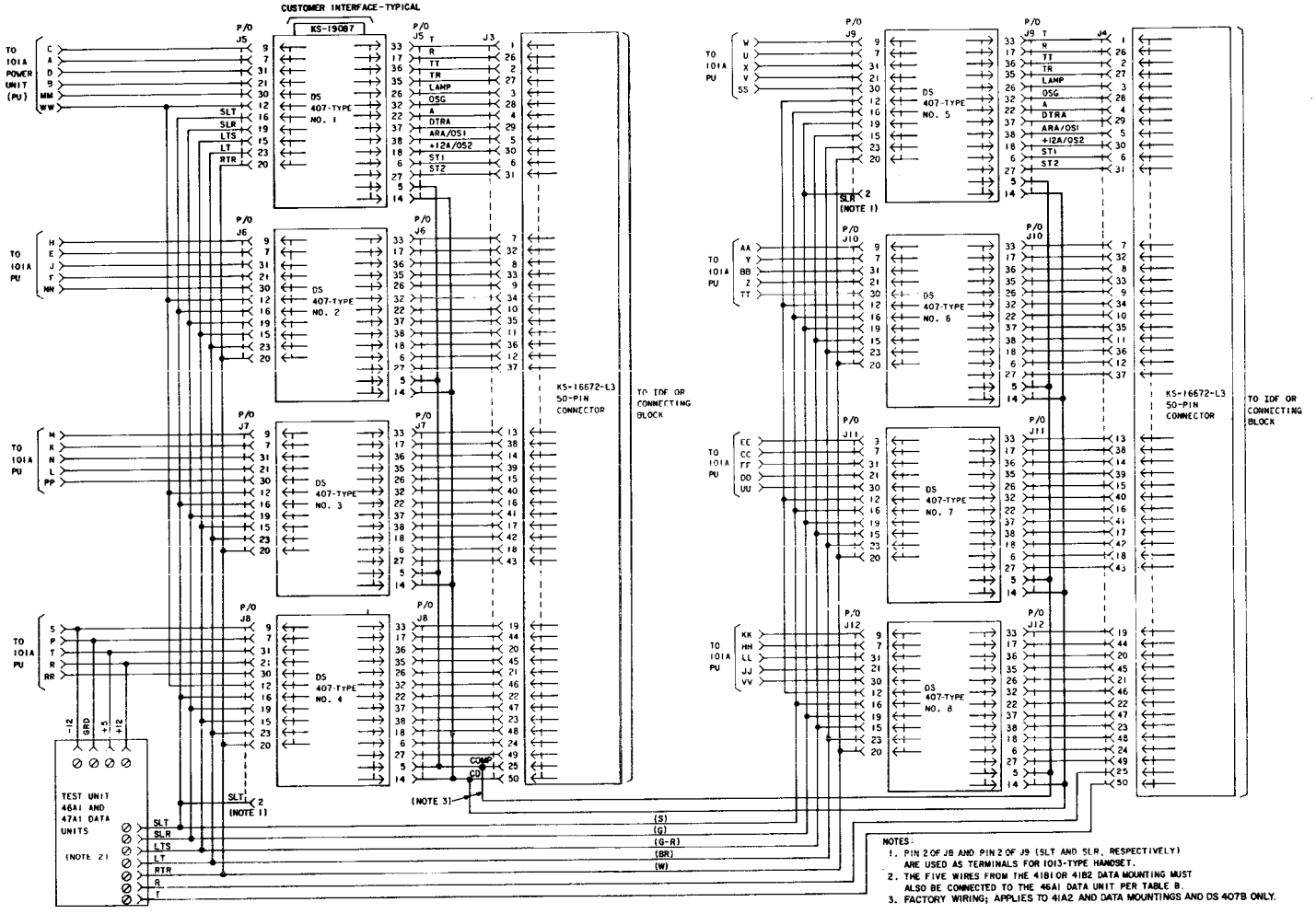


Fig. 5—41A1 or 41A2 Data Mounting and Data Set 407-Type—Interconnection Diagram

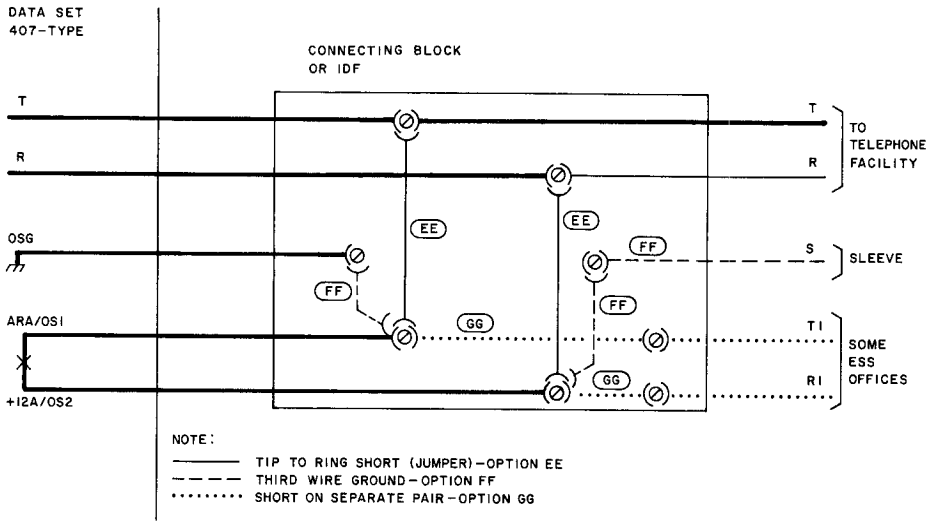


Fig. 6—Out-of-Service Wiring Connections for One Data Set 407A or 407B

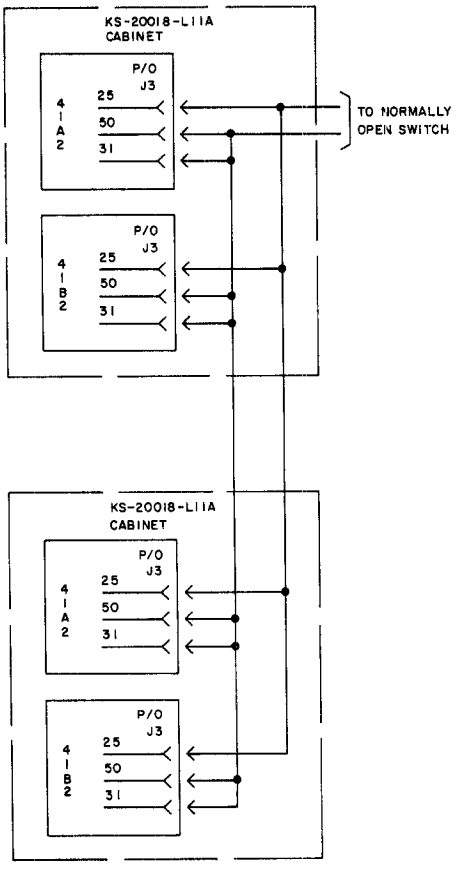


Fig. 7—Computer Down Detection by Switch Only (Option AA)

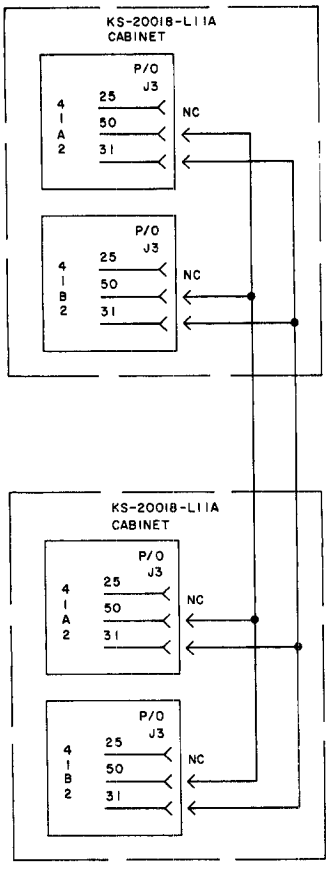


Fig. 8—Computer Down Detection by All DTR OFF Only (Option BB)

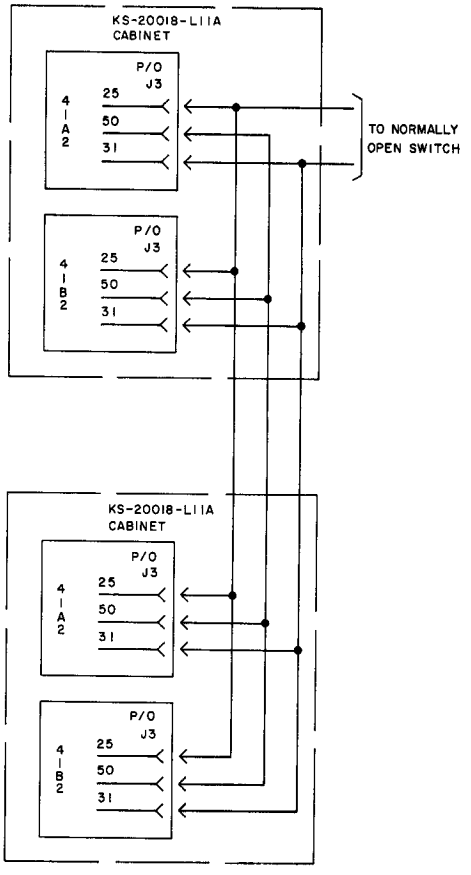


Fig. 9—Computer Down Detection by Switch or All DTR OFF (Option CC)

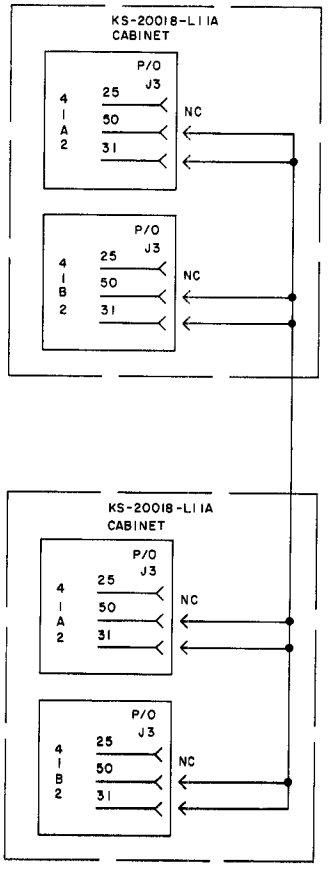


Fig. 10—Computer Down Detection Not Used (Option DD)

TABLE E

CONNECTION ARRANGEMENT FOR DATA SET 407-TYPE TO A 565HK TELEPHONE SET OR CALL DIRECTOR

565HK KEY TEL SET CALL DIRECTOR		CONNECTING BLOCK OR IDF		KS-16672-L3 50-PIN CONNECTOR
DESIG	PIN NO.	DESIG	PIN NO.	J3
R1	1	TR	27	
T1	26	TT	2	DATA
A1	2 (to GRD)	—	—	SET
AH	27	A	4	1
L1	3 (to 10V RMS — Note 1)	—	—	(Note 2)
LG1	28	LAMP	3	
R2	4	TR	33	
T2	29	TT	8	
A	Common to DATA SET 1	—	—	DATA
A-H-S2	30	A	10	SET
L2	6 (to 10V RMS — Note 1)	—	—	2
LG2	31	LAMP	9	(Note 2)
R3	7	TR	39	
T3	32	TT	14	DATA
A	Common to DATA SET 1	—	—	SET
A-H-S3	33	A	16	3
L3	9 (to 10V RMS — Note 1)	—	—	(Note 2)
LG3	34	LAMP	15	
R4	10	TR	45	
T4	35	TT	20	DATA
A	Common to DATA SET 1	—	—	SET
A-H-S4	36	A	22	4
L4	12 (to 10V RMS — Note 1)	—	—	(Note 2)
LG4	37	LAMP	21	

Notes:

1. The 10V RMS must be locally supplied. If more than one lamp is required per data set, a 412A, or equivalent, KTU should be used.
2. Data set 1 is mounted in the far left slot of the 41-type data mounting. The J4 connector provides the same pin assignment as the J3 connector for data sets 5 through 8.

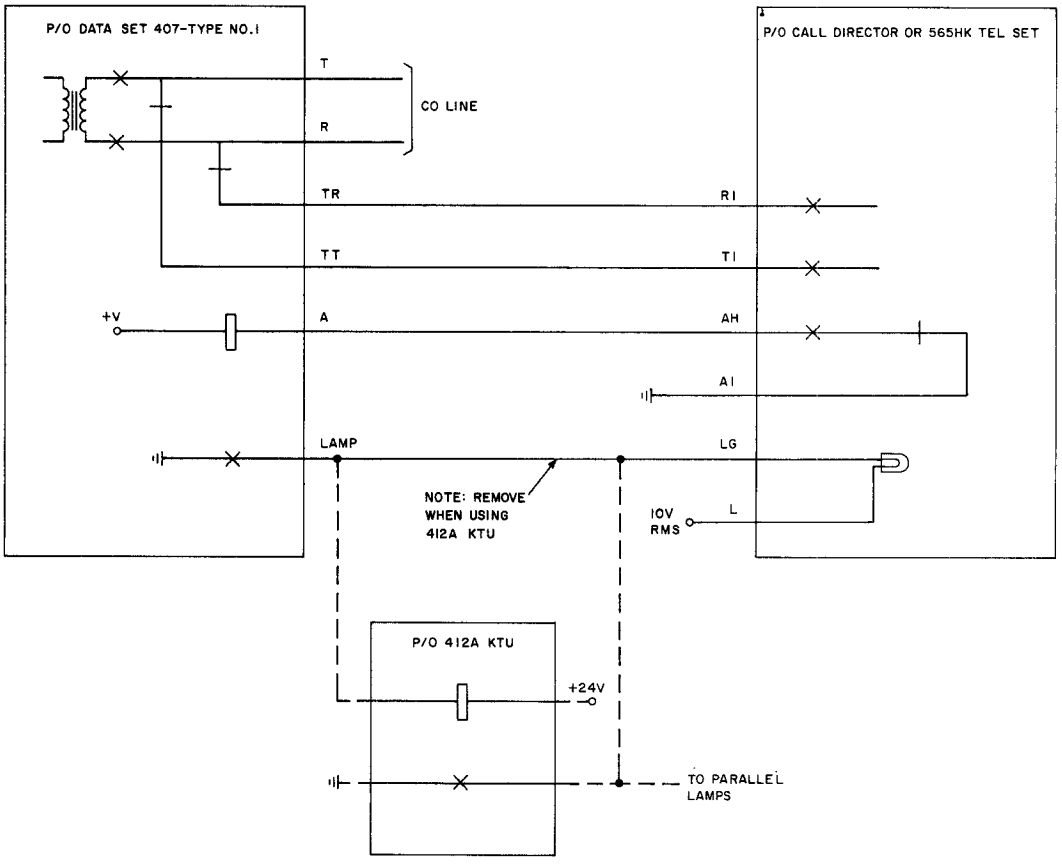


Fig. 11—Functional Wiring Arrangement From Data Set 407-Type to Call Director or 565HK Telephone Set

NO NEED TO CALL THE DATA TEST CENTER!!!

Data set 407A/B can be tested with the Automatic Data Test System (ADTS) using the DIVA feature and TOUCH-TONE® signalling (from a rotary dial phone, use a KS-21799-L1 tone coupler).

DDD	TEST FUNCTION LB RT ER DL
X	X

Use local instructions for DIVA access.

Test commands are entered into ADTS by letters and numbers on the TOUCH-TONE dial. To enter letters depress the number sign (#), then depress the TOUCH-TONE key that has the desired alpha character on it. Then depress the digit (1, 2, or 3) corresponding to the position of the alpha character on the TOUCH-TONE key.

Examples: 202C10 202#2310*
401J 401#51*
208B 208#22*

FUNCTION	CHARACTERS
NO	0*
YES	1*
RESULTS	7*
LIST ALL TEST FUNCTIONS	8*
REPEAT LAST MESSAGE	#*
DIGITAL LOOPBACK (DL)	35*
ERROR RUN (ER)	37*
LOOPBACK TEST (LB)	52*
STOP AND DISCONNECT	#63*
STOP PRESENT FUNCTION	#73*
REMOTE TEST (RT)	78*

For fast test of above, depress 3 before function, eg,352*. Be sure to use #63* to disconnect in every case.

For more details, see Sections 590-010-500 and 668-600-102.

407-TYPE MULTIPLE DATA STATION
TEST PROCEDURES

CONTENTS PAGE

1. GENERAL 1
2. LOCAL TEST 1
3. REMOTE TEST 3
4. POWER UNIT TEST 5
5. VERIFICATION TEST 6

1. GENERAL

1.01 This section describes the test procedures and associated test requirements to be met at the time of installation or when investigating trouble conditions associated with the 407-type multiple data station.

1.02 This section is reissued to include coverage of data set (DS) 407B.

1.03 Before proceeding with any test, verify that the data loops have been tested and meet requirements specified in the section entitled Data Systems—Dataphone® Service on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines (314-205-501) or Voiceband Private Line Data Circuits—Tests and Requirements (314-410-500).

1.04 When test or demonstration calls are made, refer to the section entitled Crediting Charges on Test Calls (010-250-001) for the proper procedure for crediting charges.

1.05 The 407-type multiple data station contains a test unit, consisting of the 46A1 and 47A1 data units, which is provided with the 41A1 or 41A2 data mounting. The test unit provides both local and remote testing capabilities for any data set 407-type mounted in the cabinet. The test unit also provides a lamp testing feature for all the light emitting diodes (LEDs) in the station.

1.06 When a data set is placed in the remote test mode, the data set is connected to a service line and then tested by the data test center. The local test may be conducted by the customer or telephone company (telco) employee using the test unit. A typical test arrangement is shown in Fig. 1.

1.07 The test procedures given in this section are for one data set and must be repeated for each additional data set.

1.08 A KS-20538-L1 volt-ohm-milliammeter (VOM), or equivalent, is needed to perform the power unit test. A 1013-type handset, or equivalent, is required for the verification test.

2. LOCAL TEST

2.01 This test checks the operation of a data set 407-type under normal input conditions via the 47A1 data unit (modified 16-button Touch-Tone® dial). The local test does ***not*** check the line control circuit. When a character is transmitted from the dial and received by the data set, the LEDs representing the horizontal and vertical coordinates of the character key will flash at a steady rate if the data set is functioning properly. Perform the local test as follows:

STEP	PROCEDURE
1	Operate LOCAL-REMOTE TEST switch to REMOTE.
2	Depress LAMP TEST switch.

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STEP	PROCEDURE
	Requirement: All LEDs light on all data sets in the cabinet and on the 46A1 and 47A1 data units.
3	Remove customer interface cable from data set to be tested.
4	Plug the test connector into data set by operating the catch located on the extension. (The extension provides a means of depressing the TEST button located on the front of the data set.)
	Requirement: ON and OS LEDs light (disregard TR LED).
5	Operate LOCAL-REMOTE switch on test unit (46A1 data unit) to LOCAL position.
	Requirement: After a delay, the MR and LOCAL TEST LEDs light.
6	Depress and hold pushbutton 1 on the 47A1 data unit.
	Requirement: Associated row and column LEDs (on the 47A1 data unit) and DP LED (on the data set) flash at a steady rate (10 pulses per second). Refer to Fig. 1 for an example of which LEDs are flashing on the 47A1 data unit when pushbutton 1 is depressed.
7	Repeat Step 6 for all other pushbuttons.
	Note 1: When testing DS 407B with option K installed, the AR lamp will light when the * (star) key is depressed on the 47A1 data unit. If option K is not installed, test of DS 407B is identical to the test of DS 407A.
	Note 2: If some LEDs do not flash properly, replace the associated data set. Verify that the replacement data set has proper options installed per Section 594-800-200.
8	Remove test connector from data set by operating the catch on the extension.
9	Plug customer interface connector into data set and tighten screws.
10	Repeat test as required for each data set.
11	Return station to pretest condition.

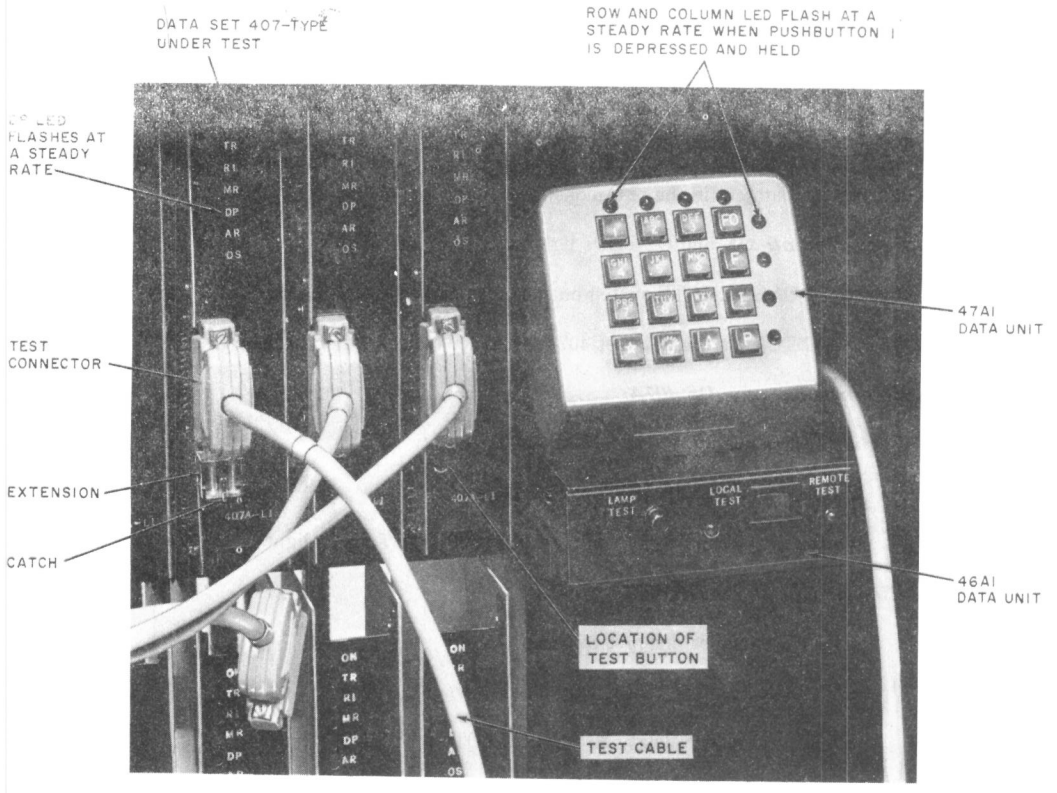


Fig. 1—Data Set 407-Type Test Arrangement—Typical

3. REMOTE TEST

3.01 This test provides a thorough check of the data set. The line control circuitry is checked along with parameters such as sensitivity and bandwidths. In the remote test mode, the data set under test is connected to a service line associated with the installation and called by the data test center (DTC). Since the 407-type multiple data station is normally on a hunting group, the service line provides a means of accessing a particular data set.

Note: "Computer down" is optionally detected by means of a switch or by detecting all DTRs off in a station. If the switch is used, it should be in the "computer up" position. When the switch is in the "computer down" position, all TR lights in the station will be ON. If the "all DTRs off" method is used, all TR lights in the station will be ON.

Perform the remote test as follows:

STEP	PROCEDURE
1	Call the DTC and arrange for a remote test in accordance with DTC procedures.
2	Remove customer interface cable from the data set to be tested.

STEP	PROCEDURE
3	Plug the test connector into the data set by operating the catch located on the extension (placing the data set in the test mode). ***Requirement:*** ON and OS LEDs light (disregard TR LED).
4	Operate LOCAL-REMOTE switch on the test unit to REMOTE position.
5	When the DTC calls the data set 407-type under test, observe the following: ***Requirements for DS 407A:*** • RI LED flashes one or two times. • TR LED lights (TR LED may already be on). • After a 3-second delay, MR and REMOTE TEST LEDs light. ***Requirements for DS 407B:*** • RI LED flashes one or two times. • TR LED lights (TR LED may already be on). • After a 3-second delay, MR and REMOTE TEST LEDs light. • After a 12- to 15-second delay, the DTC will transmit * * and the AR LED will light or flash. • If the "all DTRs off" method of detection of computer down is used, all of the TR lights in the cabinet will go OFF.
6	When the DTC transmits a valid Touch-Tone character, observe the following: ***Requirements:*** • The DP LED flashes at a steady rate (10 pulses per second). • On the 47A1 data unit, the row and column LEDs associated with the character being transmitted by the DTC will also flash at a steady rate (10 pulses per second). • When * is transmitted, the AR LED may light or flash.
7	When all the remote test is completed, the DTC transmits a ***hang-up*** character sequence (* # *) which terminates the call. ***Requirement:*** ON and OS LEDs (on data set) are lighted and REMOTE TEST LED extinguishes (on 46A1 data unit).

STEP	PROCEDURE
	Note: If data set fails the above test, replace the data set. Verify that replacement data set has proper options installed per Section 594-800-200.
8	Remove test cable from data set by operating the catch on the extension.
9	Plug customer interface connector into data set.
10	Repeat Steps 2 through 9, as required, for each data set.
11	Return station to pretest condition.

4. POWER UNIT TEST

4.01 The following procedure is used to measure the voltages of the 101A power unit. Since each data set operates from a separate regulator in the power unit, one data set could be out of service due to trouble within a particular regulator. In this case, the power unit may have to be replaced. A data set may also have power unit trouble even if the ON lamp on the data set under test is lighted. A KS-20538-L1 VOM is required for this test.

STEP	PROCEDURE
1	Gain access to the rear of the 41-type data mounting(s).
2	Set VOM FUNCTION switch to 30 Vdc.
3	Connect VOM leads as follows: • Negative lead to terminal 9 of J terminal interface (J5-J12) as required for data set under test. • Positive lead to terminal 7 of J terminal interface (J5-J12) as required for data set under test. ***Requirement:*** VOM reads 10 to 14 volts.
4	Disconnect both VOM leads and reconnect as follows: • Negative lead to terminal 7 of J terminal interface (J5-J12) as required for data set under test. • Positive lead to terminal 21 of J terminal interface (J5-J12) as required for data set under test. ***Requirement:*** VOM reads 10 to 14 volts.
5	Disconnect both VOM leads.

STEP	PROCEDURE
6	Set VOM FUNCTION switch to 10 Vdc.
7	Connect VOM leads as follows: • Negative lead to terminal 7 of J terminal interface (J5-J12) as required for data set under test. • Positive lead to terminal 31 of J terminal interface (J5-J12) as required for data set under test. ***Requirement:*** VOM reads 4.8 to 5.2 volts.
8	Remove test leads and return station to pretest condition.

5. VERIFICATION TEST

5.01 This test is performed during the installation procedure prior to connecting the customer interface cables to the data sets mounted in the 41-type data mounting. The test verifies that the data set is functioning properly prior to connecting the customer-provided computer to the data set. A 1013-type handset is required for this test. The verification test is as follows:

STEP	PROCEDURE
1	Operate LOCAL-REMOTE TEST switch to REMOTE.
2	Depress LAMP TEST switch. ***Requirement:*** All LEDs light.
3	Plug the test connector into data set by operating the catch located on the extension. (The extension provides a means of depressing the TEST button located on the front of the data set.)
4	Operate LOCAL-REMOTE switch on test unit (46A1 data unit) to LOCAL position. ***Requirement:*** After a delay, the MR and LOCAL test LEDs light.
5	Depress and hold pushbutton 1 on the 47A1 data unit. ***Requirement:*** Associated row and column LEDs and DP LED flash at a steady rate (10 pulses per second).
6	Repeat Step 5 for all other pushbuttons on the 47A1 data unit. ◗***Note 1:*** With DS 407B with option K, the AR LED will light or flash when * (A_4 B_1) is depressed.◖

STEP	PROCEDURE
	Note 2: If some LEDs do not flash properly, replace the associated data set. Verify that replacement data set has proper options installed.
7	Connect a 1013-type handset across the service line tip and ring (pins 2 of J8 and 2 of J9, respectively.
8	Operate the TALK-MON switch on the handset to TALK.
9	Operate LOCAL-REMOTE switch to REMOTE position.
10	Call the ring-back number using the 1013-type handset.
11	Operate TALK-MON switch on the handset to MON.
	Requirement: After ringing is tripped, monitor the following: • 2025-Hz answer tone is heard in handset • REMOTE TEST LED lighted • MR LED lighted.
12	Remove test connector from data set by operating the catch on the extension.
13	Plug customer interface connector into data set.
14	Repeat test as required for each data set mounted in the 41-type data mounting(s).
15	Remove 1013-type handset leads from service line.
16	Perform remote test per Part 3 of this section on any one data set.
	Note: This verifies the ability to perform a remote test.
17	End of verification test.

407C MULTIPLE DATA STATION
DESCRIPTION

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1. GENERAL

1.01 This section provides information on the 407C multiple data station. The 407C multiple data station performs functions similar to 407A and 407B multiple data stations, but provides a much larger selection of options. Data set (DS) 407C is designed primarily for TOUCH-TONE® inquiry/FSK (frequency shift keyed) response systems requiring a serial interface at the computer. It can provide a serial interface according to Electronic Industries Association (EIA) Standard RS-232-C. It may be optioned to perform as a DS 407A or B, with either EIA voltage or contact closure equivalent customer interface.

1.02 This section is reissued to show DS 407C-L1, series 1 rated manufacture discontinued (MD), and to show DS 407C-L1, series 2 as the replacing data set. Four new end-of-message options have been added in DS 407C-L1, series 2, which are customer options.

1.03 Unlike DS 407A or 407B, DS 407C-type is a functionally inseparable dual, or twin, data set which serves two incoming lines and two data ports simultaneously. DS 407C-type contains two circuit packs (CP1 and CP2), each made up of three printed wiring boards, as follows:

CP1

- Central Processor Unit
- RM1 Line Board
- Option Board

CP2

- TOUCH-TONE Detector Board
- RM1 Line Board

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- Option Board

The two circuit packs are fastened together and electrically interconnected by two plug-in ribbon cables. The input and output signals from each of the two RM1 line boards and the TOUCH-TONE detector board are multiplexed to the central processor unit. The detector and central processor are common to both input and output lines.

1.04 A 407C multiple data station, shown in Fig. 1, consists of the following units:

- DS 407C-L1 (one for every two data lines served).
- 57A-type data mounting (houses up to four DSs 407C) equipped with:

  229A power unit.

  KS-14532-L24 power cord. This 6-foot power cord is used for connection to the 81A detector.

  51A-type data unit (supplied ***only*** with 57A-type data mounting).

  47A-type data unit (supplied ***only*** with 57A-type data mounting).

- 57B-type data mounting (houses an additional four data sets). Equipped the same as 57A-type data mounting except it does not contain 51A-type and 47A-type data units.
- A KS-20018-L20 cabinet.

  Note: The KS-20018-L20 cabinet will accommodate two 57-type data mountings with a maximum of eight DS 407Cs.

- 81A (thermal) detector.
- KS-14532-L25 power cord. This 3-meter (10-foot) power cord is used to connect 117 Vac to the 407C multiple data station.

1.05 The 407C multiple data station is used primarily for TOUCH-TONE inquiry/FSK data response systems. These systems may be used in such applications as credit checking or retrieving information from a customer-provided computer. Using a TOUCH-TONE telephone dial or transaction telephone as the input device, a clerk may call a credit bureau computer and receive credit approval via a telephone. DS 407C-type may transmit the response via FSK signals, keyed answer-tone signals, or audio signals generated by the customer's equipment. For operation with TOUCH-TONE telephone sets, these audio signals may consist of machine-generated or prerecorded phrases. These phrases are under control of a customer-provided computer equipped with an audio response unit.

1.06 DS 407C-type contains a low-speed, parallel receiver that detects 2-out-of-8 multifrequency signals generated by a TOUCH-TONE-type telephone. The data set receives data from either the 2-wire switched telecommunications network or an unconditioned private line facility. In parallel mode only, the data set provides a two-way voice channel. In the serial mode, ▶only a transmit◀ channel is provided. The data set has the capability of generating 2025- and 2225-Hz tones ▶under certain conditions◀. Status light-emitting diodes (LEDs), as shown in Fig. 2, are provided on the front panel of DS 407C to indicate the state of various functions and customer interface signals. DS 407C provides a serial data interface in accordance with EIA Standard RS-232-C, or a parallel data interface using either a 2-out-of-8 code or a binary coded matrix (BCM) code. The signals used for these outputs conform to EIA voltage specifications of RS-232-C. In addition, for the 2-out-of-8 output, a contact ***equivalent*** output is available.



The contact equivalent interface is not compatible with all customer equipment. Refer to Section 594-800-152 for details.

1.07 The 57A-type data mounting will accommodate up to four DS 407Cs. The 57A-type data mounting contains a 229A power unit, one 51A-type data unit, and one 47A-type data unit. The 57B-type data mounting is identical to the 57A-type data mounting except that it does not contain the 51A-type and 47A-type data units (test unit). The 57A-type data mounting is used to accommodate the first four DS 407Cs and the 51A-type and 47A-type data units. When additional DS 407Cs are used, one 57B-type data mounting is used for four additional data sets. When more than eight data sets are required at a particular installation, another KS-20018-L20 cabinet is required for each eight additional data sets.

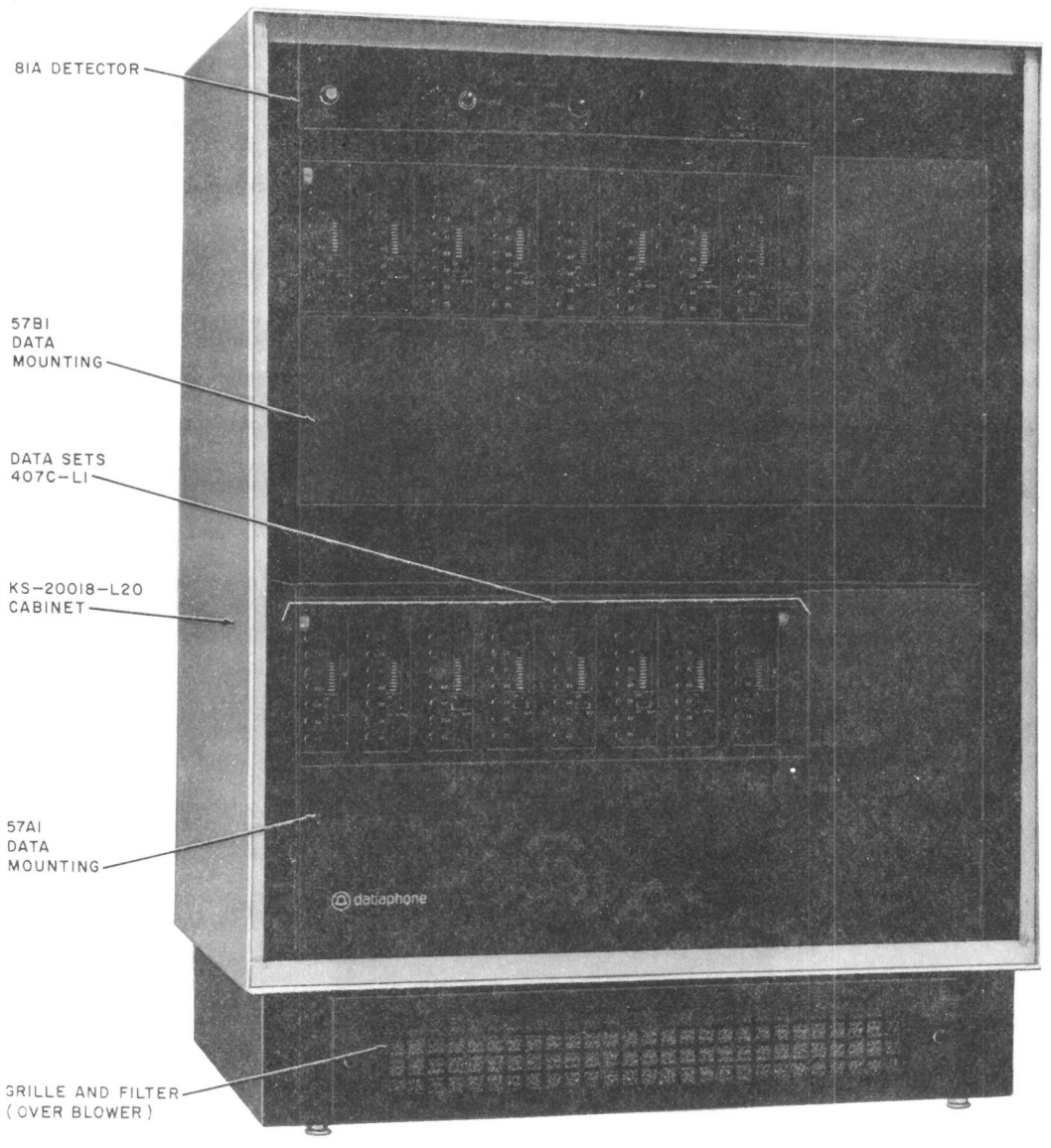


Fig. 1—Front View of 407C Multiple Data Station With Plastic Front Cover Removed

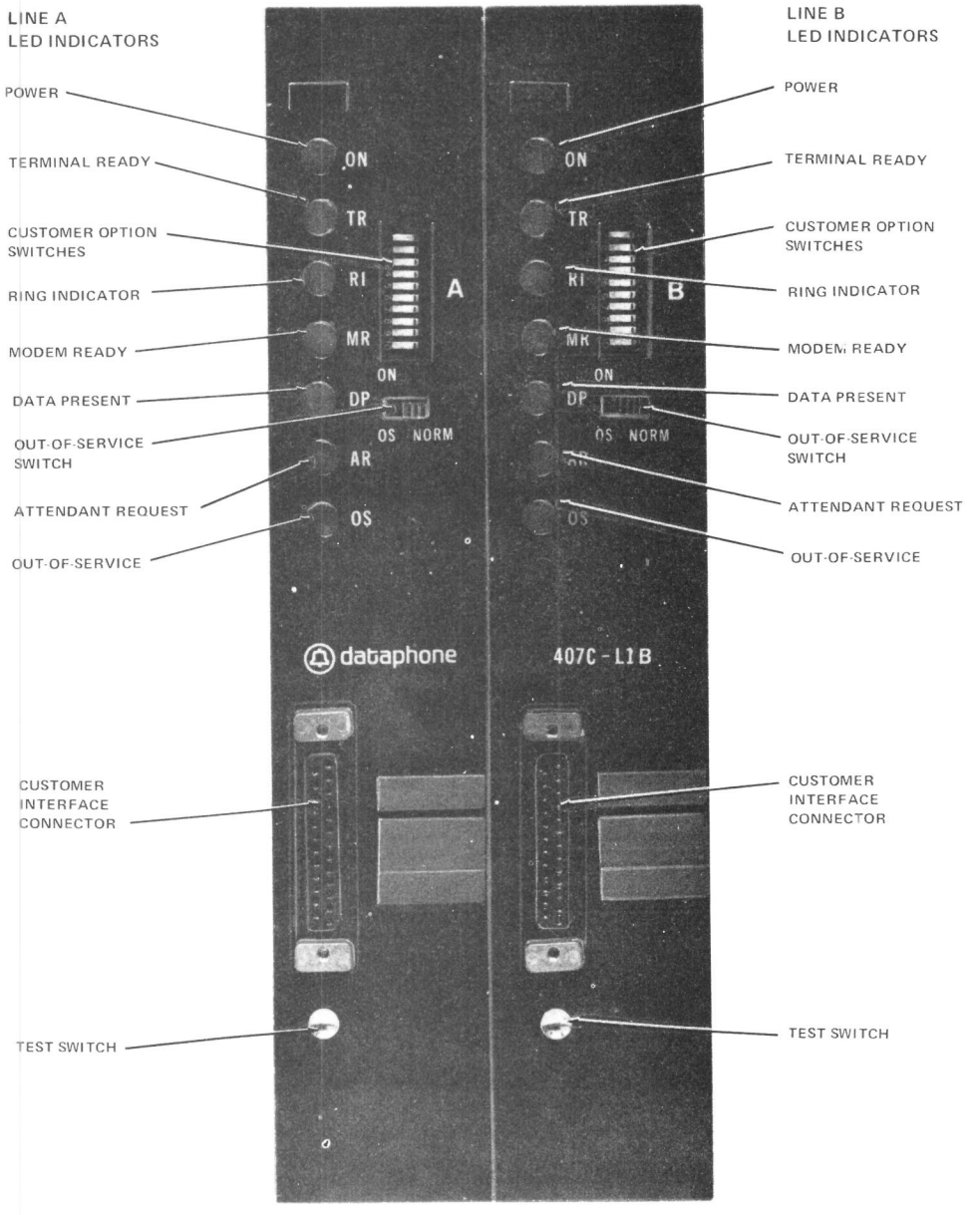


Fig. 2—Data Set 407C-L1—Front View

1.08 The 51A-type data unit, together with the 47A-type data unit, (Fig. 1) provided with the 57A-type data mounting, enable local or remote testing of any DS 407C in the cabinet.

The 407C multiple data station is housed in a KS-20018-L20 cabinet. Because of thermal limitations, any other housing is not recommended.

1.09 The 407C multiple data station is compatible with key-type telephone sets or a CALL DIRECTOR®. These units provide REFERRAL, TALK and return to DATA functions as well as normal telephone set functions if required. The 407C multiple data station is also compatible with automatic call distributors (ACDs) and automatic calling units (ACUs).

2. PHYSICAL DESCRIPTION

2.01 The 407C multiple data station will operate in an ambient temperature range from 4 to 49° Celsius (40 to 120°F), with a relative humidity of less than 95 percent.

Data Set 407C-L1

2.02 DS 407C (Fig. 3) consists of two circuit packs (CP1 and CP2) mounted together. Two KS-19087-type 25-pin connectors are located on the front of the data set, which provide the interface with customer-provided terminal equipment. Printed wiring board terminals are located on the rear of the data set which enable the data set to plug into the 57-type data monting. The data set is 25 cm high, 33 cm deep, and 9 cm wide (10 in. high, 13.2 in. deep, 3.7 in. wide), and weighs about 2.5 kg (5.5 lb). The data sets require power sources of +12 volts, -12 volts, +5 and -5 volts, which are provided by the 229A power unit. DS 407C is not interchangeable with any other data set.

57-Type Data Mountings

2.03 The 57A-type data mounting (Fig. 4) contains a test unit (which is comprised of a 51A-type data unit and a 47A-type data unit) and is approximately 51 cm wide, 27 cm high, and 42 cm deep (21 in. wide, 10.6 in. high, and 16.6 in. deep). It mounts in a KS-20018-L20 cabinet and weighs about 17 kg (37 lb) without the 229A power unit. The 57B-type data mounting (Fig. 5) has the same physical dimensions as the 57A-type data mounting

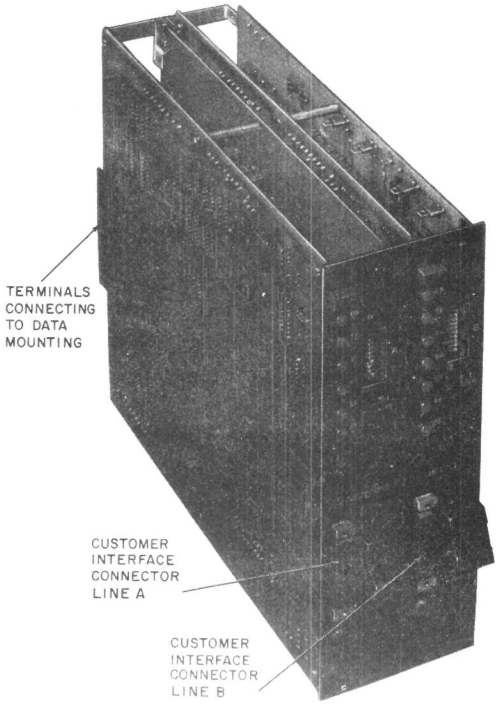


Fig. 3—Data Set 407C-L1—Overall View

and weighs about 15 kg (33 lb) without the 229A power unit. The 57A-type and 57B-type data mountings are supplied with a KS-14532-L24 2 meter (6-ft)-long power cord. The power cord has a Hubbel Twist-lock receptacle on one end and a three-prong male plug on the other end. The 57B-type does ***not*** contain a test unit. Data sets in the 57B-type are tested by the test unit in the 57A-type data mounting. Both data mountings are equipped with a 229A power unit; however the power units are shipped separately to prevent intransit damage to the data mountings. The power unit weighs about 14 kg (30 lb). Each data mounting when equipped with four data sets requires approximately 250 watts of 117-Vac 60-Hz power.

2.04 The 57-type data mountings are provided with eight 908J1 connectors, to mate with the two printed wiring board connectors on each

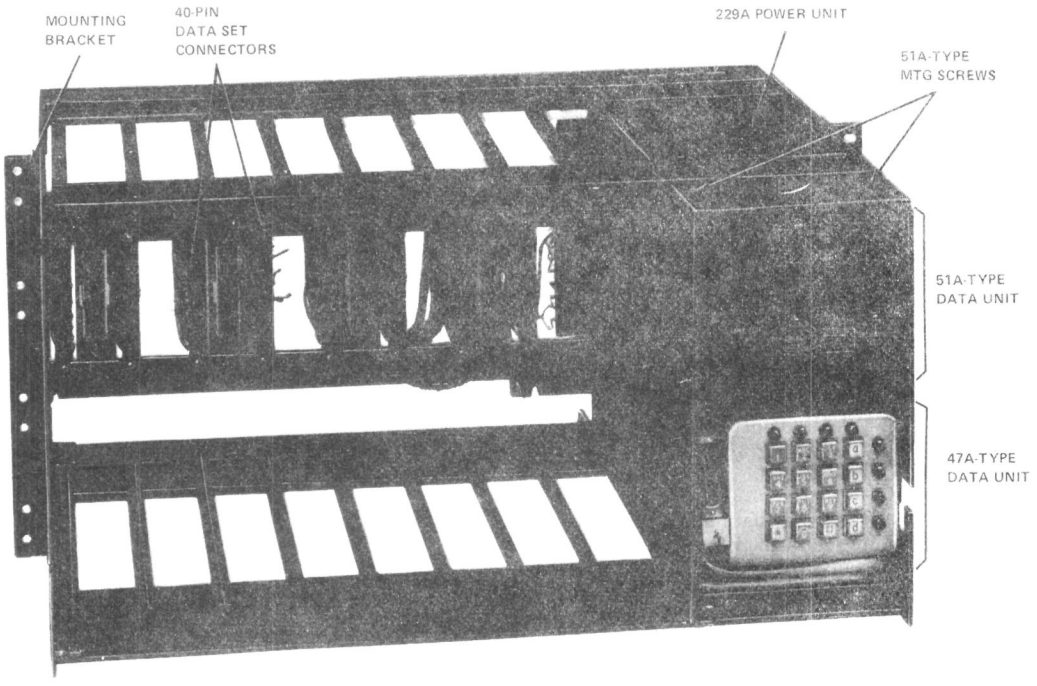


Fig. 4—57A-Type Data Mounting With Front Cover Removed

data set. Backplane wiring is provided with the data mountings.

2.05 The 57-type data mountings are provided with a removable front cover. Decals are attached to the inside of this cover. One decal provides data set number location as well as computer port assignment and telephone number for each data set in the 57-type data mounting and a second decal shows which options have been selected by the customer for each data set. These decals appear on both 57-type data mountings. A third decal is located on the 57A-type data mounting to provide local test information.

2.06 A25D connector cables equipped with KS-16689-L3 plugs are used to make the necessary line facility connections per four data sets. The KS-16689-L3 plugs are connected to the KS-16672-L3 connectors (J9, J10, J11, and J12) on the rear of the 57-type data mounting. A 1-1/2 meter (5 ft)-long test connector cable is provided with the 57A-type data mounting to facilitate testing of any data set in the cabinet.

229A Power Unit

2.07 The dc voltages are supplied to the data sets via the data mounting by the 229A power unit (Fig. 6). The 229A power unit is mounted on the right side of the data mounting. Four regulated voltages (+12, -12, +5, and -5 volts) are required for each DS 407C. The 229A power unit supplies four sets of these voltages, (one per data set). The four sets of voltages are independent of each other; thus, a failure of one set of voltages does not cause a failure of all data sets in the data mounting. The power unit is designed to operate on an input voltage of 106 to 127 volts at 60 ±0.1 Hz.

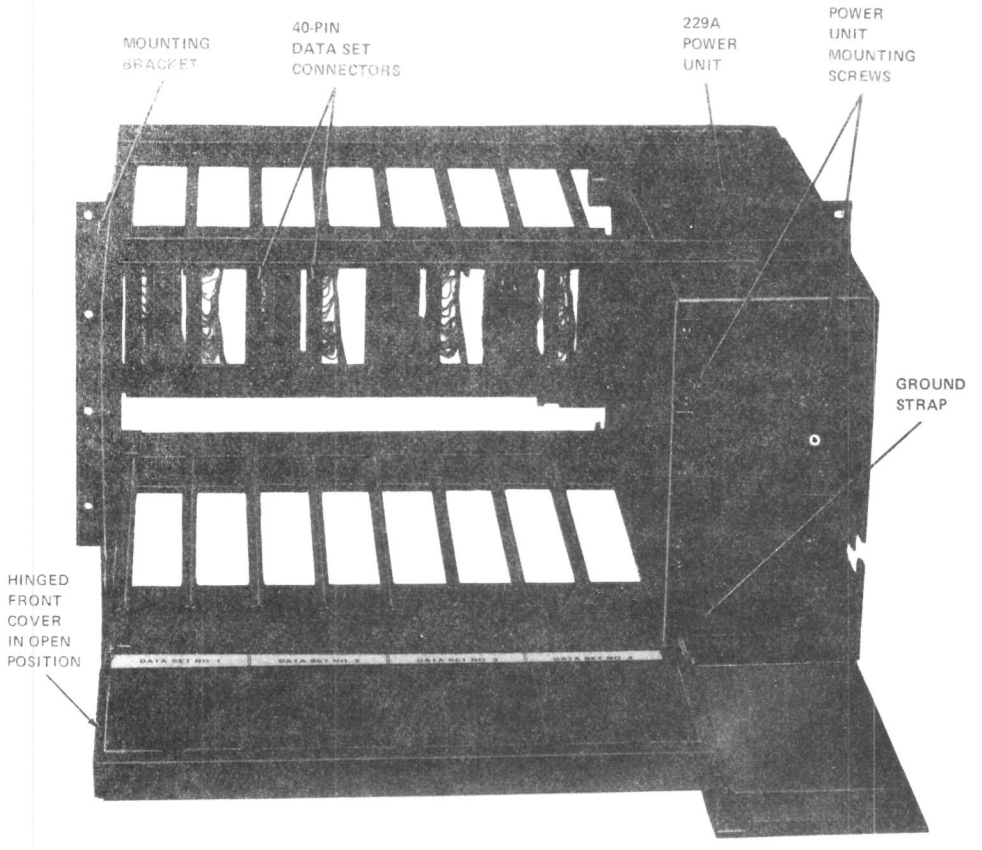


Fig. 5—57B-Type Data Mounting With Front Cover Open

51A-Type Data Unit

2.08 The 51A-type data unit (Fig. 4) is 13 cm wide, 13 cm high, 7 cm deep (5.2 in. wide, 5 in. high, 2.8 in. deep), and weighs about 1 kg (2.5 lb). This data unit contains a LOCAL TEST-REMOTE TEST switch, test indication LEDs, and a LAMP TEST switch for testing all LEDs in the cabinet.

47A-Type Data Unit

2.09 The 47A-type data unit (Fig. 4) is approximately 11 cm wide, 6 cm high, 11 cm deep (4.5 in. wide, 2.5 in. high, 4.5 in. deep), and weighs about 0.7 kg (1.5 lb). This data unit is a modified 16-button TOUCH-TONE dial. The data unit contains LEDs across the top and down the right side of the dial.

KS-20018-L20 Cabinet

2.10 The 407-type multiple data station can be housed only in the KS-20018-L20 cabinet. ***Any other cabinet is not recommended.*** The front panel of each cabinet is tinted plastic, while the back panel is perforated metal. The cabinet exteriors are aluminum with a clear finish. The KS-20018-L20 cabinet can house one 57A-type and one 57B-type data mounting with a maximum

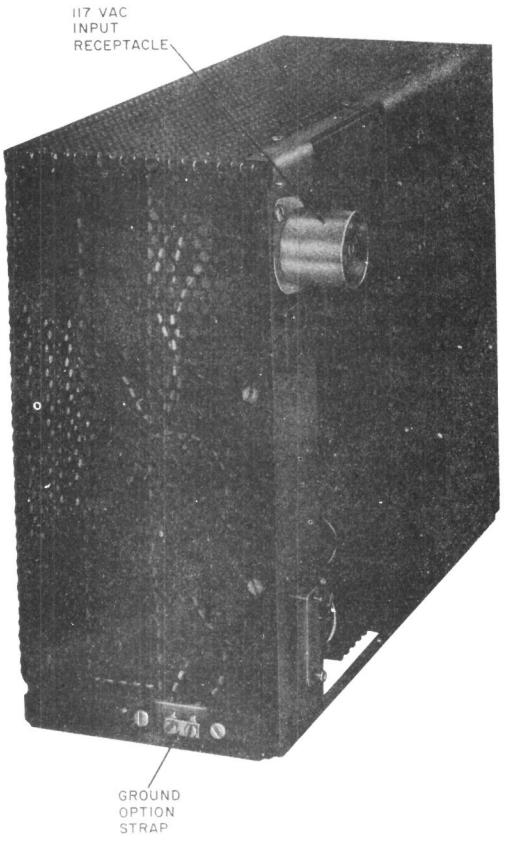


Fig. 6—229A Power Unit

of eight DS 407Cs. The cabinet is 61 cm wide, 81 cm high, 48 cm deep (24 in. wide, 32 in. high, 19 in. deep), and weighs 14 kg (31 lb). The cabinet is equipped with a 4250 liters per minute [150 cubic feet per minute (CFM)] blower in the bottom. The blower uses approximately 80 watts of 117-Vac, 60-Hz power. A replaceable throw-away filter is provided over the blower intake. Replacement filters are available from McLean Company as their part number S-1032-21.

2.11 Stations requiring more than eight data sets can be accommodated by using multiple KS-20018-L20 cabinets. Interconnection between cabinets must be made at time of installation.

81A (Thermal) Detector

2.12 An 81A (thermal) detector must be installed in the top of the KS-20018-L20 cabinet. The 229A power unit in the 57A-type data mounting is connected to an ac outlet on the side of the detector. The 229A power unit in the 57B-type data mounting is connected to an outlet on the 229A power unit in the 57A-type data mounting. The detector will shut off all ac power to the cabinet except alarms if cabinet temperature rises to 57° Celsius (135°F). Power will automatically be restored when cabinet temperature drops below 47° Celsius (118°F). Visual and audible alarms are provided on the front of the detector. The 81A detector measures 58 cm wide by 6 cm high by 22 cm deep (23 in. wide by 2-1/4 in. high by 8.6 in. deep), and weighs about 2.3 kg (5 lb). The detector is provided with a 3-meter (10-ft)-long KS-14532-L25 power cord for connecting to a customer-supplied source of 117-Vac 60-Hz power. The customer-provided power outlet should ***not*** be under control of a switch, to ensure uninterrupted service. The detector is not provided as part of the KS-20018-L20 cabinet, and must be ordered separately.

3. FUNCTIONAL DESCRIPTION

3.01 The 407C multiple data station provides a maximum of eight interfaces between the data sets and the customer-provided terminal per data mounting. Four line facility interface connectors per data mounting are also provided. The four line facility connectors provide the necessary interface to connect four data sets to the switched telecommunications network and referral equipment. The telephone network connections are made via a connecting block, as required. A functional block diagram is shown in Fig. 7.

Data Set 407C-L1

3.02 DS 407C is a dual unit; that is, each DS 407C serves two incoming telephone lines and two computer ports simultaneously. Furthermore, the data set may be optioned to function in either parallel or serial interface mode. In the ***parallel mode,*** the data set translates incoming TOUCH-TONE signals into a 2-out-of-8 code or BCM for parallel presentation to the computer. In the parallel mode, DS 407C functions similar to a DS 407A or 407B in audio response DIVA (digital inquiry voice answer) systems. No translation is made to ASCII characters. Responses are in the form of keyed

answer tone or audio signals generated by the customer's equipment. However, FSK "words" can be recorded on an audio response unit and transmitted through the voice port to provide FSK response in the parallel mode. In the ***serial mode,*** TOUCH-TONE signals are translated into ASCII characters according to Table A. Outgoing ASCII data from the computer is transmitted as FSK data or translated to keyed answer tone (KAT). Operation in serial mode is half-duplex, since reliable detection of TOUCH-TONE signals cannot be made in the presence of outgoing FSK.

TABLE A

TOUCH-TONE TO ASCII TRANSLATION

TOUCH-TONE CHARACTER	ASCII CHARACTER
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
0	0
*	<
#	:
a	;
b	=
c	>
d	?

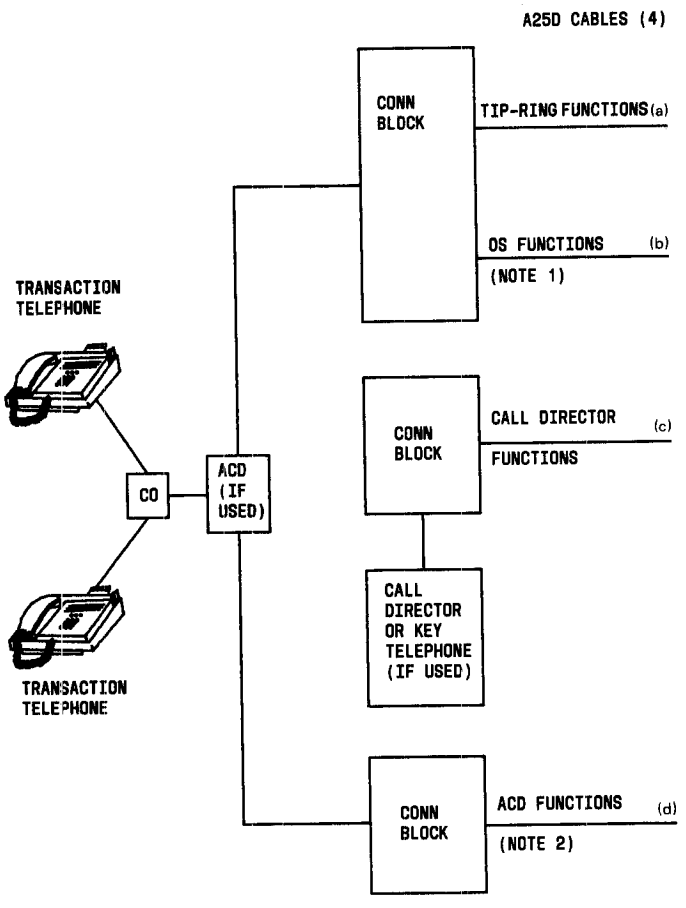
3.03 A comparison of features and options available on all DS 407-type is given in Table B.

3.04 The receiver portion of the data set accepts 2-out-of-8 TOUCH-TONE signals. The TOUCH-TONE signals consist of two groups of frequencies, a low group and a high group, each containing four frequencies. These frequencies are grouped and designated as shown in Fig. 8. The receiver detects TOUCH-TONE signals at a maximum rate of ten characters per second. A character consists of one frequency from each group. Therefore, the 2-out-of-8 code provides 16 different frequency pairs (characters). DS 407C recognizes all of these characters.

3.05 ⏵The transmitter portion of the data set is equipped with a tone generator which operates at two frequencies: 2025 Hz and 2225 Hz. This oscillator is activated during the call answering sequence to generate 2025-Hz answer tone. With the data set optioned for parallel mode, the oscillator will generate 2025-Hz tone whenever the tone answer-back (TAB) customer interface lead is in the ON state. When the data set is optioned for serial mode, the oscillator is activated by data set control logic to generate frequency shift keyed (FSK) signals, 1.5 and 3.0 second 2025-Hz tones, or a beeping 2025-Hz tone. These signals are generated in response to commands from the customer equipment. A voice answer-back channel is also provided for customer use. It accepts a voice signal, on a balanced 600-ohm pair, up to 0 dBm and passes it to the telephone line. The voice answer-back channel is disabled whenever the tone generator is activated.⏴

3.06 Seven status LEDs are provided on the front of each line of the data set as shown in Fig. 2. The LED names and functions are defined as follows:

- The "ON" LED indicates that power is applied to the data set.
- The terminal ready (TR) LED indicates that the data set is ready to receive a call or is in the process of handling a call.
- The ring indicator (RI) LED indicates that ringing is being applied to the data set.
- The modem ready (MR) LED indicates the status of data set ready signal to the customer interface.
- The data present (DP) LED indicates that the data set is receiving valid data.
- The attendant request (AR) LED indicates the occurrence of a computer-generated or terminal-initiated referral request.
- The out-of-service (OS) LED indicates that the data set has been placed out of service.



NOTES:
1. OS FUNCTIONS ARE NOT USED IN ACD.
2. ACD TIP AND RING USE J9. ALL OTHER FUNCTIONS ARE IN J12.
3. THE 57B1 DATA MOUNTING IS FUNCTIONALLY THE SAME AS THE 57A1 DATA MOUNTING EXCEPT THERE IS NO TEST UNIT WITH THE 57B1 DATA MOUNTING.

Fig. 7 — 407C Multiple Data Station—Functional Block Diagram (Sheet 1 of 2)

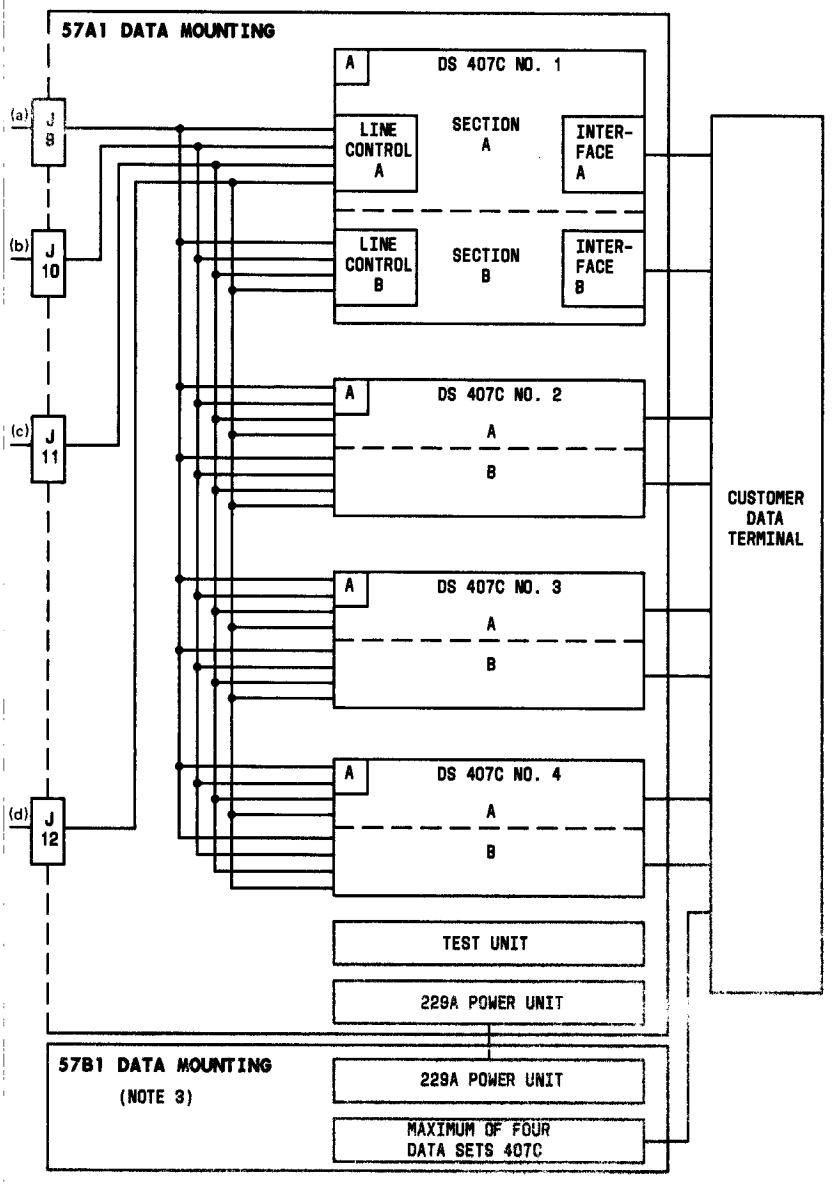


Fig. 7 — 407C Multiple Data Station—Functional Block Diagram (Sheet 2 of 2)

TABLE B

SUMMARY OF FEATURES AND OPTIONS ON DS 407-TYPE

FEATURE OR OPTION	AVAILABLE ON DS 407		
	A	B	C
TOUCH-TONE reception up to 10 characters/second	X	X	X
Voice answer-back	X	X	X
Private line or switched network	X	X	X
Used with automatic call distributor	X	X	X
EIA or contact parallel interface	X	X	X
Normal voice telephone service w/key telephone set	X	X	X
Return to data	X	X	X
Tone answer-back	X	X	X
Local and remote test capability	X	X	X
Indicator LEDs	X	X	X
ACU compatibility	X	X	X
Separate or common ground	X	X	X
Adjustable answer-back level	X	X	X
Terminal initiated referral		X	X
Out of service controlled by DTR		X	X
Computer down detection		X	X
Remote call termination		X	X
Limited call-handling capability w/computer down		X	X
Error control			X
Logon/sign-on procedure			X
Serial (ASCII) interface			X
BCM with parallel EIA interface			X
Buffered data			X
Speed selection (10, 15 or 30 characters/second)			X
Message blocking			X
Automatic punctuation			X
Positive acknowledgment			X
End-of-message characters			X
Data flow control protocol			X
Multiple message segments			X
Common audible signal			X
Out-of-service switch			X

3.07 The data set has the capability of giving an out-of-service indication to the connecting data facility under any of the following conditions:

- Out-of-service customer interface lead is placed in the ***on*** state by the customer terminal (option AE).
- If DTR is ***off*** for more than 200 ms (option AC).
- If OS switch is ***on.***
- The data set line is under test.
- Power is lost to the data set. (All LEDs extinguished.)
- The data set is not plugged into the nest.
- The connector to the customer terminal is not plugged in. This does not occur when options F and H are installed.
- The computer fails to respond to a disconnect message from the data set (option E).

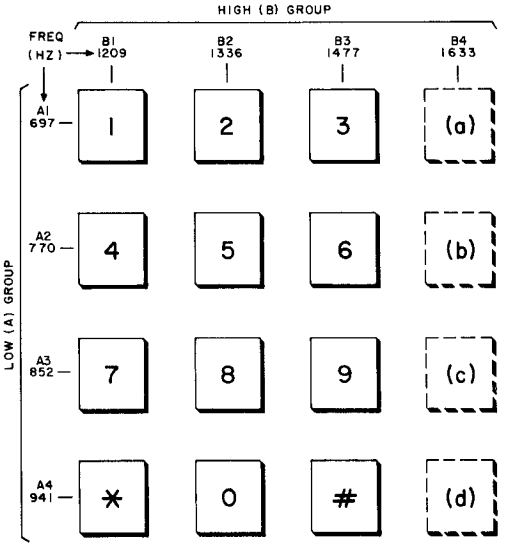


Fig. 8—TOUCH-TONE Dial Frequency Assignments

3.08 The data set detects ringing current on its associated line circuit and generates an RI signal on the customer interface. If the customer terminal is ready to accept the call [data terminal ready (DTR) is turned on], the line control circuit will answer the call automatically and then sense dc loop current. After a 1.5-second delay, a 2025-Hz answer tone is transmitted for 1.5 seconds to the calling station, indicating the call has been answered. The data set ready (DSR) lead is turned ***on*** indicating that the data set is connected to the line. During a call, the line control circuit will indicate line and data set status by means of a lamp indication on the associated CALL DIRECTOR or key-type telephone station as follows:

- In the ***idle*** mode the lamp is ***off.***
- In the ***data*** mode the lamp is ***on.***
- In the ***data*** mode, when the attendant request is made, the lamp flashes.
- In the ***talk*** or ***referral*** mode the lamp is ***on.***
- In the ***out-of-service*** mode the lamp is ***on.***

Note: An arrangement for a common audible signal in the referral mode is available.

The call is terminated when loop current is interrupted during a call after the automatic answering sequence is over. The call is also disconnected by the following means:

- TALK or REFERRAL mode—attendant hangs up.
- DATA mode—DTR ***off*** or disconnect sequence is received.

3.09 DS 407C performs all the functions of DS 407A and 407B, and also provides the follcwing additional features:

- Serial interface
- ◗FSK or keyed answer-tone responses◖
- ◗Several end-of-message indicators◖
- Data flow control protocol
- Error control
- Logon/sign-on procedure
- Buffering of incoming TOUCH-TONE messages
- Automatic punctuation of outgoing ASCII messages
- OS switch.

Note: See Table B for a complete listing of features and options on DS 407-type.

Telco Options

3.10 There are twenty-two telephone company (telco) options on DS 407C. Thirteen of these options are implemented by means of Cambion shorting plugs which fit into numbered jacks; seven are implemented by back-plane wiring, and two are implemented by a strap on the 229A power unit. Telco options for DS 407C are listed in Table C.

Customer Options

3.11 Customer options are provided by two 10-segment switches (total 20) on the front of the data set, ◗providing a total of 40◖ customer options. These options are listed in Table D.

Note: All options selected apply to both lines of the data set.

3.12 Descriptions of telco and customer options are given in Section 594-800-202.

Customer Interface Information

3.13 Either serial or parallel operation is provided in DS 407C by option. Interface lead functions and mnemonics for DS 407C operating in the serial mode are given in Table E. Interface lead functions and mnemonics for parallel operation with 2-out-of-8 output are given in Table F. Interface lead functions and mnemonics for parallel operation with BCM output are given in Table G. The BCM code is given in Table H.

57-Type Data Mounting

3.14 The 57-type data mounting is a multiple apparatus housing which will accommodate a maximum of four data sets. Connectors J9 through J12 on the 57-type data mounting provide interconnection from the eight mounting slots to the telephone network via a connecting block. The 908J1 connectors (eight per mounting) accept DS 407C.

3.15 Each 57-type data mounting is equipped with one 229A power unit. The 229A power unit supplies power to a maximum of four data sets. Separate outputs on the power unit provide +12 volts, -12 volts, +5 volts, and -5 volts regulated dc power for each data set in the 57-type mounting. The power unit is powered from a 117-volt 60-Hz three-wire (with ground) source.

3.16 The test unit (two data units) in the 57A-type data mounting provides both local and remote test capabilities for all the data sets within a single cabinet.

Test Unit—47A-Type and 51A-Type Data Units

3.17 When a data set is placed under test (local or remote), the customer interface cable is removed from the data set and the test cable from the 51A-type data unit (CA1) is connected directly to the data set line A or line B interface connector. When the data set is placed in the test mode, the following functions occur:

- Data set is transferred from its associated line to a test line.
- The local test start (LTS) lead of the set under test is connected to the test circuit.

- The interface leads are placed in the parallel contact equivalent mode.

- If an ACD is used for voice access and call distribution, the DTR indication to the ACD is disabled. This makes the data set under test appear busy to the ACD.

- The incoming line is placed out-of-service so no calls will be directed to the data set under test.

3.18 The 51A-type data unit provides local, remote, and LED testing of up to eight DS 407Cs in a multiple data station. The LOCAL TEST-REMOTE TEST test switch is operated to REMOTE TEST, thereby placing the data set line in the remote test mode. In the remote test mode, the data set line under test is connected to a service line and then called from a remote data test center.

3.19 When the LAMP TEST switch is depressed, the status LEDs on the data sets and test unit should light. This test feature checks that all LEDs are in working condition.

3.20 The 47A-type data unit provides means for local testing of up to eight data sets by the customer or telco employee, by operating the LOCAL TEST-REMOTE TEST switch on the 51A-type data unit to LOCAL TEST, thereby connecting the data set line to the 47A-type data unit. When a TOUCH-TONE button on the 47A-type data unit is depressed and held, the two LEDs representing the horizontal and vertical coordinates of the depressed button will flash at a steady rate. This test enables the customer or telco employee to obtain a rapid check of a data set.

TABLE C

TELCO OPTIONS

OPTION			REMARKS
FEATURE	SELECTION	DESIG	
Type of Operation	Switched Network	A	
	Private Line	B	
Used With ACD	Yes	C	
	No	D	
Interface Mode	Serial	E	If option E is selected, options G and I must also be selected.
	Parallel	F‡	
Interface* Type	EIA Voltage	G	If option E is selected, option G must also be selected. *
	Contact Equivalent	H	
Call Control Code Detector	Enable	I	Option I enables terminal initiated referral, computer down, and automatic disconnect features of DS 407C. If option E is selected, option I must be selected.
	Disable	J	
Computer Down Detection	Switch	K	These options are implemented by backplane wiring.
	All DTR OFF	L	
	Switch or All DTR OFF	M	
	Disabled	N	
Out-of-Service Wiring	Tip-Ring Short	O	OS1-T OS2-R (in J9 and J10)
	Third Wire Ground	P	OS1-FG OS2-third wire (in J10)
	Separate Pair Short	Q	OS1 OS2 } OS pair (in J10)
Grounding	Frame Ground Connected to Signal Ground	R	Option R connects strap on power unit.
	Frame Ground and Signal Ground Not Connected	S†	Option S removes strap on power unit.
Transmit Level	−4 dBm	T	Sets transmit level between −12 dBm and −16 dBm at serving CO.
	−8 dBm	U	
	−13 dBm	V	

* If option G is selected, customer option BH must be selected; if option H is selected, customer option BG must be selected.

† SG paralleled to all data mountings.

‡ Switch must be operated.

TABLE D

CUSTOMER OPTIONS

OPTION				REMARKS
FEATURE	AVAIL*	SWITCH SELECTION	DESIG	
# Line Disconnect	P or S	A1 ON	AA	Data set disconnects line when a TOUCH-TONE *#* is received with option AA. Option AB disables option AA.
		A1 OFF	AB	
OS Controlled by DTR	P or S	A2 ON	AC	Data set is out of service if DTR is *off* more than 200 ms with option AC. Option AD disables option AC.
		A2 OFF	AD	
OS Controlled by OS Lead	P or S	A3 ON	AE	Data set is out of service whenever OS lead is *on* with option AE. Option AF disables option AE.
		A3 OFF	AF	
Terminal Initiated Referral— Computer Up	P or S	A4 ON	AG	Data set will initiate a referral when computer is operative on receipt of a TOUCH-TONE ** with option AG.
		A4 OFF	AH	
Terminal Initiated Referral — Computer Down	P or S	A5 ON	AI	Data set will initiate a referral when computer is down on receipt of a TOUCH-TONE ** with option AI.
		A5 OFF	AJ	
End of Message 1 End of Message 2 End of Message 3	S	A6 OFF A6 ON A7 OFF A7 ON A8 OFF A8 ON		Selects end of message (EOM) characters given to computer after all control sequences and end of block (EOB) characters expected from computer. Selected as follows:
			AK0	A6 OFF, A7 OFF, A8 OFF — EOM: None — EOB: DC3 or ENQ
			AL0	A6 ON, A7 OFF, A8 OFF — EOM: CR — EOB: DC3 or ENQ
			AM0	A6 OFF, A7 ON, A8 OFF — EOM: CR LF DC3 — EOB: DC3 or ENQ
			AN0	A6 ON, A7 ON, A8 OFF — EOM: DC3 — EOB: DC3 or ENQ
			AK1	A6 OFF, A7 OFF, A8 ON — EOM: ETX — EOB: DC3 or ENQ
			AL1	A6 OFF, A7 ON, A8 ON — EOM: EOT — EOB: DC3 or ENQ
			AM1	A6 ON, A7 OFF, A8 ON — EOM: ETX — EOB: DC3, ENQ, or ETX
			AN1	A6 ON, A7 ON, A8 ON — EOM: EOT — EOB: DC3, ENQ, or EOT
Binary Coded Matrix	P	A8 ON	AO	BCM output from data set (with options F, G, and BH only).
		A8 OFF	AP	2-out-of-8 output from data set, with option F only.

TABLE D (Contd)

CUSTOMER OPTIONS

OPTION				REMARKS
FEATURE	AVAIL*	SWITCH SELECTION	DESIG	
Speed Select 1	S	A9 ON	AQ	Data speed is 110 bps with option AQ. Data speed is 150 bps with option AR unless overridden by option BI.
		A9 OFF	AR	
Message Blocking	S	B1 ON	AS	Data set translates TOUCH-TONE ## into X EOM; computer must "block" outgoing messages by ending them with DC3 or with ENQ, option AS. If option AT is selected, switches B2 through B8 must be *off*.
		B1 OFF	AT	
STX/ETX Punctuation	S	B2 ON	AU	Data set will add ASCII characters STX and translate DC3 to ETX on all FSK messages, with options AU *and* AS. With option AV, DC3 will be transmitted.
		B2 OFF	AV	
Error Control	S	B3 ON	AW	Option AW (with option AS) provides data set compatibility with error control features of transaction telephone, as follows: (1) Adds STX, ETX, and LRC to all FSK messages. (2) On incoming messages, data set checks LRC and CCT, and notifies computer of validity of message: good, bad, or no check. (3) When FSK messages or timed answer-tones are sent out, a data set timer is set and computer is notified if anticipated response is not received in time. (4) Option AW is disabled if the leading TOUCH-TONE "b" is not received. Option AX disables option AW.
		B3 OFF	AX	
Positive Acknowledgment	S	B4 ON	AY	Option AY (with options AS and AW) provides an acknowledgment of receipt of a correct message within the time-out period by sending the ASCII sequence A EOM to the computer. Option AZ disables this feature.
		B4 OFF	AZ	
Data Flow Control Protocol	S	B5 ON	BA	Option BA (with option AS) allows data set to control flow of data across customer interface. Permits computer to put FSK on-line only when remote terminal is not transmitting and passes data to computer only when computer signifies it is ready.
		B5 OFF	BB	

TABLE D (Contd)

CUSTOMER OPTIONS

OPTION				REMARKS
FEATURE	AVAIL*	SWITCH SELECTION	DESIG	
Logon/Sign-on	S	B6 ON	BC	Option BC (with options AS and BA) allows transaction telephone to communicate with computers which require Logon characters. If option BE is also present, then option BD provides for a fixed sign-on in addition to a Logon.
		B6 OFF	BD	
Multiple Message Segments	S	B7 ON	BE	Option BE (with options AS and BA) permits data set "handshaking" required by certain computers which allow multiple-segmented messages. The type of "handshaking" depends on option BC or BD.
		B7 OFF	BF	
Closure Type/ EIA Voltage Interface	P	B8 ON	BG	Contact equivalent or closure type
		B8 OFF	BH	EIA voltage; option BH must be used with telco option G. This option is required whenever option E or AO is used. Option BG must be used with telco options F and H and option AP only.
Speed Select 2	S	B9 ON	BI	Option BI (with option AR) provides data speed of 300 bps. Options BI and AQ cannot be used together.
		B9 OFF	BJ	

* P denotes parallel interface; S denotes serial interface.

Note: Switches A10 and B10 unassigned.

TABLE E

CUSTOMER INTERFACE LEAD FUNCTIONS – SERIAL MODE

PIN NO.	FUNCTION	DATA SET MNEMONIC	EIA DESIGNATION (RS-232-C)
1	Frame Ground	FG	AA
2	Send Data	SD	BA
3	Receive Data	RD	BB
4	Request to Send (Not Used)	RS	CA
5	Clear to Send	CS	CB
6	Data Set Ready	DSR	CC
7	Signal Ground	SG	AB
8	Data Carrier Detector	DCD	CF
9	(Connected to 8)	—	—
10-13	Not Used	—	—
14	(Connected to 22)	—	—
15,16	Not Used	—	—
17	Voice Answer-Back A	VAA	Non-EIA
18	Voice Answer-Back B	VAB	Non-EIA
19	Not Used	—	—
20	Data Terminal Ready	DTR	CD
21	Not Used	—	—
22	Ring Indicator	RI	CE
23,24	Not Used	—	—
25	Out-of-Service	OS	Non-EIA

TABLE F

CUSTOMER INTERFACE LEAD FUNCTIONS – PARALLEL MODE
WITH 2-OUT-OF-8 OUTPUT

PIN NO.	FUNCTION	DATA SET MNEMONIC
1	Frame Ground	FG
2	One-Half of Voice Receive Pair	VRA
3	A-Group Frequency Identifier	A1
4	A-Group Frequency Identifier	A2
5	A-Group Frequency Identifier	A3
6	A-Group Frequency Identifier	A4
7	Not Used	—
8	One-Half of Voice Receive Pair	VRB
9	B-Group Frequency Identifier	B1
10	B-Group Frequency Identifier	B2
11	B-Group Frequency Identifier	B3
12	B-Group Frequency Identifier	B4
13	Not Used	—
14	Ring Indicator	RI
15	Attendant Request	AR
16	Data Present Indicator	DP
17	Voice Answer-Back A	VAA
18	Voice Answer-Back B	VAB
19	Data Mode Indicator	DM
20	Tone Answer-Back Control	TAB
21	Data Receiver Enable	DR
22	Data Terminal Ready	DTR
23	Data Set Ready	DSR
24	Signal Ground	SG
25	Out-of-Service	OS

TABLE G

CUSTOMER INTERFACE LEAD FUNCTIONS – PARALLEL MODE
WITH BCM OUTPUT

PIN NO.	FUNCTION	DATA SET MNEMONIC
1	Frame Ground	FG
2	One-half of Voice Receive Pair	VRA
3	Received Data 1	RD1
4	Received Data 2	RD2
5	Received Data 3	RD3
6	Received Data 4	RD4
7	Not Used	—
8	One-half of Voice Receive Pair	VRB
9—13	Not Used	—
14	Ring Indicator	RI
15	Attendant Request	AR
16	Data Present Indicator	DP
17	Voice Answer-Back A	VAA
18	Voice Answer-Back B	VAB
19	Data Mode Indicator	DM
20	Tone Answer-Back Control	TAB
21	Data Receiver Enable	DR
22	Data Terminal Ready	DTR
23	Data Set Ready	DSR
24	Signal Ground	SG
25	Out-of-Service	OS

TABLE H

BCM CODE

SYMBOL	RECEIVE DATA LEADS			
	RD1	RD2	RD3	RD4
1	1	0	1	0
2	1	0	0	1
3	1	0	1	1
4	0	1	1	0
5	0	1	0	1
6	0	1	1	1
7	1	1	1	0
8	1	1	0	1
9	1	1	1	1
0	0	0	0	1
*	0	0	1	0
#	0	0	1	1
a	1	0	0	0
b	0	1	0	0
c	1	1	0	0
d	0	0	0	0

1 = MARK = — voltage
0 = SPACE = + voltage

4. GLOSSARY OF TERMS AND ABBREVIATIONS

4.01 Terms and abbreviations used in this and related sections are defined as follows:

TERM OR ABBREVIATION	DEFINITION
ACD	Automatic Call Distributor
AR	Attendant Request (LED indicator)
ARU	Audio Response Unit
ASCII	American Standard Code for Information Interchange (standard)
"b", Leading	Identifies caller as a transaction telephone
BCM	Binary Coded Matrix—Parallel interface provides translation of TOUCH-TONE signals to BCM signals on interface leads 3, 4, 5, and 6
BPS	Bits per Second
Buffering	Temporary storage (of TOUCH-TONE signals)
CCT	Character Count—Transmitted by transaction telephone for error control
CFM	Cubic Feet per Minute
CPE	Customer Provided Equipment (terminal)
CPU	Customer Computer
CR	Carriage Return (ASCII)
DC3	Control Character (ASCII)
DIVA	Digital Inquiry Voice Answer
DP	Data Present (LED indicator)
DSR	Data Set Ready
DTR	Data Terminal Ready
EIA	Electronic Industries Association (standard)
ENQ	Enquiry (ASCII)
EOB	End of Block (from computer)
EOM	End of Message (to computer)
EOT	End of Transmission
ETX	End of Text

TERM OR ABBREVIATION	DEFINITION
FSK	Frequency Shift Keyed
KAT	Keyed Answer Tone
Leading, "b"	Identifies caller as a transaction telephone
LED	Light-Emitting Diode
LF	Line Feed (ASCII)
Logon	Procedure for assuring security of system; identification of caller
LRC	Longitudinal Redundancy Check—Transmitted by transaction telephone and DS 407C in FSK mode for error control
LTS	Local Test Start
MR	Modem Ready (LED indicator)
OS	Out-of-Service (LED indicator)
Protocol, Data Flow Control	Option is which data set controls direction of data flow across interface with computer
RD	Receive Data (interface lead)
REFERRAL	Computer or terminal may request attendant intervention. Computer requests referral by transmitting : : before the first ? in any message. Terminal requests referral by transmitting * * any time.
RI	Ring Indicator (LED indicator)
STX	Start of Text (ASCII)
Telco	Telephone Company
Terminal	Transaction I or II telephone
TIR	Terminal Initiated Referral
TR	Terminal Ready (LED indicator)
TT	TOUCH-TONE (signals)
* *	Referral signal from terminal (TIR)
* # *	Disconnect signal from terminal

5. REFERENCES

5.01 The following documents pertain to the 407C multiple data station.

NUMBER	TITLE
SD & CD 1D279-01	Data System Station—407C Data Station
SD & CD 82414-01	229A Power Unit
41409	◗Technical Reference◖
41805	◗Technical Reference◖

SECTION	TITLE
314-811-100	1A Transaction Telephone Test Line Station—Description
476-270-203	2B Automatic Call Distributing System—Cabling and Cross Connects
581-235-101	2B Automatic Call Distributor—General Description Information
590-100-133	47A1 Data Unit—Identification
590-100-137	51A1 Data Unit—Identification
590-102-143	57-Type Data Mountings—Description
594-030-101	Data Set 407C—Identification
594-800-182	407C Multiple Data Station—Summarizing Specification
594-800-202	407C Multiple Data Station—Installation and Connections
594-800-302	407C Multiple Data Station—Maintenance
594-800-502	407C Multiple Data Station—Test Procedures
594-800-501	407-Type Multiple Data Station Using 2B Automatic Call Distributor—Test Procedures
668-104-541	Data Test Center 904A- and 904C-Types—407C Multiple Data Station—Loopback Test

407C MULTIPLE DATA STATION
INSTALLATION AND CONNECTIONS

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1. GENERAL

1.01 This section provides installation and connection procedures to be followed when installing the 407C multiple data station. Installation information is also provided on the CALL DIRECTOR®, key-type telephone set, 801-type automatic calling unit (ACU), and 2B or 3A automatic call distributor (ACD) which may be associated with the data station. Information concerning associated customer-provided equipment (CPE), data terminal equipment, or related services is ***not*** included.

1.02 This section is reissued to show data set (DS) 407C-L1, series 1 rated manufacture discontinued (MD) and to show DS 407C-L1, series 2 as the replacement. DS 407C-L1, series 2 provides four additional end-of-message (EOM) characters, which are customer options.

1.03 The 407C multiple data station consists of DSs 407C-L1, 57-type data mounting(s) (four data sets per data mounting), and a KS-20018-L20 cabinet (Fig. 1 and 2). Both of the 57-type data mountings (Fig. 3 and 4) contain a 229A power unit (Fig. 5), but only the 57A1 contains a test unit. One 229A power unit will supply power to one data mounting or a maximum of four data sets. The test unit consists of the 51A-type and 47A-type data units. The DS 407Cs are receivers of TOUCH-TONE® signals used primarily in TOUCH-TONE inquire/FSK (frequency shift keyed) data response systems.

1.04 The 407C multiple data station is housed in a KS-20018-L20 cabinet. ***The use of any other cabinet is not recommended because of thermal limitations.*** The KS-20018-L20 cabinet can house one 57A-type and one 57B-type data mounting, with a maximum of eight data sets. A blower is provided in the bottom of the cabinet (Fig. 1), while an 81A (thermal) detector must be installed in the top of the cabinet (Fig. 1 and 6) to protect the data sets from operation above their maximum temperature limit. The 81A detector must be ordered separately. The detector will shut off all power in the cabinet, except for audible and visual alarms, when the temperature in the cabinet reaches 57° Celsius (135°F). All power is restored automatically when the cabinet temperature drops to 47° Celsius (118°F). Installations requiring more than eight data sets (16 lines) require additional KS-20018-L20 cabinets.

1.05 Plugs and cables for connecting CPE to the data sets are provided by the customer and should not exceed 50 feet in length. Cables for connecting the multiple data station to transmission line facilities must be terminated at the data mounting end in a 50-pin connector, such as the one on the A25D-type connector cable.

1.06 The multiple data station may be installed in any location that is convenient for the customer, within 16 meters (50 ft) of the CPE. It is desirable to mount the station adjacent to or within view of the CPE. This will allow visual monitoring of the status light emitting diodes (LEDs) on the data sets while operating or testing the CPE. Verify that the location selected by the

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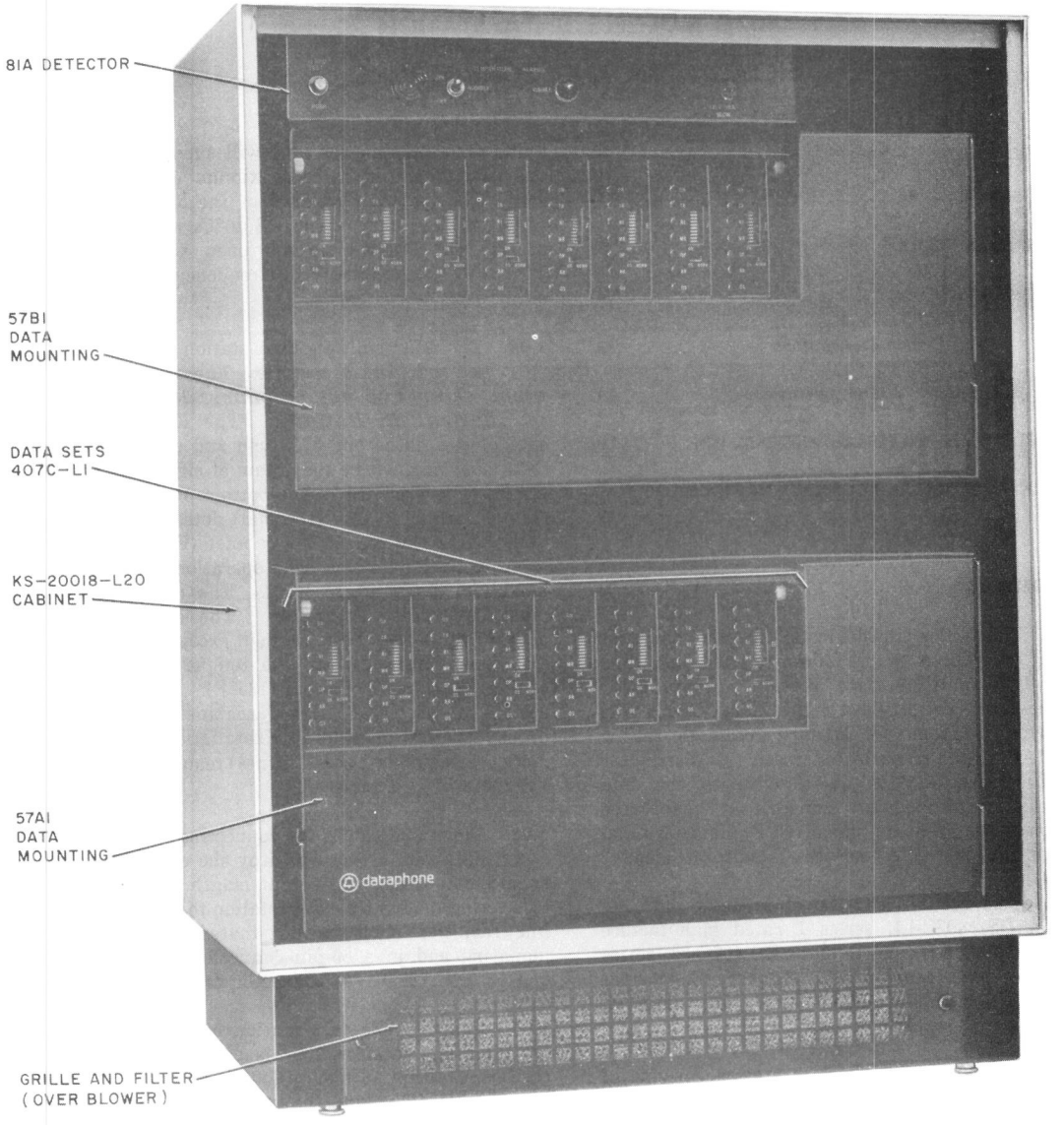


Fig. 1—Front View of 407C Multiple Data Station With Plastic Front Cover Removed

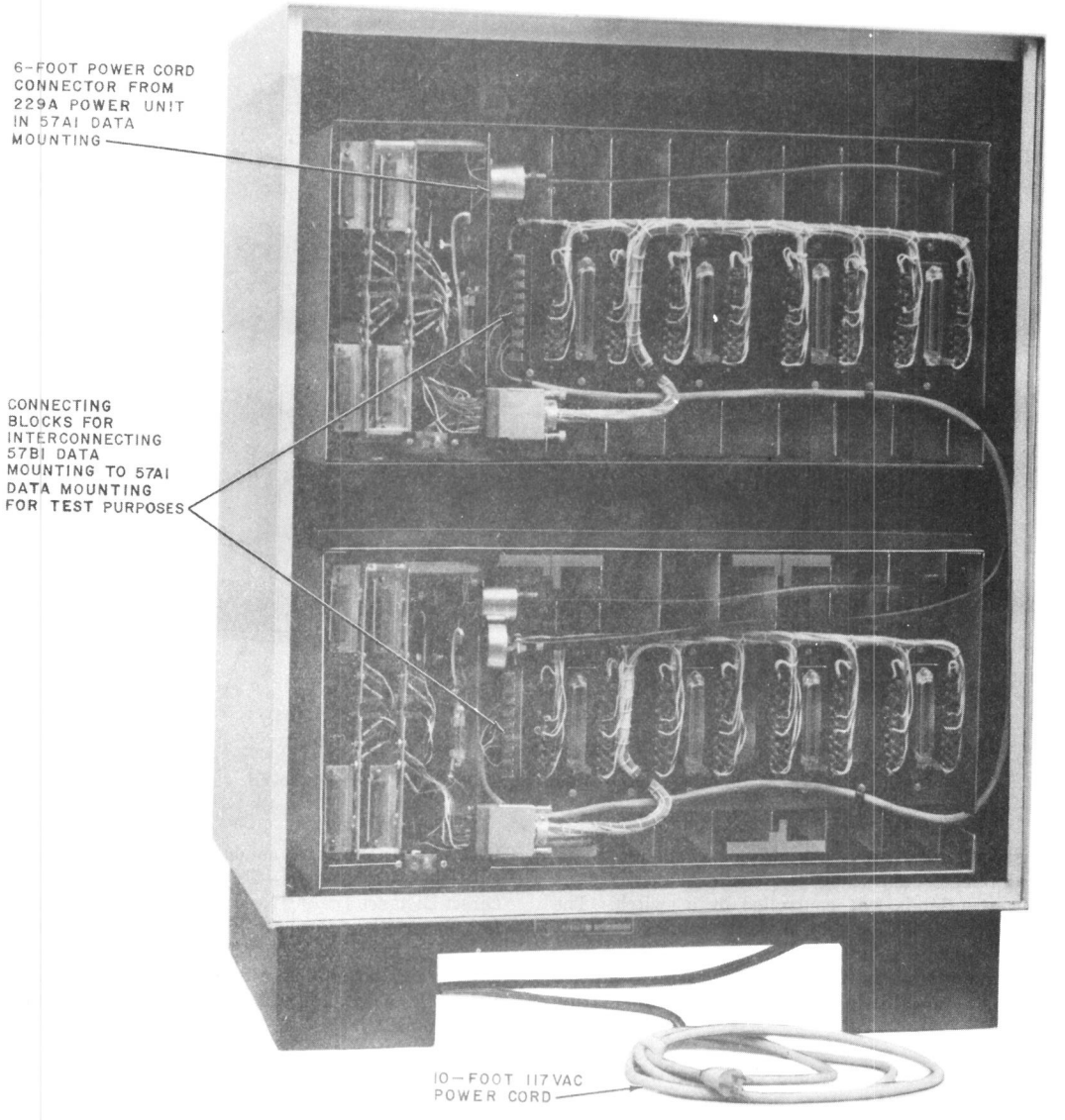


Fig. 2—Rear View of 407C Multiple Data Station With Grille Removed

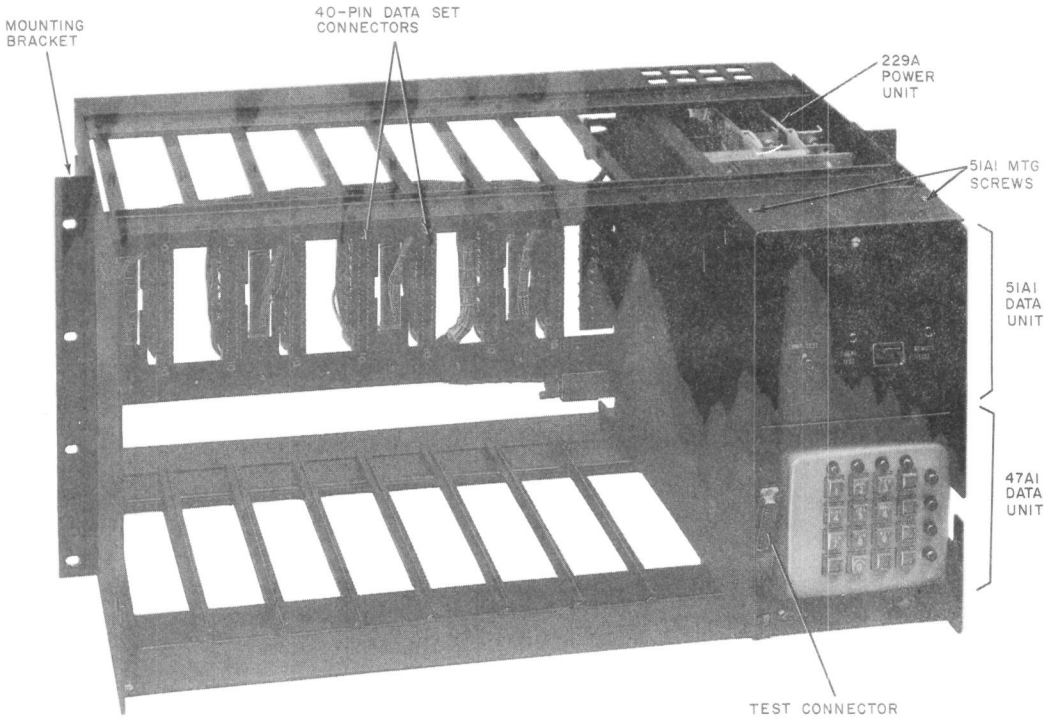


Fig. 3—57A-Type Data Mounting With Front Cover Removed

customer for the installation is adequate for maintenance and that the customer-provided ac power outlet is ***not*** controlled by a switch. The ac power outlet must be within 2 meters (6 ft) of the equipment cabinet. For additional information on installation planning, refer to the section entitled Data Sets—Multiple Installation Information (590-010-201).

1.07 Reference directions (left, right, front, or rear) on the data mounting are in respect to facing the front of the apparatus.

1.08 When test or demonstration calls are made, refer to the section entitled Crediting Charges on Test Calls (010-250-001) for the proper procedure for crediting charges.

1.09 Ensure that the data loops have been tested and meet requirements for TYPE I DATAPHONE® lines as outlined in the section entitled Data Systems—DATAPHONE Service on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines (314-205-501) or basic private lines as outlined in the section entitled Voice Bandwidth Private Line Data Circuits—Tests and Requirements (314-410-500).

1.10 It is recommended that the cabinet(s) for the data station be installed on a table top, desk or other suitable surface approximately 28 to 32 inches above floor level. ***In any event, the 57A-type data mounting must be mounted in the bottom of the cabinet, whether one or two data mountings are used, to afford proper cooling.***

1.11 Data sets, data units, and power units found to be defective should be returned to a

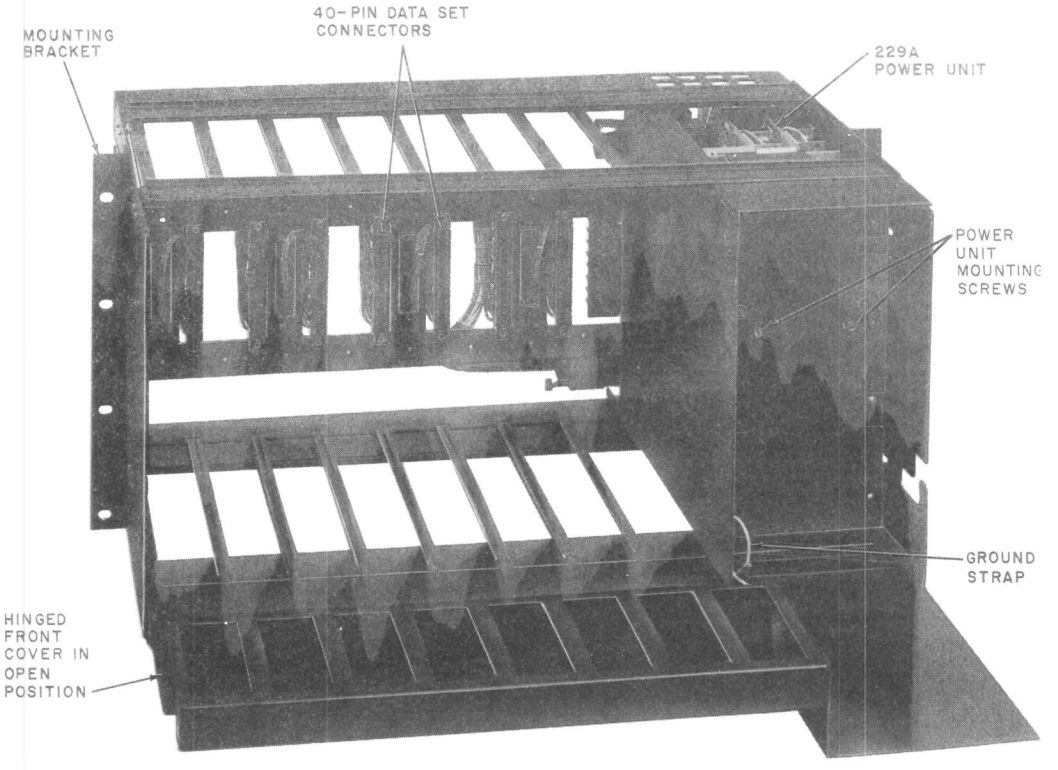


Fig. 4—57B-Type Data Mounting With Front Cover Open

Western Electric Company distributing house for repair. Sets should be tagged to indicate the nature of the trouble. ***No attempt should be made to repair DS 407C in the field.***

2. SPECIAL TOOLS

2.01 In addition to the standard installation tools, installation of the data mountings will require the following special tool.

- TH-10 Hold-E-Zee® Screw-holding screwdriver, (Mfg by Upson Tools, Inc) or equivalent screw-holding screwdriver with 25 cm (10-in.) blade.

3. OPTIONS

3.01 Options for 407C multiple data station vary with application. Thirteen of the twenty-two telephone company (telco) options are installed on the circuit packs by means of Cambion shorting plugs which fit into numbered jacks on DS 407C-L1. Seven telco options are implemented by backplane wiring. Two telco options are implemented by means of a strap on the 229A power unit. Customer options on DS 407C-L1 are made by means of two groups of ten switches each on the front panel of the data set, providing a total of forty customer options, each of which applies to both lines. Installation of options should be made in accordance with the service order or the circuit layout record card. There are no options associated with the data units. ***Install telco options in DS***

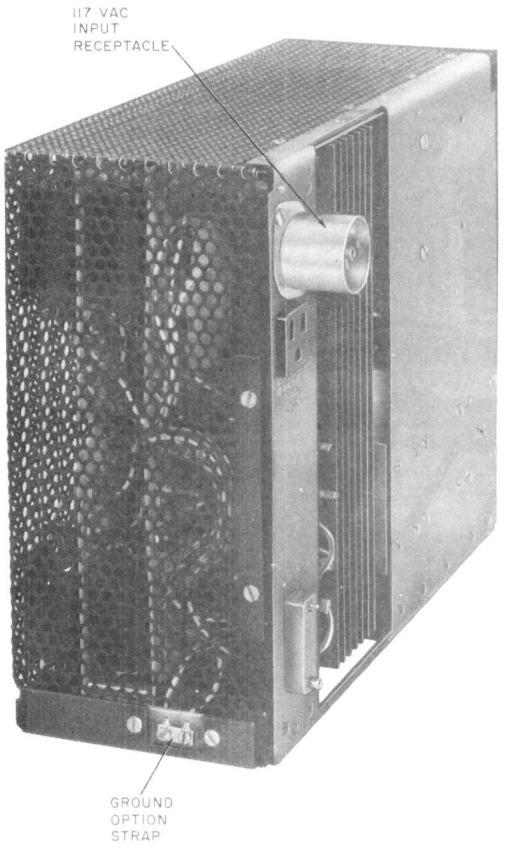


Fig. 5—229A Power Unit

407C-L1 as applicable before installing the data sets in the data mounting. Telco plug-type options which apply to DS 407C are illustrated in Fig. 7 and 8; plug, strap, and backplane wiring options are listed in Table A.

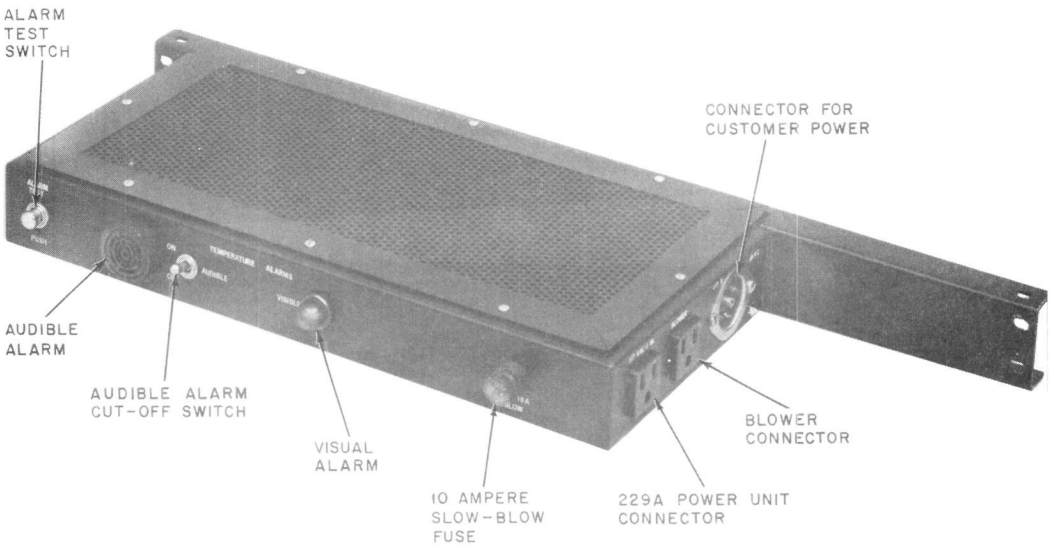


Fig. 6—81A Detector Removed From Cabinet

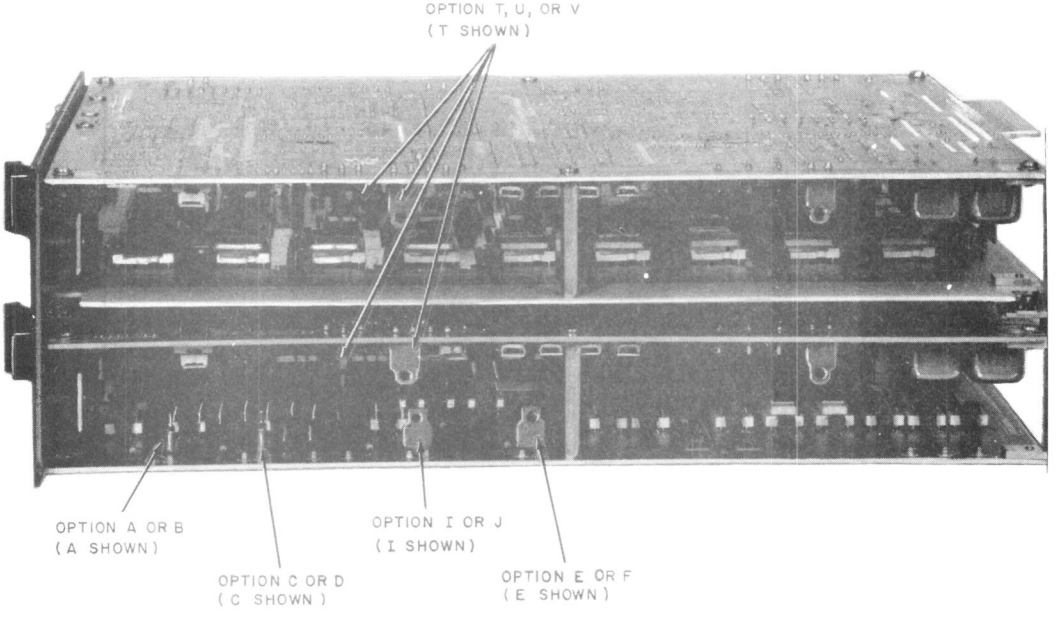


Fig. 7—Top View of DS 407C Showing Telco Option Plugs

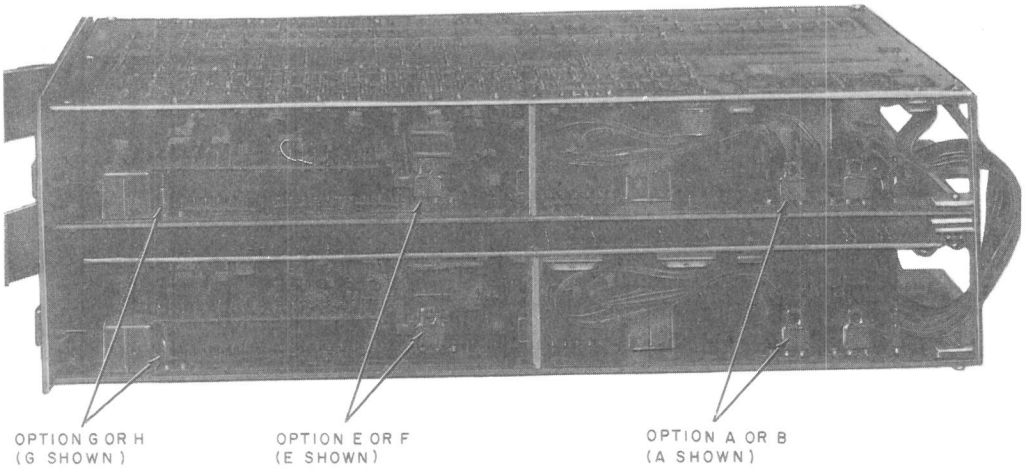


Fig. 8—Bottom View of DS 407C Showing Telco Option Plugs

Note: Some options are interdependent; the data sets will not function properly if improper option combinations are selected.

Telco Option Descriptions

3.02 The following describes the telco options:

(a) ***Option A***—This option provides switched telecommunications network operation.

(b) ***Option B***—This option provides private line (PL) operation. When this option is installed, the line control circuit of the data set is slaved to the customer's equipment such that the data set is placed on-line via the data terminal ready (DTR) customer interface lead.

(c) ***Option C***—This option is provided when there is an automatic call distributor (ACD) associated with the data station.

(d) ***Option D***—This option is provided when a CALL DIRECTOR or key telephone is associated with the data station. When referral is not provided, this option is used.

(e) ***Option E***—This option provides a serial customer interface per Electronic Industries Association (EIA) Standard RS-232-C. With this option, options G and I must be selected.

(f) ***Option F***—This option provides a parallel customer interface.

(g) ***Option G***—This option provides a voltage interface per EIA Standard RS-232-C. When this option is selected, customer option BH must also be selected.

(h) ***Option H***—This option provides a contact ***equivalent*** interface when option F is selected. When option H is selected, customer options AP and BG must also be selected.

(i) ***Option I***—This option enables terminal initiated referral, ▶computer down,◀ and automatic disconnect.

(j) ***Option J***—This option disables option I.

(k) ***Option K***—This option provides for "computer-down" detection by means of a customer-actuated switch. It is implemented by backplane wiring. ▶This switch must be provided locally and installed separately.◀

(l) ***Option L***—This option provides for "computer down" detection by means of all DTR leads being in the ***off*** condition simultaneously. ***It is provided unless disabled by backplane wiring.***

(m) ***Option M***—This option provides for "computer down" detection either by customer-actuated switch or by all DTR leads being ***off.*** It is implemented by backplane wiring. [See (k).]

(n) ***Option N***—"Computer down" detection not used. This option is implemented by backplane wiring.

(o) ***Option O***—This option provides out-of-service wiring by means of a tip-to-ring short.

(p) ***Option P***—This option provides out-of-service wiring by means of a third wire (sleeve) ground.

(q) ***Option Q***—This option provides out-of-service wiring by means of a short on a separate pair.

(r) ***Option R***—This option provides a connection from frame ground to signal ground on the 229A power unit.

(s) ***Option S***—This option removes connection between frame ground and signal ground on the 229A power unit.

(t) ***Option T***—This option provides a -4 dBm transmit level.

(u) ***Option U***—This option provides a -8 dBm transmit level.

(v) ***Option V***—This option provides a -13 dBm transmit level.

TABLE A

TELCO OPTIONS

OPTION			STRAPPING				
FEATURE	SELECTION	DESIG	ON BOTH LINE CONTROL BOARDS	ON TOUCH-TONE DETECTOR BOARD	ON TERMINAL BLOCK TB1	ON 229A POWER UNIT	REMARKS
Type of Operation	Switched Network	A	E20-E21	E10-E11	—	—	
	Private Line	B	E19-E20	E10-E12	—	—	
Used With ACD	Yes	C	—	E7-E8	—	—	
	No	D	—	E7-E9	—	—	
Interface Mode	Serial	E	E13-E14	E1-E2	—	—	If option E is installed, options G and I must also be installed.
	Parallel	F[1]	E14-E15	E2-E3	—	—	
Interface Type [2]	EIA Voltage	G	E16-E17	—	—	—	If option E is selected, option G must also be selected.[1]
	Contact Equivalent	H	E17-E18	—	—	—	
Call Control Code Detector	Enable	I	—	E1-E5	—	—	Option I enables terminal initiated referral, computer down, and automatic disconnect features of DS 407C if option F is used. If option E is installed, option I must also be installed.
	Disable	J	—	E5-E6	—	—	
Computer Down Detection	Switch	K	—	—	7-SG; 6-SWITCH[3]	SG-SWITCH[3] SG-TB1-7	These options are implemented by backplane wiring. *Note:* TB1 connecting blocks of all 57-type data mountings must be multipled.
	All DTR OFF	L	—	—	—	—	
	Switch or All DTR OFF	M	—	—	6-SWITCH [3]	SG-SWITCH [3]	
	Not Used	N	—	—	7-SG	SG-TB1-7	

TABLE A (Contd)

TELCO OPTIONS

OPTION			STRAPPING				
FEATURE	SELECTION	DESIG	ON BOTH LINE CONTROL BOARDS	ON TOUCH-TONE DETECTOR BOARD	ON TERMINAL BLOCK TB1	ON 229A POWER UNIT	REMARKS
Out -of-Service Wiring	Tip-Ring Short	O	—	—	—	—	OS1-T OS2-R (in J9 and J10)
	Third Wire Ground	P	—	—	—	—	OS1-FG OS2-third wire (in J10)
	Separate Pair Short	Q	—	—	—	—	OS1 OS2 OS pair (in J10)
Grounding	Frame Ground Connected to Signal Ground	R	—	—	—	SG-FG SHORT	Option R connects strap on power unit.
	Frame Ground and Signal Ground Not Connected	S	—	—	—	SG-FG OPEN[4]	Option S removes strap on power unit.
Transmit Level	−4 dBm	T	E1-E3; E5-E6	—	—	—	Sets transmit level to produce −12 dBm at serving CO.
	−8 dBm	U	E2-E3; E6-E7	—	—	—	
	−13 dBm	V	E3-E4; E7-E8	—	—	—	

Note 1: Switch must be operated.

Note 2: If option G is selected, customer option BH must also be selected; if option H is selected, customer options AP and RG must also be selected.

Note 3: SWITCH is a single-pole single-throw make contact provided locally and installed separately.

Note 4: SG paralleled to all data mountings.

Customer Option Descriptions

3.03 Customer options are summarized in Table B and described in the following paragraphs:

(a) ***Option AA***—This option causes the data set to disconnect the line when a TOUCH-TONE * # * is received from a remote terminal. Available with parallel or serial interface (option F or E).

(b) ***Option AB***—This option disables * # * line disconnect (option AA).

(c) ***Option AC***—This option places data set out of service if DTR is ***off*** more than 200 ms. Available with parallel or serial interface (option F or E).

(d) ***Option AD***—This option disables option AC.

(e) ***Option AE***—This option places data set out of service whenever OS lead is ***on.*** Available with parallel or serial interface (option F or E).

(f) ***Option AF***—This option disables option AE.

(g) ***Option AG***—This option will cause the data set to initiate a referral to an attendant on receipt of a TOUCH-TONE * * when computer is operative ("up"). Available with parallel or serial interface (option F or E).

(h) ***Option AH***—This option disables option AG.

(i) ***Option AI***—This option will cause the data set to initiate a referral to an attendant on receipt of a TOUCH-TONE * * when computer is inoperative ("down"). Available with parallel or serial interface (option F or E).

(j) ***Option AJ***—This option disables option AI.

(k) ***Option AK0***—This is one of ⧫eight⧫ options which select end-of-message (EOM) characters given to the computer after all control sequences. This option provides ***no*** EOM characters. ⧫The end-of-block (EOB) character expected from the computer is DC3 or ENQ.⧫ Available with serial interface only (option E).

(l) ***Option AL0***—This is one of ⧫eight⧫ options which select EOM characters given to the computer after all control sequences. This option provides the EOM character ***CR.*** ⧫The EOB character expected from the computer is DC3 or ENQ.⧫ Available with serial interface only (option E).

(m) ***Option AM0***—This is one of ⧫eight⧫ options which select EOM characters given to the computer after all control sequences. This option provides the EOM characters ***CR LF DC3.*** ⧫The EOB character expected from the computer is DC3 or ENQ.⧫ Available with serial interface only (option E).

(n) ***Option AN0***—This is one of ⧫eight⧫ options which select EOM characters given to the computer after all control sequences. This option provides the EOM character ***DC3.*** ⧫The EOB character expected from the computer is DC3 or ENQ.⧫ Available with serial interface only (option E).

(o) ⧫***Option AK1***—This is one of eight options which select EOM characters given to the computer after all control sequences. This option provides the EOM character ETX. The EOB character expected from the computer is DC3 or ENQ. Available with serial interface only (option E).⧫

(p) ⧫***Option AL1***—This is one of eight options which select EOM characters given to the computer after all control sequences. This option provides the EOM character EOT. The EOB character expected from the computer is DC3 or ENQ. Available with serial interface only (option E).⧫

(q) ⧫***Option AM1***—This is one of eight options which select EOM characters given to the computer after all control sequences. This option provides the EOM character ETX. The EOB character expected from the computer is DC3, ENQ, or ETX. Available with serial interface only (option E).⧫

(r) ⧫***Option AN1***—This is one of eight options which select EOM characters given to the computer after all control sequences. This option provides the EOM character EOT. The EOB character expected from the computer is DC3,

TABLE B

CUSTOMER OPTIONS

OPTION				
FEATURE	AVAIL*	SWITCH SELECTION	DESIG	REMARKS
# Line Disconnect	P or S	A1 ON	AA	Data set disconnects line when a TOUCH-TONE *#* is received with option AA. Option AB disables option AA.
		A1 OFF	AB	
OS Controlled by DTR	P or S	A2 ON	AC	Data set is out of service if DTR is *off* more than 200 ms with option AC. Option AD disables option AC.
		A2 OFF	AD	
OS Controlled by OS Lead	P or S	A3 ON	AE	Data set is out of service whenever OS lead is *on* with option AE. Option AF disables option AE.
		A3 OFF	AF	
Terminal Initiated Referral— Computer Up	P or S	A4 ON	AG	Data set will initiate a referral when computer is operative on receipt of a TOUCH-TONE ** with option AG.
		A4 OFF	AH	
Terminal Initiated Referral — Computer Down	P or S	A5 ON	AI	Data set will initiate a referral when computer is down on receipt of a TOUCH-TONE ** with option AI.
		A5 OFF	AJ	
End of Message 1 End of Message 2 End of Message 3	S	A6 OFF A6 ON A7 OFF A7 ON A8 OFF A8 ON		Selects end of message (EOM) characters given to computer after all control sequences and end of block (EOB) characters expected from computer. Selected as follows:

	A6	A7	A8	EOM	EOB
AK0	OFF	OFF	OFF	None	DC3 or ENQ
AL0	ON	OFF	OFF	CR	DC3 or ENQ
AM0	OFF	ON	OFF	CR LF DC3	DC3 or ENQ
AN0	ON	ON	OFF	DC3	DC3 or ENQ
AK1	OFF	OFF	ON	ETX	DC3 or ENQ
AL1	OFF	ON	ON	EOT	DC3 or ENQ
AM1	ON	OFF	ON	ETX	DC3, ENQ, or ETX
AN1	ON	ON	ON	EOT	DC3, ENQ, or EOT

Binary Coded Matrix	P	A8 ON	AO	BCM output from data set (with options F, G, and BH only).
		A8 OFF	AP	2-out-of-8 output from data set, with option F only.

TABLE B (Contd)

CUSTOMER OPTIONS

OPTION				REMARKS
FEATURE	AVAIL*	SWITCH SELECTION	DESIG	
Speed Select 1	S	A9 ON	AQ	Data speed is 110 bps with option AQ. Data speed is 150 bps with option AR unless overridden by option BI.
		A9 OFF	AR	
Message Blocking	S	B1 ON	AS	Data set translates TOUCH-TONE ## into X EOM; computer must "block" outgoing messages by ending them with DC3 or with ENQ, option AS. If option AT is selected, switches B2 through B8 must be *off*.
		B1 OFF	AT	
STX/ETX Punctuation	S	B2 ON	AU	Data set will add ASCII characters STX and translate DC3 to ETX on all FSK messages, with options AU *and* AS. With option AV, DC3 will be transmitted.
		B2 OFF	AV	
Error Control	S	B3 ON	AW	Option AW (with option AS) provides data set compatibility with error control features of transaction telephone, as follows: (1) Adds STX, ETX, and LRC to all FSK messages. (2) On incoming messages, data set checks LRC and CCT, and notifies computer of validity of message: good, bad, or no check. (3) When FSK messages or timed answer-tones are sent out, a data set timer is set and computer is notified if anticipated response is not received in time. (4) Option AW is disabled if the leading TOUCH-TONE "b" is not received. Option AX disables option AW.
		B3 OFF	AX	
Positive Acknowledgment	S	B4 ON	AY	Option AY (with options AS and AW) provides an acknowledgment of receipt of a correct message within the time-out period by sending the ASCII sequence A EOM to the computer. Option AZ disables this feature.
		B4 OFF	AZ	
Data Flow Control Protocol	S	B5 ON	BA	Option BA (with option AS) allows data set to control flow of data across customer interface. Permits computer to put FSK on-line only when remote terminal is not transmitting and passes data to computer only when computer signifies it is ready.
		B5 OFF	BB	

TABLE B (Contd)

CUSTOMER OPTIONS

OPTION				REMARKS
FEATURE	AVAIL*	SWITCH SELECTION	DESIG	
Logon/Sign-on	S	B6 ON	BC	Option BC (with options AS and BA) allows transaction telephone to communicate with computers which require Logon characters. If option BE is also present, then option BD provides for a fixed sign-on in addition to a Logon.
		B6 OFF	BD	
Multiple Message Segments	S	B7 ON	BE	Option BE (with options AS and BA) permits data set "handshaking" required by certain computers which allow multiple-segmented messages. The type of "handshaking" depends on option BC or BD.
		B7 OFF	BF	
Closure Type/ EIA Voltage Interface	P	B8 ON	BG	Contact equivalent or closure type
		B8 OFF	BH	EIA voltage; option BH must be used with telco option G. This option is required whenever option E or AO is used. Option BG must be used with telco options F and H and option AP only.
Speed Select 2	S	B9 ON	BI	Option BI (with option AR) provides data speed of 300 bps. Options BI and AQ cannot be used together.
		B9 OFF	BJ	

* P denotes parallel interface; S denotes serial interface.

Note: Switches A10 and B10 unassigned.

ENQ, or EOT. Available with serial interface only (option E).◀

(s) ***Option AO***—This option provides a binary coded matrix (BCM) output from the data set. Available with parallel interface and EIA voltage interface only (options F and G). (See Table F for BCM code.)

(t) ***Option AP***—This option provides a 2-out-of-8 output from the data set. Available with parallel interface only (option F). (See figure entitled ***TOUCH-TONE Dial Frequency Assignments*** in Section 594-800-102.)

(u) ***Option AQ***—This option provides a data speed of 110 bps. Available with serial interface only (option E).

(v) ***Option AR***—This option provides a data speed of 150 bps unless overridden by option BI. Available with serial interface only (option E).

(w) ***Option AS***—This option causes the data set to translate an incoming TOUCH-TONE ## into X EOM; the computer must then "block" messages by ending them with DC3 ▶or ENQ.◀ Available with serial interface only (option E).

(x) ***Option AT***—This option disables option AS. When this option is selected, customer option switches B2 through B8 must be ***off.***

(y) ***Option AU***—With this option ***and*** option AS, the data set will add ASCII character STX at the start of an FSK response message

and translate DC3 to ETX on all FSK response messages. Available with serial interface only (option E).

(z) ***Option AV***—With this option, the data set will ▶not punctuate FSK messages as in (y). DC3 will be transmitted.◀

(aa) ***Option AW***—This option, together with option AS, provides data set compatibility with the error control features of the transaction telephone, as follows:

(1) Adds STX, ETX, and LRC (start of text, end of text, and longitudinal redundancy check, respectively) to all FSK messages.

(2) On incoming messages, the data set checks LRC and CCT (character count), and notifies the computer of the validity of the message: good, bad, or no check.

(3) When FSK messages or timed answer-tones are sent out, a data set timer is actuated and the computer is notified if anticipated response is not received during the timed interval.

(4) This option is disabled if the first incoming TOUCH-TONE character is not a "b" (A_2 B_4).

(ab) ***Option AX***—This option disables option AW.

(ac) ***Option AY***—This option, together with options AS and AW, causes the data set to indicate receipt of a correct acknowledgment within the time-out period (mentioned under option AW) by sending the ASCII sequence A EOM to the computer. Available with serial interface only (option E).

(ad) ***Option AZ***—This option disables option AY.

(ae) ***Option BA***—This option, together with option AS, provides data flow control protocol by allowing the data set to control the flow of data across the customer interface and telephone line. This allows the computer and remote terminal to alternately use the line for transmitting. In addition, the data set will pass data to the computer only when the computer signifies it is ready. Available with serial interface only (option E).

(af) ***Option BB***—This option disables option BA.

(ag) ***Option BC***—This option, together with option AS, allows transaction telephones to communicate with computers which require Logon characters. Available with serial interface only (option E).

(ah) ***Option BD***—With option BF, this option disables option BC.

(ai) ***Option BE***—This option, together with options AS and BA, permits data set "handshaking" required by certain computers which allow multiple-segmented messages. The type of "handshaking" depends on option BC or BD. Available with serial interface only (option E).

(aj) ***Option BF***—This option disables option BE.

(ak) ***Option BG***—This option, together with option H, provides a contact equivalent or closure-type interface with the computer. Available with parallel interface (option F) and 2-out-of-8 interface (option AP) only.

(al) ***Option BH***—This option together with option G, provides an EIA voltage interface with the computer. This option must be used when option E (serial interface) or option AO (BCM interface) is selected.

(am) ***Option BI***—This option, together with option AR, provides a data speed of 300 bps. Available with serial interface only (option E).

(an) ***Option BJ***—This option disables option BI.

4. CUSTOMER INTERFACE INFORMATION

4.01 Either serial or parallel operation is provided in DS 407C by option. Interface lead functions and mnemonics for DS 407C operating in the serial mode are given in Table C.

4.02 Interface lead functions and mnemonics for parallel operation with 2-out-of-8 output are given in Table D. Interface lead functions and

TABLE C

CUSTOMER INTERFACE LEAD FUNCTIONS – SERIAL MODE

PIN NO.	FUNCTION	DATA SET MNEMONIC	EIA DESIGNATION (RS-232-C)
1	Frame Ground	FG	AA
2	Send Data	SD	BA
3	Receive Data	RD	BB
4	Request to Send (Not Used)	RS	CA
5	Clear to Send	CS	CB
6	Data Set Ready	DSR	CC
7	Signal Ground	SG	AB
8	Data Carrier Detector	DCD	CF
9	(Connected to 8)	—	—
10-13	Not Used	—	—
14	(Connected to 22)	—	—
15,16	Not Used	—	—
17	Voice Answer-Back A	VAA	Non-EIA
18	Voice Answer-Back B	VAB	Non-EIA
19	Not Used	—	—
20	Data Terminal Ready	DTR	CD
21	Not Used	—	—
22	Ring Indicator	RI	CE
23,24	Not Used	—	—
25	Out-of-Service	OS	Non-EIA

mnemonics for parallel operation with BCM output are given in Table E. The BCM code is given in Table F.

5. INSTALLATION AND CONNECTION PROCEDURE

5.01 The front cover of the 57-type data mounting is removable (by opening to a horizontal position and sliding the cover to the right to clear the stud and then to the left to remove the pivot pin from its mounting hole). A decal is attached to the inside cover of each of the 57-type data mountings, which provides the data set number, telephone number, and computer port number for each data set in the data mounting. Another decal is attached to the inside cover of the 57A-type data mounting, which provides local test information.

5.02 Perform the installation and connection procedure for the 407C multiple data station as follows:

STEP	PROCEDURE
	Do not apply power to the cabinet or any of the related components of the data station until the complete station has been installed except for insertion of data sets. The data sets are to be installed one at a time and tested per Section 594-800-502 before the next data set is installed.

STEP	PROCEDURE

TABLE D

CUSTOMER INTERFACE LEAD FUNCTIONS – PARALLEL MODE
WITH 2-OUT-OF-8 OUTPUT

PIN NO.	FUNCTION	DATA SET MNEMONIC
1	Frame Ground	FG
2	One-Half of Voice Receive Pair	VRA
3	A-Group Frequency Identifier	A1
4	A-Group Frequency Identifier	A2
5	A-Group Frequency Identifier	A3
6	A-Group Frequency Identifier	A4
7	Not Used	—
8	One-Half of Voice Receive Pair	VRB
9	B-Group Frequency Identifier	B1
10	B-Group Frequency Identifier	B2
11	B-Group Frequency Identifier	B3
12	B-Group Frequency Identifier	B4
13	Not Used	—
14	Ring Indicator	RI
15	Attendant Request	AR
16	Data Present Indicator	DP
17	Voice Answer-Back A	VAA
18	Voice Answer-Back B	VAB
19	Data Mode Indicator	DM
20	Tone Answer-Back Control	TAB
21	Data Receiver Enable	DR
22	Data Terminal Ready	DTR
23	Data Set Ready	DSR
24	Signal Ground	SG
25	Out-of-Service	OS

1 Position the KS-20018-L20 cabinet near the customer-provided 60-Hz power outlet and CPE interface cords as described in paragraph 1.06.

2 Gain access to rear of cabinet. Install 81A detector in top of cabinet using four screws provided with detector. (Use top two mounting holes.)

Note: For ease of installation of the 57-type data mounting(s), the KS-20018-L20 cabinet may be placed ***face down*** during installation of the mounting(s).

STEP PROCEDURE

TABLE E

CUSTOMER INTERFACE LEAD FUNCTIONS – PARALLEL MODE WITH BCM OUTPUT

PIN NO.	FUNCTION	DATA SET MNEMONIC
1	Frame Ground	FG
2	One-half of Voice Receive Pair	VRA
3	Received Data 1	RD1
4	Received Data 2	RD2
5	Received Data 3	RD3
6	Received Data 4	RD4
7	Not Used	—
8	One-half of Voice Receive Pair	VRB
9—13	Not Used	—
14	Ring Indicator	RI
15	Attendant Request	AR
16	Data Present Indicator	DP
17	Voice Answer-Back A	VAA
18	Voice Answer-Back B	VAB
19	Data Mode Indicator	DM
20	Tone Answer-Back Control	TAB
21	Data Receiver Enable	DR
22	Data Terminal Ready	DTR
23	Data Set Ready	DSR
24	Signal Ground	SG
25	Out-of-Service	OS

3 Gain access to ♦back♦ of cabinet.

Note: Eight No. 12 mounting screws are supplied with each 57-type data mounting.

4 Remove front cover of each 57-type data mounting to be installed.

5 Mount 57A-type data mounting at bottom of cabinet. If cabinet was placed face down, stand cabinet upright.

6 Remove 51A-type data unit by removing two screws in top of data unit and carefully pull forward to gain access to power supply mounting holes.

STEP PROCEDURE

TABLE F

BCM CODE

SYMBOL	RECEIVE DATA LEADS			
	RD1	RD2	RD3	RD4
1	1	0	1	0
2	1	0	0	1
3	1	0	1	1
4	0	1	1	0
5	0	1	0	1
6	0	1	1	1
7	1	1	1	0
8	1	1	0	1
9	1	1	1	1
0	0	0	0	1
*	0	0	1	0
#	0	0	1	1
a	1	0	0	0
b	0	1	0	0
c	1	1	0	0
d	0	0	0	0

1 = MARK = — voltage
0 = SPACE = + voltage

7 Install 229A power unit from rear in the 57A-type data mounting and secure with two screws in front and one screw in side of power unit.

8 Replace 51A-type data unit and secure, using two screws removed in Step 6.

9 Store data unit cable along left side of power unit.

10 If more than four DS 407Cs are to be installed, mount a 57B-type data mounting above the 57A-type data mounting. Provide 2 to 2-1/2 inches between data mountings.

11 If cabinet was turned face ♦down♦ for installation of 57B-type data mounting, place cabinet in upright position.

12 Install 229A power unit in 57B-type data mounting from rear of cabinet and secure.

STEP	PROCEDURE

13 Connect a KS-14532-L24 6-foot power cable between the side of the bottom 229A power unit and the receptacle labeled "117 VAC/9A" on the 81A detector (Fig. 6). Connect blower cable to receptacle labeled BLOWER. Connect another KS-14532-L24 6-foot power cord from the upper power unit to the 117 Vac outlet in the lower power unit, if used.

14 Connect seven wires from TB1 of the 57B-type data mounting to TB1 of the 57A-type data mounting, terminal for terminal (ie, 1 to 1, 2 to 2, etc) per Fig. 9.

15 Verify that terminals SG and FG on 229A power unit are connected together (option R) per Fig. 5. If the service order or circuit layout record card requires that signal ground ***not*** be connected to frame ground (option S), remove the strap between SG and FG on 229A power unit per Fig. 5. Connect SG on 57A-type data mounting to SG on 57B-type data mounting.

16 Insert telephone connector plugs (A25D connector cable equipped with KS-16689-L3 plug) as required into J9, J10, J11, and J12 located on the rear of each 57-type data mounting. Route the A25D connector cables, as required, through the slot in the left side of the data mounting and out the bottom of the cabinet to the connecting block and terminate per Table G.

17 Connect service line to pins 48 and 23 of the A25D connector cable going to J10 of the 57A-type data mounting as shown in Fig. 9.

Note: For private line systems (option B), connect tip and ring pairs ***only*** per Table G. The remainder of the arrangement is connected per customer requirement.

18 If a 2B or 3A ACD is specified on the service order or circuit layout record card it must be locally engineered.

19 Connect the central office telephone lines to the tip and ring pairs of the data sets at the connecting block per Table G.

20 Wire the out-of-service option (O, P, or Q) per local engineering or circuit layout record card in ***one of the three ways*** per Table A and Fig. 10 for each data set in the 57-type data mounting.

Note: The out-of-service option is only used in non-ACD switched network systems (telco options D and A, respectively).

21 Wire the computer down detection option (K, L, M, or N) as specified on the service order or circuit layout record card, in accordance with Table A.

22a If key telephone sets, or CALL DIRECTORS are specified on the service order or circuit layout record card—
Make connections from connecting block to CALL DIRECTORS or key telephone sets. Refer to Fig. 11 for a functional wiring arrangement from data set number 1 to the CALL DIRECTOR or key telephone set. Referral systems must be locally engineered.

22b If an 801 ACU is used, install per Fig. 12 and local engineering information.

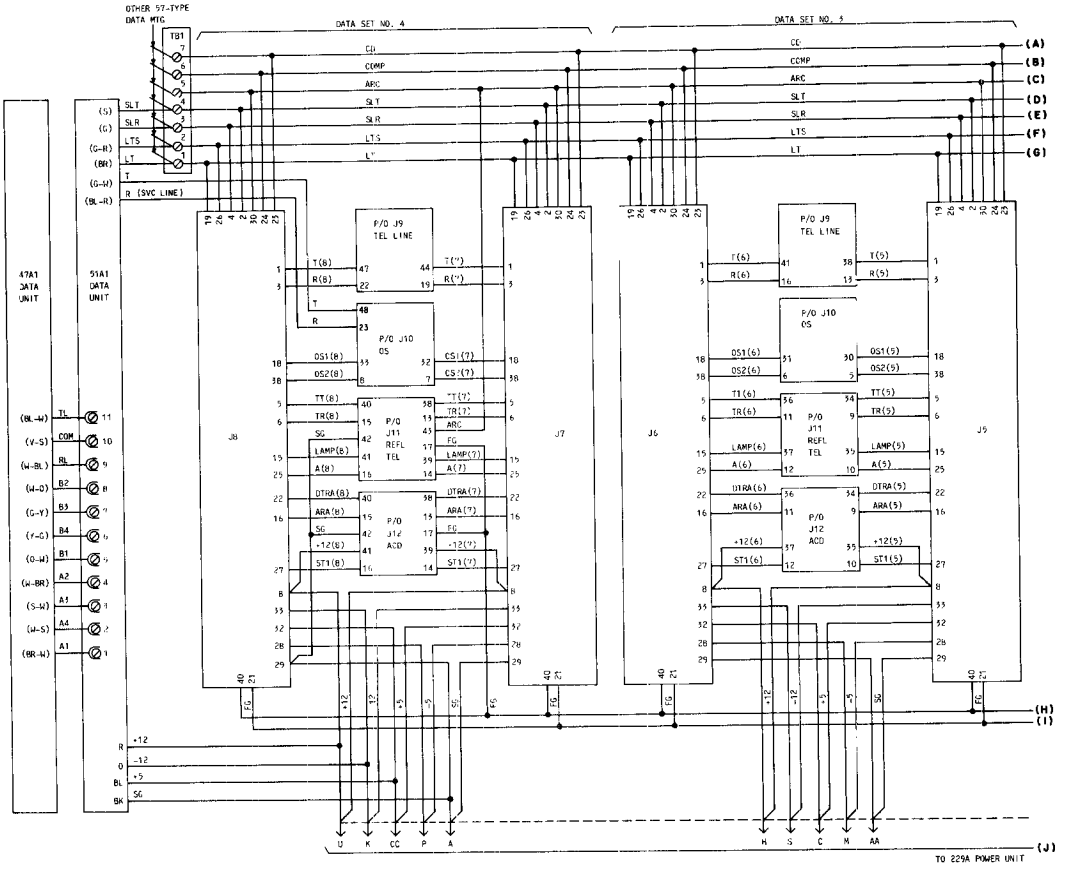


Fig. 9—57-Type Data Mounting and DS 407C—Interconnection Diagram (Sheet 1 of 2)

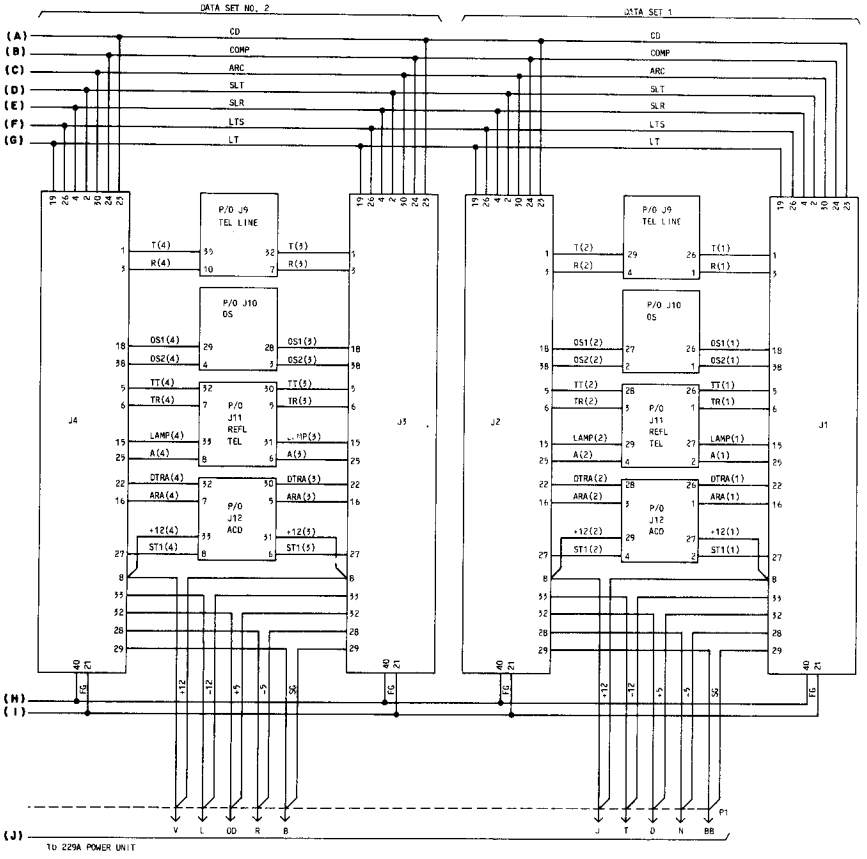


Fig. 9—57-Type Data Mounting and DS 407C—Interconnection Diagram (Sheet 2 of 2)

STEP PROCEDURE

TABLE G

TELEPHONE INTERFACE CONNECTIONS FOR DS 407C-L1

DATA SET		J9 CABLE PAIRS		J10 CABLE PAIRS				J11 CABLE PAIRS				J12 CABLE PAIRS			
NO.	LINE	TIP	RING	OS1	OS2	SVC LINE T	SVC LINE R	TT	TR	LAMP	A	DTRA	ARA	+12	ST1
1	A	26	1	26	1	48	23	26	1	27	2	26	1	27	2
	B	29	4	27	2	48	23	28	3	29	4	28	3	29	4
2	A	32	7	28	3	48	23	30	5	31	6	30	5	31	6
	B	35	10	29	4	48	23	32	7	33	8	32	7	33	8
3	A	38	13	30	5	48	23	34	9	35	10	34	9	35	10
	B	41	16	31	6	48	23	36	11	37	12	36	11	37	12
4	A	44	19	32	7	48	23	38	13	39	14	38	13	39	14
	B	47	22	33	8	48	23	40	15	41	16	40	15	41	16

23 If ***multiple*** KS-20018-L20 cabinets are used (more than eight data sets in the system) equip additional cabinet(s) per Steps 1 through 22. Multiple TB1 terminals 5, 6, and 7 of all cabinets. If option S is used, signal ground (SG) must be multipled.

24 Connect the 10-foot KS-14532-L16 power cord from the 81A detector to a 117-volt 60 ±0.1 Hz ac outlet that is not under control of a switch.

25 Verify that specified telco options are installed in all data sets.

26 Install first data set in position 1 and perform installation test per Section 594-800-502. After the first data set has passed test, install second data set in position 2 and test. Install remaining data sets one at a time in position sequence and test each data set as it is installed.

27 After all data sets have been installed and passed installation test, install front covers on 57-type data mounting(s). Install all front and rear covers on cabinet(s).

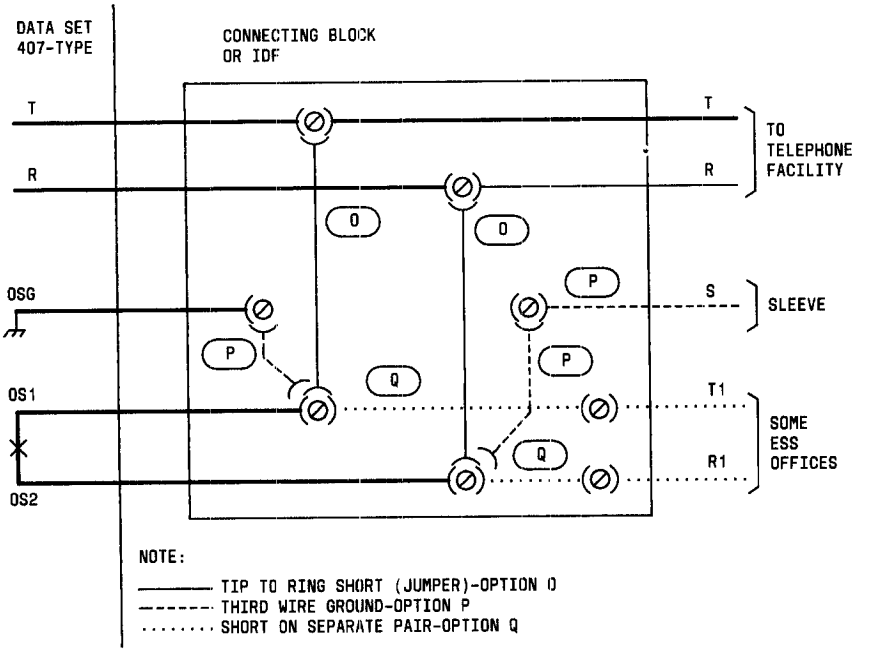


Fig. 10—Out-of-Service Wiring Connections for One DS 407C-L1

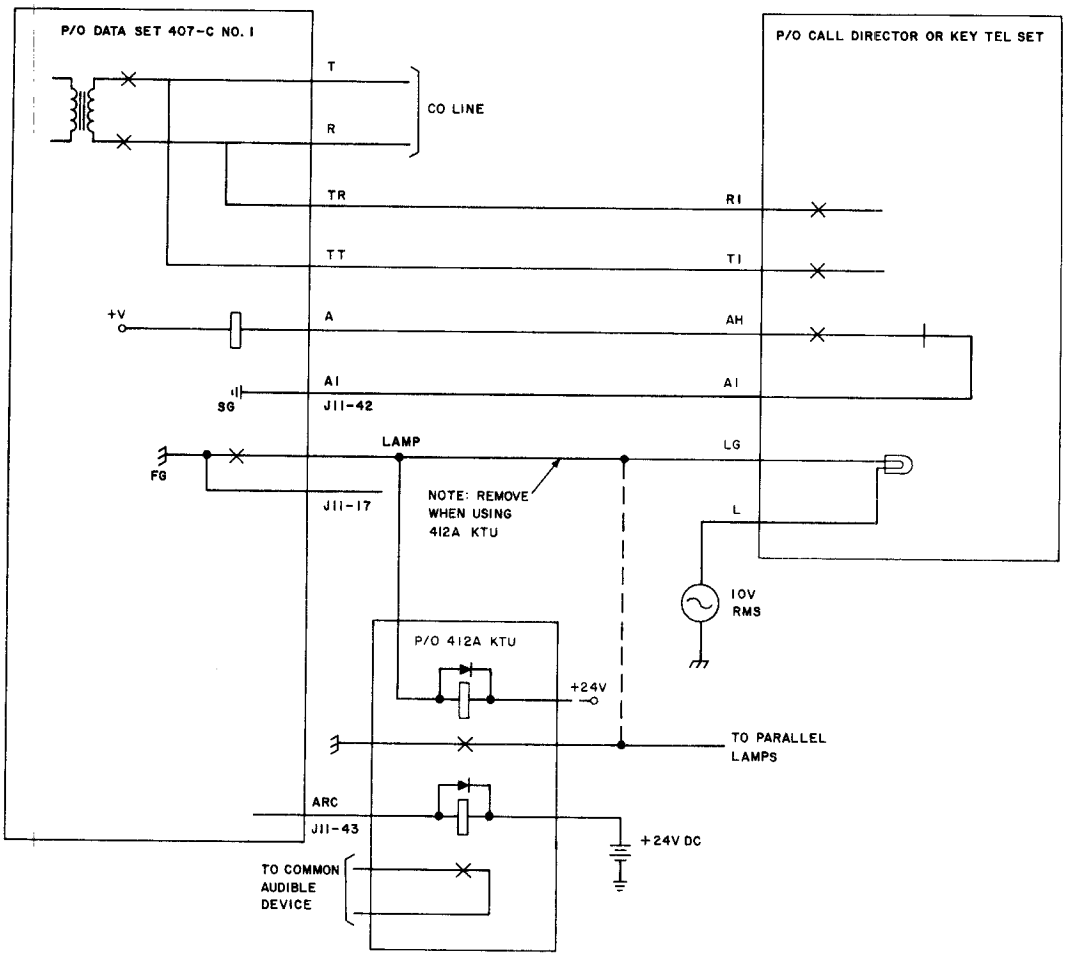


Fig. 11—Functional Wiring Arrangement From DS 407C to CALL DIRECTOR or Key Telephone Set

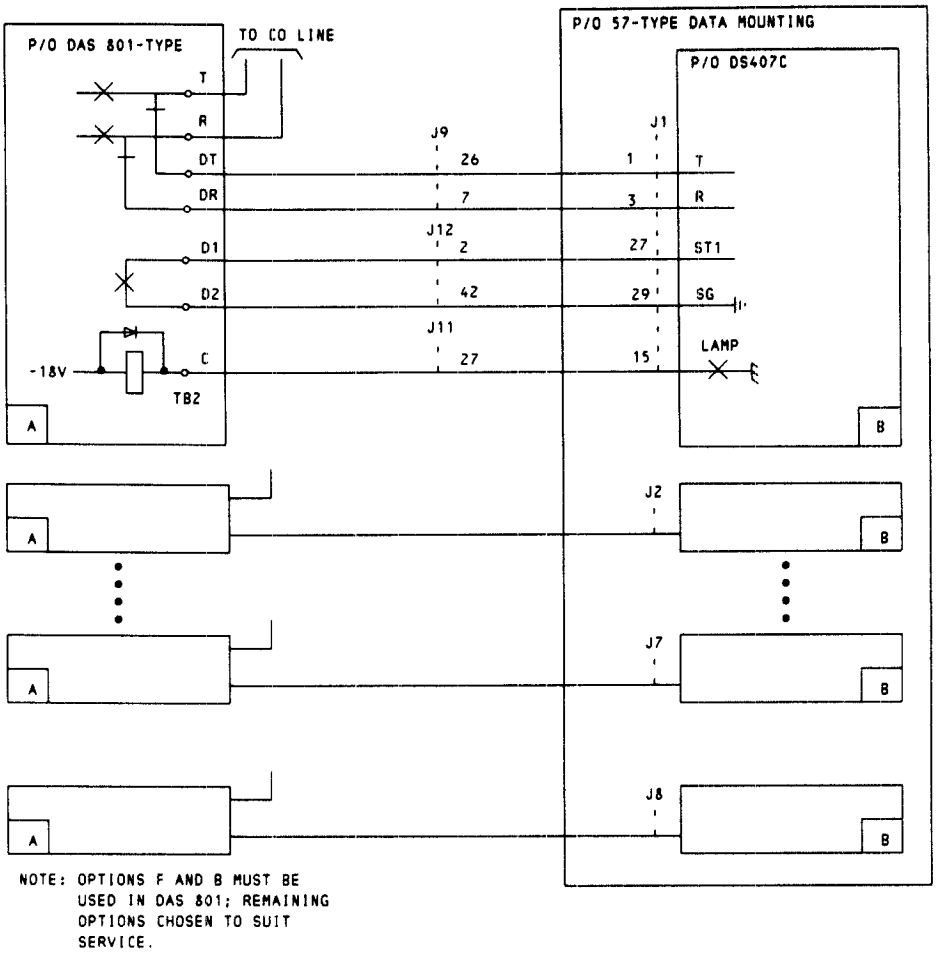


Fig. 12—Connections for Data Auxiliary Set 801-Type in 407C Multiple Data Station

407C MULTIPLE DATA STATION
TEST PROCEDURES

CONTENTS PAGE

1. GENERAL 1
2. INSTALLATION TEST 1
3. LOCAL TEST 4
4. REMOTE TEST 6
5. POWER UNIT TEST 7

1. GENERAL

1.01 This section describes the test procedures and associated test requirements to be met at the time of installation or when investigating trouble conditions associated with the 407C multiple data station.

1.02 This section is reissued to show data set (DS) 407C-L1, series 1 rated manufacture discontinued (MD) and to show DS 407C-L1, series 2 as the replacement. DS 407C-L1, series 2 provides four additional end-of-message (EOM) characters, which are customer options. Due to extensive changes, arrows ordinarily used to indicate changes have been omitted.

1.03 Before proceeding with any test, verify that the data loops have been tested and meet requirements specified for Type I loops described in the section entitled Data Systems—DATAPHONE® Service on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines (314-205-501) or for basic private lines as outlined in the section entitled Voiceband Private Line Data Circuits—Tests and Requirements (314-410-500).

1.04 When test or demonstration calls are made, refer to the section entitled Crediting Charges on Test Calls (010-250-001) for the proper procedure for crediting charges.

1.05 The 407C multiple data station contains a test unit, consisting of the 51A-type and 47A-type data units, which is provided with the 57A-type data mounting. The test unit provides both local and remote testing capabilities for all data sets (DS) 407C mounted in the cabinet. The test unit also provides a lamp test feature for all the light emitting diodes (LEDs) in the cabinet.

1.06 When a data set is placed in the remote test mode, the data set is connected to a service line and then tested by a data test center (DTC). The local test may be conducted by the customer or telephone company (telco) employee using the test unit. A typical test arrangement is shown in Fig. 1.

1.07 The test procedures given in this section are for one line of one data set and must be repeated for the second line and for each line of any additional data sets in the data station.

1.08 A KS-20538-L1 volt-ohm-milliammeter (VOM), or equivalent, is needed to perform the power unit test. A 1013-type handset, or equivalent, is required for the installation test.

2. INSTALLATION TEST

2.01 This test is performed during installation prior to connecting the customer interface cables to the data sets mounted in the 57-type data mounting. The test verifies that the data set is functioning properly prior to connecting the customer-provided equipment (CPE) to the data set.

2.02 Perform the installation test as follows:

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Not for use or disclosure outside the
Bell System except under written agreement

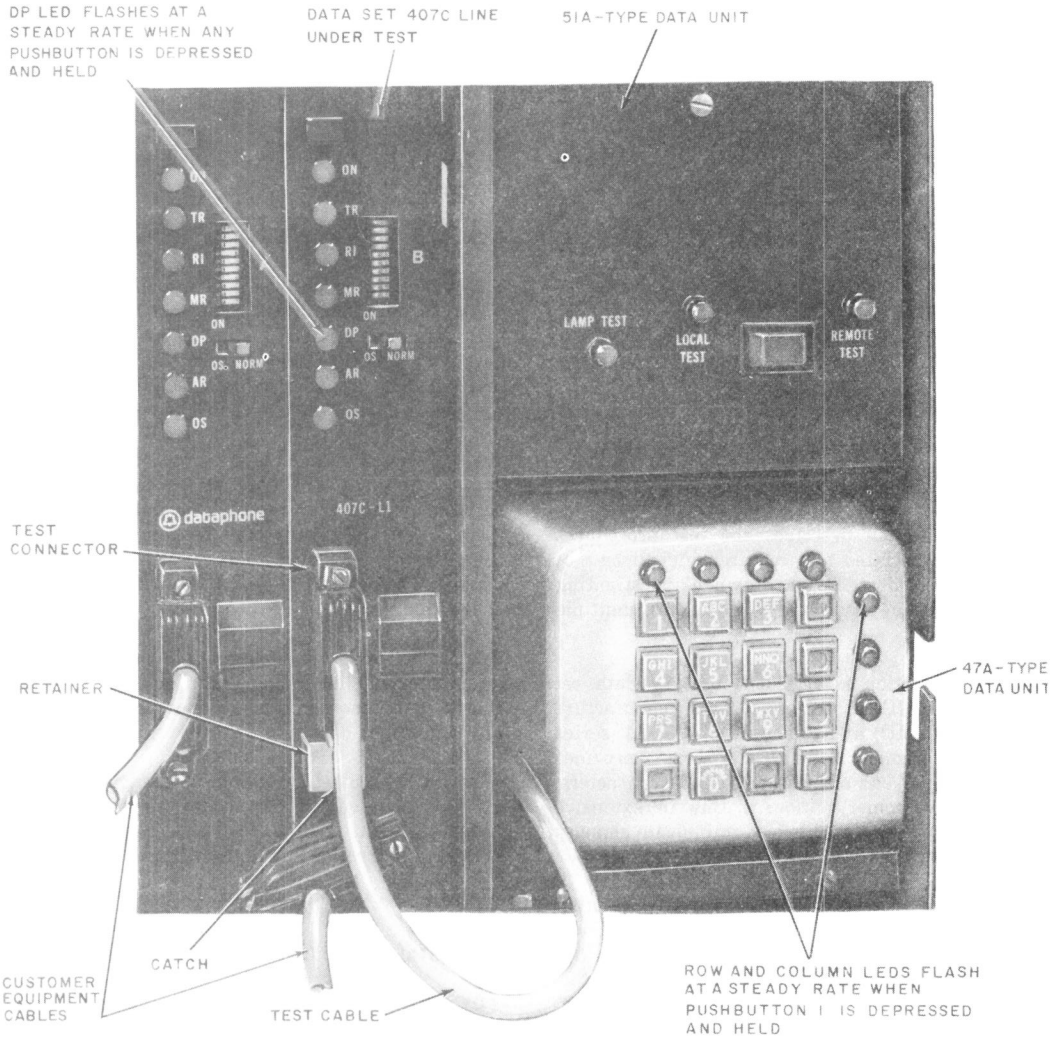


Fig. 1—Data Set 407C Test Arrangement

STEP	PROCEDURE

Note: Install data set No. 1 and test lines A and B. Install data set No. 2 and test, etc, until the last data set has been installed and tested.

STEP	PROCEDURE
1	Operate LOCAL TEST-REMOTE TEST switch to REMOTE TEST.
2	Depress LAMP TEST switch. ***Requirement:*** All LEDs illuminate.
3	Plug the test connector into data set line A by operating the catch located on the pushbutton retainer. ***The retainer provides a means of depressing the TEST button located on the front of the data set. Ensure that retainer is fully engaged.*** ***Requirement:*** The TR and OS LEDs illuminate on the line being tested.
4	Operate LOCAL TEST-REMOTE TEST switch on test unit (51A-type data unit) to LOCAL TEST position. ***Requirement:*** The LOCAL TEST LED illuminates immediately. The MR LED illuminates after a short delay of not more than 10 seconds. During this delay, the AR and RI LEDs will flash. ***Note:*** If the MR LED does not illuminate within 10 seconds, the data set is defective. Record the LED indications on the 47A-type data unit and supply this information with the data set when it is returned for repair.
5	Depress and hold pushbutton 1 on the 47A-type data unit. ***Requirement:*** Associated row and column LEDs (on the 47A-type data unit) and DP LED (on the data set line being tested) flash at a steady rate (10 pulses per second). Refer to Fig. 1 for an example of which LEDs are flashing on the 47A-type data unit when pushbutton 1 is depressed.
6	Repeat Step 5 for all other pushbuttons on the 47A-type data unit. If customer option switch A4 is ON (option AG), the AR LED will light or flash when the * button is depressed. ***Note:*** If some LEDs do not flash properly, replace the associated data set. Verify that replacement data set has proper telco and customer options installed, then repeat the test.
7	Connect a 1013-type handset across the service line tip and ring (pins 48 and 23 of J10, respectively).
8	Operate the TALK-MON switch on the handset to TALK.
9	Operate LOCAL TEST-REMOTE TEST switch to REMOTE TEST position. ***Requirement:*** The MR and LOCAL TEST LEDs are extinguished.
10	Call the ring-back number using the 1013-type handset.
11	Operate TALK-MON switch on the handset to MON.

STEP	PROCEDURE
	Requirement: After ringing is tripped, monitor the following: • REMOTE TEST LED illuminated • 2025-Hz answer tone is heard in handset (for 1.5 seconds) • One second of silence • 2225-Hz tone is heard in handset (for 14 seconds) • FSK "chirping" is heard • MR LED illuminated • 2025-Hz answer tone is heard in handset. ***Note:*** Data set will automatically disconnect and extinguish REMOTE TEST LED after 15 seconds.
12	Remove test connector from data set line A by operating the catch on the retainer.
13	Plug customer interface connector into data set line A and tighten screws.
14	Repeat test as required for line B and for lines A and B of all other data sets as they are mounted in the 57-type data mounting(s).
15	Remove 1013-type handset leads from service line.
16	Perform remote test per Part 4 of this section on any one data line. ***Note:*** This verifies the ability to perform a remote test.
17	End of installation test.

3. LOCAL TEST

3.01 This test checks the operation of a DS 407C under normal input conditions via the 47A-type data unit (modified 16-button TOUCH-TONE® dial). The local test does ***not*** check the line control circuit. When a character is transmitted from the dial and received by the data set, the LEDs representing the horizontal and vertical coordinates of the character key will flash at a steady rate if the data set is functioning properly.

3.02 Perform the local test as follows:

STEP	PROCEDURE
1	Operate LOCAL TEST-REMOTE TEST switch to REMOTE TEST.

STEP	PROCEDURE
2	Depress LAMP TEST switch. ***Requirement:*** All LEDs illuminate on all data sets in the cabinet and on the 51A-type and 47A-type data units.
3	Remove customer interface cable from data set line to be tested.
4	Plug the test connector into data set line A by operating the catch located on the pushbutton retainer. ***The retainer provides a means of depressing the TEST button located on the front of the data set. Ensure that retainer is fully engaged.*** ***Requirement:*** The OS and TR LEDs illuminate on the data set line being tested.
5	Operate LOCAL TEST-REMOTE TEST switch on test unit (51A-type data unit) to LOCAL TEST position. ***Requirement:*** The LOCAL TEST LED illuminates immediately. The MR LED illuminates after a short delay of not more than 10 seconds. During this delay, the AR and RI lamps will flash. ***Note:*** If the MR LED does not illuminate within 10 seconds, the data set is defective. Record the LED indications on the 47A-type data unit and supply this information with the data set when it is returned for repair.
6	Depress and hold pushbutton 1 on the 47A-type data unit. ***Requirement:*** Associated row and column LEDs (on the 47A1 data unit) and DP LED (on the data set line being tested) flash at a steady rate (10 pulses per second). Refer to Fig. 1 for an example of which LEDs are flashing on the 47A-type data unit when pushbutton 1 is depressed.
7	Repeat Step 6 for all other pushbuttons on the 47A-type data unit. If customer option switch A4 is ON (option AG), the AR LED will light or flash when the * button is depressed. ***Note:*** If some LEDs do not flash properly, replace the associated data set. Verify that the replacement data set has proper telco and customer options installed to correspond to the data set being replaced; then perform installation test and local test.
8	Remove test connector from data set line A by operating the catch on the retainer.
9	Plug customer interface connector into data set line A and tighten screws.
10	Repeat test as required for line B, and for lines A and B for all other data sets to be tested.
11	Return station to pretest condition.

4. REMOTE TEST

4.01 This test provides a thorough check of the data set. The line control circuitry is checked along with all options and parameters such as sensitivity and bandwidth. In the remote test mode, the data set under test is connected to a service line associated with the installation and called by the DTC. Since the 407C multiple data station is normally on a hunting group, the service line provides a means of accessing a particular data set.

4.02 Perform the remote test as follows:

STEP	PROCEDURE
1	Call the DTC and arrange for a remote test in accordance with DTC procedures.
2	Remove customer interface cable from line A of the data set to be tested.
3	Operate LOCAL TEST-REMOTE TEST switch on the test unit to REMOTE TEST position.
4	Plug the test connector into data set line A by operating the catch located on the pushbutton retainer, placing the data set in the test mode. ***The retainer provides a means of depressing the TEST button located on the front of the data set. Ensure that retainer is fully engaged.*** ***Requirement:*** The OS and TR LEDs illuminate on the data set line under test.
5	When the DTC calls the DS 407C under test, observe the following: ***Requirements:*** • RI LED flashes one or two times. • REMOTE TEST LED illuminates. • After up to 30-second delay, MR LED illuminates. During delay, RI and AR LEDs will flash briefly.
6	When the DTC transmits a valid TOUCH-TONE character, observe the following: ***Requirements:*** • The DP LED (on data set line under test) flashes at a steady rate (10 pulses per second). • On the 47A-type data unit, the row and column LEDs associated with the character being transmitted by the DTC will also flash at a steady rate (10 pulses per second). • When * is transmitted, the AR LED may illuminate or flash.
7	When all the remote test is completed, the DTC transmits a ***hang-up*** character "a" which terminates the call. The call will also be terminated automatically if a 15-second timer times out.

STEP	PROCEDURE
	Requirement: The ON, OS, and TR LEDs (on data set line under test) are illuminated and the REMOTE TEST LED extinguishes (on 51A-type data unit).
	Note: If data set fails the above test, replace the data set. Verify that replacement data set has proper telco and customer options installed to correspond to the data set being replaced; then perform installation test, local test, and remote test.
8	Remove test cable from data set line A by operating the catch on the retainer.
9	Plug customer interface connector into data set line A and tighten screws.
10	Repeat Steps 2 through 9, as required, for line B, and for lines A and B of all other data sets to be tested.
11	Return station to pretest condition.

5. POWER UNIT TEST

5.01 The following procedure is used to measure the voltages of the 229A power unit. Since each data set operates from a separate regulator in the power unit, one data set could be out of service due to trouble within a particular regulator. In this case, the power unit may have to be replaced. A data set may also have power unit trouble even if the ON lamp on the data set under test is illuminated. A KS-20538-L1 VOM is required for this test.

5.02 Perform the power unit test as follows:

STEP	PROCEDURE
1	Gain access to the rear of the 57-type data mounting(s).
2	Set VOM FUNCTION switch to 30 Vdc.
3	Connect VOM leads as follows: • Negative lead to terminal 33 of J terminal interface (J1-J8) as required for data set under test. • Positive lead to terminal 29 of J terminal interface (J1-J8) as required for data set under test. ***Requirement:*** VOM reads 11.4 to 12.6 volts.
4	Disconnect both VOM leads and reconnect as follows: • Negative lead to terminal 29 of J terminal interface (J1-J8) as required for data set under test.

STEP	PROCEDURE
	• Positive lead to terminal 8 of J terminal interface (J1-J8) as required for data set under test.
	Requirement: VOM reads 11.4 to 12.6 volts.
5	Disconnect both VOM leads.
6	Set VOM FUNCTION switch to 10 Vdc.
7	Connect VOM leads as follows:
	• Negative lead to terminal 29 of J terminal interface (J1-J8) as required for data set under test.
	• Positive lead to terminal 32 of J terminal interface (J1-J8) as required for data set under test.
	Requirement: VOM reads 4.8 to 5.2 volts.
8	Disconnect both VOM leads and reconnect as follows:
	• Negative lead to terminal 28 of J terminal interface (J1-J8) as required for data set under test.
	• Positive lead to terminal 29 of J terminal interface (J1-J8) as required for data set under test.
	Requirement: VOM reads 4.8 to 5.2 volts.
9	Remove test leads and return station to pretest condition.

5000AM TRANSACTION I SET BASE WITH 220- OR 2220-TYPE HAND TELEPHONE SET

1. GENERAL

1.01 This section contains identification, installation, connection, and maintenance information for the Transaction I telephone set which consists of a 5000AM base, faceplate and a 220- or 2220-type hand telephone set. For detailed information on components, refer to CD- and SD-69926-01.

1.02 This section is reissued to:

- Revise installation procedures
- Add information on fuses
- Add information on 5000A dial.

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 For use behind a key system, A and A1 leads are provided by the black (BK) and yellow (Y) leads, respectively, in the mounting cord. If common audible ringing is to be provided, a separate ringer is required.

1.04 For additional information on the Transaction telephone system, refer to Technical Reference, PUB 41804, titled "Switched Network Transaction Telephone System Interfacing With Audio Response Units," and PUB 41805, titled "Transaction Telephone Systems Interfacing With Transmission Control Units."

2. IDENTIFICATION

2.01 The 5000AM Transaction I telephone set base, equipped with a 220- or 2220-type hand telephone set (Fig. 1) provides the standard features of a single line rotary or TOUCH-TONE® telephone set.

Note: If the customer elects to have the dial of the hand telephone set made inoperable (as covered by 3.29) then it can only provide incoming service and card dialer service.

It can also automatically dial and electronically transmit information, read from a magnetic stripe on a credit card, or keyed on a 15-button manual entry pad (Fig. 1) to a data center for immediate credit authorization, check verification, or inventory control.

2.02 ***Design Features:***

- Modular type
- Magnetic stripe card reader (ABA Track 2)
- Automatic dialer
- Click-disc type 15-button manual entry pad
- Operating instruction lamps (light emitting diodes [LED])
- Green/yellow approval or referral lamps (LED).

2.03 ***Optional Features:***

- TT/DP (TOUCH-TONE/DIAL PULSE) option allows use of button pad and card reader into a rotary or a TOUCH-TONE dial office
- 15-button manual entry pad may be locked inoperable for outgoing calls
- TOUCH-TONE signal output level of set from button pad or card operation may be changed to compensate for loop loss
- An auxiliary manual entry pad (5000A-50 dial) may be connected to allow use of a Personal Identification Number (PIN).

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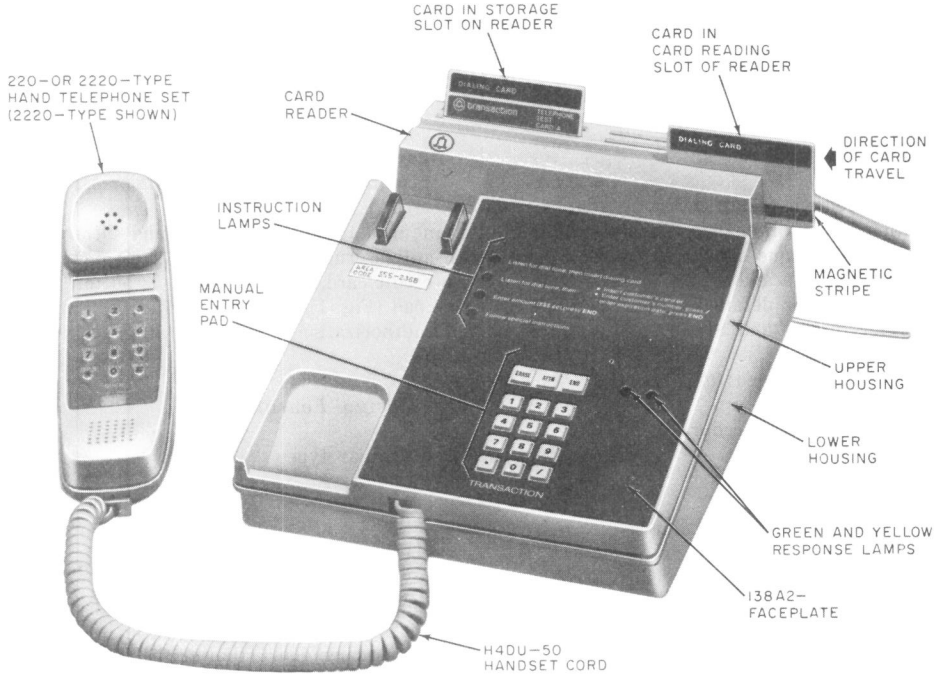


Fig. 1—5000AM Transaction I Telephone Set Base Equipped With 220- or 2220-Type Hand Telephone Set

2.04 The 5000AM Transaction I telephone set base is available in Ivory (-50) only. These bases will be shipped with a disposable protective faceplate, so it is necessary to order the proper faceplate separately (Table A).

2.05 ***Ordering Guide:***

(a) The 5000AM Transaction I telephone set base consists of all the necessary circuitry including power unit and card reader and should be ordered as:

- Base, Telephone Set, 5000AM (includes the following):

  Cord, Handset, H4DU-50

  Adapter, 227A (for handset cord)

  Cord, Mounting, D4BU-29 (7-foot provided, 14- or 25-foot available)

  840703904 Test Card A (additional cards may be ordered)

  Subscriber Instruction Booklet (SIB-2459B).

(b) One of the following is also required and must be ordered separately:

- Set, Telephone, Hand, 220A-50 (Rotary dial)
- Set, Telephone, Hand, 2220B-50 (TOUCH-TONE dial).

(c) If the auxiliary manual entry pad is to be used, it will be necessary to order the D-180687 Kit of Parts (which includes the 5000A-50 dial) and also an appropriate faceplate (Table A).

3. INSTALLATION

3.01 Terminate the local loop into a connecting block suitable for the D4BU-29 mounting

TABLE A
TRANSACTION I
FACEPLATE ORDERING GUIDE

TEL SET	FACEPLATE CODE NUMBER	LETTERING	INTENDED USE
5000AM Tel Set Base	138A1-*	Blank	Without Auxiliary Manual Entry Pad
	138A2-*	Standard Instructions	
	138B1-*	Blank	With Auxiliary Manual Entry Pad
	138B3-*	Standard Instructions	

* Add appropriate color suffix from Table B.

cord, but do not connect the mounting cord at this time. The use of a 625-type connecting block (Fig. 2) is recommended. For information on other modular connecting blocks or adapters, refer to Section 503-100-100.

Warning: Any magnetic stripe card may have its encoding destroyed if the card is carried or stored near a magnet or magnetized object.

3.02 Connect the TRIMLINE® handset to the 5000AM telephone set base using the handset cord and adapter. (A 616P jack is provided on the front of the base.)

3.03 Insure that there is an available 110-volt 3-wire AC receptacle, not controlled by a switch, within reach of the 6-foot power cord.



A 3-wire outlet is required for safety and proper operation of the set. Third conductor must be grounded. If third wire is not provided and grounded, the resistance of the set to electrostatic damage is lowered and the probability of failure is greatly increased.

3.04 To install 138-type faceplate, proceed as follows:

(1) Remove disposable faceplate by lifting at the midpoints of the left and right edges. When faceplate is bowed slightly, the locking tabs at top and bottom will release.

Note: If auxiliary manual entry pad is to be installed, do not install faceplate at this time.

(2) Install new faceplate by inserting bottom tab into housing and slightly bowing the faceplate enough to insert upper tabs into slots of housing.

TRANSMISSION MEASUREMENTS (INSERTION LOSS)

3.05 The signal output level of the TOUCH-TONE frequencies transmitted by the Transaction I set must be adjusted to match the loop being used. Make a loop insertion loss measurement using a 23D Transmission Measuring Set, or the equivalent, and a 900 ohm termination. Dial the milliwatt supply (1000 Hz) of the serving central office; read and record the loss of the loop.

3.06 It is recommended that at this time the set should be opened (3.07) and all option plugs on main printed wiring board (PWB) checked to insure that they are in their "when shipped" positions as shown by Tables C and D or Fig. 4. Check wiring terminations and if any loose connections are found, reterminate per Fig. 9.

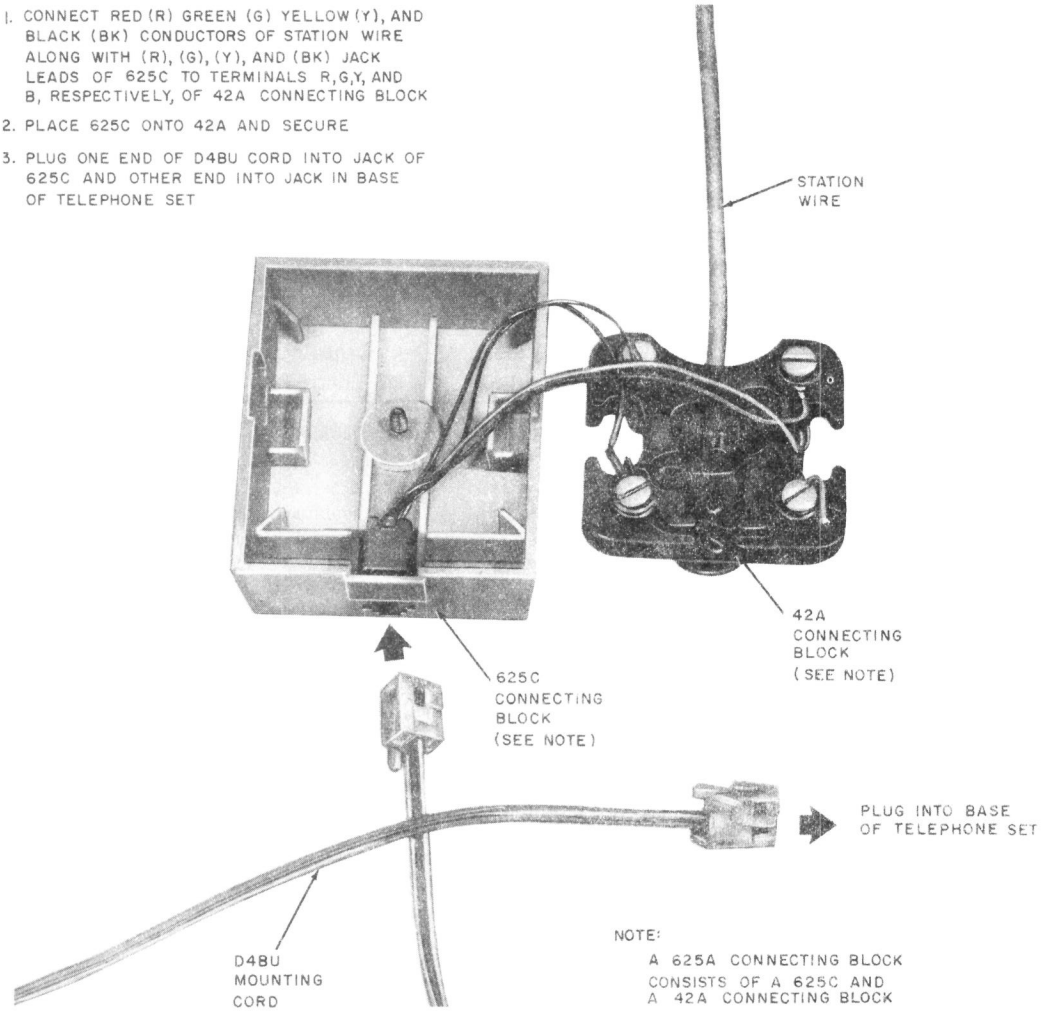


Fig. 2—Installation of 625A Connecting Block

3.07 To open set in order to access option plugs and/or terminals proceed as follows:

(1) Disconnect power plug from AC outlet, if connected.

(2) Invert set and loosen the two captive screws holding the upper housing and chassis (Fig. 3).

(3) Lay the upper housing and chassis to the right, as shown by Fig. 5, without disconnecting any cables.

TABLE B

COLOR ORDERING GUIDE (SEE NOTE)

HAND TEL SET		FACEPLATES	
SUFFIX	COLOR	SUFFIX	COLOR
-50	Ivory	-100	Avocado
		-108	Teak
		-109	Walnut
		-111	Gold
		-112	Orange
		-113	Brown
		-114	Red
		-115	Blue
		-118	Black

Note: The 5000AM telephone set base is available in Ivory only and the hand telephone set should also be Ivory. The faceplate must be ordered separately.

(4) To reassemble, reverse procedure.

3.08 Set the TOUCH-TONE signal output level for the actual measured loss (AML) of the loop (3.05) as follows:

(1) Place the option plugs in their proper positions for the measured loss. As shown in Table C and Fig. 4.

(2) If the actual measured loss of the loop is 3.9 dB, or less, resistors R2 and R3 should be placed in the circuit. This is done by moving the orange (O) and slate (S) leads from pins T2 and R2 to pins O and S, respectively. See Table C and Fig. 9.

Note: Early production sets do not have the pin connector arrangement but have clip type terminals for placing resistors R2 and R3 in the circuit. The green (G) and red (R) leads from the 623E4 jack are connected to terminals T and R, respectively, and the (O) and (S) leads are connected across the resistors by clip-type terminals. If the AML of the loop is 3.9 dB, or less, proceed as follows:

(a) Remove (G) lead from terminal T on control board. Remove either end of (O) lead from clip-type terminal at R3 and connect to terminal T. Connect (G) lead which was removed from T to now vacant R3 clip-type terminal.

(b) Remove (R) lead from terminal R on control board. Remove either end of (S) lead from clip-type terminal at R2 and connect to terminal R. Connect (R) lead which was removed from R to now vacant R2 clip-type terminal.

(3) If loss of loop exceeds 12 dB the quality of the service may be impaired. Defer, according to local procedures, until an acceptable loop is made available.

3.09 Connect the set to the telephone line by inserting the mounting cord into the connecting block.

3.10 Remove the gum-backed "OPTIONS" sticker which is packed with the base and attach it to the bottom of the base near the front. If the service order does not call for the implementation of any options (Dial Pulse, Lockout, or disconnection of the ringer) at this time, reassemble set and proceed to 3.12.

Note: If the order calls for making dial of hand telephone set inoperable, do not disable dial until all testing is completed.

OPTIONS



The service order must specify that each option is, or is not, required. If the service order does not so specify, the sales representative should be contacted, or refer to supervisor for clarification of requirements.

3.11 If the service order specifies that the Dial Pulse and/or Lockout options be activated,

TABLE C

ADJUSTMENT OF *TOUCH-TONE* OUTPUT LEVEL (NOTE)

LOOP LOSS IN DBs	OPTION PLUG POSITIONS ON MAIN PWB			WIRING ON CONTROL BOARD						NOMINAL OUTPUT LEVEL IN DBM
				RESISTOR – R2			RESISTOR – R3			
	R-34	R-35	R-36	LEAD COLOR	REMOVE FROM PIN	CONNECT TO PIN	LEAD COLOR	REMOVE FROM PIN	CONNECT TO PIN	
0 to 1.9†	E33—E34	E31—E32	E28—E29	(S)	R2	S	(O)	T2	O	—13.5
2.0 to 3.9†	E34—E35	E30—E31	E28—E29	(S)	R2	S	(O)	T2	O	—11.5
4.0 to 5.9	E34—E35‡	E30—E31‡	E27—E28‡	—	—	—	—	—	—	— 9.5
6.0 to 7.9	E34—E35	E30—E31	E28—E29	—	—	—	—	—	—	— 7.5
8.0 to 10.4	E34—E35	E31—E32	E27—E28	—	—	—	—	—	—	— 5.5
10.5 or more	E34—E35	E31—E32	E28—E29	—	—	—	—	—	—	— 3.0

Note: See Fig. 4 for location of option plugs on main PWB.
See Fig. 9 for location of wiring option on control board.
† If loop loss is 3.9 dB or less, resistors R2 and R3 should be connected into the circuit as shown. (See Note 4 of Fig. 9). For early production sets, refer to note after 3.08 (2).
‡ Plug positions when shipped from factory.

TABLE D (SEE NOTE)

PLACEMENT OF OPTION PLUGS

OPTION	PLUG POSITION	RESULT
Key Pad Lock out	*E42—E43	Not locked (can dial out from key pad)
	E43—E44	Locked (cannot dial out from key pad)
TT/DP Dialing	*E21—E22	Key pad dials in TT frequencies
	E22—E23	Key pad sends out dial pulses
FSK†	*E40—E41	FSK receiver is not present
	E39—E40	FSK receiver is present

* Option plug positions when shipped.

† Frequency shift keying (FSK) option not available at this time.

Note: See Fig. 4 for location of option plugs.

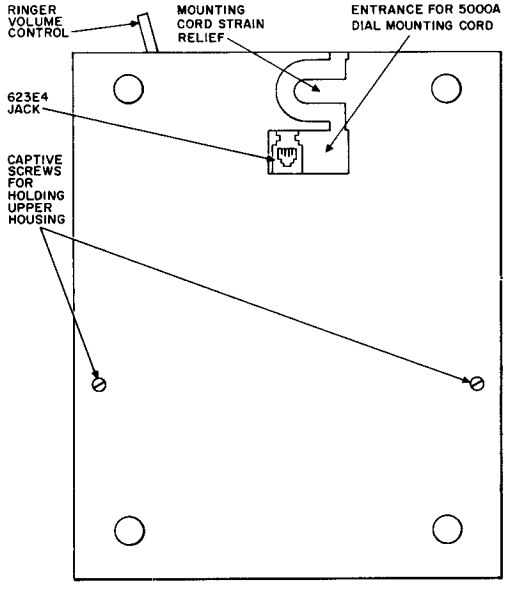


Fig. 3—Bottom of 5000AM Transaction I Telephone Base

or that ringer be disconnected, access the main PWB (3.07) and proceed as follows:

(a) If both the Dial Pulse and Lockout options are called for:

(1) Place TT/DP option plug for DP per Table D.

(2) Place upper housing and chassis back on set and reconnect AC power cord.

(3) Go off-hook and, using manual entry pad, dial any test number and verify that the call is completed. This tests the dial pulse feature.

(4) Disconnect power cord, lay upper housing and chassis aside, and move Lockout option plug to lockout position per Table D.

(5) Reassemble set and reconnect AC power cord.

(6) Test lockout by going off-hook and depressing any button on manual entry pad to verify absence of dial pulses being transmitted.

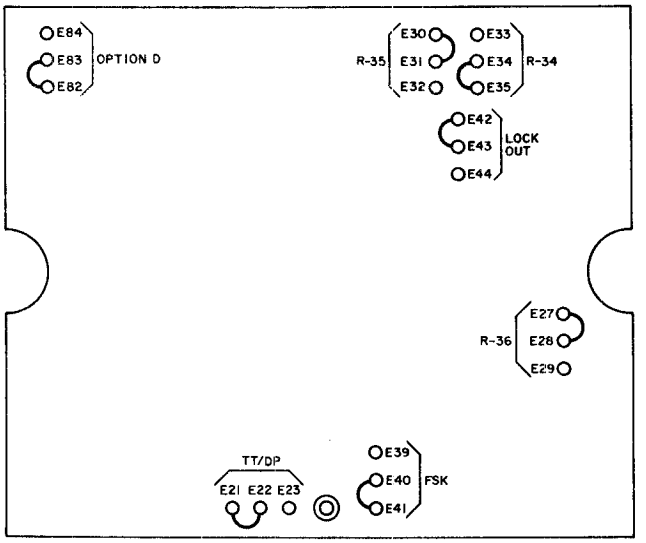


Fig. 4—Main PWB, Option Plug Locations Showing Plug Positions as Shipped

Note: If the service order specifies keyboard lockout, the TT/DP option plug must still be set for the correct class of service, TOUCH-TONE or Rotary.

(b) If only Dial Pulse option is specified:

(1) Proceed as in (a) Step (1), (2), (3), and (5).

(c) If only Lockout option is specified:

(1) Move Lockout option plug per Table D.

(2) Reassemble set and reconnect AC power cord.

(3) Test lockout by going off-hook and depressing any button on manual entry pad to verify absence of TOUCH-TONE frequency signals.

(d) To disconnect P2B ringer:

(1) Remove red (R) and black (BK) ringer leads from terminal P1 and T, respectively, on control board, insulate and store.

(2) Reassemble set and reconnect AC power cord.

Note: Indicate on the sticker on the base of the set any options that are implemented.

3.12 With handset on-hook, plug in power cord and then go off-hook momentarily to reset Transaction I telephone set.

Note: If no lamps light when handset is taken off-hook, either AC receptacle is defective or fuses may be open. If fuses are suspected, refer to 4.02 in Maintenance section.

PRELIMINARY TEST PROCEDURE

3.13 Go off-hook by lifting handset; first instruction lamp will light. Run test card A, (card is packed with the 5000AM base) through the card reader from right to left. Card must be held with the magnetic stripe down and to the front and must be moved through the slot smoothly and without hesitation. First instruction lamp should go out and second instruction lamp should light. Correct operation of these two lamps indicates that the test card is properly coded and the card reader

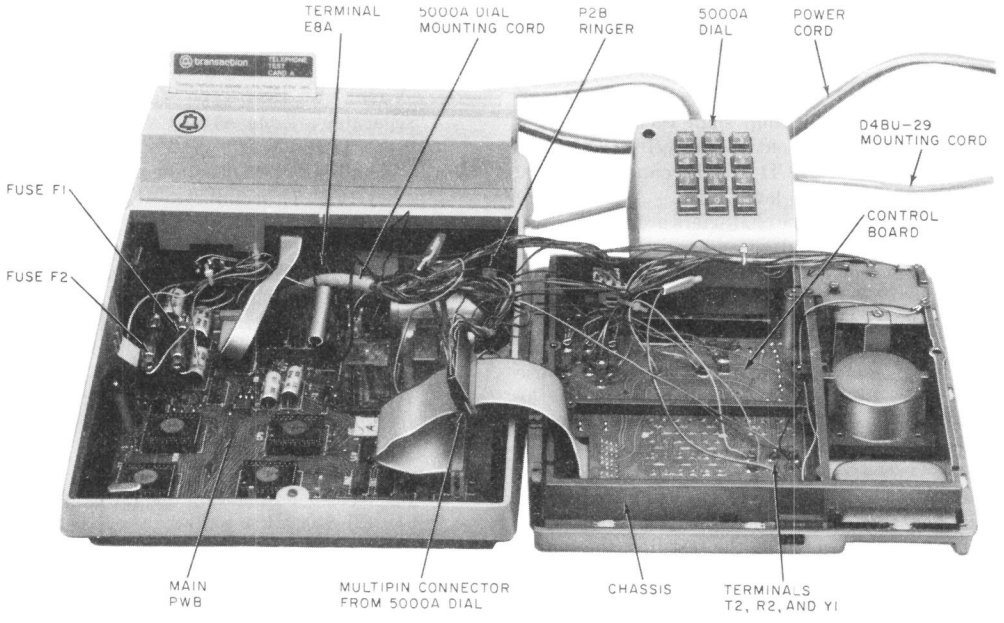


Fig. 5—5000AM Transaction I Telephone Set Base With Upper Housing and Chassis Laid Aside and 5000A Dial Connected

is good. If the card is not read correctly the first lamp will blink and the card reading procedure should be repeated.

INSTALLATION TEST PROCEDURES

3.14 Using the TRIMLINE handset, perform the normal tests, including ringback, for a rotary or TOUCH-TONE telephone set (as applicable) according to local procedures.

REMOTE TEST PROCEDURE



In the following test there must not be over a 10-second delay between steps or the test line will interpret this as an error.

Note: If an interrupted tone (1/2 second on, 1/2 second off), lasting about 5 seconds, is heard at any time, an error is indicated. The 1A Transaction Telephone Test Line Station (TTTLS) will disconnect at the end of the interrupted tone. To retest, it will be necessary to redial the test line (3.15) through (3.19).

3.15 Go off-hook, first instruction lamp is lighted and dial tone is heard. Manually dial the number of the Transaction Telephone Test Line Station (TTTLS), using the TRIMLINE handset.

3.16 When the call is completed to the TTTLS, it will respond with a 3-second answer tone which will be heard on the TRIMLINE handset. After the answer tone has terminated, the test card should be passed through the reader two (2) times. The instruction lamps should sequence—the second instruction lamp should light after the card is passed through the first time, and when the card has been passed through the second time, the third lamp will be lighted.

3.17 Key in digits by depressing buttons on the manual entry pad, ***in sequence,*** 1 through 9, •, 0, /, and END. The third instruction lamp will now be extinguished. While you are doing this, the set will transmit the buffered data as

TOUCH-TONE pulses. It is not necessary to wait for the end of transmission of data from the test card.

3.18 The green (G) lamp shall then light for 3 seconds and go out as the yellow (Y) lamp lights. Three TOUCH-TONE characters are transmitted as the (Y) lamp lights. After the (Y) lamp lights and the three characters are transmitted, depress the ERASE button and pause to listen for the transmission of two more TOUCH-TONE characters. Next, depress the ATTN button and hear two more characters transmitted. (If you do not hear an interrupted tone, the set is working properly.) You may hear a muted 3 second response tone. The TTTLS will disconnect. Place the handset on-hook. The yellow lamp may be extinguished by momentarily going off-hook.

3.19 Go off-hook, dial the TTTLS using the handset and then depress END button four times. As this call is answered by the test line, the fourth instruction lamp will be lighted. (On the standard faceplate, this lamp is labeled "Follow Special Instructions.") This tests the lamp and associated circuitry. Go on-hook to release test line. Go off-hook momentarily to reset Transaction telephone set and extinguish lamp. If no auxiliary manual entry pad is provided, proceed to 3.25.

AUXILIARY MANUAL ENTRY PAD (PERSONAL IDENTIFICATION NUMBER [PIN])

3.20 If the auxiliary manual entry pad is to be used, it should be installed at this time. Install the D-180687 Kit of Parts (Fig. 6), which includes:

1—5000A-50 dial

1—841934946 mounting plate

1—841935109 key (push-to-lock, push-to-unlock)

4—840694194 screws

1—840713366 label

2—D-161488 connectors (provided with kit of parts manufactured after 1st quarter of 1976).

(1) Remove faceplate by lifting at the midpoints of the right and left edges. When faceplate is bowed slightly, the locking tabs at top and bottom will release.

Note: A 138B-type faceplate (ordered separately, Table A) will also be required.

(2) Install 841934946 mounting plate and 841935109 key (Fig. 7) as follows:

(a) Remove screw holding static arrester spring (Fig. 7) and slide mounting plate under the spring. Replace the screw holding the spring and the associated lead. This should secure right side of mounting plate.

Note: The static arrester spring is intended to ground the faceplate and the chrome ring for electrostatic protection.

(b) Secure left side of mounting plate with (2) 840694194 screws.

(c) Insert 841935109 key with trimmed portion to right, the LED in the upper right, and the two indexing or alignment holes over tabs on the mounting plate to the left.

(d) Secure right side of key using the other (2) 840694194 screws provided.

(3) Install new 138B-type faceplate.

(4) Open the set (3.07); lay the upper housing and chassis to the right (Fig. 5).

(5) Hold the lower housing up on its side and feed the mounting cord of the dial through the cord entrance hole in the base pan. Using Fig. 5, make connections as follows:

(a) Plug multipin connector of mounting cord into connector on flex ribbon cable.

Note: A polarizing key in the female connector assures proper mating of connectors.

(b) Connect 508 plug to 841935109 key.

(c) Connect the black (BK) spade-tipped mounting cord conductor to terminal E8A on the main PWB.

Note: In early production sets there is no terminal E8A. In this case, remove the black

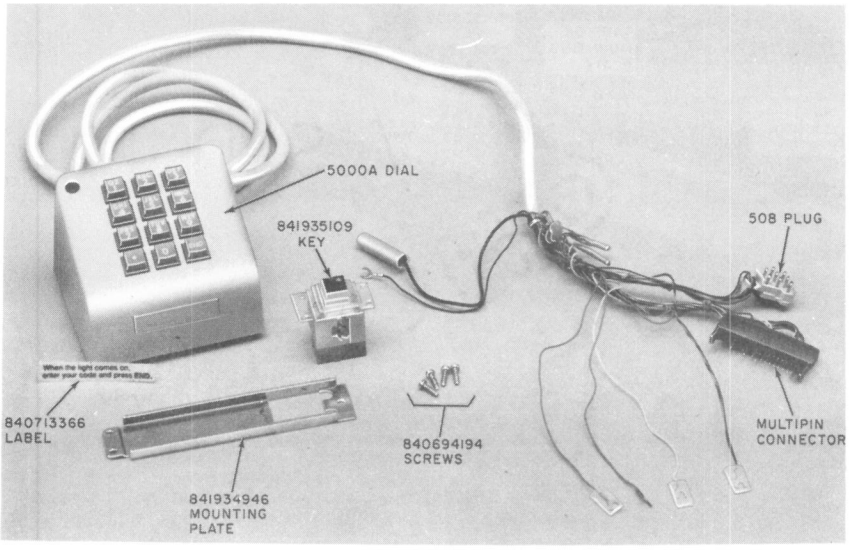


Fig. 6—D-180687 Kit of Parts

(BK) lead connected to terminal E8 and plug it into the connector on the black mounting cord conductor; tape or insulate the connection. Now connect the black spade-tipped mounting cord conductor to terminal E8.



If the auxiliary manual entry pad should ever be removed, it is imperative that leads be reconnected to their normal locations. Remove the (BK) lead from the connector on the black mounting cord conductor and reterminate on terminal E8.

(d) Connect the slate (S) spade-tipped mounting cord conductor to terminal Y1 on the control board (Fig. 9).

(e) Connect the white (W) spade-tipped mounting cord conductor to terminal W on the control board (Fig. 9).

Note: In later production models, there is no terminal W on the control board; in this case, insulate and store the white mounting cord conductor.



In some early production sets, the control board had neither a Y1 nor a W terminal. If a PIN pad is to be provided with one of these sets, the (S) and (W) spade-tipped mounting cord conductors should be connected together using a D-161488 connector.

(f) Insulate and store any unused mounting cord leads.

(6) Replace upper housing and chassis and tighten captive screws holding upper and lower housing together.

(7) Place jacketed portion of mounting cord under strain relief as shown in Fig. 3.

(8) Affix 840713366 label to top of 5000A dial directly above number buttons.

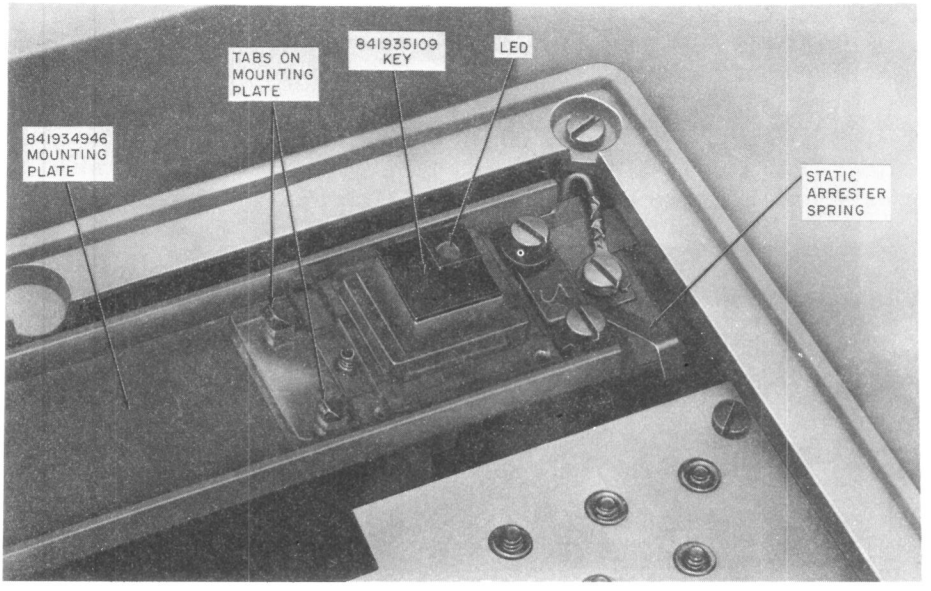


Fig. 7—5000AM With Faceplate Removed Showing Mounting Plate and 651G Key Installed

3.21 To test the auxiliary manual entry pad, press the Personal Identification Number (PIN) key to enable the pad. Observe that both Light Emitting Diodes (LED) light, one on the PIN key and one on the 5000A-50 dial. Depress the PIN key again and observe that both LED's are extinguished.

3.22 Repeat 3.15 and 3.16 and then press the PIN key to enable the pad.

3.23 Key in by depressing, ***in sequence,*** digits 1 through 9, •, and 0 on the 5000A-50 dial. (It is not necessary to wait for data from card to be transmitted.) Depress / (slash) on the 5000AM base and then depress END on the 5000A-50 dial. The third instruction lamp shall be extinguished.

3.24 The green response lamp shall light for 3 seconds and go out as the yellow lamp lights. Depress the PIN key and place the handset on-hook. Go off-hook momentarily to extinguish the yellow lamp and reset the Transaction I set.

FINAL TEST PROCEDURE

3.25 If the customer has a dialing card, ask him to use his card and place a call to his data center to verify that data center can be reached.

3.26 This completes the test procedures. Write the telephone number of the TTTLS on the test card for customer's future reference and give test card to customer along with the Subscriber Instruction Booklet. Explain to the customer the use of the test card per Subscriber Instruction Booklet.

DIAL RESTRICTION OF HAND TELEPHONE SET

3.27 Some customers may want the dial of the hand telephone set restricted from making outgoing calls. This feature is not recommended and will only be incorporated at the customer's insistence.

Note: If dial restriction is to be provided, all installation tests must be completed prior to making the modification.



If dial is restricted, the set can no longer be used as a normal telephone set since calls can only be initiated by a dialing card.

3.28 Only the 220-type hand telephone set may be restricted. If dial restriction is requested at a location that has been equipped for TOUCH-TONE service, the 2220-type hand telephone set should be replaced with a 220-type hand telephone set that has been modified per 3.29.

3.29 To restrict the dial in a 220-type hand telephone set, proceed as follows:

(1) Remove handset cord from handset using KS-21107 releaser or equivalent.

(2) Remove cover or number card retainer located just above dial using KS-21107 releaser or equivalent.

(3) Remove light seal plate and the 2 screws located under retainer. This will release the cover from the handset.

(4) Place a strap between the pulsing contacts as shown in Fig. 8. The dial will remain in the handset.

Note: If new 220C-50 handset has been provided, place strap between the two screws located near the top center of the flex wiring board.

(5) Reassemble handset and reconnect handset cord.

(6) Note this modification on the option sticker.

3.30 Outgoing calls may now be made only by using a dialing card.

4. MAINTENANCE



Before attempting to make any maintenance tests, check option sticker under base of set, to see what options (3.11 or 3.29) may have been implemented.

4.01 In case of commercial power failure, Transaction telephone sets can be used as standard telephone sets using the TRIMLINE handset. All other functions of the Transaction telephone set are rendered inoperative by the loss of AC power.

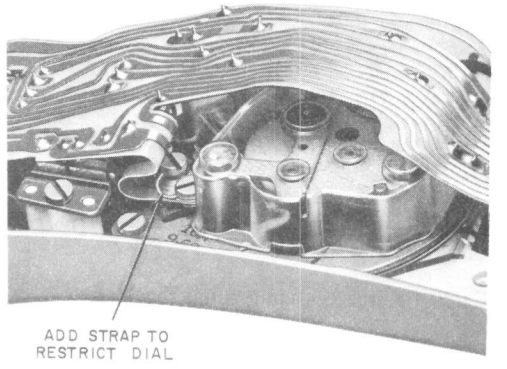


Fig. 8—Restricting Dial of 220-Type Hand Telephone Set



If dial of hand telephone set has been restricted (3.29), the set cannot be used as a standard telephone set. The restricted handset may be unplugged and replaced for maintenance testing purposes. Be sure to reinstall customer's handset when testing is completed.

4.02 There are two fuses, (F1 for -12 volt and F2 for +5 volt circuitry) mounted on a block near the left rear corner of the main PWB, Fig. 5. If a fuse failure is suspected, the fuses may be removed (access per 3.07), and checked visually or observe the following indications:

(1) If fuse F1 is open:

(a) No TOUCH-TONE or dial pulse signals may be heard on handset when buttons are depressed on manual entry pad.

Note: If Lockout option has been activated this would be an inconclusive test.

(b) Lights on set may or may not be operable.

(2) If F2 fuse is open, there will be no lamps operable on set. These are Bussman MDL

one point six (1.6) ampere fuses and may be obtained locally.

WARNING: FOR CONTINUED PROTECTION AGAINST FIRE HAZARD, REPLACE FUSES ONLY WITH 1.6 AMP SLO-BLO (BUS MDL) OR EQUIVALENT.

4.03 Other field maintenance of the sets shall consist of the following:

(a) Check for line continuity (dial tone).

(b) Check for proper connection of cords and jacks.

(c) Check for loose wire or connections on main PWB or control board (Fig. 9).

(d) Replacement of H4DU-50 handset cord and/or 227A adapter.

(e) Replacement of D4BU-29 mounting cord.

(f) Replacement of TRIMLINE handset.

(g) Replacement of auxiliary manual entry pad.

4.04 If the loss of the loop changes due to cable activity, etc. and/or difficulty is encountered in communicating with the remote data center, the loop loss should be measured and the TOUCH-TONE signal output level adjusted per 3.08.

4.05 Field repairs on the 5000AM base shall not be attempted. Return defective base to Western Electric Service Center in accordance with local procedures. If base is being replaced, return disposable faceplate from new base with defective base.

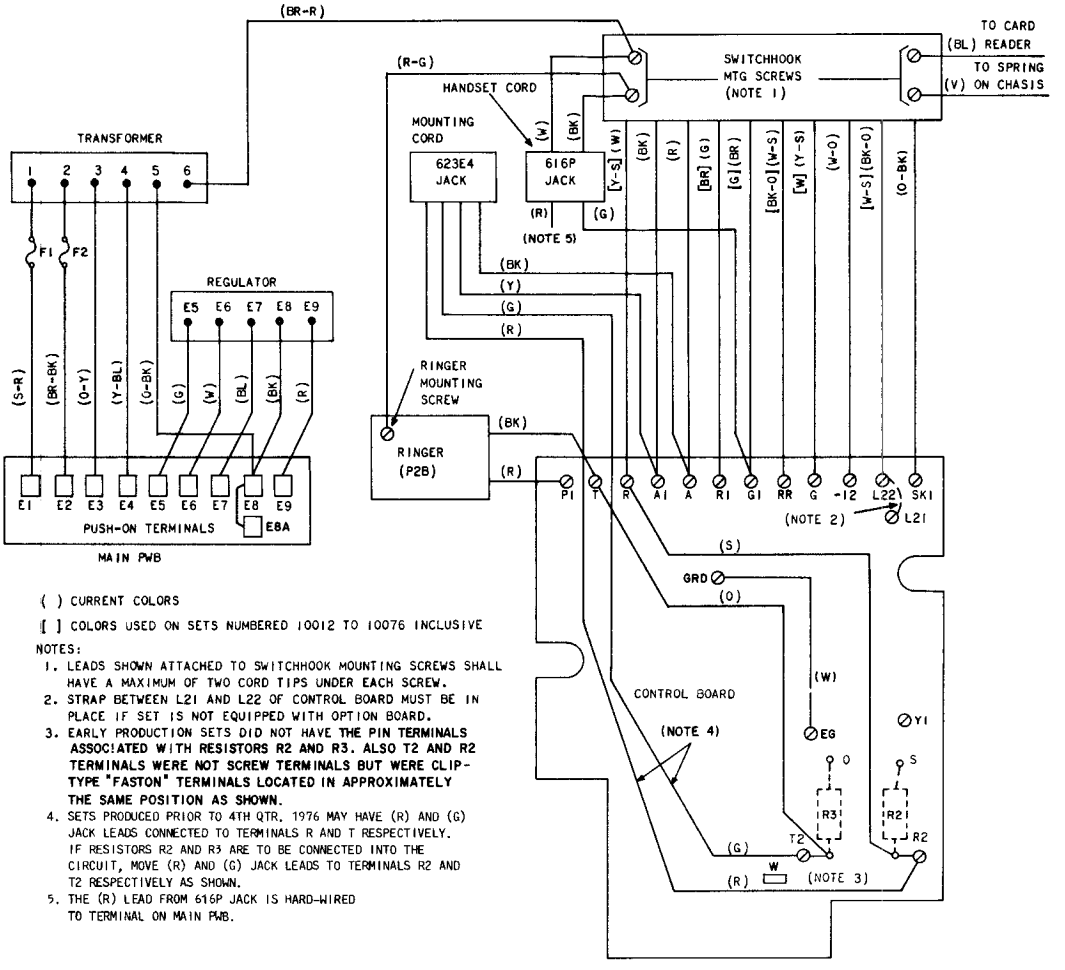


Fig. 9—Partial Schematic Showing Conductors Attached by Screws or Push-On Terminals

5100AM TRANSACTION TELEPHONE SET BASE WITH 220- OR 2220-TYPE HAND TELEPHONE SET

1. GENERAL

1.01 This section contains identification, installation, connection, and maintenance information for the Transaction II telephone set which consists of a 5100AM base, faceplate and a 220- or 2220-type hand telephone set. For detailed information on components, refer to CD- and SD-69926-01.

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

1.03 For use behind a key system, A and A1 leads are provided by the black (BK) and yellow (Y) leads, respectively, in the mounting cord. If common audible ringing is to be provided, a separate ringer is required.

1.04 For additional information on the Transaction telephone system, refer to Technical Reference, PUB 41804, titled "Switched Network Transaction Telephone System Interfacing With Audio Response Units."

2. IDENTIFICATION

2.01 The 5100AM Transaction telephone set base, equipped with a 220- or 2220-type hand telephone set (Fig. 1) provides the standard features of a single line rotary or TOUCH-TONE® telephone set.

Note: If the customer elects to have the dial of the hand telephone set made inoperable (as covered by 3.33) then it can only provide incoming service and card dialer service.

It can also automatically dial and electronically transmit information read from a magnetic stripe on a credit card, or keyed on a 15-button manual entry pad (Fig. 1), to a data center for immediate credit authorization, check verification, or inventory control. In addition, it is possible for a transaction to be accomplished in a hands-free mode.

2.02 ***Design Features:***

- Modular type
- Magnetic stripe card reader (ABA Track 2)
- Automatic dialer
- Click-disc type 15-button manual entry pad
- Operating instruction lamps (light emitting diodes [LED])
- Hands-free operation
- Electronic switchhook and call progress sounder
- Volume control for call progress sounder
- Green/yellow approval or referral lamps (LED)
- Data receiver and an 8-digit alpha/numeric display.

2.03 ***Optional Features:***

- TT/DP (TOUCH-TONE/DIAL PULSE) option allows use of button pad and card reader into a rotary or a TOUCH-TONE dial office
- 15-button manual entry pad may be locked inoperable for outgoing calls
- TOUCH-TONE signal output level of set from button pad or card operation may be changed to compensate for loop loss
- An auxiliary manual entry pad (5000A-50 dial) may be connected to allow use of a Personal Identification Number (PIN).

NOTICE
Not for use or disclosure outside the
Bell System except under written agreement

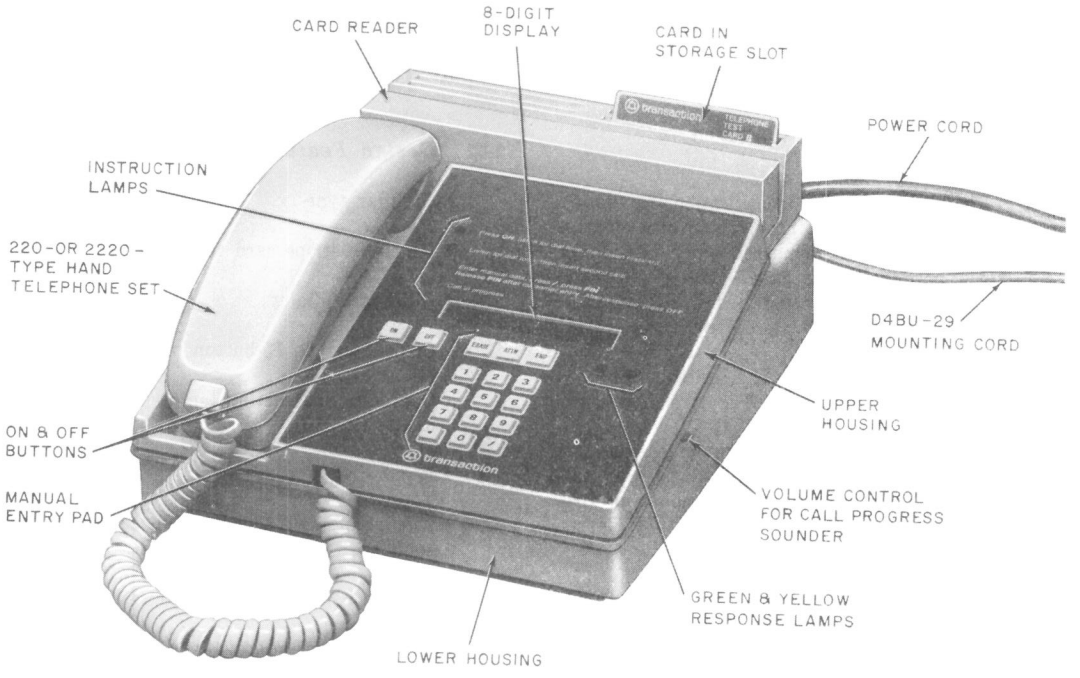


Fig. 1—5100AM Transaction II Telephone Set Base Equipped With 220- or 2220-Type Hand Telephone Set

2.04 The 5100AM Transaction II telephone set base is available in Ivory (-50) only. These bases will be shipped with a disposable protective faceplate, so it is necessary to order the proper faceplate separately (Table A).

2.05 ***Ordering Guide:***

(a) The 5100AM Transaction II telephone set base consists of all the necessary circuitry including power unit and card reader and should be ordered as:

- Base, Telephone Set, 5100AM (includes the following):

  Cord, Handset, H4DU-50

  Cord, Mounting, D4BU-29 (7 foot provided, 14- or 25-foot available)

  Adapter, 227A (for handset cord)

  840996003 Test Card B (additional cards may be ordered)

  Subscriber Instruction Booklet (SIB-2482C)

(b) One of the following is also required and must be ordered separately:

- Set, Telephone, Hand, 220A-50 (Rotary dial)

- Set, Telephone, Hand, 2220B-50 (TOUCH-TONE dial)

(c) If the auxiliary manual entry pad is to be used, it will be necessary to order the D-180687 Kit of Parts (which includes the 5000A-50 dial) and also an appropriate faceplate (Table A).

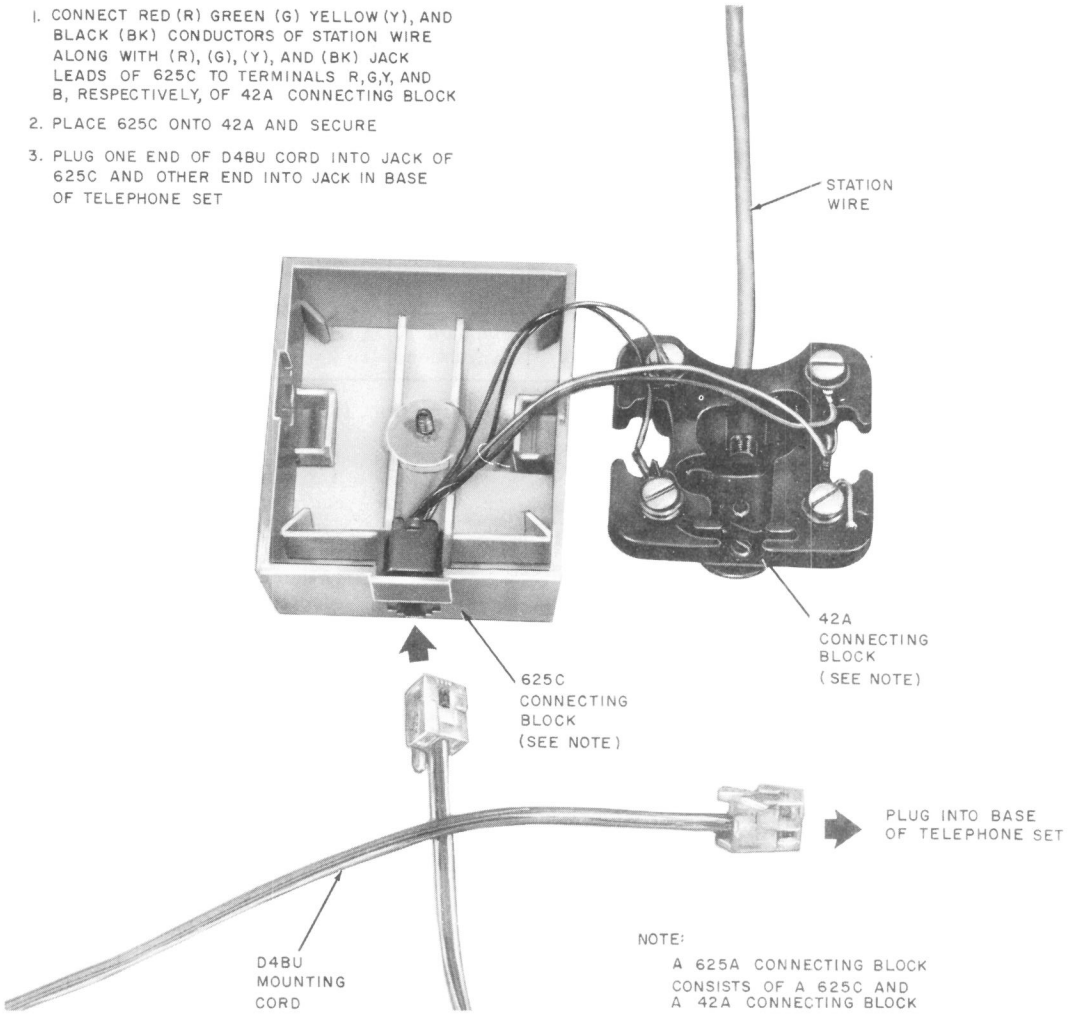


Fig. 2—Installation of 625A Connecting Block

3. INSTALLATION

3.01 Terminate the local loop into a connecting block suitable for the D4BU-29 mounting cord, but do not connect the mounting cord at this time. The use of a 625-type connecting block (Fig. 2) is recommended. For information on other modular connecting blocks or adapters, refer to Section 503-100-100.

Warning: Any magnetic stripe card may have its encoding destroyed if the card is carried or stored near a magnet or magnetized object.

TABLE A

TRANSACTION II

FACEPLATE ORDERING GUIDE

TEL SET	FACEPLATE CODE NUMBER	LETTERING	INTENDED USE
5100AM Tel Set Base	138C1-*	Blank	Without Auxiliary Manual Entry Pad
	138C5-*	Standard Instructions	
	138D1-*	Blank	With Auxiliary Manual Entry Pad
	138D6-*	Standard Instructions	

* Add appropriate color suffix from Table B

TABLE B

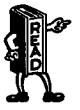
COLOR ORDERING GUIDE (SEE NOTE)

HAND TEL SET		FACEPLATES	
SUFFIX	COLOR	SUFFIX	COLOR
-50	Ivory	-100	Avocado
		-108	Teak
		-109	Walnut
		-111	Gold
		-112	Orange
		-113	Brown
		-114	Red
		-115	Blue
		-118	Black

Note: The 5100AM telephone set base is available in Ivory only and the hand telephone set should also be Ivory. The faceplate must be ordered separately.

3.02 Connect the TRIMLINE® handset to the 5100AM telephone set base using the handset cord and adapter. (A 616P jack is provided on the front of the base.)

3.03 Insure that there is an available 110-volt, 3-wire AC receptacle, not controlled by a switch, within reach of the 6-foot power cord.



A 3-wire outlet is required for safety and proper operation of the set. Third conductor must be grounded. If third wire is not provided and grounded, the resistance of the set to electrostatic damage is lowered and the probability of failure is greatly increased.

3.04 To intall 138-type faceplate, proceed as follows:

(1) Remove disposable faceplate by lifting at the midpoints of the left and right edges. When faceplate is bowed slightly, the locking tabs at top and bottom will release.

(2) Install new faceplate by inserting bottom tab into housing and slightly bowing the faceplate enough to insert upper tabs into slots of housing.

Note: If auxiliary manual entry pad is to be installed, do not install faceplate at this time.

TRANSMISSION MEASUREMENTS (INSERTION LOSS)

3.05 The signal output level of the TOUCH-TONE frequencies transmitted by the Transaction II set must be adjusted to match the loop being used. Make a loop insertion loss measurement using a 23D Transmission Measuring Set, or the equivalent, and a 900 ohm termination. Dial the milliwatt supply (1000 Hz) of the serving central office, read and record the loss of the loop.

3.06 It is recommended that at this time the set should be opened up (3.07) and all option plugs on main printed wiring board (PWB) and control board checked to insure that they are in their "when shipped" positions as shown by Tables C and D or Fig. 4 and 5. Check wiring terminations and if any loose connections are found, reterminate per Fig. 11.

3.07 To open set in order to access option plugs and/or terminals proceed as follows:

(1) Disconnect power plug from AC outlet, if connected.

(2) Invert set and loosen the two captive screws holding the upper housing and chassis (Fig. 3).

(3) Lay the upper housing and chassis to the right, as shown by Fig. 6, without disconnecting any cables.

(4) To reassemble, reverse procedure.

3.08 Set the TOUCH-TONE signal output level for the actual measured loss of the loop (3.05) as follows:

(1) Place the options on their proper positions. See Fig. 4 and Table C.

(2) If the loss of the loop is 3.9 dB, or less, resistors R2 and R3 on the control board should be placed in the circuit. This is done by moving the option pins from B-C to A-B as shown by Fig. 5.

(3) If loss of loop exceeds 12 dB the quality of the service may be impaired. Defer, according to local procedures, until an acceptable loop is made available.

3.09 Connect the set to the telephone line by inserting the mounting cord into the connecting block.

3.10 Remove the gum-backed "OPTIONS" sticker which is packed with the base and attach it to the bottom of the base near the front. If the service order does not call for the implementation of any options (Dial Pulse, Lockout, or disconnection of the ringer) at this time, reassemble set and proceed to 3.12.

Note: If the order calls for making dial of hand telephone set inoperable, do not disable dial until all testing is completed.

OPTIONS

3.11 If the service order specifies that the Dial Pulse and/or Lockout options be activated, or that ringer be disconnected, access the main PWB (3.07) and proceed as follows:

(a) If both Dial Pulse and Lockout options are called for:

(1) Place TT/DP option plug for DP per Table D.

(2) Place upper housing and chassis back on set and reconnect AC power cord.

(3) Go off-hook and, using manual entry pad, dial any test number and verify that the call is completed. This tests the dial pulse feature.

(4) Disconnect power cord, lay upper housing and chassis aside, and move Lockout option plug to lockout position per Table D.

(5) Reassemble set and reconnect AC power cord.

(6) Test lockout by going off-hook and depressing any button on manual entry pad to verify absence of TOUCH-TONE frequency signals.

(b) If only Dial Pulse option is specified:

(1) Proceed as in (a) Steps (1), (2), (3) and (5).

(c) If only Lockout option is specified:

(1) Move Lockout option plug per Table D.

(2) Reassemble set and reconnect AC power cord.

(3) Test lockout by going off-hook and depressing any button on manual entry pad to verify absence of TOUCH-TONE frequency signals.

TABLE C

ADJUSTMENT OF TOUCH-TONE OUTPUT LEVEL (NOTE)

LOOP LOSS IN DBs	OPTION PLUG POSITIONS ON MAIN PWB			WIRING ON CONTROL BOARD				NOMINAL OUTPUT LEVEL IN DBM
				RESISTOR - R2‡		RESISTOR - R3‡		
	R-34	R-35	R-36	REMOVE FROM	CONNECT TO	REMOVE FROM	CONNECT TO	
0 to 1.9*	E33-E34	E31-E32	E23-E29	B-C†	A-B	B-C†	A-B	-13.5
2.0 to 3.9*	E34-E35	E30-E31	E23-E29	B-C†	A-B	B-C†	A-B	-11.5
4.0 to 5.9	E34-E35†	E30-E31†	E27-E28†	-	-	-	-	- 9.5
6.0 to 7.9	E34-E35	E30-E31	E28-E29	-	-	-	-	- 7.5
8.0 to 10.4	E34-E35	E31-E32	E27-E28	-	-	-	-	- 5.5
10.5 to 12	E34-E35	E31-E32	E28-E29	-	-	-	-	- 3.0

* If loop loss is 3.9 dB or less, resistors R2 and R3 should be connected into the circuit as shown.

† Plug positions when shipped from factory.

‡ Designations are not on board, see Fig. 5.

Note: See Fig. 4 for location of option plugs on main PWB.
See Fig. 5 for location of wiring option on control board.

TABLE D

PLACEMENT OF OPTION PLUGS (SEE NOTE)

OPTION	PLUG POSITION	RESULT
Key Pad Lock out	E42-E43*	Not locked (can dial out from key pad)
	E43-E44	Locked (cannot dial out from key pad)
TT/DP Dialing	E21-E22*	Key pad dials in TT frequencies
	E22-E23	Key pad sends out dial pulses
Power Up Reset	E39-E40*	Resets terminal to ON-HOOK condition following commercial power failure.

* Option plug positions when shipped.

Note: See Fig. 4 for location of option plugs.

(d) To disconnect P2B ringer:

(1) Remove red (R) and black (BK) ringer leads from terminal P1 and T, respectively, on control board, insulate and store.

(2) Reassemble set and reconnect AC power cord.

Note: Indicate on the sticker on the base of the set any options that are implemented.

3.12 With handset on-hook, plug in power cord and then go off-hook momentarily to reset Transaction II telephone set.

Note: If no lamps light when handset is taken off hook, either AC receptacle is defective

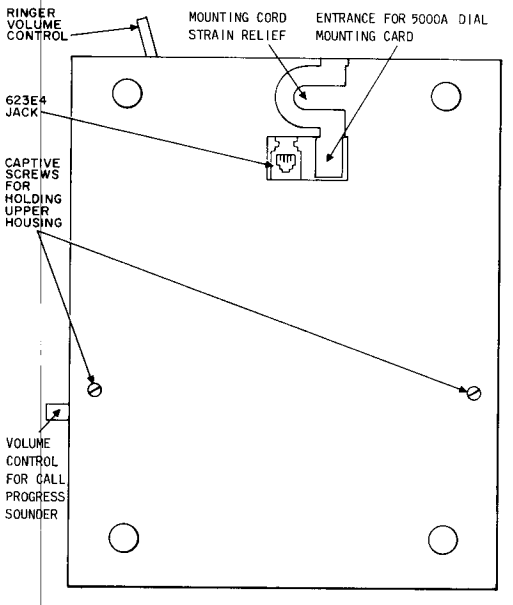


Fig. 3—Bottom of 5100AM Transaction II Telephone Base Showing Upper Housing Screws and Mounting Cord Jack

or fuses may be open. If fuses are suspected, refer to 4.02 in Maintenance section.

PRELIMINARY TEST PROCEDURE

3.13 Go off-hook by lifting handset; first and fourth instruction lamps will light. Replace the handset; both lamps will extinguish. Press the ON button; both lamps will light again. Run test card B (card is packed with the 5100AM base) through the card reader from right to left. Card must be held with the magnetic stripe down and to the front and must be moved through the slot smoothly and without hesitation. First instruction lamp should go out and second instruction lamp should light. Correct operation of these lamps indicates that the test card is properly coded and the card reader is good. If the card is not read correctly the first lamp will blink and the card reading procedure should be repeated. Press the OFF button; both lamps will extinguish.

INSTALLATION TEST PROCEDURES

3.14 Using the TRIMLINE handset, perform the normal tests, including ringback, for a rotary or TOUCH-TONE telephone set (as applicable) according to local procedures.

3.15 Depress ON button (listen to dial tone), and check operation of call progress tone sounder volume control (Fig. 1). Adjust volume control to acceptable level and depress OFF button.

REMOTE TEST PROCEDURE



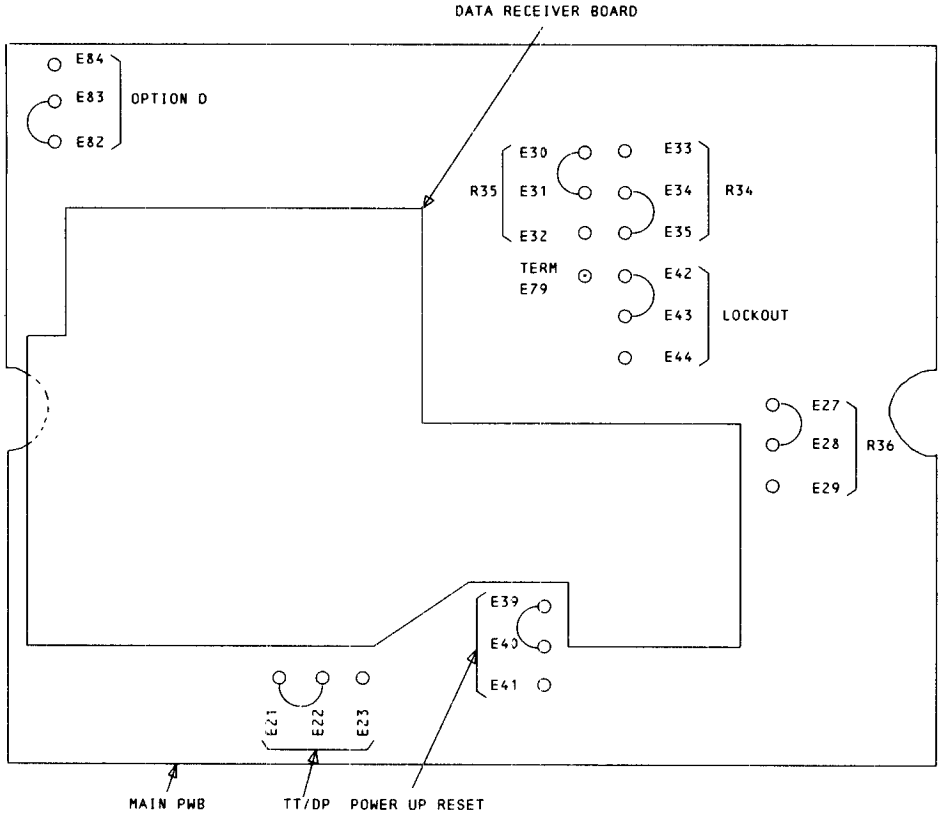
In the following tests there must not be over a 10-second delay between steps or the test line will interpret this as an error.

Note: If an interrupted (1/2 second on, 1/2 second off), lasting about 5 seconds, is heard at any time, an error is indicated. The 1A Transaction Telephone Test Line Station (TTTLS) will disconnect at the end of the interrupted tone. To retest, it will be necessary to redial the test line (3.16) through (3.22).

3.16 Go off-hook by lifting the handset, first and fourth instruction lamps are lighted and dial tone is heard. (The fourth instruction lamp will remain lighted as long as the set is off-hook.) Manually dial the number of the 1A Transaction Telephone Test Line Station (TTTLS) using the TRIMLINE handset.

3.17 When the call is completed to the TTTLS, it will respond with a 3-second answer tone which will be heard on the TRIMLINE handset. After the answer tone has terminated, the test card should be passed through the reader two (2) times. The instruction lamps should sequence—the second instruction lamp should light after the card is passed through the first time, and when the card has been passed through the second time, the third lamp will be lighted.

3.18 Key in digits by depressing buttons on the manual entry pad, ***in sequence,*** 1 through 9, ●, 0, /, and END. The third instruction lamp will now be extinguished. While you are doing this, the set will transmit the buffered data as TOUCH-TONE pulses. The digits keyed in will have appeared on the visual display as they are



NOTE: DUE TO SPACE LIMITATION ONLY TWO PINS MAY BE IDENTIFIED ON EACH OPTION PLUG

Fig. 4—Main PWB and Data Receiver Board Showing Option Plug Locations and Plug Positions as Shipped

keyed and the display will clear when transmission is completed.

3.19 The green (G) response lamp will then flash and the display shall be filled with 8's.

3.20 Press the ERASE button. The display should fill with decimal points, and the (G) response lamp will continue to flash.

3.21 Key in 1, 2, 3, END. The display should erase and the yellow (Y) lamp should light. If the (Y) lamp does not light and the display shows E-0-0, reenter 1, 2, 3, END (you have 7 seconds to do this) and the (Y) lamp should light.

3.22 Press ATTN. A muted 3-second response is heard and the TTTLS will disconnect. Place handset on-hook. The (Y) lamp may be extinguished by momentarily going off-hook.

AUXILIARY MANUAL ENTRY PAD

3.23 If the auxiliary manual entry pad is to be used, it should be installed at this time.

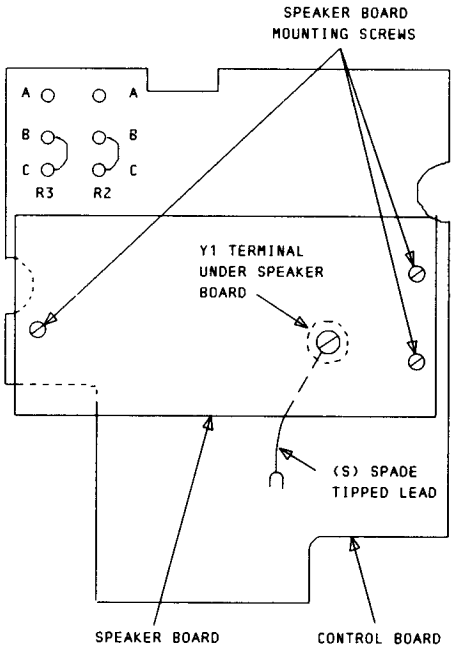


Fig. 5—Control Board and Speaker Board Showing Location of R2 and R3 Option Plugs and Terminal Y1

To install the D-180687 Kit of Parts (Fig. 7) which includes:

1 - 5000A-50 dial

1 - 841934946 mounting plate

1 - 651G key (push-to-lock, push-to-unlock)

4 - 840694194 screws

1 - 840713366 label

2 - D-161488 connectors (provided with kit of parts manufactured after 1st quarter of 1976).

(1) Remove faceplate by lifting at the midpoints of the right and left edges. When faceplate is bowed slightly, the locking tabs at top and bottom will release.

Note: An 138D-type faceplate (ordered separately, Table A) will also be required.

(2) Install 841934946 mounting plate and 651G key (Fig. 8) as follows:

(a) Remove screw holding static arrester spring (Fig. 8) and slide mounting plate under the spring. Replace the screw holding the spring and the associated lead. This should secure right side of mounting plate.

(b) Secure left side of mounting plate with (2) 840694194 screws.

(c) Insert 651G key with cut-out portion of key mounting to right and the two indexing or alignment holes over tabs on the mounting plate to the left.

(d) Secure right side of key using the other (2) 840694194 screws provided.

(3) Install new 138D-type faceplate.

(4) Open the set (3.07); lay the upper housing and chassis to the right (Fig. 6).

(5) Hold the lower housing up on its side and feed the mounting cord of the dial through the cord entrance hole in the base pan. Using Fig. 6, make connections as follows:

(a) Plug multipin connector of mounting cord into connector on flex ribbon cable.

Note: A polarizing key in the female connector assures proper mating of connectors.

(b) Connect 508 plug to 651G key.

(c) Connect the black (BK) spade-tipped mounting cord conductor to terminal E8A on the main PWB.

(d) Connect the spade-tipped blue-black (BL-BK) mounting cord conductor to the spade-tipped (BL-BK) lead from terminal E79 on the main PWB using a D-161488 connector. Insulate the connection.

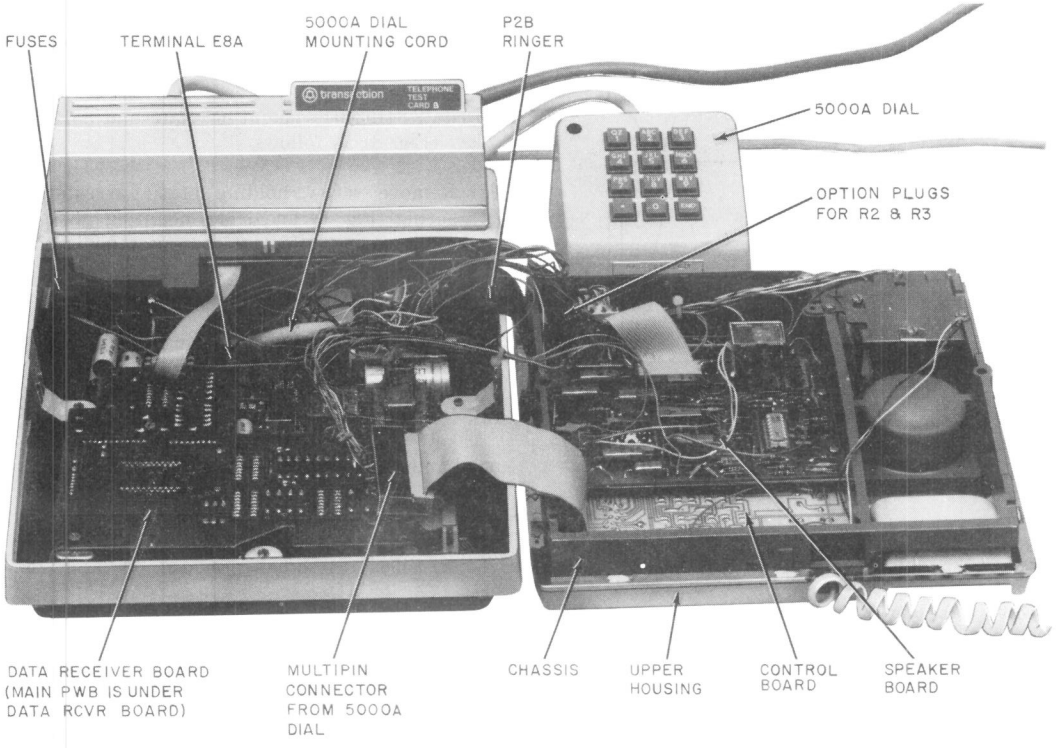


Fig. 6—5100AM Transaction II Telephone Set Base With Upper Housing and Chassis Laid Aside, 5000A Dial Connected

Note: In later production models there is a push-on terminal at E79 instead of a spade-tipped lead. Connect the (BL-BK) mounting cord conductor to this terminal.

(e) Connect the spade-tipped slate (S) mounting cord conductor to the spade-tipped (S) lead from terminal Y1 on the control board using a D-161488 connector. Insulate the connection.

Note: In later production models, terminal Y1 is accessible at the lower right corner of the control board. Connect the (S) mounting cord conductor to terminal Y1.

(f) Insulate and store any unused mounting cord leads.

(6) Pull slack out of mounting cord as upper housing and chassis are replaced. Invert set and tighten captive screws holding the upper and lower housing together.

(7) Place jacketed portion of mounting cord under strain relief as shown in Fig. 3.

3.24 To test the auxiliary manual entry pad, press the Personal Identification Number (PIN) key to enable the pad. Observe that both Light Emitting Diodes (LED) light, one on the PIN key and one on the 5000A-50 dial. Depress PIN key again and observe that both LED's are extinguished.

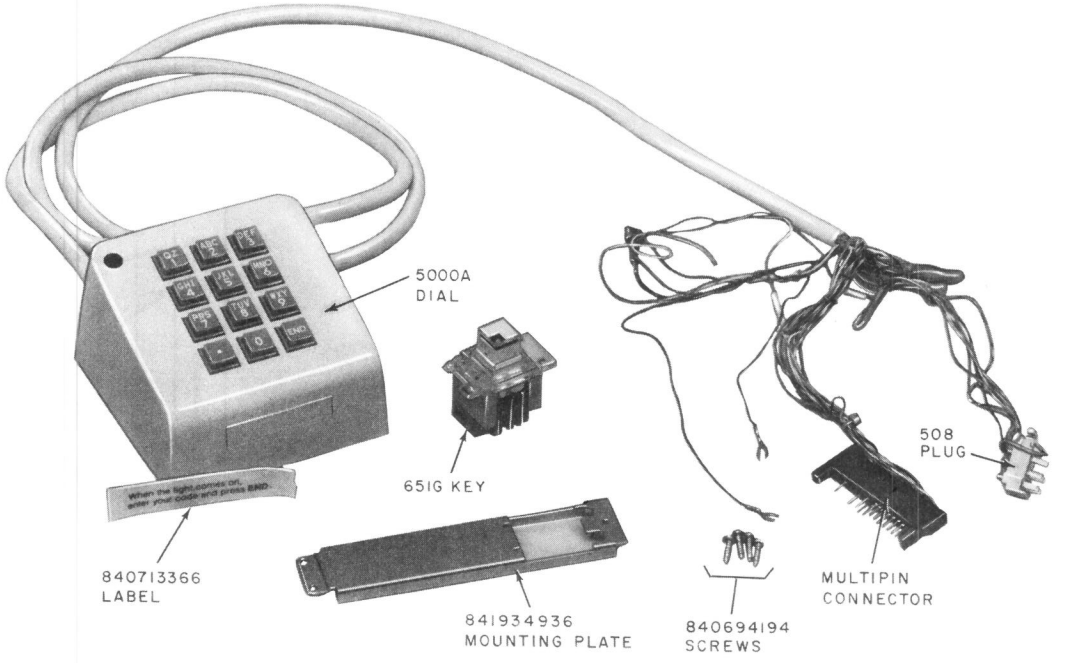


Fig. 7—D-180687 Kit of Parts

3.25 Repeat 3.16 and 3.17 and then press the PIN key to enable the pad.

3.26 Key in by depressing, ***in sequence***, digits 1 through 9, •, and 0 on the 5000A-50 dial. (None of the entries from the 5000A-50 dial should appear on the display.) Depress / (slash) on the 5100AM base and then depress END on the 5000A-50 dial. The third instruction lamp shall be extinguished.

3.27 The (G) response lamp shall flash and the display shall be filled with 8's. Depress the PIN key and observe that the LED's (on both the 5000A-50 dial and the 5100AM base) shall be extinguished. Hang up the hand telephone set.

3.28 Depress the PIN key and then the ON button. The first and fourth instruction lamps should light. Depress the END button on the manual entry pad of the 5100AM telephone set base and then depress the END button on the 5000A-50 dial. First instruction lamp is extinguished and second lamp is lighted. Depress OFF button and then the PIN key. All lamps should now be extinguished. This completes the testing procedure of the auxiliary manual entry pad.

3.29 If the customer has a dialing card, ask him to use his card and place a call to his data center to verify that he can reach it.

3.30 This completes the test procedures. Write the telephone number of the TTTLS on the test card for customer's future reference and give test card to customer along with the Subscriber Instruction Booklet. Explain to the customer the use of the test card per Subscriber Instruction Booklet.

DIAL RESTRICTION OF HAND TELEPHONE SET

3.31 Some customers may want the dial of the hand telephone set restricted from making outgoing calls. This feature is not recommended

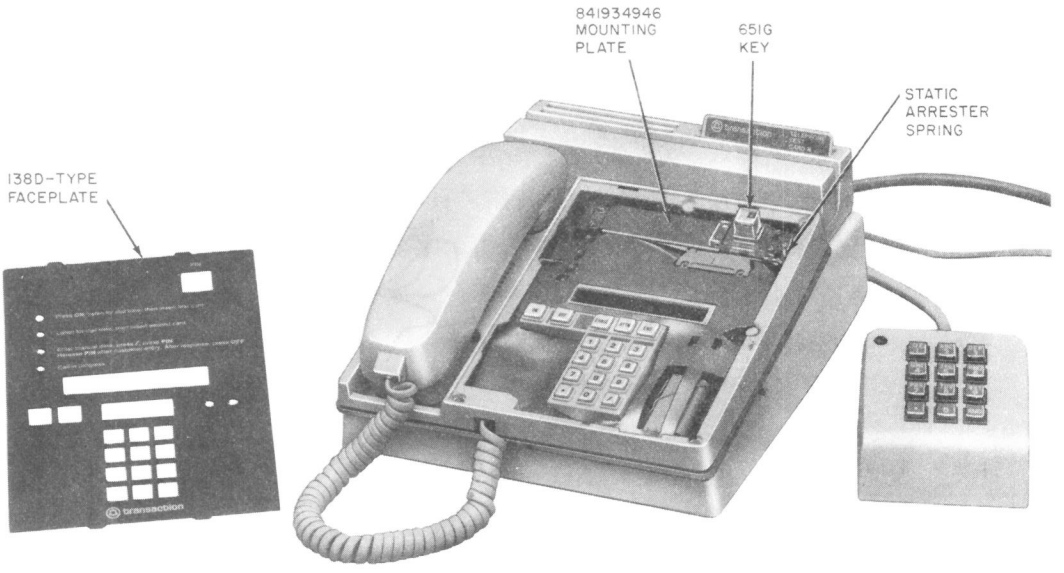


Fig. 8—5100AM Transaction II Telephone Set With Faceplate Removed for Installation of 651G Key

and will only be incorporated at the customer's insistence.

Note: If dial restriction is to be provided, all installation tests must be completed prior to making the modification.



If dial is restricted, the set can no longer be used as a normal telephone set since calls can only be initiated by a dialing card.

3.32 Only the 220-type hand telephone set may be restricted. If dial restriction is requested at a location that has been equipped for TOUCH-TONE service, the 2220-type hand telephone set should be replaced with a 220-type hand telephone set that has been modified per 3.33.

3.33 To restrict the dial in a 220-type hand telephone set, proceed as follows:

(1) Remove handset cord from handset using KS-21107 releaser or equivalent.

(2) Remove cover or number card retainer located just above dial using KS-21107 releaser or equivalent.

(3) Remove light seal plate and the 2 screws located under retainer. This will release the cover from the handset.

(4) Place a strap between the pulsing contacts as shown in Fig. 10. The dial will remain in the handset.

(5) Reassemble handset and reconnect handset cord.

(6) Note this modification on the option sticker.

3.34 Outgoing calls may now be made only by using a dialing card.

4. MAINTENANCE



Before attempting to make any maintenance tests, check option sticker under base of set, to see what options (3.11 or 3.33) may have been implemented



Fig. 9—Transaction II Telephone Set With 5000A Dial Installed

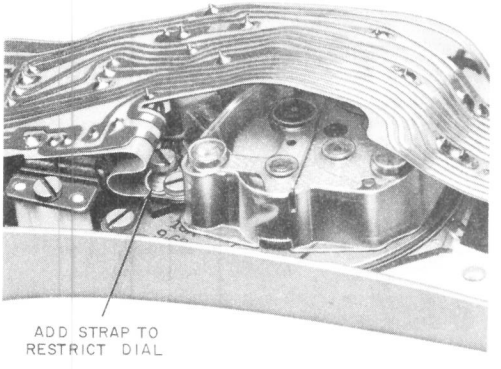


Fig. 10—Restricting Dial of 220A Hand Telephone Set

4.01 In case of commercial power failure, Transaction telephone sets can be used as standard telephone sets using the TRIMLINE handset. All other functions of the Transaction telephone set are rendered inoperative by the loss of AC power.



If dial of hand telephone set has been restricted (3.33), the set can not be used as a standard telephone set. The restricted handset may be unplugged and replaced for maintenance testing purposes. Be sure to reinstall customer's handset when testing is completed.

4.02 There are two fuses, (F1 for -12 volt and F2 for +5 volt circuitry) housed in plastic "in-line" holders and located at the left rear corner of the main PWB. If a fuse failure is suspected, the fuses may be removed (access per 3.06), and checked visually or observe the following indications:

(1) If fuse F1 is open:

(a) Depressing the ON button will not take set off-hook, (no dial tone heard on call progress sounder).

(b) No TOUCH-TONE signals may be heard on handset when buttons are depressed on manual entry pad.

Note: If Lockout option has been activated this would be an inconclusive test.

(c) Lights on set may or may not be operable.

(2) If F2 fuse is open, there will be no lamps operable on set. These are Bussman MDL two (2) ampere fuses and may be obtaind locally.

WARNING: FOR CONTINUED PROTECTION AGAINST FIRE HAZARD, REPLACE FUSES ONLY WITH 2 AMP SLO-BLO (BUS MDL) OR EQUIVALENT.

4.03 Other field maintenance of the sets shall consist of the following:

(a) Check for line continuity (dial tone).

(b) Check for proper connection of cords and jacks.

(c) Check for loose wire or connections on main PWB or control board (Fig. 11).

(d) Replacement of H4DU-50 handset cord and/or 227A adapter.

(e) Replacement of D4BU-29 mounting cord.

(f) Replacement of TRIMLINE handset.

(g) Replacement of auxiliary manual entry pad.

4.04 If the loss of the loop changes due to cable activity, etc. and/or difficulty is encountered in communicating with the remote data center, the loop loss should be measured and the TOUCH-TONE signal output level adjusted per 3.08.

4.05 Field repairs on the 5100AM base shall not be attempted. Return defective base to Western Electric Service Center in accordance with local procedures. If base is being replaced, return disposable faceplate from new base with the used base.

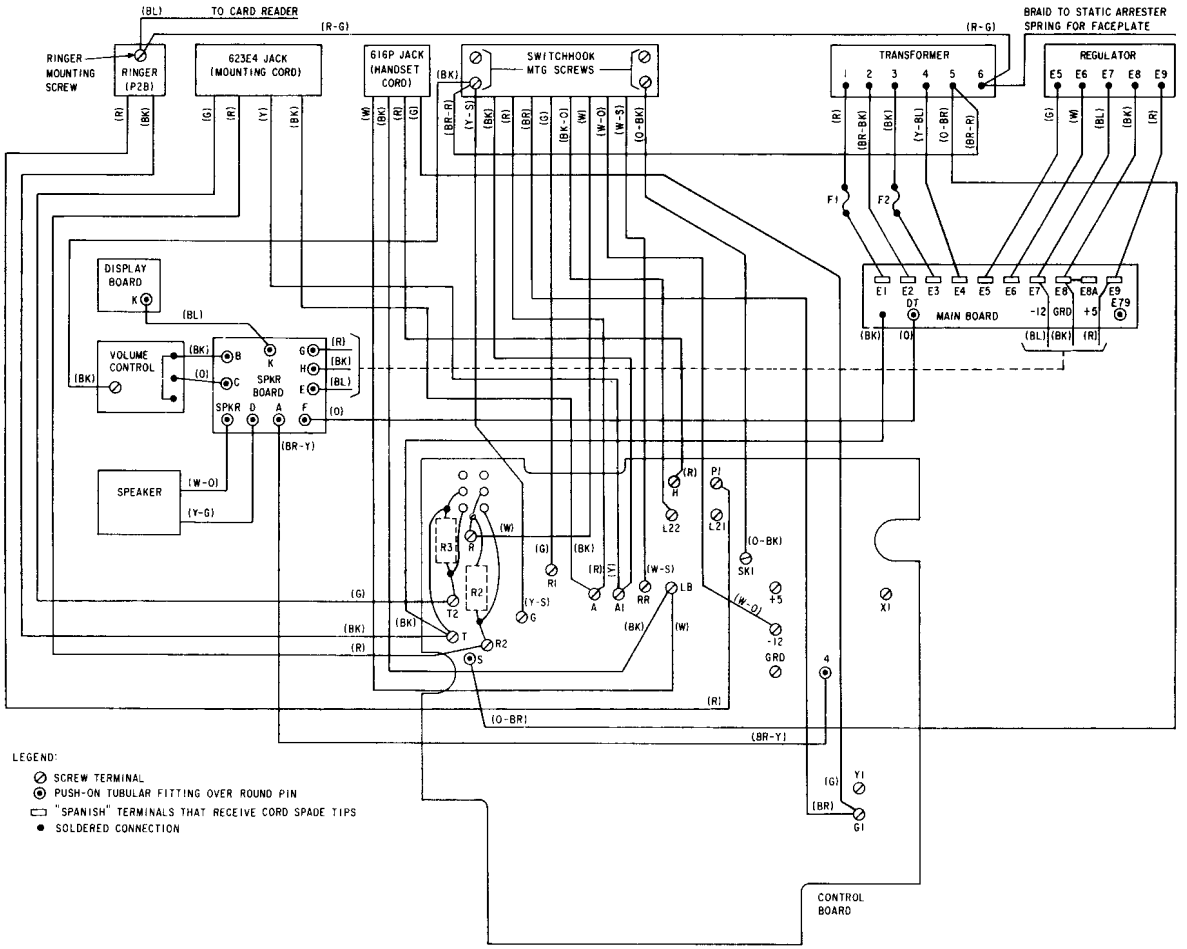


Fig. 11—Partial Schematic Showing Conductors Attached by Screws or Push-On Terminals

5000A TRANSACTION III TERMINAL SET —WITH OR WITHOUT 5000A PRINTER

1. GENERAL

1.01 This section contains identification, installation, testing, and maintenance information for the Transaction III terminal set. It also contains information on the 5000A printer as used with this set. For detailed information on the terminal set, refer to CD- and SD-69945-01. For detailed information on the 5000A printer, refer to CD- and SD-69949-01.

1.02 This section is reissued to:

- Add information on the 5000A printer
- Add Personal Identifiation Number (PIN) option using manual entry pad
- Add information on 5000D or 5000F dials available as auxiliary manual entry pads.

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 For additional information on the Transaction Network Service (TNS) see Bell System Data Communication Technical Reference, PUB 41024, titled "Transaction Network Service" and Bell System Technical Reference, PUB 41025, titled "Transaction Network Service Polled Interface Specifications."

2. IDENTIFICATION

2.01 The 5000A Transaction III terminal set (Fig. 1) satisfies the interface requirements of the polled access circuits of the Transaction Network Service. It may be used to perform transactions such as credit authorization, check verification, inventory control, or electronic funds transfer.

2.02 ***Design Features:***

- Magnetic stripe card reader (ABA Track 2)
- Click-disc type 19-button pad
- Operating instruction lamps [light emitting diodes (LED)]
- Transaction progress indicator lamps (LED)
- Four response lamps (LED)
- Frequency-shift key (FSK) modem
- A 128 character text message length
- An 8-digit numeric display with paging capabilities.

2.03 ***Optional Features:***

(a) A 5000A printer may be connected to provide a printed response from the data center.

(b) The capability of entering a Personal Identification Number (PIN) during a transaction to positively identify an account. This may be accomplished by one of the following:

- Activating the manual entry pad PIN option
- Connecting an auxiliary manual entry pad consisting of a 5000B, D, or F dial (Fig. 8)

2.04 The 5000A Transaction III terminal set is available in Ivory (-50) only. These terminal sets will be shipped with a disposable protective faceplate, so it will be necessary to order the proper faceplate separately (Table A).

NOTICE
Not for use or disclosure outside the
Bell System except under written agreement

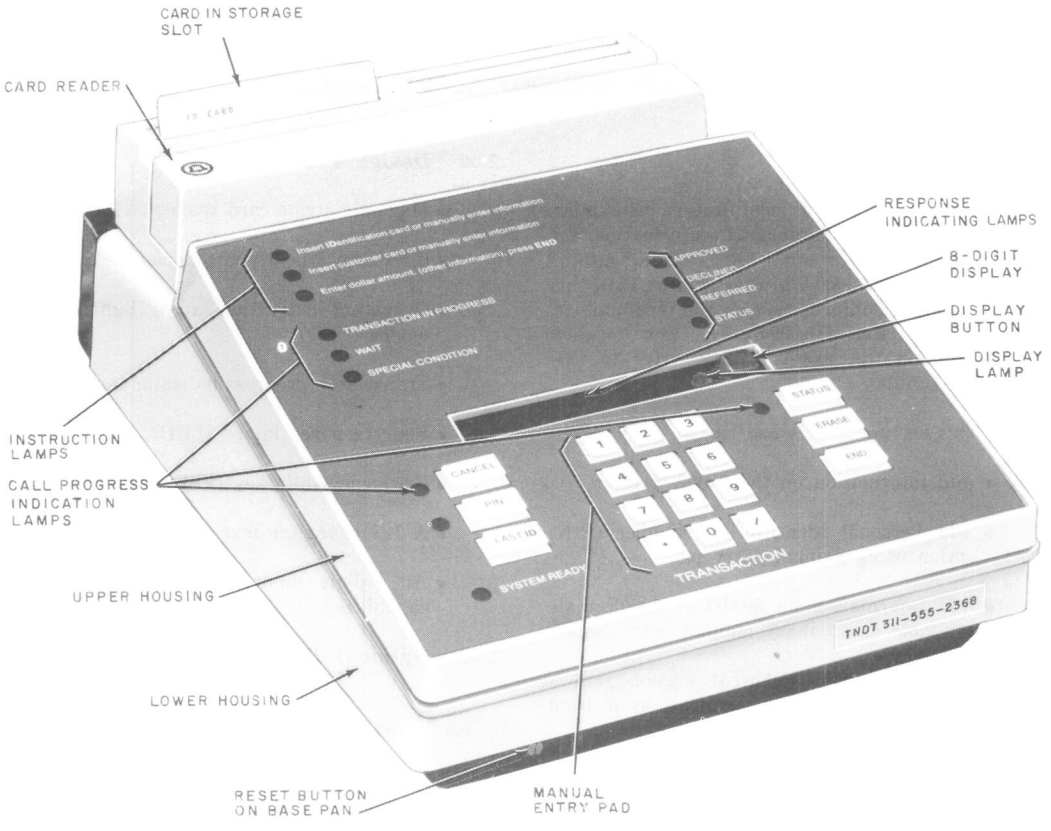


Fig. 1—5000A Transaction III Terminal Set

2.05 *Ordering Guide:*

(a) The 5000A Transaction III terminal set consists of all the necessary circuitry including power unit and card reader and should be ordered as:

- Set, Terminal, 5000A, Transaction III, includes the following: Cord, Mounting, D4BT-87 (7-foot provided, 14- or 25-foot cords are optional and may be ordered separately) and Test Card C.

(b) Faceplate, 139-type (Table A), ordered separately

(c) If an auxiliary manual entry pad is to be used, it will be necessary to order one of the following:

- Dial, 5000B, includes 5-foot M19A cord
- Dial, 5000D, includes 10-foot M19A cord
- Kit of Parts, D-180822, includes 5000F dial with 20-foot M19A cord and a KS-21884L3 (A52D7PC) Read Only Memory (ROM) or intergrated circuit package.

TABLE A

TRANSACTION III
FACEPLATE ORDERING GUIDE

FACEPLATE CODE		COLOR GUIDE	
139A-* LETTERING	139B-* LETTERING	SUFFIX	COLOR
Standard Instruction	Blank	-100	Avocado
		-108	Teak
		-109	Walnut
		-111	Gold
		-112	Orange
		-113	Brown
		-114	Red
		-115	Blue
		-118	Black

*Add appropriate color suffix.

(d) If a 5000A printer is to be provided, it must be ordered separately and will be shipped with the following items:

- Cord, M14H, to interconnect with 5000A terminal set, (3-foot provided, 10-foot available)
- Housing Spacer, to be used when 5000A terminal set is placed on top of printer (Fig. 10)
- Test Cards D and E. (Test Card D is provided for use with the 5100BM Transaction set and will not be used with this terminal.)
- Cord, Power, KS-14532L30, 6-foot long

Note: Power cords with right angle plugs are available in other lengths as follows:

824013262 (P-40J326) 1-1/2 foot

824013270 (P-40J327) 2 foot

824013288 (P-40J328) 4 foot

824013296 (P-40J329) 6 foot

824010995 (P-40J099) 12 foot

3. INSTALLATION

3.01 Verify that a Transaction Network polled access line has been installed and terminated in a 150A Channel Service Unit (CSU) Fig. 2.

Note: The mounting cord of the 5000A terminal set must connect directly with a 150A CSU which has been tested and the attenuator switches set for the correct signal level. For installation and testing of the CSU, refer to Section 590-101-000.

3.02 Secure the ***J-hook*** (Fig. 2) of the D4BT mounting cord into the baseplate of the CSU and terminate as follows:

(1) Feed end of mounting cord under printed wiring board (PWB) to opposite side of CSU.

(2) Terminate tip (G) and ring (R) cord conductors to CT and CR screw terminals, respectively, of CSU.

(3) Insulate and store the (Y) and (BK) mounting cord leads so they will not interfere with wiring components of the CSU.

3.03 To open the 5000A terminal set, proceed as follows:

(1) Invert set and loosen the two captive screws holding the upper housing and chassis.

(2) Lay the upper housing and chassis to the right, as shown by Fig. 3 without disconnecting any cables.

3.04 The Terminal Identification (TID) for the terminal being installed (number is on the service order) should now be set on the terminal identification switches (Fig. 3). The 4 digits of the TID are set by closing the appropiate rocker-switches in each digit group which have values of 1, 2, 4, and 8 counting from left to right. If front side of rocker switch is depressed, the switch will close and the horizontal mark across the bar is not visible. If rear side of rocker switch is depressed, the switch will open and the horizontal mark across the bar is visible. Only closed switches produce a 1, 2, 4, or 8 (counting left to right) or a combination thereof. See Fig. 4 for example of switches coded for TID No. 5874.

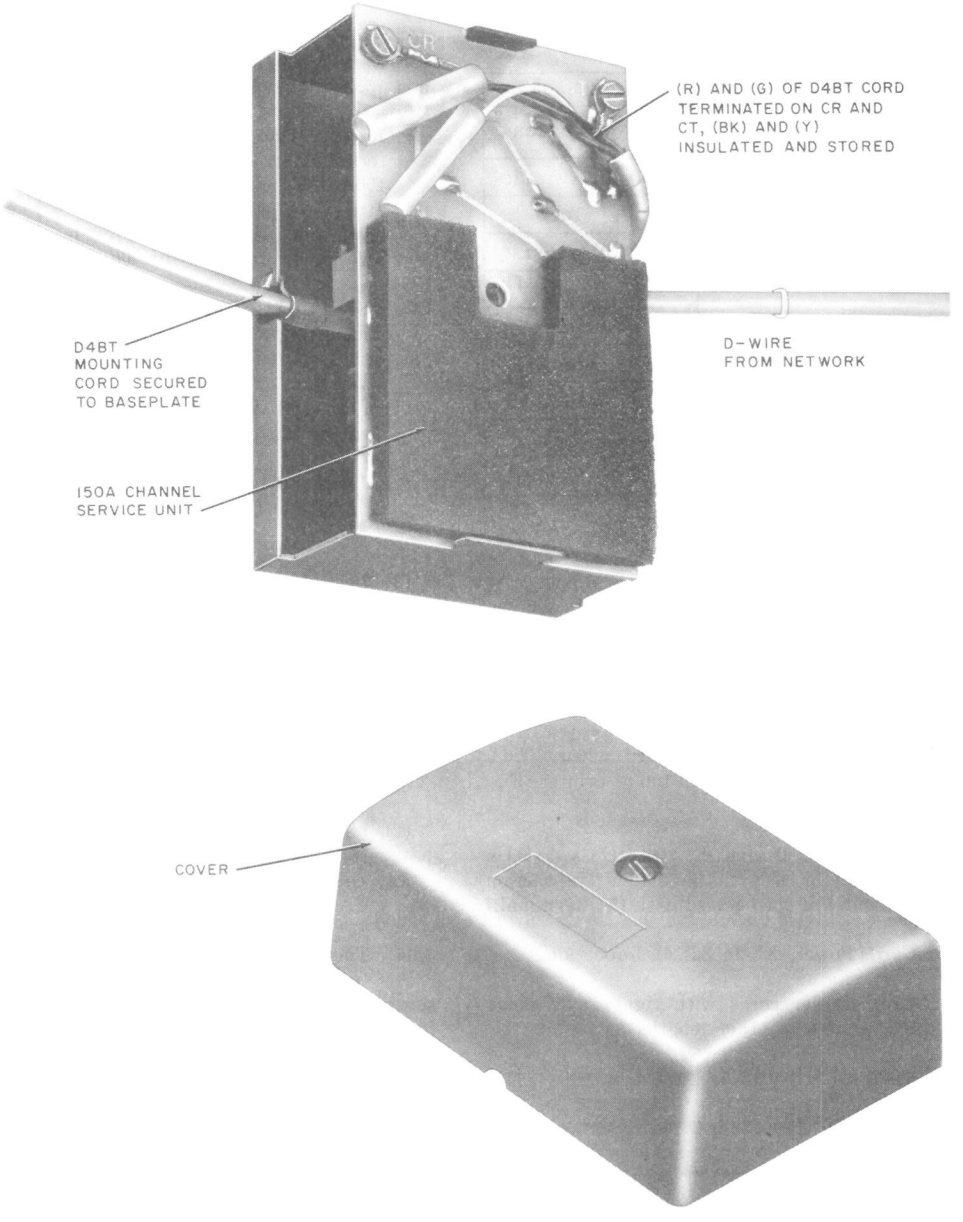


Fig. 2—150A Channel Service Unit Showing Connection of Transaction III Terminal Set

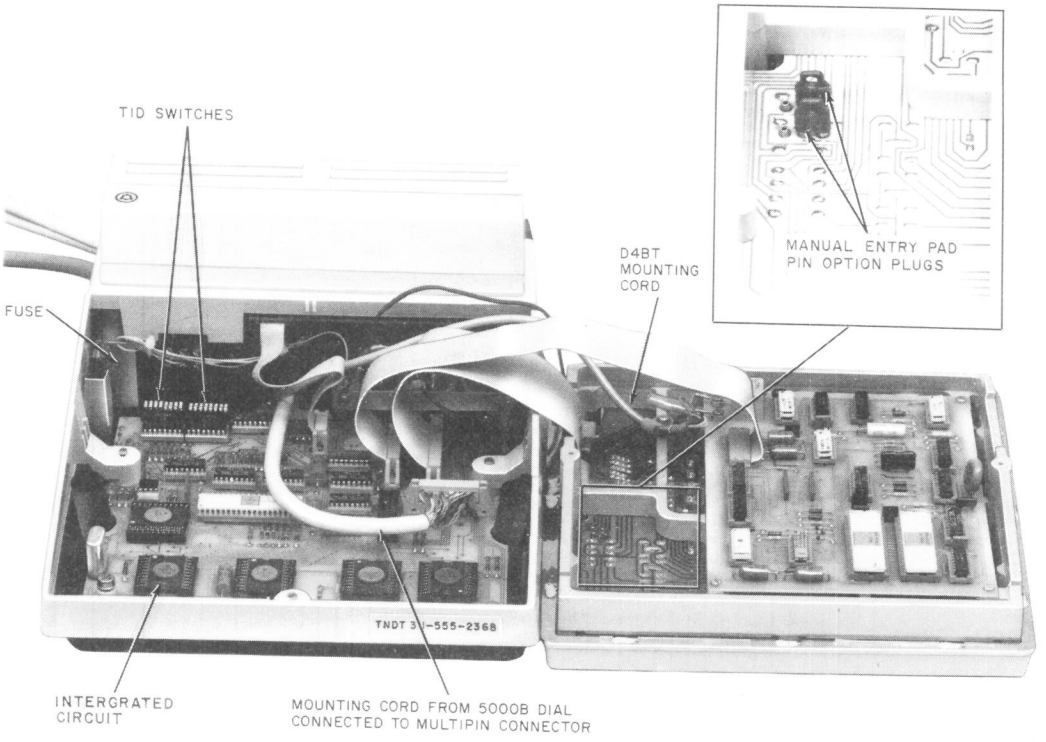


Fig. 3—5000A Transaction III Terminal Set With Upper Housing and Chassis Laid Aside — 5000B, D, or F Dial Connected

Note: The TID number should be displayed in the number card holder on the set, both for future reference and for the subscriber's use. (Early production models may only have a gummed label on front of the lower housing. Write number on label.)

OPTIONS

A. Personal Identification Number (PIN) Provided from Manual Entry Pad on 5000A Terminal Set (Fig. 1)

3.05 To provide this manual entry pad PIN option, move the two option plugs shown in Fig. 3 to the two left pin positions.



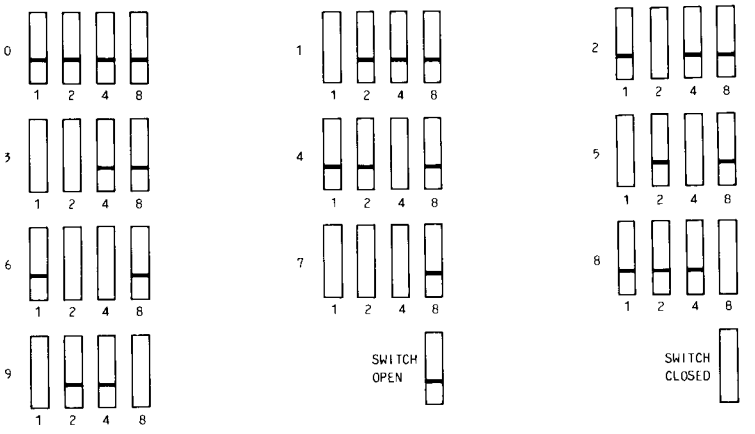
Options A and B cannot be provided on the same set simultaneously.

B. Personal Identification Number (PIN) (Provided by the Addition of an Auxiliary Entry Pad (Fig. 8)

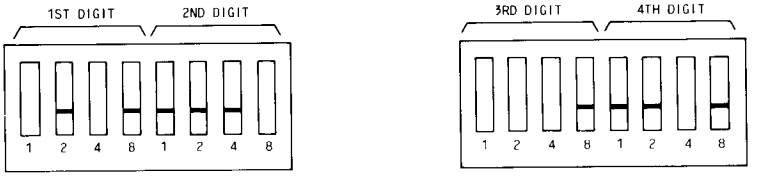
3.06 To provide this option, proceed as follows:

(1) Verify that manual entry pad PIN option plugs are in the right pin positions as shown by the insert of Fig. 3.

(2) Hold the lower housing up on its side and feed the mounting cord of the 5000B, D, or



A. SWITCH SETTINGS FOR EACH DIGIT, 0 THRU 9



B. EXAMPLE OF TID SWITCHES SET FOR 5874

Fig. 4—Terminal Identification (TID) Switches

F dial through the cord entrance hole in the base pan.

(3) Plug multipin connector of dial mounting cord into receptacle on main printed wiring board (PWB) Fig. 3. (Cord should extend toward the front of the set when connector is correctly oriented.)

(4) If a 5000F dial is being used, the A52D7PC intergrated circuit provided with the D-180822 Kit of Parts must be installed in place of the A52D7PB circuit on the main printed wiring board, (Fig. 3). Carefully pry up the edge of the existing intergrated circuit package and lift it out. When properly oriented the new circuit package may be plugged in.

Note: Be sure that the intergrated circuit being replaced is a A52***D7***PB.



Options A and B cannot be provided on the same set simultaneously.

C. 5000A Printer

3.07 If a 5000A printer is to be provided, the end of the M14H printer interconnect cord not equipped with a cord stay hook should now be connected as follows:

(1) Hold the lower housing of the 5000A terminal set on its side and feed the end of the

M14H cord through the cord entrance hole in the base pan.

(2) Plug the connector of the M14H cord into receptacle on main printed wiring board (PWB) Fig. 6. The connector is keyed and should not be forced.

3.08 Close terminal set as follows:

(1) Pull excessive slack out of adjunct cord(s) as upper housing and chassis are replaced. Invert set and tighten captive screws holding the upper and lower housing together.

(2) Place jacketed portion of cord(s) under strain relief along with terminal set mounting cord which is shown in Fig. 5.

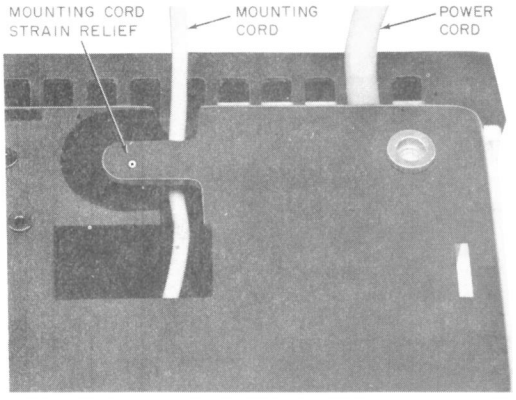


Fig. 5—Partial Bottom View of 5000A Terminal Set Showing Mounting Cord Strain Relief

3.09 Remove the disposable faceplate by lifting at the midpoints of the left and right edges. Install new faceplate by inserting bottom tab into housing and then lower faceplate onto adhesive pads.

Note: Verify that static arrester spring (Fig. 7) at upper right corner has not been distorted. It must make contact with bottom of metallic faceplate.

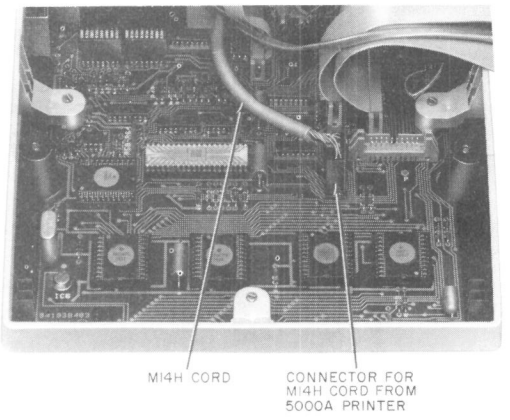


Fig. 6—5000A Terminal Set Main PWB with 5000A Printer Connected

3.10 Verify that there is an available 117-volt, 3-wire ac receptacle, not controlled by a switch, within reach of the 6-foot power cord.



A 3-wire outlet is required for safety and proper operation of the set. The third conductor must be grounded.

3.11 To install a 5000A printer with 5000A terminal set located on printer (Fig. 9), proceed as follows:

(1) Remove back cover from printer by removing the four screws holding the cover in place (Fig. 10).

(2) Turn printer onto either side. Connect the M14H cord from the 5000A terminal set by plugging the keyed connector into bottom of the printer and secure the strain relief using the screw provided (Fig. 11).

(3) Connect end of printer power cord into recessed power receptacle in the bottom of the printer (Fig. 11) and place printer upright. ***Do not connect cord to ac outlet at this time.***

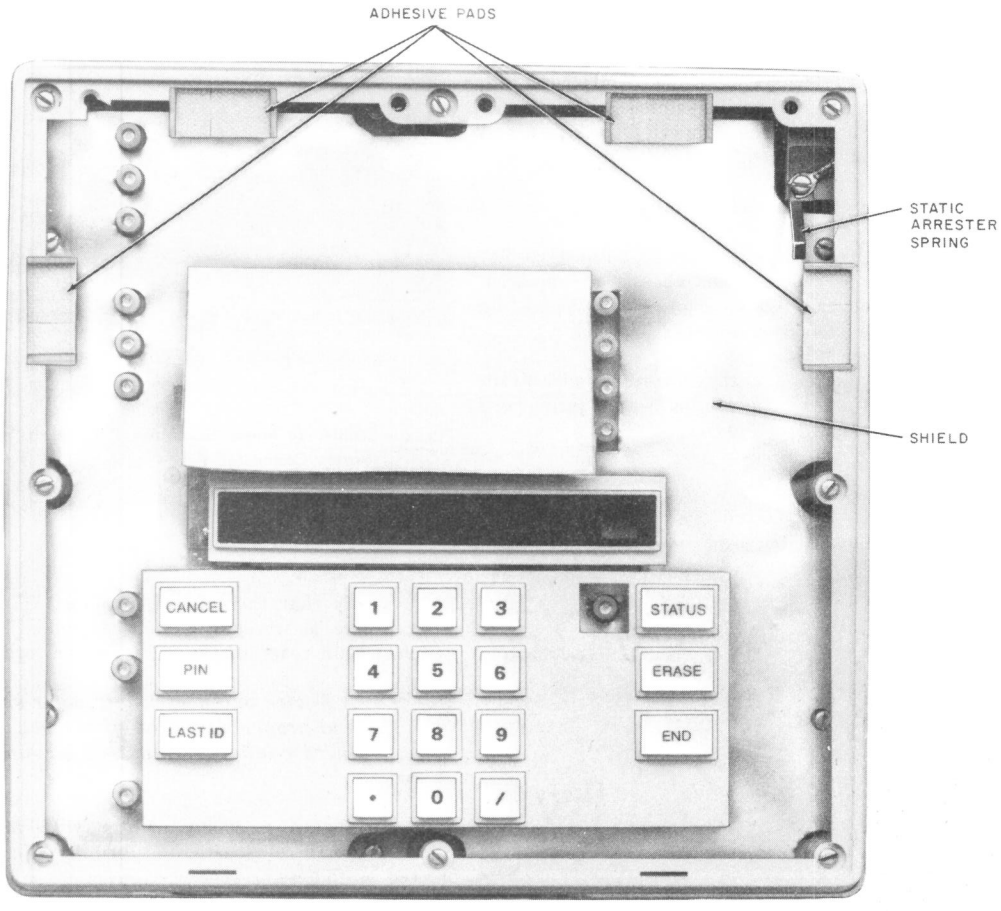


Fig. 7—5000A Transaction III Terminal Set With Faceplate Removed

(4) Place housing spacer, provided with printer, onto the printer (Fig. 10) and place the 5000A terminal set on top of the spacer.

(5) Plug 5000A terminal power cord into receptacle in rear of printer and wind the M14H and the 5000A terminal power cord around the cord storage spools at the rear of the printer (Fig. 12).

(6) Dress mounting cord(s) through the slots provided in rear of printer and replace back cover. Proceed to 3.13.

3.12 To install a 5000A printer adjacent to the 5000A terminal set, proceed as follows:

(1) Remove back cover from printer [3.11(1)] and remove cover insert from the stored location above the spools in rear of the printer. Slide the insert into the top of the back cover and replace storage screw in printer.

(2) Connect the M14H cord to the printer and connect the printer power cord to the printer [3.11 (2) and (3)].

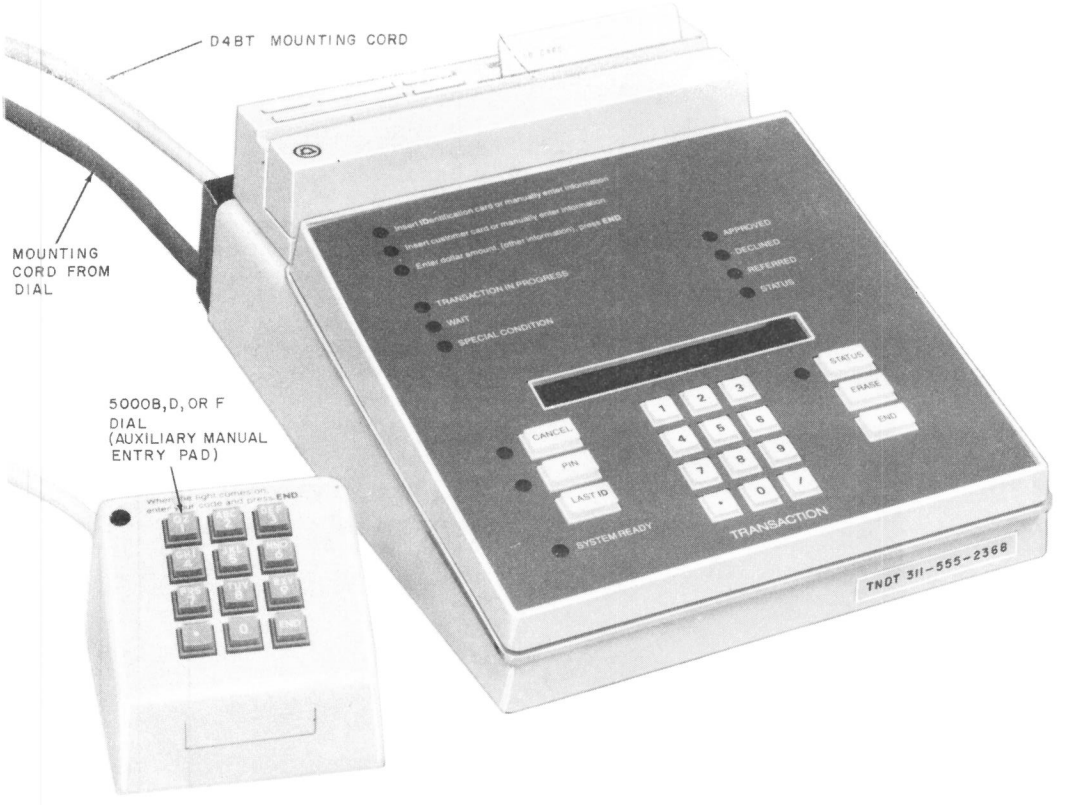


Fig. 8—5000A Transaction III Terminal Set With 5000B, D, or F Dial Installed

(3) The power cord of the 5000A terminal set may be connected to the power receptacle inside the printer or the two power cords may be run to separate ac receptacles. ***Do not connect to ac power at this time.*** If 5000A terminal set power cord is connected to printer receptacle, dress the cord through slot provided in rear of printer and replace back cover.

3.13 Connect power cord(s) to ac outlet and verify that the first instruction light is on and the SYSTEM READY light is on. The blinking of the SYSTEM READY lamp indicates that the line is connected to the Transaction Network and that it is being polled.

Note: If no lamps light when power cord is connected, either ac receptacle is defective or fuses may be open. If fuses are suspected, refer to 5.02 and 5.03 in Part 5, Maintenance.

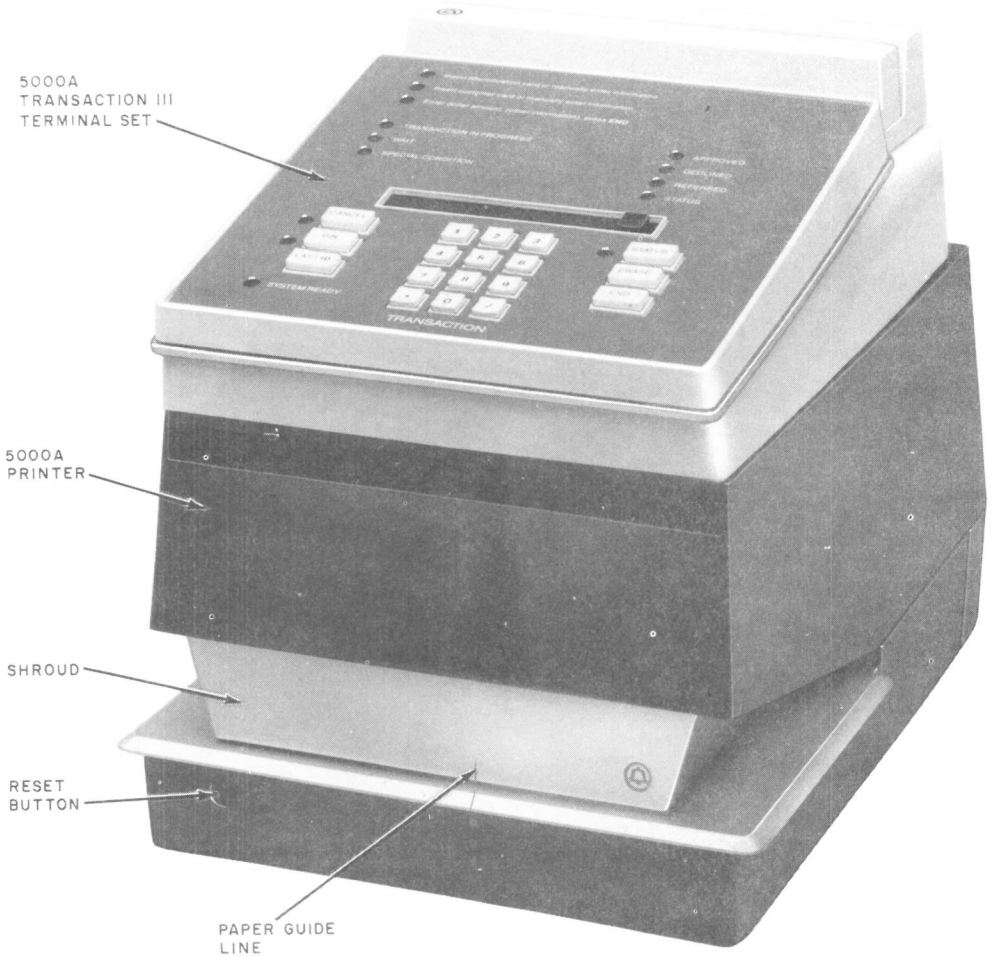


Fig. 9—5000A Transaction III Terminal Set Installed on 5000A Printer

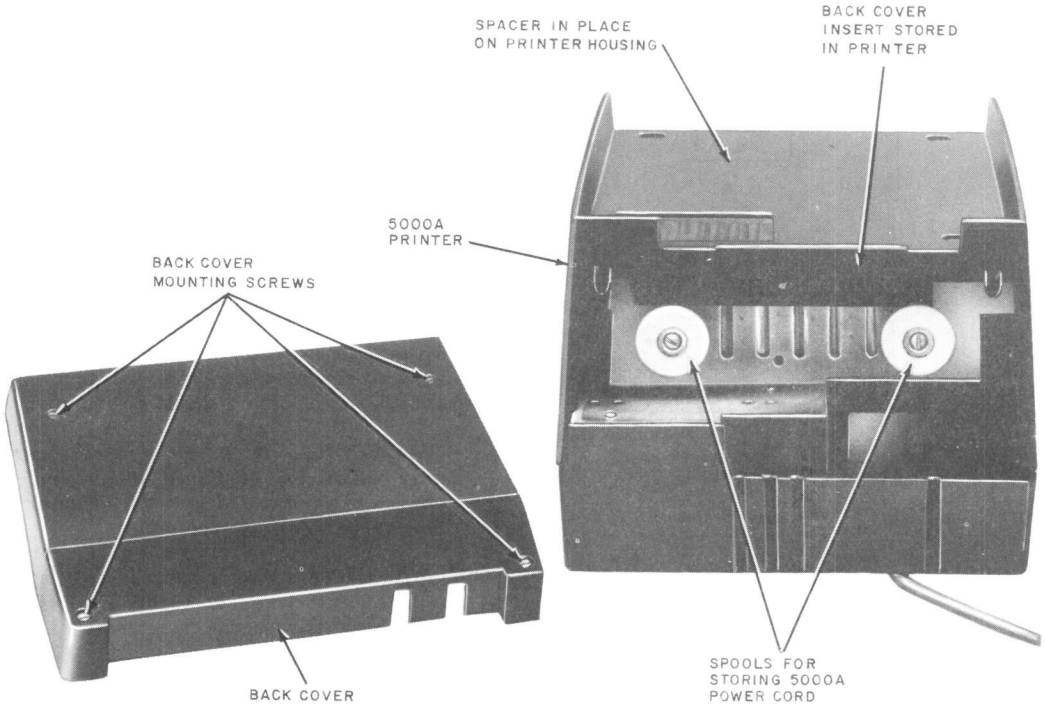


Fig. 10—5000A Printer With Back Cover Removed

4. TESTING



The following test procedures are designed to test all functions of the 5000A terminal set and associated equipment. A condensed format of the test procedures may be found at the end of this part.

Note: If a 5000A printer is being provided, have an 8-1/2 by 11 inch sheet of paper available before beginning test, but do not insert paper into printer.

4.01 The following are test sequences required to determined if the Transaction III terminal set (and printer, if provided) is operational.

Note: Any step that fails during the test means the test has failed. Repeat test before proceeding to the maintenance section.

4.02 Depress and hold RESET button momentarily. The SYSTEM READY lamp should go off and stay off as long as RESET button is held down.

4.03 Relese RESET button. The first instruction lamp should be on. SYSTEM READY lamp should be on and blinking. This may be considered to be the ***initial state*** of the terminal. If SYSTEM READY lamp is lighted but not blinking, it could indicate any of the following:

(a) Terminal set not connected to network.

(b) Trouble with Transaction Network or some component.

Note: If network failure is suspected, call the Transaction Network Customer Service Bureau.

(c) Trouble with the terminal set itself.

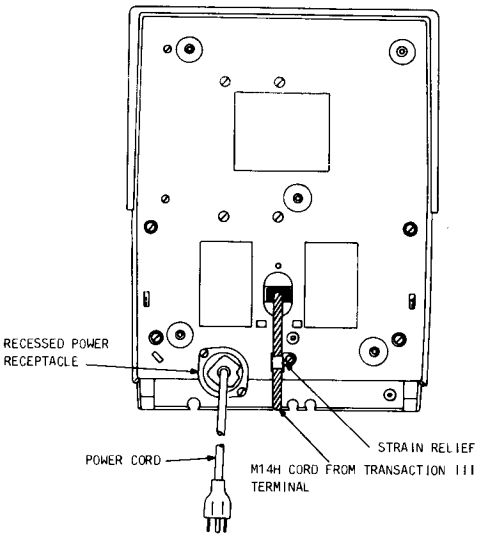


Fig. 11—Bottom View of 5000A Printer

4.04 Verify TID by simultaneously depressing the RESET and END buttons. Release RESET button while holding END. The TID should appear on visual display.

> ***Note:*** If the rocker switches associated with a digit are operated improperly, so that a number greater than a nine (9) is indicated, it will appear on the display as a dash (-) or invalid number.

If incorrect TID appears on display, disconnect power cord, open terminal (3.03), reset TID (3.04), and retest. If correct TID is displayed, depress RESET button to return terminal to its initial state.

4.05 Depress the 8 button eight times and the display shall be filled with 8's. Depress the • (decimal point) button eight times and the display shall be filled with •'s.

TEST PROCEDURE FOR 5000A TERMINAL WITHOUT PRINTER (TEST A)

4.06 Depress RESET button and release. Pass test card C (card is packed with 5000A terminal) through the card reader from right to left. Card must be held with the magnetic stripe down and to the front and must be moved through the slot smoothly and without hesitation. First instruction lamp should go out and second instruction lamp should light. Pass the test card through the reader a second time and the instruction lamps should sequence again. Correct operation of these lamps indicates that the test card is properly coded and the card reader is good. If the card is not read correctly an instruction lamp will blink and the card reading procedure should be repeated.

> ***WARNING: Any magnetic stripe card may have its encoding destroyed if the card is carried or stored near a magnet or magnetized object.***

4.07 With third instruction lamp lighted, key in digits, ***in sequence,*** 1 through 9, •, 0, and / (slash) on the manual entry pad.

4.08 Depress END button on terminal set and observe that TRANSACTION IN PROGRESS (TIP) lamp will light briefly. Observe that all response lamps including WAIT are on and the DISPLAY lamp (arrow toward right side of visual display) is blinking. The display will show • 2-999-0.

> ***Note:*** If ***Error 01*** appear on display, possible problems may be:
>
> - Incorrect TID number on service order
> - Connected to wrong line.

4.09 Depress DISPLAY button and display will show 1 2 3 4 5 6.

4.10 Depress DISPLAY button again and display will now show 1 2 3 4 5 6 7 8.

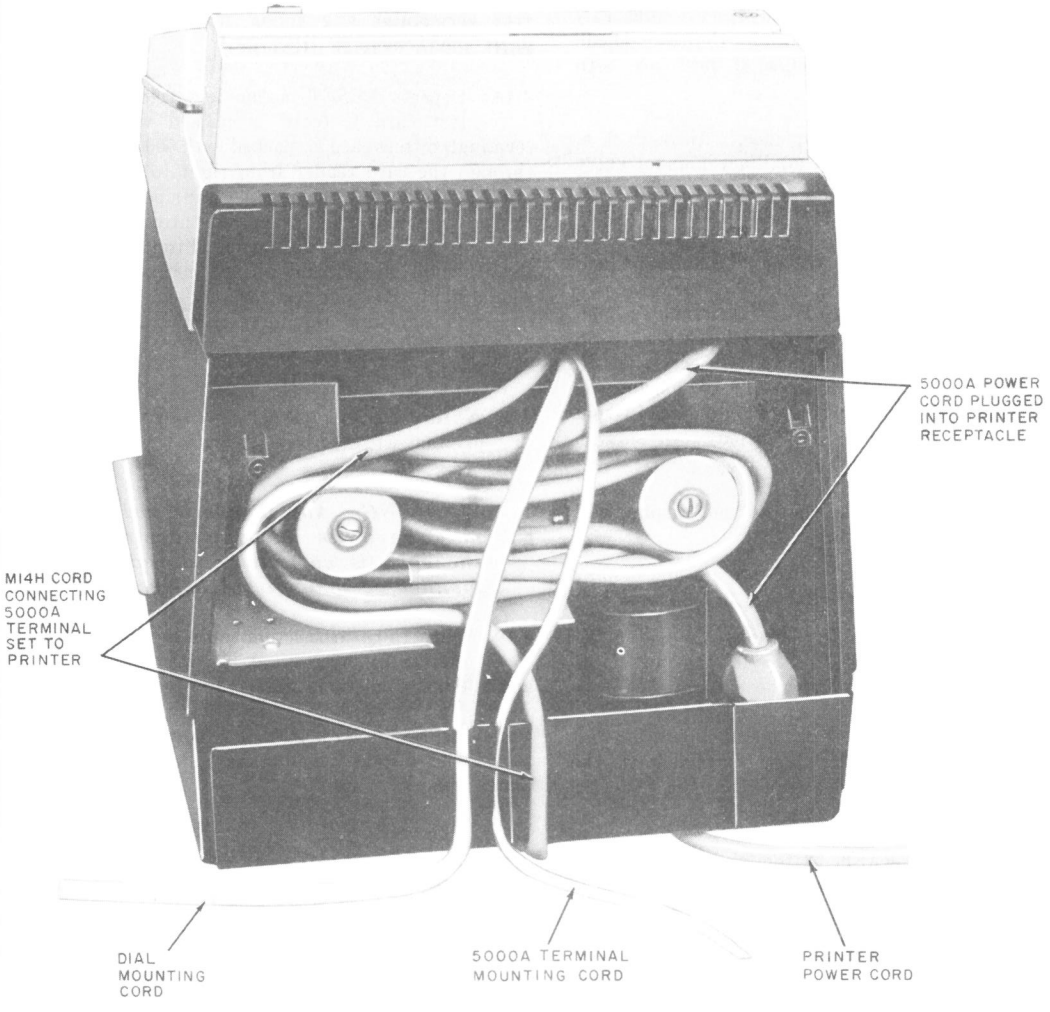


Fig. 12—5000A Terminal Shown Installed on 5000A Printer — Printer Cover Removed to Show Cord Storage

4.11 Depress DISPLAY button again. Verify that display now shows 9●0-. Display lamp (blinking arrow) will now be extinguished. If no provision has been made for a PIN pad, proceed to 4.13.

4.12 If PIN option A (3.05) or B (3.06) has been provided, test the appropriate pad as follows:

(1) Depress RESET button and run test card C through the card reader from right to left. Card must be held with the magnetic stripe down and to the front and must be moved through the slot smoothly and without hesitation. First instruction lamp should go out and second intruction lamp should light. Pass the test card through the reader a second time and the instruction lamps should sequence again.

(2) Depress PIN button and observe that PIN lamp on set and the Light Emitting Diode (LED) on the auxiliary dial (if used) are both lighted.

(3) Key in digits, in sequence, 1 through 9, •, 0, and END on the auxiliary manual entry pad (if used), or on the manual entry pad of the set. Each entry will appear on the display as a letter "P". The PIN lamp and the LED on the auxiliary dial will now be extinguished.

(4) Depress END button on terminal set and observe that TRANSACTION IN PROGRESS (TPI) lamp will light briefly. Observe that all response lamps including WAIT are on and the DISPLAY lamp (arrow toward right side of visual display) is blinking. The display will show • 2-999-0.

(5) Depress DISPLAY button and display will show 1 2 3 4 5 6.

(6) Depress DISPLAY button again and display will now shown 1 2 3 4 5 6 7 8.

(7) Depress DISPLAY button again and verify that display shows 9 • 0. Display lamp (blinking arrow) will now be extinguished.

4.13 Depress STATUS button and observe that all response lamps are extinguished, the visual display is now clear and that the STATUS button lamp lights.

4.14 Depress ERASE button and the STATUS lamp will be extinguished.

4.15 Depress CANCEL button. Observe that the CANCEL button lamp lights and TRANSACTION IN PROGRESS lamp will light briefly. After CANCEL lamp goes out, (• 2-999-0 will have appeared on the visual display), depress RESET button to restore terminal set to its initial state.

4.16 Depress LAST ID button and observe that SPECIAL CONDITION lamp is blinking. Display will show ***Error 04.***

4.17 Depress CANCEL button and set is restored to its initial state. Proceed to 4.32.

TEST PROCEDURE FOR 5000A TERMINAL SET USED WITH 5000A PRINTER (TEST B)

4.18 Depress RESET button and release. Pass test card C (card is packed with 5000A terminal) or test card E (packed with 5000A printer) through the card reader from right to left. Card must be held with the magnetic stripe down and to the front and must be moved through the slot smoothly and without hesitation. First instruction lamp should go out and second instruction lamp should light. Pass the test card through the reader a second time and the instruction lamps should sequence again.

Note: Test card D (also packed with 5000A printer) will not be used with this terminal.

WARNING: Any magnetic stripe card may have its encoding destroyed if the card is carried or stored near a magnet or magnetized object.

4.19 With third instruction lamp lighted, key in digits, ***in sequence,*** 1 through 9, •, 0, and / (slash) on the manual entry pad.

4.20 Depress END button on 5000A terminal set. The display should show PAPEr. Insert paper into the printer.

Note: Paper may be inserted from the front or from the right side. Position paper so that back of paper is against the paper guide and the left side lines up with the paper guide line on the shroud (Fig. 9).

4.21 The display will show PUSH End. Depress the END button. The printer will clamp the paper at this time.

4.22 Observe that TRANSACTION IN PROGRESS (TIP) lamp will light briefly. Then observe that all response lamps, and WAIT lamp, are on and the display lamp (arrow on right side of visual display) is blinking. The display will show •

Note: If ***Error 01*** appears on display, possible problems may be:

- Incorrect TID number on service order
- Connected to wrong line.

4.23 Depress DISPLAY button and display will show 1 2 3 4 5 6. Printer will be heard to operate. Do not remove paper. If no provision has been made for a PIN pad, proceed to 4.25.

4.24 If PIN option A (3.05) or B (3.06) has been provided, test the appropriate pad as follows:

(1) Depress RESET button and run test card C or E through the card reader from right to left. Card must be held with the magnetic stripe down and to the front and must be moved through the slot smoothly and without hesitation. First instruction lamp should go out and second instruction lamp should light. Pass the test card through the reader a second time and the instruction lamps should sequence again.

(2) Depress PIN button and observe that PIN lamp on set and the Light Emitting Diode (LED) on the auxiliary dial (if used) are both lighted.

(3) Key in digits, in sequence, 1 through 9, •, 0, and END on the auxiliary manual entry pad (if used) or on the manual entry pad on the set. Each entry will appear on the display as a letter "P". The PIN lamp and the LED on the auxiliary dial will now be extinguished.

(4) Depress END button terminal set and observe that TRANSACTION IN PROGRESS (TIP) lamp will light briefly. Observe that all response lamps including WAIT are on and the DISPLAY lamp (arrow toward right side of visual display) is blinking. The display will show • 2-999-0.

(5) Depress DISPLAY button and display will show 1 2 3 4 5 6. Printer will operate again.

4.25 Depress STATUS button and observe that all response lamps are extinguished, the visual display is now clear and that the STATUS button lamp lights.

4.26 Depress ERASE button and the STATUS lamp will be extinguished.

4.27 Depress CANCEL button. Observe that CANCEL button lamp lights and TIP lamp will light briefly. After CANCEL button lamp goes out, the response lamps will light and the display will show • 2-999-0.

4.28 Depress DISPLAY button. Display will show 1 2 3 4 5 6 and printer will operate again.

4.29 Depress RESET button to restore terminal to its initial state. Remove paper from printer. If PIN option has been provided, printing should read:

1 2 3 4 5 6 7 8 9 < 0 =

1 2 3 4 5 6 7 8 9 < 0

1 2 3 4 5 6 7 8 9 < 0

If no PIN capability has been provided, printing should read:

1 2 3 4 5 6 7 8 9 < 0 =

1 2 3 4 5 6 7 8 9 < 0 =

4.30 Depress LAST ID button and observe that SPECIAL CONDITION lamp is blinking. Display will show ***Error 04.***

4.31 Depress CANCEL button and set is restored to its initial state.

4.32 This completes the test procedures. Give test card to customer along with the How To Operate Manual. Explain to the customer the use of the test card per the How To Operate Manual.

Note: If no printer has been installed, leave test card C. If a 5000A printer has been provided, leave test card E which is provided with the printer. Both test cards have the same data on their magnetic stripes, only the testing instructions on the cards are different. If test card E is being provided, the validity of the card should be checked by the procedure given in 4.06 using test card E instead of test card C.

TEST A (SEE NOTE)

5000A TRANSACTION III TERMINAL SET

STEP	ACTION	VERIFICATION
1	Depress RESET and release, Pass test card thru reader.	1st lamp out —2nd lamp lights
2	Pass card thru reader again	2nd lamp out —3rd lamp lights
3	Key 1 thru 9, •, 0, and / on manual entry pad, Depress END	TIP lamp lights briefly, Response lamps and WAIT are on, Display lamp blinking, Display shows • 2-999-0
4	Depress DISPLAY button	Display shows 1 2 3 4 5 6
5	Depress DISPLAY button	Display shows 1 2 3 4 5 6 7 8
6	Depress DISPLAY button	Display shows 9•0- Display lamp extinguished

If PIN capability is not provided, proceed to Step 14.

7	Depress RESET and pass test card thru reader 2 times.	Lamps sequence as above, 3rd lamp lighted
8	Depress PIN button	PIN lamp and LED on 5000B, D, or F dial (if provided) lighted
9	Key 1 thru 9, •, 0, and END on auxiliary dial or manual entry pad, as provided.	Each entry appears on display as letter "P". PIN lamp and dial LED (if provide) are extinguished.
10	Depress END on 5000A terminal set.	TIP lamp lights briefly, Response lamps and WAIT are on, Display lamp blinking, Display shows • 2-999-0.
11	Depress DISPLAY button.	Display shows 1 2 3 4 5 6.
12	Depress DISPLAY button.	Display shows 1 2 3 4 5 6 7 8.
13	Depress DISPLAY button.	Display shows 9•0, Display lamp extinguished.
14	Depress STATUS button.	STATUS button lamp lights Response lamps extinguished Display is clear.
15	Depress ERASE button.	STATUS lamp extinguished.

STEP	ACTION	VERIFICATION
16	Depress CANCEL button.	CANCEL button lamp lights, TIP lamp lights briefly, CANCEL lamp goes out, Display shows • 2-999-0.
17	Depress RESET button.	1st instruction lamp on, WAIT lamp goes out, SYSTEM READY lamp blinking
18	Depress LAST ID button.	SPECIAL CONDITION lamp blinking, Display shows ***Error 04.***
19	Depress CANCEL button.	1st instruction lamp on, SYSTEM READY lamp blinking.

Note: For more detailed information, see 4.06 through 4.17.

TEST B (SEE NOTE)

5000A TRANSACTION III TERMINAL SET WITH 5000A PRINTER

STEP	ACTION	VERIFICATION
1	Depress RESET and release, Pass test card thru reader.	1st lamp out — 2nd lamp lights.
2	Pass card thru reader again.	2nd lamp out — 3rd lamp lights.
3	Key 1 thru 9, •, 0, and / on manual entry pad.	
4	Depress END button.	Display shows PAPEr.
5	Insert paper into printer.	Display shows PUSH End.
6	Depress END.	Paper clamped by printer, TIP lamp lights briefly, Response lamps and WAIT are on, Diplay lamp blinking, Display shows • 2-999-0.
7	Depress DISPLAY button.	Display shows 1 2 3 4 5 6 Printer operates.
	If PIN capability is not provided, proceed to Step 13.	
8	Depress RESET and pass test card thru reader 2 times.	Lamps sequence as above, 3rd lamp lighted.
9	Depress PIN button.	PIN lamp and LED on 5000B, D, or F dial (if provided) are lighted.
10	Key 1 thru 9, •, 0, and END on manual entry pad or auxiliary dial as provided.	Each entry appears on display as letter "P". PIN lamp and dial LED (if provided) are extinguished.
11	Depress END on 5000A terminal set.	TIP lamp lights briefly, Response lamps and WAIT are on, Display lamp blinking Display shows • 2-999-0.
12	Depress DISPLAY button.	Display shows 1 2 3 4 5 6 Printer operates.
13	Depress STATUS button.	STATUS button lamp lights, Response lamps extinguished, Display is clear.
14	Depress ERASE button.	STATUS lamp extinguished.

STEP	ACTION	VERIFICATION
15	Depress CANCEL button.	CANCEL button lamp lights, TIP lamp lights briefly, CANCEL lamp goes out, Response lamps light Display shows • 2-999-0.
16	Depress DISPLAY button.	Display shows 1 2 3 4 5 6 Printer operates.
17	Depress RESET button.	1st instruction lamp on WAIT lamp goes out, SYSTEM READY lamp blinking.
18	Remove paper from printer.	Printed display (With PIN capability provided) 1 2 3 4 5 6 7 8 9 < 0 = 1 2 3 4 5 6 7 8 9 < 0 1 2 3 4 5 6 7 8 9 < 0 (Without PIN capability) 1 2 3 4 5 6 7 8 9 < 0 = 1 2 3 4 5 6 7 8 9 < 0 =
19	Depress LAST ID button.	SPECIAL CONDITION lamp blinking, Display shows ***Error 04.***
20	Depress CANCEL button.	1st instruction lamp on SYSTEM READY lamp blinking.

Note: For more detailed information, see 4.18 through 4.31.

5. MAINTENANCE

5.01 All functions of the Transaction III terminal set are rendered inoperative by the loss of ac power.

5.02 There are two fuses housed in plastic ***in-line*** holders located at the left rear corner of the main PWB. If a fuse failure is suspected, the fuses may be removed (access per 3.03), and checked visually.

CAUTION: Insure that fuses do not get interchanged. The F1 fuse in the -12 volt circuitry is a 3/4 ampere fuse (connected by red leads) and the F2 fuse for +5 volt is a 3 ampere fuse (connected by black leads).

5.03 If the F2 fuse is open, there will be no lighted lamps on the terminal set and no visual display.

WARNING: For continued protection against fire hazard, replace fuses only with 3/4 AMP or 3 AMP (as specified) SLO-BLO (BUS MDL) or Equivalent.

5.04 Other field maintenance of the terminal set shall consist of the following:

(a) Check for proper connection of cord.

(b) Replacement of D4BT-87 mounting cord.

(c) Check for loose wires or connections on main PWB.

(d) Replacement of auxiliary manual entry pad.

(e) Check position of option plugs.

5.05 Field repairs on the 5000A terminal set shall not be attempted. Return defective set to Western Electric Service Center in accordance with local procedures. If set is being replaced, return disposable faceplate from new set with the used set.



If set should fail to sequence when using test card (4.06 or 4.18), try another test card before presuming the terminal set defective and replacing it.

5.06 If 5000A terminal set fails test procedure with printer connected, remove M14H cord from terminal set and retest per 4.06 through 4.17. If set passes terminal tests, replace printer.

5.07 Field repairs on the 5000A printer shall not be attempted. Return defective printer to Western Electric Service Center in accordance with local procedures.

5.08 Paper problems with the 5000A printer should be treated as follows:

(a) If paper is jammed or can not be removed easily:

(1) Push RESET button.

(2) Try to remove paper.

(3) If paper can not be removed, replace printer.

(b) If paper is ***lost*** in printer:

(1) Try to push paper out using another sheet of paper.

(2) Replace printer.



Do not attempt to remove paper from 5000A printer by forcing metal tools or hard objects through the paper slot as this may damage the printing mechanism.

5.09 Some printer related problems may be indicated by ***Error 09*** being displayed on the 5000A terminal set. These are:

(a) Paper not registering properly causing paper sensor switch to open before printing is completed.

(b) Defective M14H interconnect cord or improper engagement of M14H with connector in 5000A terminal or in 5000A printer.

(c) Malfunction in printer.

(d) Defective or faulty output from 5000A terminal.

(e) Errors in text transmitted from data center to terminal.

5.10 Repeated occurrences of the following symptoms indicate a printer malfunction and/or a need for printer replacement:

(a) Light printing on original (top) copy.

(b) Missing dots in characters.

(c) Characters printed over one another.

(d) Line feed (paper advance) is nonuniform, skewed (successive lines not parallel), or no line feed at all.

(e) Printer functions without paper present.

(f) Extreme nonuniformity in character width or spacing between characters. Some nonuniformity in the first 5 characters of the printed line is normal.

(g) Printer fails to print last character(s) on line, and stops leaving paper still clamped.

(h) Paper jammed in printer, (see 5.08).

5100BM TRANSACTION TELEPHONE SET BASE WITH 220- OR 2220-TYPE HAND TELEPHONE SET— USED WITH OR WITHOUT 5000A OR 5000A2 PRINTER IDENTIFICATION, INSTALLATION, CONNECTIONS, TESTING, AND MAINTENANCE

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1. GENERAL 1
2. IDENTIFICATION 1
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1. GENERAL

1.01 This section contains information for the transaction telephone set which consists of a 5100BM base, faceplate, and a 220- or 2220-type hand telephone set. For detailed information on components, refer to CD- and SD-69926-01. It also contains installation, connection, testing, and maintenance information on the 5000A or 5000A2 printer when used with the 5100BM transaction telephone set. The printers are covered by CD- and SD-69949-01.

1.02 This section is reissued to:

- Update information for Federal Communications Commission (FCC) registered sets and add new figures.

1.03 For use behind a key system, A and A1 leads are provided by the black (BK) and yellow (Y) leads, respectively, in the mounting cord. If common audible ringing is to be provided a separate ringer is required.

1.04 For additional information on the transaction telephone system, refer to Technical Reference, PUB 41804, titled "Switched Network Transaction Telephone System Interfacing With Audio Response Units," and PUB 41805, titled "Switched Network Transaction Telephone System Interfacing With FSK System Transmission Control Units".

2. IDENTIFICATION

2.01 The 5100BM transaction telephone set base, equipped with a 220- or 2220-type hand telephone set (Fig. 1) provides the standard features of a single line rotary or TOUCH-TONE® telephone set.

> ***Note:*** If the customer elects to have the dial of the hand telephone set made inoperable (as covered by paragraph 4.31) then it can only provide incoming and card dialer service.

It can also automatically dial and electronically transmit information, read from a magnetic stripe on a credit card, or keyed on a 15-button manual entry pad (Fig. 1) to a data center for immediate credit authorization, check verification, or inventory control. In addition, it is possible for a transaction to be accomplished in a hands-free mode.

2.02 ***Design Features:***

- Modular type
- Magnetic stripe card reader (ABA Track 2)
- Automatic dialer
- Click-disc type 15-button manual entry pad
- Operating instruction lamps [light emitting diodes (LED)]

NOTICE
Not for use or disclosure outside the
Bell System except under written agreement

- Hands-free operation
- Electronic switchhook and call progress sounder
- Volume control for call progress sounder
- Green/yellow approval or referral lamps (LED)
- Data receiver and an 8-digit alpha/numeric display.

2.03 ***Optional Features:***

- TT/DP (TOUCH-TONE/DIAL PULSE) option allows use of button pad and card reader into a rotary or a TOUCH-TONE dial office
- 15-button manual entry pad may be locked inoperable for outgoing calls
- An auxiliary manual entry pad (5000A-50, 5000C-50, or 5000E-50 dial), which will be referred to as Personal Identification Number (PIN) pad, may be connected to allow use of a PIN
- A 5000A or 5000A2 printer may be connected to provide printed response from the data center
- The one-number option can be set to restrict normal transactions to a single data center. (This option can be defeated by interrupting power between transactions.)

Note: This is an FCC registered set. There are no option adjustments for TOUCH-TONE signal output level. Option plugs for E27-E35 have been removed as well as the shorting plugs on the control board. The output level is set at the factory and cannot be changed.

2.04 The 5100BM transaction telephone set base is available in Ivory (-50) only. These bases will be shipped with a disposable protective faceplate, so it is necessary to order the proper faceplate separately (Tables A and B).

2.05 ***Ordering Guide***

(a) The 5100BM transaction telephone set base consists of all the necessary circuitry including power unit and card reader and should be ordered as:

- Base, Telephone Set, 5100BM (includes the following):
- Cord, Handset, H4DU-50
- Cord, Mounting, D4BU-29 (7-foot provided, 14- or 25-foot available)
- Adapter, 227A or D (for H4DU handset cord)
- 840996003 Test Card B (additional cards may be ordered)
- How To Operate Manual.

(b) One of the following is also required and must be ordered separately:

- Set, Telephone, Hand, 220C-50, 220AL-50, or 220AM-50 (Rotary dial)
- Set, Telephone, Hand, 2220BM-50 or 2220C-50 (TOUCH-TONE dial)

(c) If the PIN pad is to be used, it will be necessary to order the appropriate D-kit of parts (Table D) and also an appropriate faceplate (Tables A and B).

(d) If the 5000A or 5000A2 printer is to be used, it will be necessary to order it separately.

Note: The printer will be shipped with the following items:

- Housing Spacer—to be used when 5100BM set is placed on top of printer
- Cord, M14H—to interconnect with 5100BM set (3-foot provided, 10-foot available)
- 841941214 Test Card D
- Cord, Power, KS-14532L30, 6-foot long.

Note: Power cords are available in other lengths with a ***right angle*** plug as follows:

- 824013262 (P-40J326), 1-1/2 foot
- 824013270 (P-40J327), 2-foot

- 824013288 (P-40J328), 4-foot
- 824013296 (P-40J329), 6-foot
- 824010995 (P-40J099), 12-foot.

(e) D-180844 Kit of Parts (printer ribbon), ordered separately.

3. INSTALLATION

Warning: Any magnetic stripe card may have its encoding destroyed if the card is carried or stored near a magnet or magnetized object.

3.01 Terminate the local loop into a connecting block suitable for the D4BU-29 mounting cord, but do not connect the mounting cord at this time. The use of a 625-type connecting block (Fig. 2) is recommended. For information on other modular connecting blocks or adapters, refer to Section 503-100-100.

3.02 Connect appropriate TRIMLINE® handset (rotary or TOUCH-TONE dial) to the 5100BM set base using the handset cord and adapter if required. (A 616P jack is provided on the front of the base.)

3.03 Insure that there is an available 117-volt, 3-wire ac receptacle, not controlled by a switch, within reach of the 6-foot power cord.



A 3-wire outlet is required for safety and proper operation of the set. Third conductor must be grounded. If third wire is not provided and grounded, the resistance of the set to electrostatic damage is lowered and the probability of failure is greatly increased.

3.04 To install 138-type faceplate, proceed as follows:

(1) Remove disposable faceplate. If faceplate is aluminum foil, peel off and discard. If faceplate is aluminized cardboard lift at the midpoints of the left and right edges. When faceplate is bowed slightly, the locking tabs at top and bottom will release.

(2) Install new faceplate by inserting upper tabs into housing and slightly bowing the faceplate enough to insert lower tabs into slots of housing.

Note: If PIN pad is to be installed, do not install faceplate at this time.

3.05 It is recommended that at this time the set be opened (paragraph 3.06) and all option plugs on main printed wiring board (PWB), control board, and the data receiver board checked to insure that they are in their ***when shipped positions as shown by Fig. 3 and 4 or Table C. Check wiring terminations and if any loose connections are found, reterminate per Fig. 19 and 20.***

3.06 To open set in order to access option plugs and/or terminals proceed as follows:

(1) Disconnect power plug from ac outlet, if connected.

(2) Invert set and loosen the two captive screws holding the upper housing and chassis (Fig. 5).

(3) Lay the upper housing and chassis to the right, as shown in Fig. 6, without disconnecting any cables.

(4) To reassemble, reverse procedure.

3.07 If loss of loop exceeds 12 dB the quality of the service may be impaired. Defer, according to local procedures, until an acceptable loop is made available.



To avoid unnecessary opening and closing of the set, it is important that the installer be aware, at this time, of what external optional features are to be provided. Internal connections must be made for either the printer or the PIN pad, but certain sequential procedures must be followed. If a printer is to be provided but no PIN pad, the M14H printer interconnect cord should be connected to the 5100BM set at this time [paragraph 3.18(1)]. The printer end of the M14H cord should NOT be connected.

3.08 Connect the set to the telephone line by inserting the mounting cord into the connecting block.

PRELIMINARY TEST PROCEDURE

3.09 Place upper housing and chassis back onto the lower housing. With handset on-hook, plug in power cord and then go off-hook momentarily to reset the 5100BM set.

> ***Note:*** If no lamps light when handset is taken off-hook, either ac receptacle is defective or fuses may be open. If fuses are suspected, refer to Part 5 Maintenance (paragraph 5.02).

3.10 Go off-hook by lifting handset; first and fourth instruction lamps will light. Replace the handset; both lamps will extinguish. Press the ON button; both lamps will light again. Run test card B (card is packed with the 5100BM base) through the card reader from right to left. Card must be held with the magnetic stripe down and to the front and must be moved through the slot smoothly and without hesitation. First instruction lamp should go out and second instruction lamp should light. Correct operation of these lamps indicates that the test card is properly coded and the card reader is good. If the card is not read correctly the first lamp will blink and the card reading procedure should be repeated. Press the OFF button; both lamps will extinguish.

OPTIONS

3.11 If the service order does not call for the implementation of any options (Dial Pulse, Lockout, one-number option, disconnection of the ringer, or provision for PIN pad and/or printer) at this time, reassemble set and proceed to paragraph 3.13.



The service order must specify that each option is or is not required. If the service order does not so specify, the sales representative should be contacted.

> ***Note:*** If the order calls for making dial of hand telephone set inoperable, do not disable dial until all testing is completed.

3.12 If the service order specifies that any of the options, Dial Pulse, Lockout, or one-number option, be activated, or that ringer be disconnected, access the main PWB (paragraph 3.06) and proceed as follows:

(a) If both Dial Pulse (DP) and Lockout options are called for.

(1) Place TT/DP option plug for DP per Table C.

(2) Place upper housing and chassis back on set and reconnect ac power cord.

(3) Go off-hook and, using manual entry pad, dial any test number and verify that the call is completed. This tests the dial pulse feature.

(4) Disconnect power cord, lay upper housing and chassis aside, and move Lockout option plug to lockout position per Table C.

(5) Place upper housing and chassis back onto lower housing and reconnect ac power cord.

(6) Test lockout by going off-hook and depressing any numeric button on manual entry pad to verify absence of dial pulse signals.

(b) If only Dial Pulse option is specified.

(1) Proceed as in (a) Steps (1), (2), (3) and (5).

(c) If only Lockout option is specified.

(1) Move Lockout option plug per Table C.

(2) Place upper housing and chassis back onto lower housing and reconnect ac power cord.

(3) Test lockout by going off-hook and depressing any numeric button on manual entry pad to verify absence of TOUCH-TONE frequency signals.

(d) If the one-number option is specified, set switch number 4 to the ON position (Fig. 3), and insure that the lockout option plug is in Locked Out position per Table C.

Note: For the ***ON*** position, depress the end of the rocker switch nearest the number 4.

(e) To disconnect P2B ringer.

(1) Remove red (R) and black (BK) ringer leads from terminal P1 and T, respectively, on control board, insulate and store.

(2) Place upper housing and chassis back onto lower housing and reconnect ac power cord.

INSTALLATION TEST PROCEDURES

3.13 Using the TRIMLINE handset, perform the normal tests, including, ringback, for a rotary or TOUCH-TONE telephone set (as applicable) according to local procedures.

3.14 Depress ON button (listen to dial tone), and check operation of call progress tone sounder volume control (Fig. 1). Adjust volume control to acceptable level and depress OFF button.

3.15 Before connecting either a PIN pad or a printer (if they are to be provided), proceed to Part 4 and complete the appropriate Remote Test Procedures.

PIN PAD

3.16 If the PIN pad (Fig. 7) is to be used, it should be installed at this time. Refer to Fig 8 and Table D for proper D-kit of parts and install as follows:

(1) Remove faceplate by lifting at the midpoints of the right and left edges. When faceplate is bowed slightly, the locking tabs at top and bottom will release.

Note: A 138D-type faceplate (ordered separately, Table A) will also be required.

(2) Install the mounting plate and enabling key (Fig. 9) as follows:

(a) Remove screw holding static arrester spring (Fig. 9) and slide mounting plate under the spring. Replace the screw holding the spring and the associated lead. This should secure right side of mounting plate.

(b) Secure left side of mounting plate with two (2) screws.

(c) Insert the key with cut-out portion of key mounting to right and the two indexing or alignment holes over tabs on the mounting plate to the left.

(d) Secure right side of key using the other two (2) screws provided.

(3) Install new 138D-type faceplate.

(4) Open the set (paragraph 3.06); lay the upper housing and chassis to the right (Fig. 6).

(5) Hold the lower housing up on its side and feed the mounting cord of the dial through the adjunct cord entrance hole in the base pan, (Fig. 5). Using Fig. 6, make connections as follows:

(a) Plug multipin connector of mounting cord into connector on flex ribbon cable.

Note: A polarizing key in the female connector assures proper mating of connectors.

(b) Connect 508 plug to enabling key.

(c) Connect the black (BK) spade-tipped mounting cord conductor to terminal E8A on the main PWB. [Some sets have a black lead connected to E8A. This must remain. Connect (BK) mounting cord lead to same terminal.]

(d) Connect the spade-tipped blue-black (BL-BK) mounting cord conductor to the spade-tipped (BL-BK) lead from terminal E79 on the main PWB (Fig. 3) using a D-161488 connector. Insulate the connection.

Note: In later production model there is a push-on terminal at E79 instead of a spade-tipped lead. Connect the (BL-BK) mounting cord conductor to this terminal.

(e) Connect the spade-tipped slate (S) mounting cord conductor to the spade-tipped (S) lead from terminal Y1 on the control board (Fig. 4) using a D-161488 connector. Insulate the connection.

Note: In later production models, terminal Y1 is accessible at the lower right corner of the control board. Connect the (S) mounting cord conductor directly to terminal Y1.

(f) Insulate and store any unused mounting cord leads.

If a printer is to be provided and the M14H printer interconnect cord has not been connected to the 5100BM set it should be connected at this time [paragraph 3.18(1)].

(6) Place upper housing and chassis back onto lower housing. Invert set and tighten captive screws holding the upper and lower housing together.

(7) Place jacketed portion of mounting cord(s) under strain relief as shown in Fig. 5.

(8) Refer to paragraphs 4.14 through 4.17 for testing procedures.

5000A OR 5000A2 PRINTER



Before connecting a printer, a visual inspection should be made and certain preliminary procedures followed to prepare the printer for operation.

3.17 Proceed with the inspection and procedures as follows:

(1) Examine the printer for any physical damage.

(2) Remove the back cover by releasing the four (4) cover mounting screws (Fig. 10).

(3) Remove the printer housing by.

(a) Carefully lay printer on its side and release the four recessed captive housing mounting screws.

(b) Set printer upright and lift housing straight up to slide housing off circuit board.

(4) Visually inspect the printer for damage and check to see that ribbon is correctly positioned around guide posts and into the guide path (Fig. 11 and 12).

(5) Manually move the spool ratchet (located between the ribbon spools, Fig. 12) toward spool A.

(6) Turn spool six (6) or seven (7) rotations to take up slack and pull ribbon around the reinking rollers for better operation.

Note: The spool ratchet must remain positioned away from the spool being turned.

(7) Replacing printer housing (not back cover), tighten screws and proceed with installation.

Note: To replace the printer housing, face the rear of the printer. Place the circuit board and metal board in the housing guide slots. Carefully slide down on housing until properly seated.

3.18 To install a printer with 5100BM set located on printer (Fig. 13 or 14) proceed as follows:

(1) Open the 5100BM set (paragraph 3.06) and feed the end of the M14H connecting cord not equipped with a cord stay hook, through the adjunct cord entrance hole in the base pan (Fig. 5). Plug the cord into the connector on the data receiver board (Fig. 6). This connector is keyed and should not be forced. Dress slack from M14H cord and place cord under strain relief (Fig. 5). Reassemble the 5100BM set.

(2) Remove the insert from the top edge of the back cover by pulling it at a right angle to the cover. Remove retaining screw from rear of printer (above cord spools) and store insert by placing retaining screw through hole in center slot of insert and fasten in place as shown in Fig. 10.

(3) Turn printer onto either side. Connect the M14H cord from the 5100BM set by plugging the keyed connector into the bottom of the printer and secure the strain relief using the screw provided (Fig. 15).

(4) Connect end of printer power cord into recessed power receptacle in the bottom of the printer (Fig. 15) and place printer upright.

(5) Place the housing spacer, provided with the printer, onto the printer (Fig. 10), and place the 5100BM set on top of the spacer.

(6) Plug 5100BM power cord into printer receptacle and wind the M14H cord and 5100BM power cord around the cord storage spools at the rear of the printer (Fig. 16).

(7) Dress cord(s) through the slots provided in rear of printer and replace cover.

(8) Remove shipping paper taped to printer platen.

(9) Connect the 5100BM set to the telephone line. With handset on-hook, plug in power cord and then go off-hook momentarily to reset the 5100BM set.

3.19 If the 5100BM set is to be placed adjacent to the printer, install the printer as follows:

(1) Install the M14H cord between the 5100BM set and the printer, and connect the printer power cord [paragraphs 3.18 (1), (3), and (4)].

(2) The power cord from the 5100BM set may be connected to the power receptacle inside the printer, or the two power cords may be run to separate ac receptacles.

(3) If the 5100BM set power cord is connected to the printer receptacle, dress it through slot provided in rear of printer and replace the back cover.

(4) Remove shipping paper taped to printer platen.

(5) Connect the 5100BM set to the telephone line. With handset on-hook, plug in power cord(s) and then go off-hook momentarily to reset the 5100BM set.

Note: When installed in this manner, the housing spacer (provided with the printer) will not be used.

3.20 Remote testing procedures must now be repeated to test operation of the printer. If the one-number option is not specified, refer to paragraphs 4.18 through 4.23. If the one-number option is specified, refer to paragraphs 4.24 through 4.26.

4. TESTING



The 5100BM set should be tested before connecting any adjuncts such as the PIN pad and/or the printer. If more than one adjunct is being provided test the PIN pad before connecting the printer. This will enable the installer to recognize a defective or nonworking component. After becoming familiar with the appropriate test procedure, the condensed format of the corresponding Step, Action, Verification tests, at the end of this part are more convenient to follow. These tests are designed to be used as follows:

(a) ***Without one-number option:***

5100BM set TEST A

5100BM set with PIN pad TEST A and C

5100BM set with printer TESTS A and E

5100BM set with PIN pad and printer TESTS A, C, and E

(b) ***With one-number option:***

5100BM set TEST B

5100BM set with PIN pad TESTS B and D

5100BM set with printer TESTS B and F

5100BM set with PIN pad and printer TESTS B, D, and F

REMOTE TEST PROCEDURES



In the following tests there should not be over a 20-second delay between steps or the test line may interpret this as an error. If an interrupted tone (1/2 second on, 1/2 second off), lasting about 5 seconds, is heard at any time, an error is indicated. The Local 1A Transaction Telephone Test Line Station (TTTLS) will disconnect at the

end of the interrupted tone. To retest, it will be necessary to redial the test line.

REMOTE TEST PROCEDURE WITHOUT ONE-NUMBER OPTION (TEST A)

4.01 Go off-hook, by lifting the handset, first and fourth instruction lamps are lighted and dial tone is heard. (The fourth instruction lamp will remain lighted as long as the set is off-hook.) Manually dial the number of the Local 1A Transaction Telephone Test Line Station (TTTLS) using the TRIMLINE handset.

4.02 When the call is completed to the Local TTTLS, it will respond with a 3-second answer tone which will be heard on the TRIMLINE handset. After the answer tone has terminated, test card B should be passed through the reader two (2) times. The instruction lamps should sequence—the second instruction lamp should light after the card is passed through the first time, and when the card has been passed through the second time, the third lamp will be lighted.

4.03 Key in digits by depressing buttons on the manual entry pad, in sequence, 1 through 9, o, 0, /, and END. The third instruction lamp will now be extinguished. While you are doing this, the set will transmit the buffered data as TOUCH-TONE pulses. The digits keyed in will have appeared on the visual display as they are keyed and the display will clear when transmission is completed.

4.04 The green response lamp will then flash and the display shall be filled with 8s.

4.05 Press the ERASE button. The display should fill with decimal points, and the green response lamp will continue to flash.

4.06 Key in 1, 2, 3, END. The display should erase and the yellow lamp should light within 10 seconds. If the yellow lamp does not light and the display shows E-0-0, reenter 1, 2, 3, END. You have 7 seconds, after E-0-0 is displayed to do this. The yellow lamp should light within 10 seconds.

4.07 After yellow lamp lights, press ATTN. A 3-second response is heard and the Local TTTLS will disconnect. Place handset on-hook. The yellow lamp may be extinguished by momentarily going off-hook.

REMOTE TEST PROCEDURE WITH ONE-NUMBER OPTION AND KEYBOARD LOCKOUT (TEST B)

4.08 Disconnect the ac power cord and then reconnect it. The display will show ***diAL Cd*** and the yellow response lamp will be blinking.

4.09 Go off-hook by lifting the handset and pass test card B through the reader once. The yellow response lamp will now be on without blinking.

4.10 Dial the number of the Local TTTLS, (see Note after paragraph 4.01), using manual entry pad. (As the Local TTTLS is being dialed, the numbers dialed will appear on the display from the right side and the ***diAL Cd*** will move off the display to the left.) Press END button. The display will clear; the yellow response lamp will go out, and the first and fourth instruction lamps are lighted. (The fourth instruction lamp will remain lighted as long as the set is off-hook.)

> ***Note:*** If the Local TTTLS is dialed (paragraph 4.10) through a rotary office (DP option provided), digits must be dialed slowly so as to allow all pulses of each digit to be outpulsed before depressing the next digit.

4.11 When the call is completed to the Local TTTLS it will respond with a 3-second answer tone which will be heard on the TRIMLINE handset. After the answer tone has terminated, press ATTN once. The first instruction lamp will extinguish and the second instruction lamp will be lighted.

4.12 Pass test card B through the reader once. The instruction lamps should sequence—the third instruction lamp should be lighted and the second instruction lamp should extinguish.

4.13 Follow the procedures of paragraphs 4.03 through 4.07, but at the conclusion of paragraph 4.07, interrupt the ac power to clear the one-number memory. If the customer dialing card is available, the one-number should be loaded with the correct dialing card before leaving. This may be done as follows:

(1) When ac power is interrupted, display will show ***diAL Cd.***

(2) Pass dialing card through reader.

(3) Press END button.

(4) Go off-hook momentarily to reset 5100BM set.

PIN PAD (TESTS C OR D)

4.14 To test the PIN pad, press the Personal Identification Number (PIN) key to enable the pad. Observe that both light emitting diodes (LED) light, one on the PIN key and one on the PIN pad. Depress PIN key again and observe that both LEDs are extinguished.

4.15 If the one-number option is not selected, repeat paragraphs 4.01 and 4.02 (Test C). If the one-number option is selected, repeat paragraphs 4.08 through 4.12 (Test D).

4.16 Press the PIN key to enable the pad. Key in by depressing, in sequence, digits 1 through 9, o, and 0 on the PIN pad. Depress / (slash) on the 5100BM base manual entry pad and then depress END on the PIN pad. The third instruction lamp shall be extinguished.

> ***Note:*** Each entry from either the PIN pad or the 5100BM base manual entry pad, while the PIN pad is activated, will cause the letter ***P*** to appear on the display.

4.17 The green response lamp shall flash and the display shall be filled with 8s. Depress the PIN key and observe that the LEDs (on both the PIN pad and the 5100BM base) shall be extinguished. Go on-hook with the hand telephone set.

REMOTE TEST PROCEDURE FOR 5000A OR 5000A2 PRINTER—WITHOUT ONE-NUMBER OPTION (TEST E)

> ***Note:*** Have an 8-1/2 by 11 inch sheet of paper available before beginning test but do not insert it into the printer.

> ***Note:*** This installation test procedure is slightly different than the customer's test procedures. Follow these instructions rather than the instructions on the back of the test card.

4.18 Repeat test procedures for 5100BM transaction telephone set per paragraphs 4.01 through 4.05.

4.19 Key in 1, 2, 3, END. The display should erase and the green lamp will go out. If the display shows E-0-0, reenter 1, 2, 3, END within 7 seconds.

4.20 Approximately 10 seconds after the green lamp goes out, the display will show ***PAPEr.*** Insert the 8-1/2 by 11 inch sheet of paper into the printer (Fig. 13).

> ***Note:*** Paper may be inserted from the front or from the right side. Position paper so that back of paper is against the paper guide and the left side lines up with the paper guide line on the shroud.

4.21 The display will show ***PUSH End.*** Press END button.

4.22 When the END button is pressed, the yellow lamp will light and the printer will print the test message shown by Fig. 17.

4.23 After the printing stops, but before removing the paper, press ATTN. The yellow lamp will go out, a 3-second response tone is heard and the TTTLS will disconnect. The paper may be withdrawn from any direction. If the paper is still clamped, press the reset button (Fig. 13 or 14) and remove the paper. If a 5000A2 printer is used, hold button and paper will feed automatically.

> ***Note:*** During printing the display may show E-0-1; this indicates a printer malfunction or that the paper is not positioned correctly. Repeat the test. If the condition continues, refer to the maintenance section for possible causes.

REMOTE TEST PROCEDURE FOR 5000A OR 5000A2 PRINTER—WITH ONE-NUMBER OPTION (TEST F)

> ***Note:*** Have an 8-1/2 by 11 inch sheet of paper available before beginning test but do not insert it into the printer.

> ***Note:*** This installation test procedure is slightly different than the customer's test procedures. Follow these instructions rather

than the instructions on the back of the test card.

4.24 Repeat one-number option test procedures for 5100BM transaction telephone set per paragraphs 4.08 through 4.12, and then paragraphs 4.03 through 4.05.

4.25 Repeat paragraphs 4.19 through 4.23 from the printer test procedure without the one-number option.

4.26 At the conclusion of the test, interrupt the ac power to clear the one-number memory. If the customer dialing card is available, the one-number memory should be loaded with the correct dialing card before leaving. This may be done as follows:

(1) When ac power is interrupted, display will show ***diAL Cd.***

(2) Pass dialing card through reader.

(3) Press END button.

(4) Go off-hook momentarily to reset 5100BM set.

FINAL TEST

4.27 If the customer has a dialing card, ask him to use his card and place a call to his data center to verify that he can reach it.

> ***Note:*** If no printer has been installed, leave test card B. If a printer has been provided, leave test card D which is provided with the printer. Both test cards have the same data on their magnetic stripes, only the testing instructions on the cards are different. If test card D is being provided, the validity of the card should be checked by the procedure given in paragraph 3.10 using test card D instead of test card B.

4.28 This completes the test procedures. Write the telephone number of the Local TTTLS on the appropriate test card for customer's future reference and give test card to customer along with the How To Operate Manual. Explain to the customer the use of the test card per the How To Operate Manual.

DIAL RESTRICTION OF HAND TELEPHONE SET

4.29 Some customers may want the dial of the hand telephone set restricted from making outgoing calls. This feature is not recommended and will only be incorporated at the customer's insistence.

> ***Note:*** If dial restriction is to be provided, all installation tests must be completed prior to making the modification.



If dial is restricted, the set can no longer be used as a normal telephone set since calls can only be initiated by a dialing card.

4.30 Only the 220-type hand telephone set may be restricted. If dial restriction is requested at a location that has been equipped for TOUCH-TONE service, the 2220-type hand telephone set should be replaced with a 220-type hand telephone set that has been modified per paragraph 4.31.

4.31 To restrict the dial in a 220A (MD), 220AM, or 220AL hand telephone set, proceed as follows:

(1) Remove handset cord from handset using KS-21107 releaser or equivalent.

(2) Remove cover or number card retainer located just above dial using KS-21107 releaser or equivalent.

(3) Remove light seal plate and the two screws located under retainer. This will release the cover from the handset.

(4) Place a strap between the pulsing contacts as shown in Fig. 18. The dial will remain in the handset.

> ***Note:*** If a 220C hand telephone set is provided, place the strap between screw terminals 1 and 2 located on the flexible circuit board.

(5) Reassemble handset and reconnect handset cord.

4.32 Outgoing calls may now be made only by using a dialing card, if keyboard lockout option was specified (paragraph 3.12).

TEST A (SEE NOTE)

5100BM WITHOUT ONE-NUMBER OPTION

STEP	ACTION	VERIFICATION
1	Go off-hook with handset.	Dial tone heard 1st and 4th instruction lamps light
2	Dial local TTTLS, using handset.	3-second answer tone heard
3	Pass test card B thru reader.	1st lamp out—2nd lamp lights
4	Pass test card B thru reader a second time.	2nd lamp out—3rd lamp lights
5	Key 1 thru 9, o, 0, /, and END.	3rd lamp out Digits appear on display as keyed Set transmitting buffered data Display clears when transmission stops Display fills with 8s Green lamp flashing
6	Press ERASE.	Display shows decimal points Green lamp flashing
7	Key 1, 2, 3, END. If display shows "E-0-0" reenter 1, 2, 3, END.	Display clears Yellow lamp lights (within 10 seconds)
8	Press ATTN.	Yellow lamp out 3-second tone heard Local TTTLS will disconnect
9	Go on-hook.	4th lamp goes out.

Note: For more detailed information, see paragraphs 4.01 through 4.07.

TEST B (SEE NOTE)

5100BM WITH ONE-NUMBER OPTION

STEP	ACTION	VERIFICATION
1	Disconnect ac power cord.	
2	Reconnect ac power cord.	Display shows "diAL Cd" Yellow lamp flashing
3	Go off-hook with handset.	Dial tone heard
4	Pass test card B thru reader.	Yellow lamp lights
5	Dial Local TTTLS, using manual entry pad.	Digits appear on display as dialed— "diAL Cd" moves off display to left
6	Press END button.	Display clears Yellow lamp goes out 1st and 4th instruction lamps light 3-second answer tone heard
7	Press ATTN.	1st lamp out—2nd lamp lights
8	Pass test card B thru reader.	2nd lamp out—3rd lamp lights
9	Key 1 thru 9, o, 0, /, and END.	3rd lamp out Digit appears on display as keyed Set is transmitting buffered data Display clears when transmission stops Display fills with 8s Green lamp flashing
10	Press ERASE button.	Display shows decimal points Green lamp flashing
11	Key 1, 2, 3, END.	Display clears—Green lamp out Yellow lamp lights
12	Press ATTN.	Yellow lamp goes out 3-second tone heard Local TTTLS disconnects
13	Go on-hook.	4th lamp goes out.

Note: For more detailed information, see paragraphs 4.08 through 4.13.

TEST C (SEE NOTE)

PIN PAD WHEN CONNECTED TO 5100BM SET—WITHOUT ONE-NUMBER OPTION

STEP	ACTION	VERIFICATION
1	Press PIN key on 5100BM.	LEDs light on PIN key and on PIN pad
2	Press PIN key again.	LEDs are extinguished
3	Go off-hook with handset.	Dial tone is heard 1st and 4th instruction lamps light
4	Dial Local TTTLS, using handset.	3-second answer tone heard
5	Pass test card B thru reader.	1st lamp out—2nd lamp lights
6	Pass test card B thru reader a second time.	2nd lamp out—3rd lamp lights
7	Press PIN key.	LEDs light on key and on PIN pad
8	Key 1 through 9, o, and 0 using PIN pad. Press / (slash) on 5100BM set. Press END on PIN pad.	Each entry appears on display as a letter "P" Set transmitting buffered data Display clears when transmission stops 3rd lamp goes out Display fills with 8s Green lamp flashing
9	Press PIN key.	LEDs are extinguished
10	Go on-hook.	4th lamp goes out Display shows 8s—Green lamp flashing
11	Go off-hook momentarily.	Display clears.

Note: For more detailed information, see paragraphs 4.14 through 4.17.

TEST D (SEE NOTE)

PIN PAD WHEN CONNECTED TO 5100BM SET—WITH ONE-NUMBER OPTION

STEP	ACTION	VERIFICATION
1	Press PIN key on 5100BM.	LEDs light on PIN key and on PIN pad
2	Press PIN key again.	LEDs are extinguished
3	Disconnect ac power cord.	
4	Reconnect ac power cord.	Display shows "diAL Cd" Yellow lamp flashing
5	Go off-hook.	Dial tone heard
6	Pass test card B thru reader.	Yellow lamp lights
7	Dial Local TTTLS, using manual entry pad.	Digits appear on display as dialed— "diAL Cd" moves off display to left
8	Press END button.	Display clears Yellow lamp goes out 1st and 4th instruction lamps light 3-second answer tone heard
9	Press ATTN.	1st lamp out—2nd lamp lights
10	Pass test card B thru reader.	2nd lamp out—3rd lamp lights
11	Press PIN key.	LEDs light on key and on PIN pad
12	Key 1 through 9, o, and 0 using PIN pad. Press / (slash) on 5100BM set. Press END on PIN pad.	Each entry appears on display as a letter "P" Set transmitting buffered data Display clears when transmission stops 3rd lamp goes out Display fills with 8s Green lamp flashing
13	Press PIN key.	LEDs are extinguished
14	Go on-hook.	4th lamp goes out Display shows 8s,—Green lamps flashing
15	Go off-hook momentarily.	Display clears.

Note: For more detailed information, see paragraphs 4.14 through 4.17.

TEST E (SEE NOTE)

5000A OR 5000A2 PRINTER WHEN CONNECTED TO 5100BM SET—WITHOUT ONE-NUMBER OPTION

STEP	ACTION	VERIFICATION
1	Go off-hook.	Dial tone is heard 1st and 4th instruction lamps light
2	Dial Local TTTLS using handset.	Local TTTLS answers with 3-second tone
3	Pass test card B thru reader.	1st lamp goes out—2nd lamp lights
4	Pass test card B thru reader.	2nd lamp goes out—3rd lamp lights
5	(Using manual entry pad) key 1 thru 9, o, 0, /, and END.	Set transmit buffered data 3rd lamp goes out Digits appear on display as keyed Display will clear—within 10 seconds— Display fills with 8s Green lamp flashing
6	Press ERASE.	Display shows decimal points Green lamp flashing
7	Key 1, 2, 3, END. If display shows "E-0-0" reenter 1, 2, 3, END.	Display clears Green lamp out— Approximately 10 seconds— Display shows "PAPEr"
8	Insert paper.	Display shows "PUSH End"
9	Press END.	Yellow lamp lights Printer prints test message Printer stops
10	Press ATTN.	Yellow lamp out 3-second tone heard Local TTTLS will disconnect
11	Go on-hook.	4th lamp goes out.
12	Withdraw paper. If clamped, press RESET button.	

Note: For more detailed information, see paragraphs 4.18 through 4.23.

TEST F (SEE NOTE)

5000A OR 5000A2 PRINTER WHEN CONNECTED TO 5100BM SET—WITH ONE-NUMBER OPTION

STEP	ACTION	VERIFICATION
1	Disconnect ac power cord.	
2	Reconnect ac power cord.	Display shows "diAL Cd" Yellow lamp flashing
3	Go off-hook.	Dial tone heard
4	Pass test card B thru reader.	Yellow lamp is on
5	Dial Local TTTLS, using manual entry pad.	Digits appear on display as dialed— "diAL Cd" moves off display to left—
6	Press END.	Display clears Yellow lamp is out 1st and 4th instruction lamps light 3-second answer tone heard
7	Press ATTN.	1st lamp out—2nd lamp lights
8	Pass test card B thru reader.	2nd lamp out—3rd lamp lights
9	Key 1 thru 9, o, 0, /, and END on manual entry pad.	3rd lamp out Digits appear on display as keyed Set transmitting buffered data Display clears when transmission stops Display fills with 8s Green lamp flashing
10	Press ERASE.	Display shows decimal points Green lamp flashing
11	Key 1, 2, 3, END. If display shows "E-0-0," reenter 1, 2, 3, END.	Display clears Green lamp out— After approximately 10 seconds— Display shows "PAPEr"
12	Insert paper.	Display shows "PUSH End"
13	Press END.	Yellow lamp lights Printer prints test message Printer stops
14	Press ATTN.	Yellow lamp out 3-second tone heard— Local TTTLS disconnects
15	Go on-hook.	4th lamp out.

STEP	ACTION	VERIFICATION
16	Withdraw paper.	

Note: For more detailed information, see paragraphs 4.24 through 4.26.

5. MAINTENANCE

5.01 In case of commercial power failure, transaction telephone sets can be used as standard telephone sets using the TRIMLINE handset. All other functions of the transaction telephone set are rendered inoperative by the loss of ac power.



If dial of hand telephone set has been restricted (paragraph 4.31), the set cannot be used as a standard telephone set. The restricted handset may be unplugged and replaced for maintenance testing purposes. Be sure to reinstall customer's handset when testing is completed.

5.02 There are two fuses, (F1 for +5 volt and F2 for -12 volt circuitry) housed in plastic ***in-line*** holders and located at the left rear corner of the main PWB. These are Bussman MDL 2-ampere fuses and may be obtained locally. If a fuse failure is suspected, the fuses may be removed (access per paragraph 3.06), and checked visually or observe the following indications.

(1) If fuse F1 is open.

(a) Depressing the ON button will not simulate set off-hook, (no dial tone heard on call progress sounder).

(b) No TOUCH-TONE signals may be heard on handset when buttons are depressed on manual entry pad.

Note: If Lockout option has been activated this would be an inconclusive test.

(c) Lights on set may or may not be operable.

(2) If F2 fuse is open, there will be no lamps operable on set.

Warning: For continued protection against fire hazard, replace fuses only with 2 amp SLO-BLO (bus MDL) or equivalent.

5.03 For maintenance checks due to reported or indicated trouble conditions, refer to the appropriate test procedure(s) in Part 4. This should help to isolate the trouble to the 5100BM set (including PIN pad, provided), or the printer and/or their associated components.

5.04 Field maintenance of the 5100BM sets shall consist of the following:

(a) Check for line continuity (dial tone).

(b) Check for proper connection of cords and jacks.

(c) Check for loose wire or connections on main PWB or control board (Fig. 19 and 20).

(d) Replacement of H4DU-50 handset cord and/or 227A or D adapter.

(e) Replacement of D4BU-29 mounting cord.

(f) Replacement of TRIMLINE handset.

(g) Replacement of auxiliary manual entry pad.

5.05 Field repairs on the 5100BM base shall not be attempted. Return defective base to Western Electric Service Center in accordance with local procedures. If base is being replaced, return disposable faceplate from new base with the used base.

5.06 Field repairs on the printer shall not be attempted except for ribbon replacement (paragraph 5.10). Return defective printer to Western Electric Service Center in accordance with local procedures.

5.07 Paper problems with the printer should be treated as follows:

(a) If paper is jammed or can not be removed easily.

(1) Push RESET button (5000A printer) or RESET and FORM FEEDOUT BUTTON on 5000A2 printer.

(2) Try to remove paper.

(3) If paper can not be removed, replace printer.

(b) If paper is ***lost*** in printer:

(1) Try to push paper out using another sheet of paper.

(2) Replace printer.



Do not attempt to remove paper from printer by forcing metal tools or hard objects through the paper slot as this may damage the printing mechanism.

5.08 Some printer related problems may be indicated by ***E-0-1*** being displayed on the 5100BM set. These are—

(a) Paper not registering properly causing paper sensor switch to open before printing is completed.

(b) Defective M14H interconnect cord or improper engagement of M14H with connector in 5100BM set or in printer.

(c) Malfunction in printer.

(d) Defective or faulty output from 5100BM set.

(e) Errors in text transmitted from data center to set.

5.09 Repeated occurrences of the following symptoms indicate a printer malfunction and/or a need for printer replacement.

(a) Light printing on original (top) copy.

(b) Occasional missing dots in character is acceptable.

(c) Characters printed over one another.

(d) Line feed (paper advance) is nonuniform, skewed (successive lines not parallel), or no line feed at all.

(e) Printer functions without paper present.

(f) Extreme nonuniformity in character width or spacing between characters, (some nonuniformity in the first 5 characters of the printed line is normal).

(g) Printer fails to print last character(s) on line, and stops leaving paper still clamped.

(h) Paper jammed in printer (see paragraph 5.07).

5.10 To replace a printer ribbon (Fig. 11 and 12) by adding (D-180844 Kit of Parts), ordered separately.

(1) Disconnect the printer from ac power source.

(2) If the 5100BM set is located on the printer (Fig. 13 or 14), it must be removed, but it should not be necessary to disconnect the power or mounting cord.

(3) Remove back cover by releasing the four cover mounting screws (Fig. 10).

(4) Remove the upper housing by—

(a) Carefully laying printer on its side and releasing the four recessed captive housing mounting screws.

(b) Set printer upright and lift housing straight up to slide housing off circuit board.

(5) Remove the plastic shroud (5000A2 printer) only, by loosening the two back wing nuts and removing the single front screw.

(6) Carefully remove ribbon guard by inserting a screwdriver at top of guard and pry outward.

Note: Insure that the ribbon guard is not bent in removal or bottom of guard will interfere with ribbon when it is reinstalled.

(7) Remove plastic spool cover (Fig. 11), and retain for later use.

(8) Remove the two ribbon spools, ribbon, and two inking rollers and discard them.

(9) From the D-180844 Kit of Parts, installed new spools, ribbon, and reinking rollers per the diagram on the ribbon guard or (Fig. 12). Insure that—

(a) Ribbon comes off spool as shown in diagram or figure.

(b) Ribbon passes around inking rollers, through the small guide posts, around corner rollers, over 45-degree guide posts and into guide path.

(c) Ribbon is not twisted under print head.

(10) Tighten ribbon by winding on ***free*** turning spool, turn approximately four (4) full turns.

(11) Carefully replace the ribbon guard (refer to Note, Step 6) and replace spool cover retained in Step 7.

(12) Replace the shroud (5000A2 only), upper housing, and cover.

Note: To replace the upper housing, turn rear of printer facing you and carefully slide housing down with the edges of the printed board in slots of housing and metal board in rear right-hand slot.

5.11 ▶Card read head problems can be resolved by cleaning the read head monthly. Cleaning of the read head can be accomplished by applying a commercial head cleaner, either by swab or specialty cleaning card. Clean read heads as follows:

(a) Apply cleaning agent to swab or spongy strip of cleaning card.

(b) Pass over read head 10 to 15 times.

(c) After a few seconds, the card reader may be used.◀

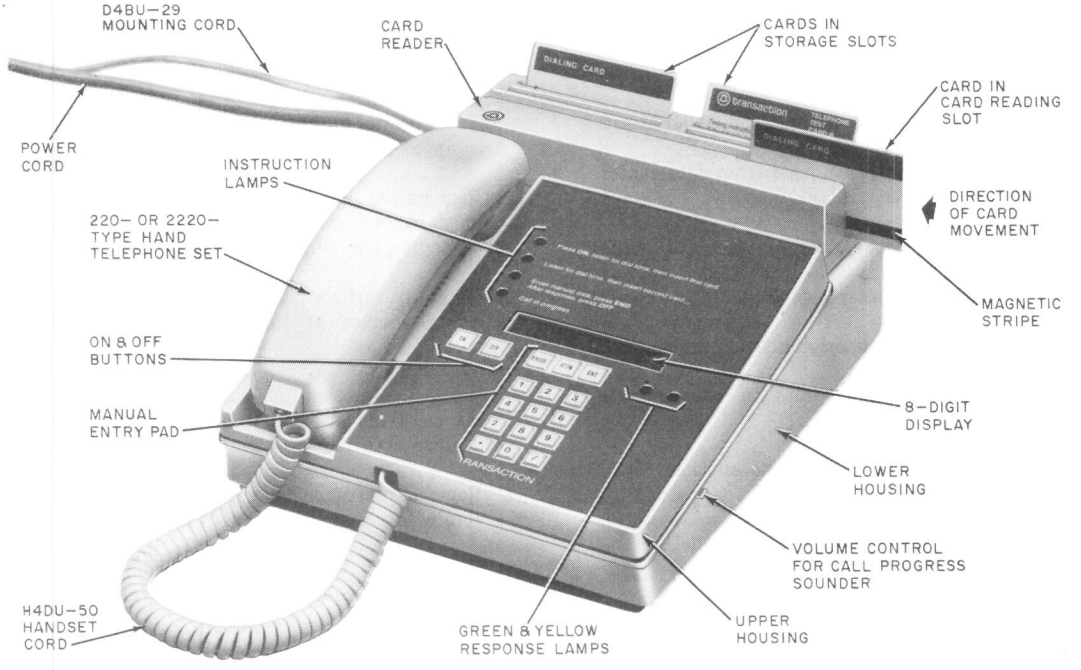


Fig. 1—5100BM Transaction Telephone Set Base Equipped With 220- or 2220-Type Hand Telephone Set

TABLE A
5100BM TELEPHONE SET
FACEPLATE ORDERING GUIDE

TEL SET	FACEPLATE CODE NUMBER	LETTERING	INTENDED USE
5100BM Tel Set Base	138C1-*	Blank	Without PIN Pad
	138C5-*	Standard Instructions	
	138D1-*	Blank	With PIN Pad
	138D6-*	Standard Instructions	

*Add appropriate color suffix from Table B.

TABLE B

COLOR ORDERING GUIDE (SEE NOTE)

HAND TEL SET		FACEPLATES	
SUFFIX	COLOR	SUFFIX	COLOR
-50	Ivory	-100	Avocado
		-108	Teak
		-109	Walnut
		-111	Gold
		-112	Orange
		-113	Brown
		-114	Red
		-115	Blue
		-118	Black

Note: The 5100BM telephone set base is available in Ivory only and the hand telephone set should also be Ivory. The faceplate must be ordered separately.

1. CONNECT RED (R) GREEN (G) YELLOW (Y), AND BLACK (BK) CONDUCTORS OF STATION WIRE ALONG WITH (R), (G), (Y), AND (BK) JACK LEADS OF 625C TO TERMINALS R,G,Y, AND B, RESPECTIVELY, OF 42A CONNECTING BLOCK
2. PLACE 625C ONTO 42A AND SECURE
3. PLUG ONE END OF D4BU CORD INTO JACK OF 625C AND OTHER END INTO JACK IN BASE OF TELEPHONE SET

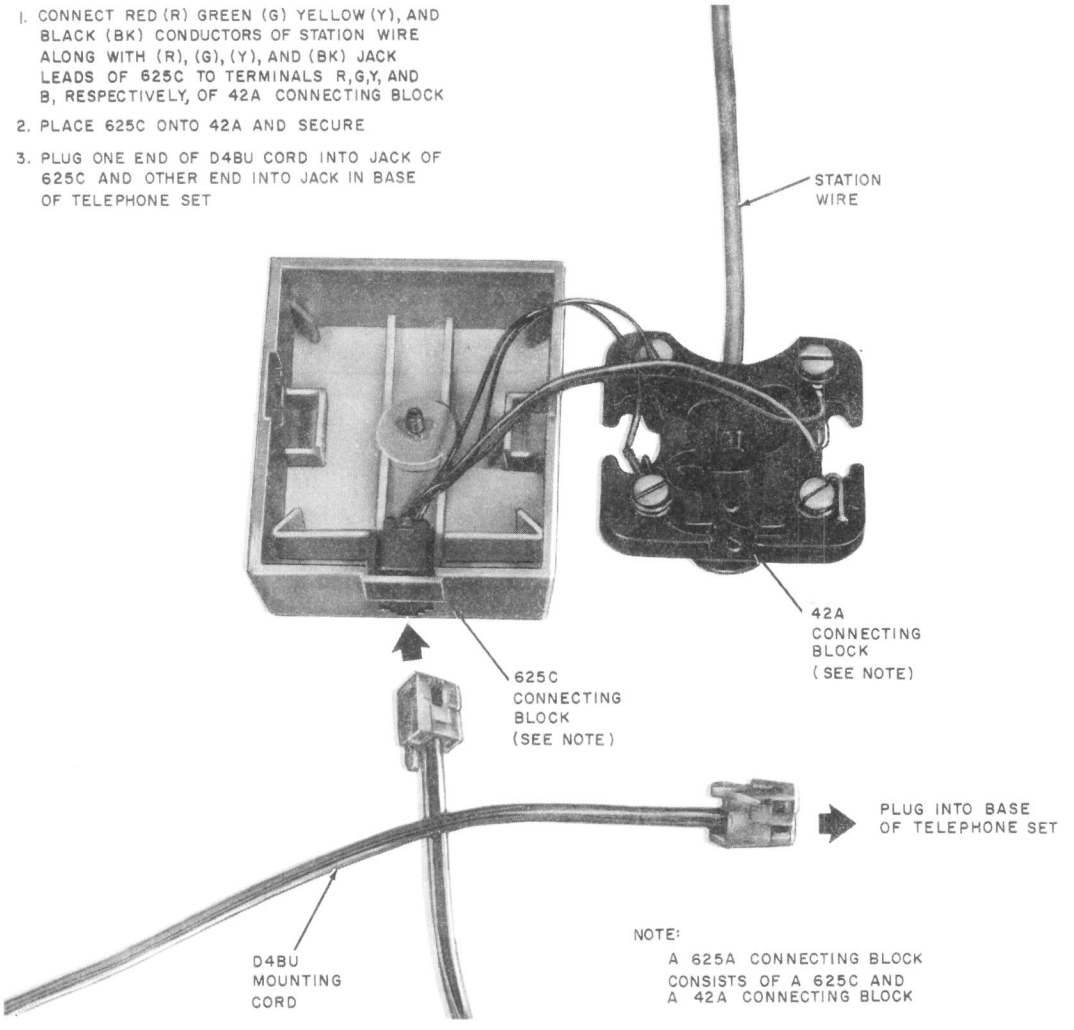


Fig. 2—Installation of 625A Connecting Block

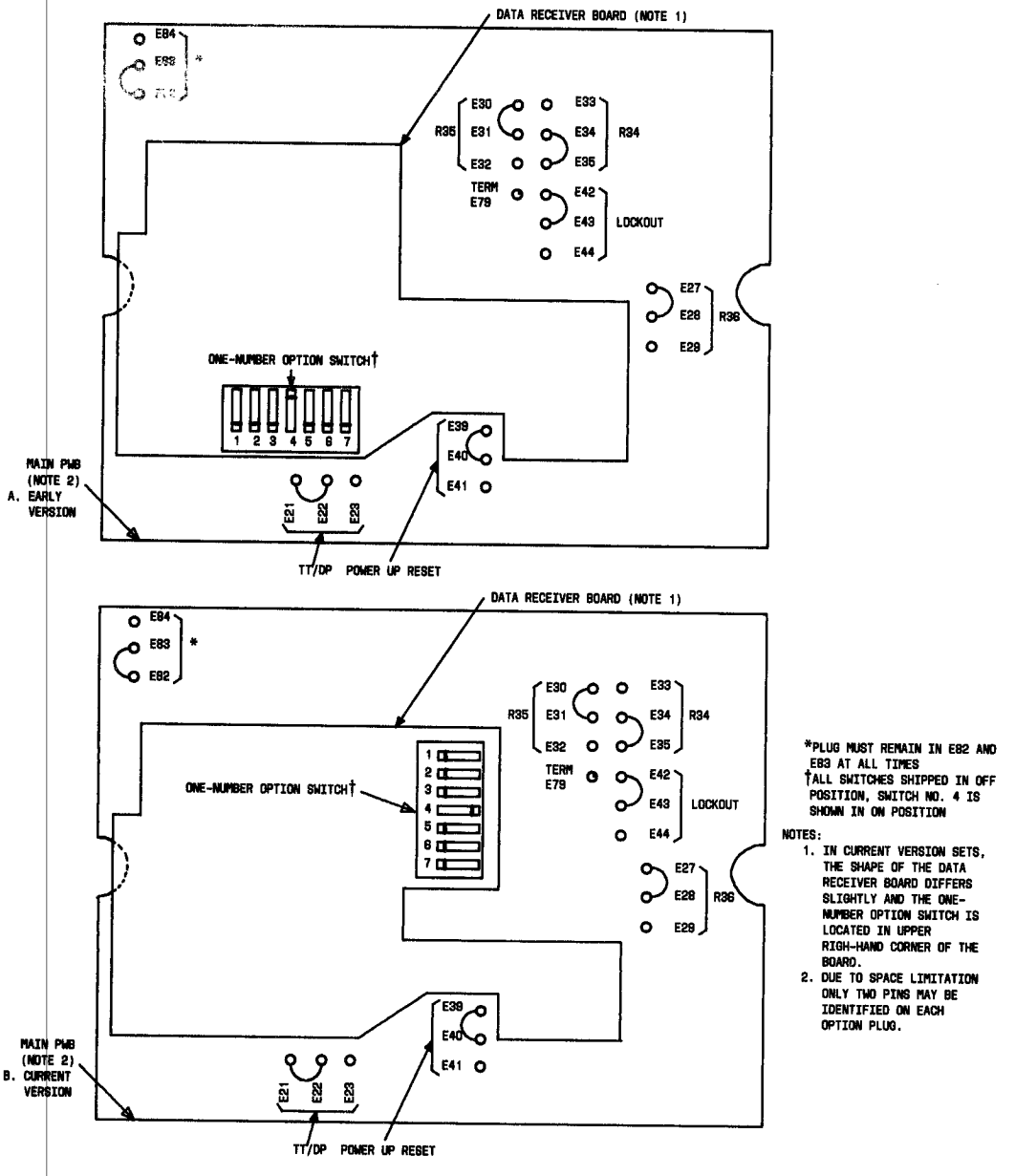


Fig. 3—Main PWB and Data Receiver Board Showing Option Plugs and One-Number Option Switch Locations on Early Version and FCC Registered Sets (Sheet 1 of 2)

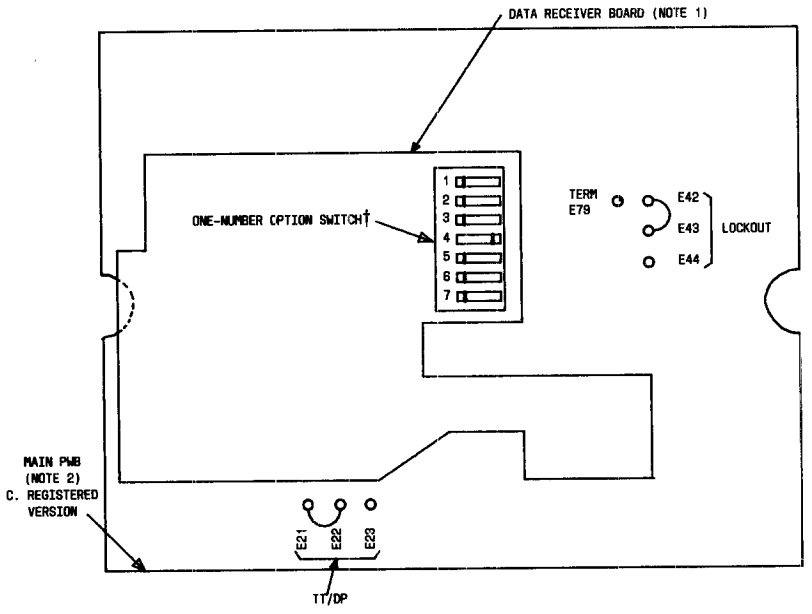


Fig. 3—Main PWB and Data Receiver Board Showing Option Plugs and One-Number Option Switch Locations on Early Version and FCC Registered Sets (Sheet 2 of 2)

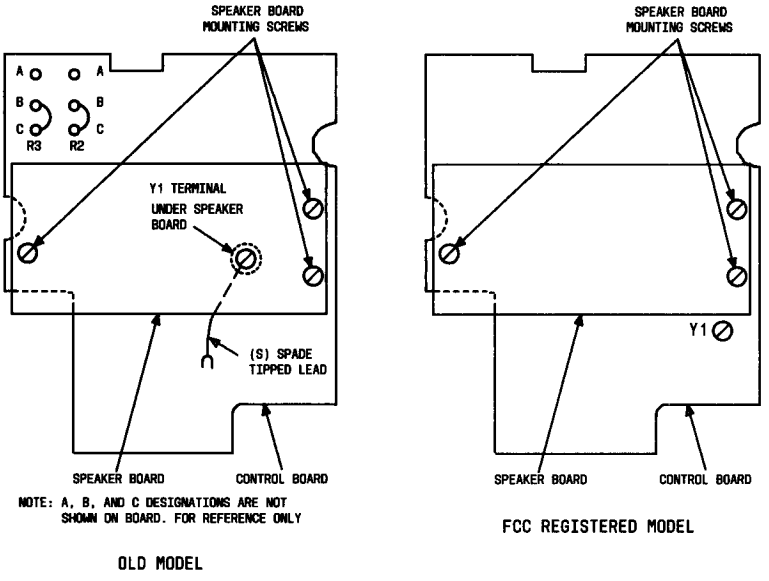


Fig. 4—Control Board and Speaker Board Showing Location of R2 and R3 Option Plugs and Terminal Y1

TABLE C

PLACEMENT OF OPTION PLUGS (SEE NOTE)

OPTION	PLUG POSITION	RESULT
Key Pad Lock out	E42-E43*	Not locked (can dial out from key pad)
	E43-E44	Locked (cannot dial out from key pad)
TT/DP Dialing	E21-E22*	Key pad dials in TT frequencies
	E22-E23	Key pad sends out dial pulses
One-Number Option	Switch #4 OFF*	Does not restrict routine transactions to a single data center
	Switch #4 ON	Restricts routine transaction to a single data center

* Option plug positions when shipped.

Note: See Fig. 3 for location of option plugs or switch.

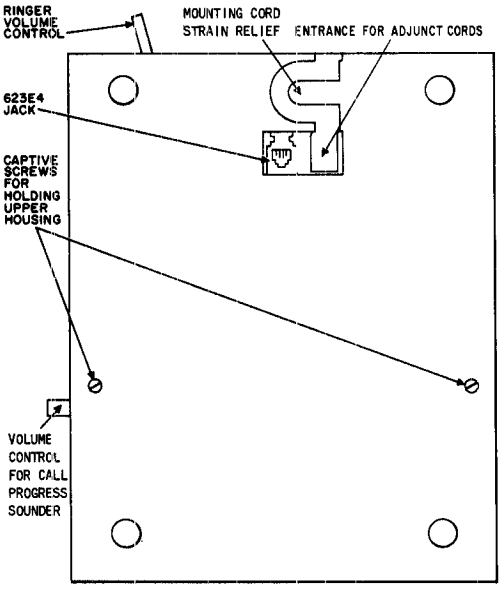


Fig. 5—Bottom of 5100BM Tranaction Telephone Set Base Showing Upper Housing Screws and Mounting Cord Jack

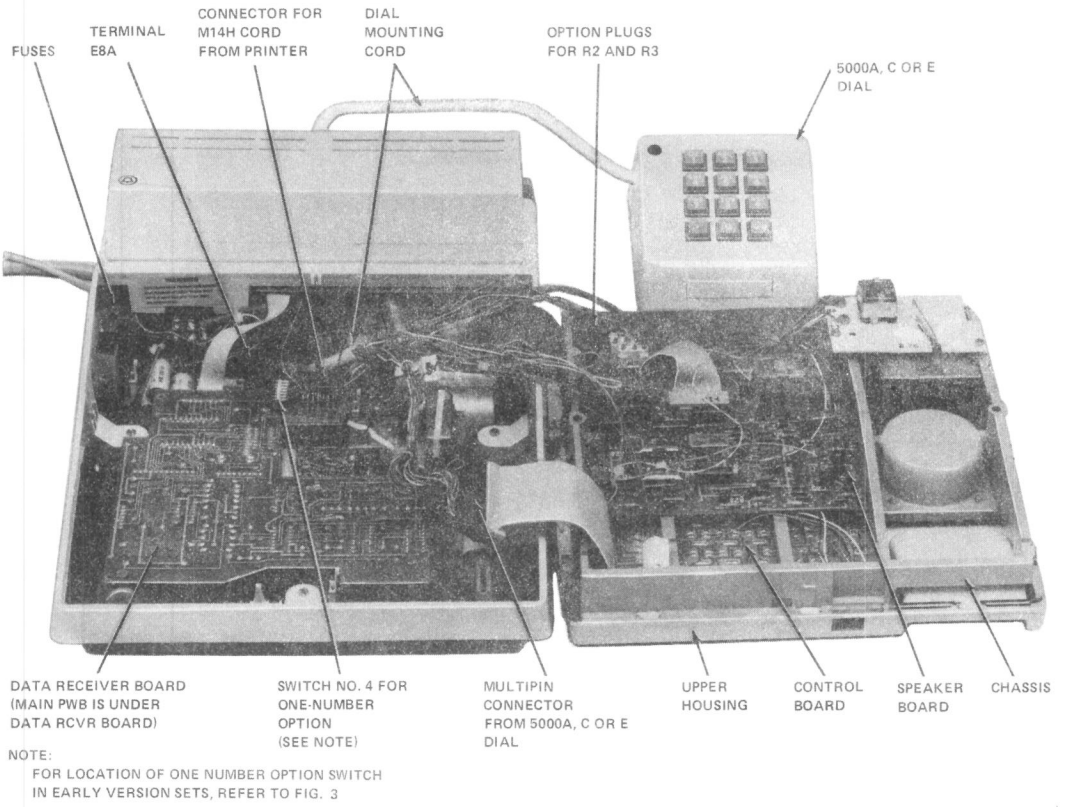


Fig. 6—5100BM Transaction Telephone Set Base With Upper Housing and Chassis Laid Aside, PIN Pad and Printer Connected



Fig. 7—5100BM Transaction Telephone Set With PIN Pad Installed

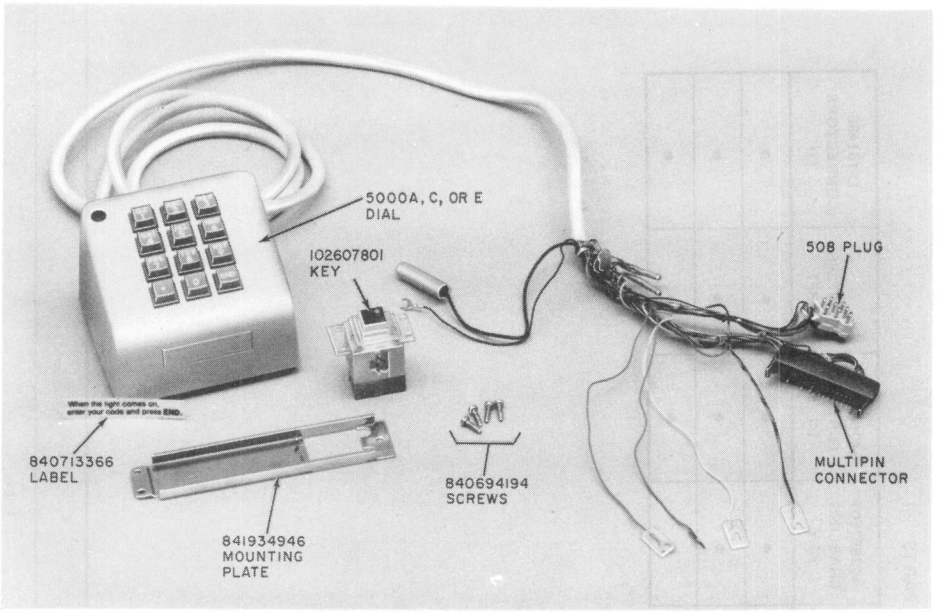


Fig. 8—PIN Pad D-Kit of Parts

TABLE D

PIN PAD D-KITS OF PARTS

KIT OF PARTS	5000A-50 DIAL 5 FT CORD	5000C-50 DIAL 10 FT CORD	5000E-50 DIAL * 20 FT CORD	841934946 MTG PLATE	102607801 ENABLING KEY	840694194 SCREWS (4)	840713366 LABEL	D-161488 CONNECTORS (2)
D-180687	•			•	•	•	•	•
D-180813		•		•	•	•	•	•
D-180820			•	•	•	•	•	•

* Includes Installation Instructions

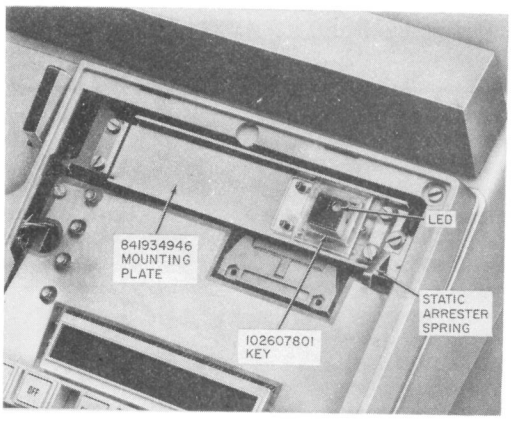


Fig. 9—5100BM With Faceplate Removed Showing Mounting Plate and 102607801 Key Installed

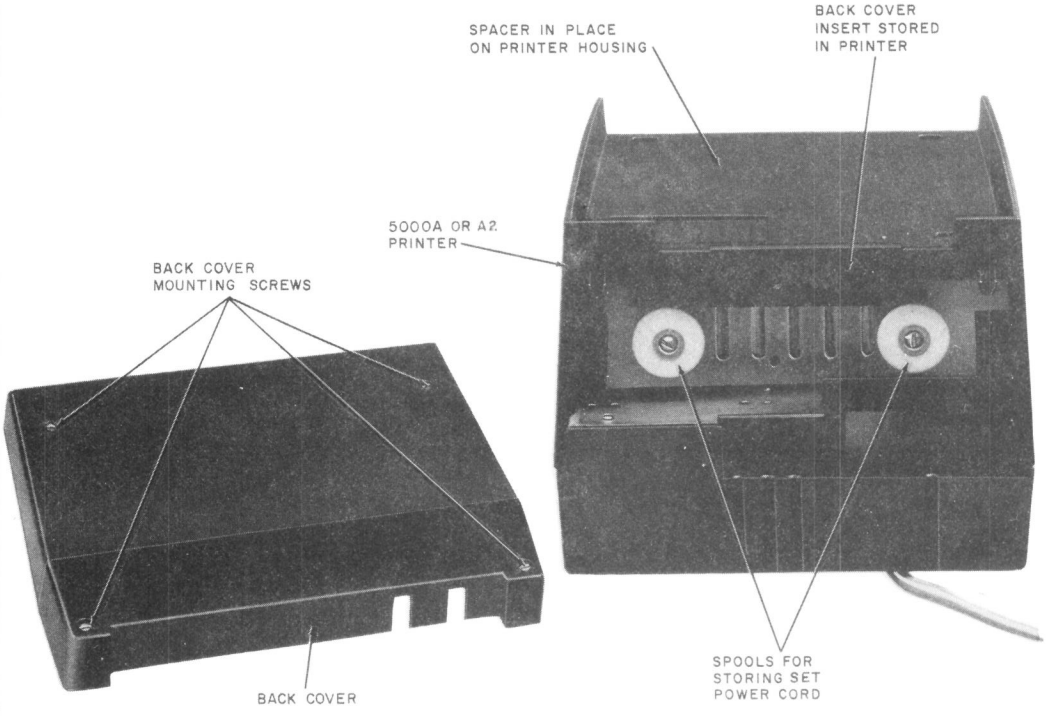


Fig. 10—5000A or 5000A2 Printer With Back Cover Removed

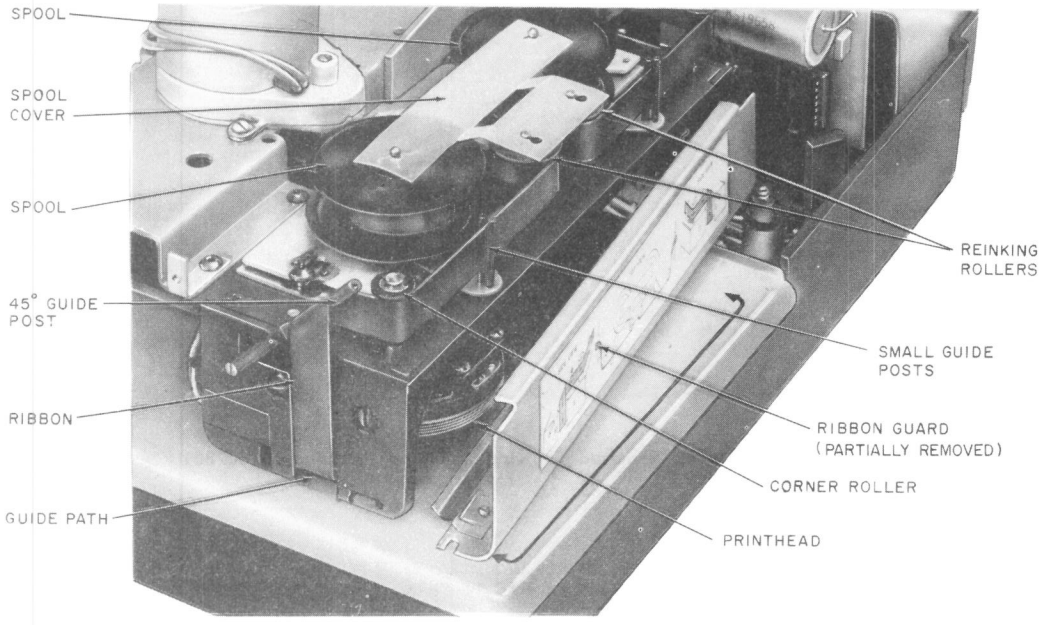


Fig. 11—Interior View of Printer With Housing Removed

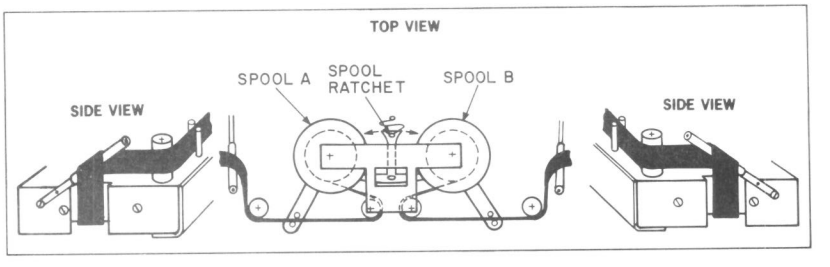


Fig. 12—5000A or 5000A2 Printer Ribbon Path

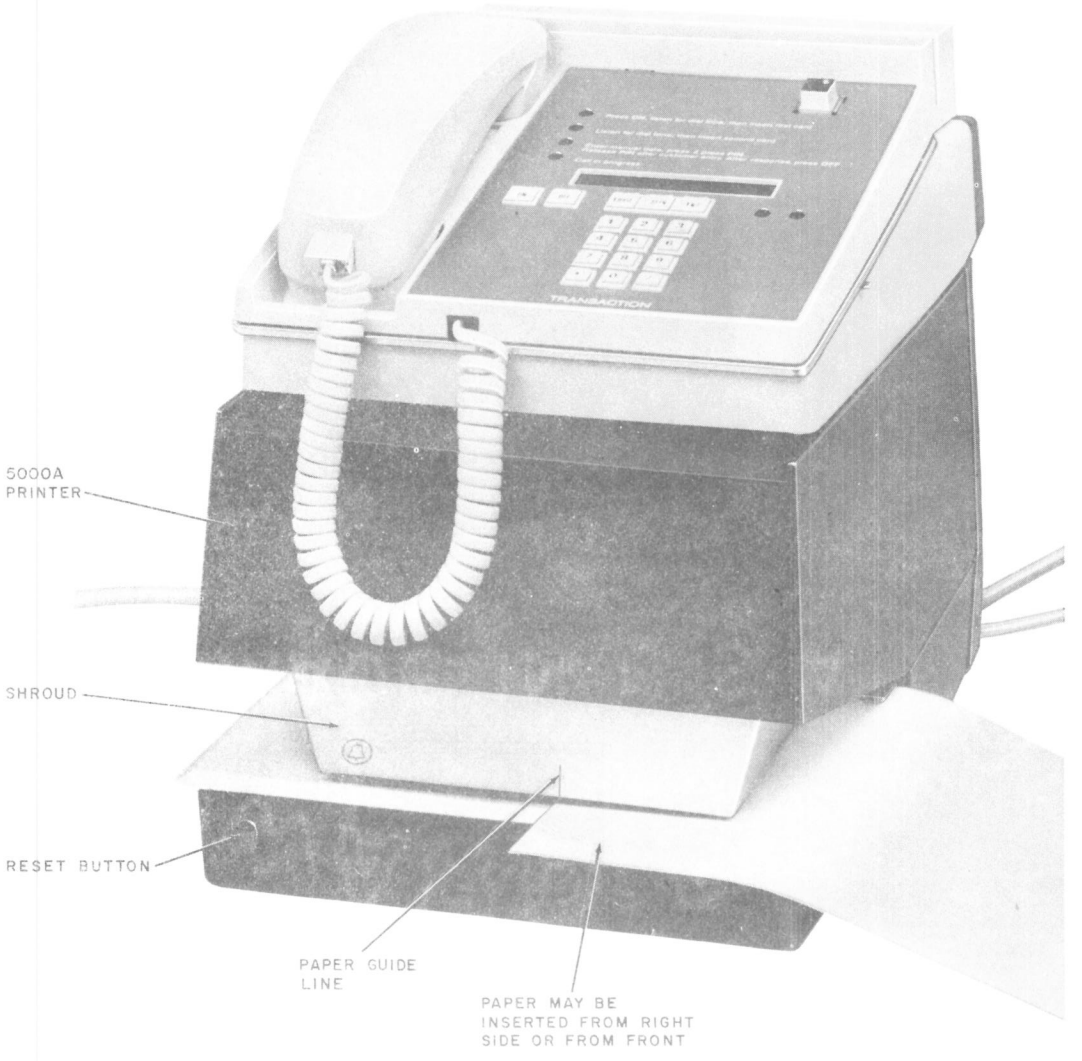


Fig. 13—5100BM Transaction Telephone Set Installed on 5000A Printer

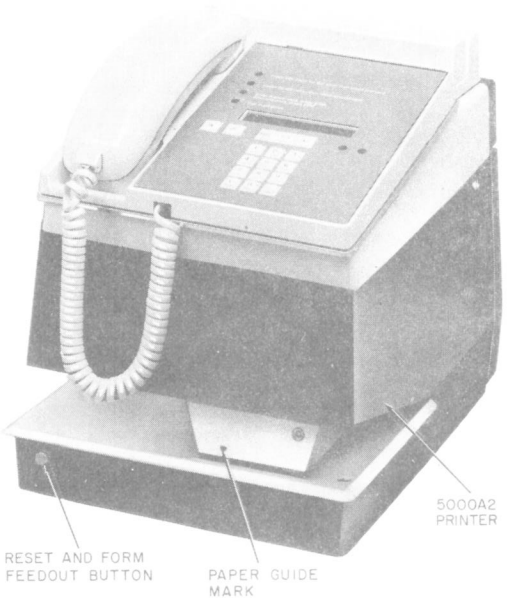


Fig. 14—5100BM Transaction Telephone Set Installed on 5000A2 Printer

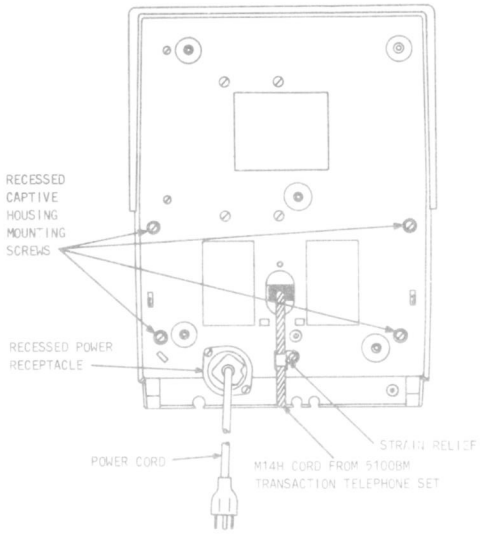


Fig. 15—Bottom View of Printer

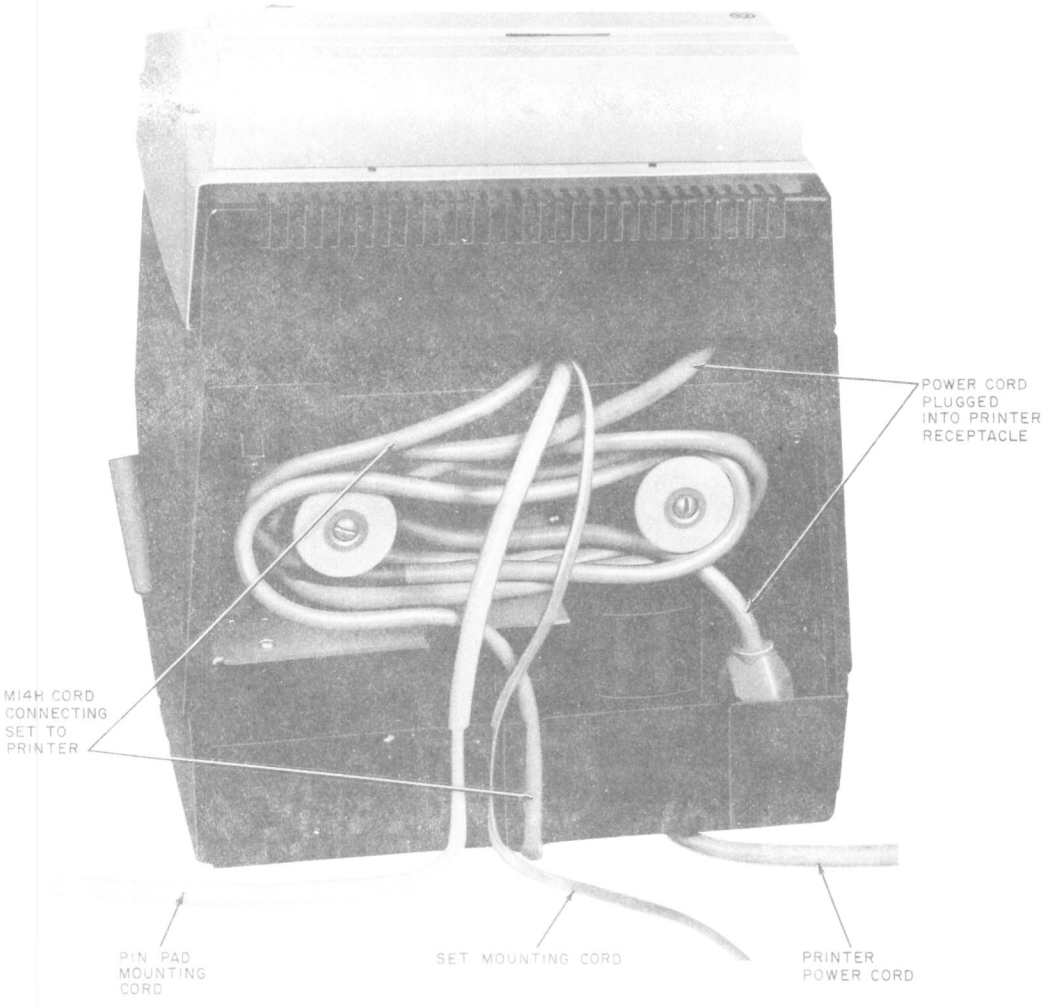
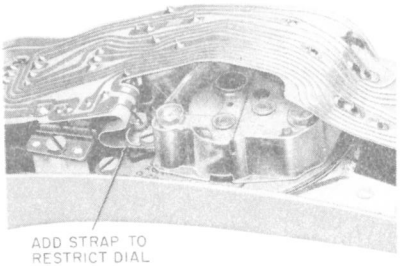


Fig. 16—5100BM Set Shown Installed on Printer—Printer Cover Removed to Show Cord Storage

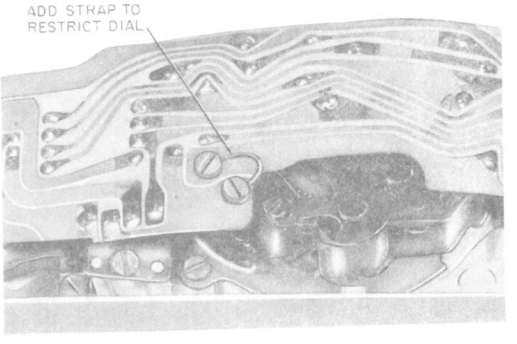
```
PRINTER TEST                1234567890
 A QUICK BROWN FOX JUMPED OVER THE LAZY
DOG'S BACK          1234567890abcd      1234567890


END TEST
```

Fig. 17—Test Message Printed by 5000A or 5000A2 Printer



A. 220A (MD), 220 AL (EARLY VERSION) AND 220 AM HAND TELEPHONE SETS



B. 220AL (CURRENT VERSION) HAND TELEPHONE SET

Fig. 18—Restricting Dial of 220A (MD), 220AM, or 220AL Hand Telephone Set

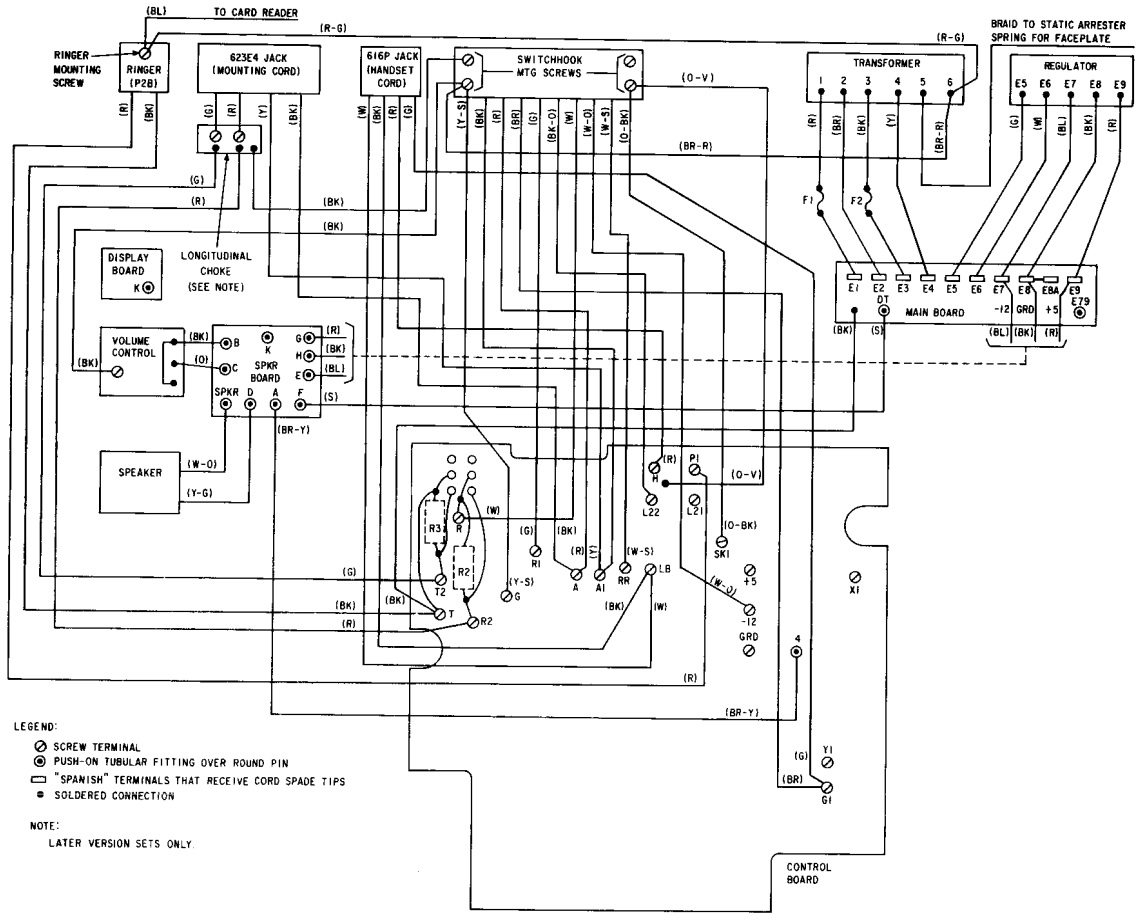


Fig. 19—Partial Schematic Showing Conductors Attached by Screws or Push-On Terminals (Early Version Sets)

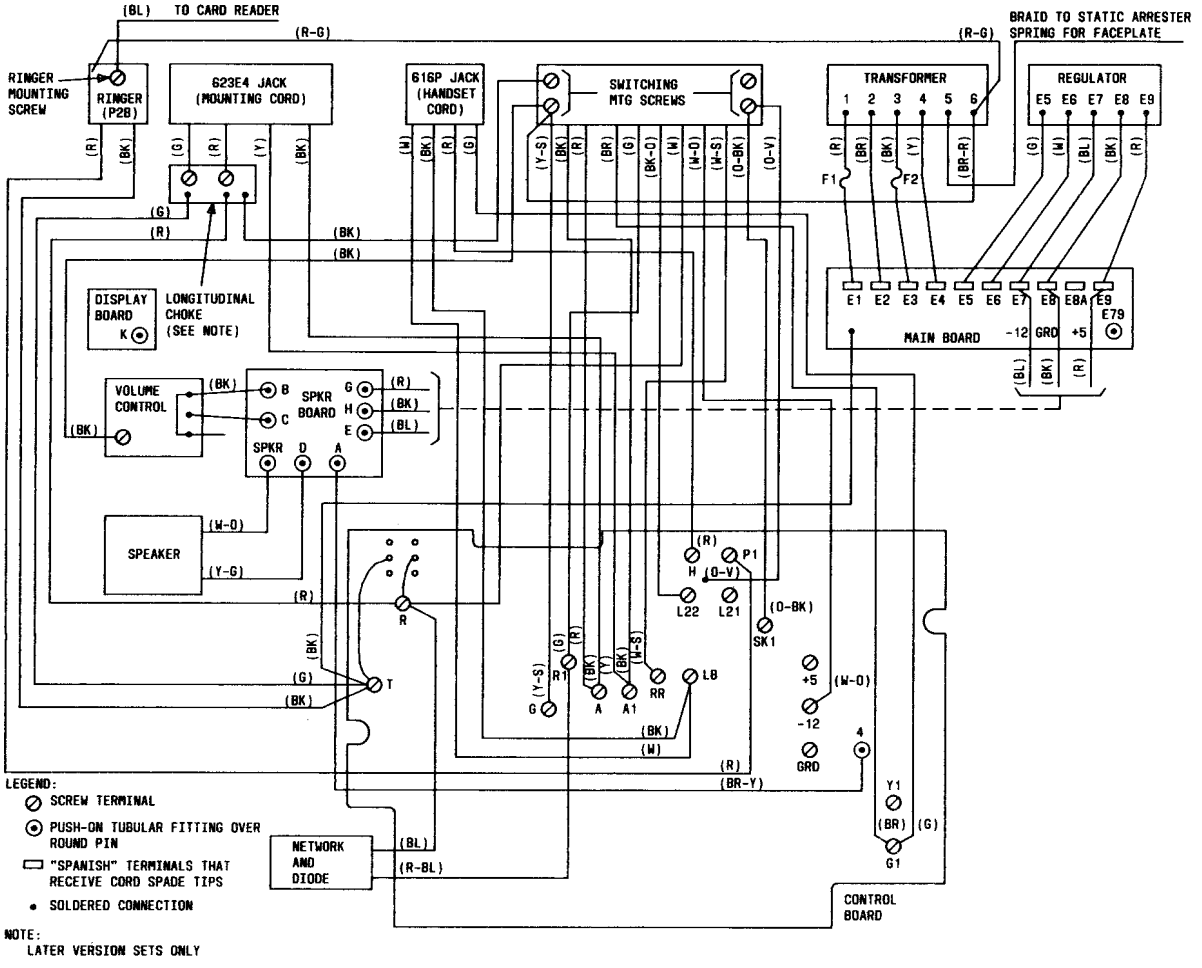


Fig. 20—Partial Schematic Showing Conductors Attached by Screws or Push-On Terminals (FCC Registered Sets)

Part 4

Part 4 — Digital Data System 500-Type

DESCRIPTION	NUMBER
500A DSU (Description)	595-200-100 (4-1)
500A DSU (Installation)	595-200-200 (4-2)
500A DSU (Test)	595-200-500 (4-3)
500B DSU (Description)	595-200-101 (4-4)
500B DSU (Installation)	595-200-201 (4-5)
500B DSU (Maintenance)	595-200-301 (4-6)
500B DSU (Test)	595-200-501 (4-7)
550A CSU (Description)	595-100-100 (4-10)
550A CSU (Installation)	595-100-200 (4-11)
550A CSU (Test)	595-100-500 (4-12)
551A CSU (Description)	314-646-100 (4-20)
551A CSU (Installation)	314-646-200 (4-21)
551A CSU (Test)	314-646-500 (4-22)

DIGITAL DATA SYSTEM
500A-TYPE DATA SERVICE UNIT
DESCRIPTION AND OPERATION

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D. Simplex Current Detector 7
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F. Customer Options 8
G. Telco Option 9
4. OPERATION 9
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1. GENERAL

1.01 This section contains information concerning the description and operation of the 500A-type data service unit, hereafter referred to as the DSU. Other than a description of interface signals and customer options, information pertaining to the associated customer-provided equipment (CPE) is not given.

1.02 This section is reissued to include information on multiple installations and additional options. Since this revision constitutes a general revision, arrows ordinarily used to denote changes have been omitted.

1.03 The DSU is primarily intended for full-duplex operation in 4-wire private line (PL) applications. It provides the CPE with access to the synchronous digital data system (DDS). The DSU accepts serial, unipolar data from the customer and transmits baseband, bipolar signals over the local channel to the serving central office (SCO).

1.04 The 500A-type DSU is apparatus-coded with respect to customer data rates as follows:

500A-L1/2—operates at 2.4 kb/s

500A-L1/3—operates at 4.8 kb/s

500A-L1/4—operates at 9.6 kb/s

500A-L1/5—operates at 56 kb/s.

All DSUs operating at speeds other than 56 kb/s will be referred to as subrate DSUs.

1.05 The customer interface provided by a subrate 500A-type DSU conforms to the electrical characteristics of EIA Standards RS-232-C and RS-334. The data and clock signals of a 500A-L1/5 DSU operating at 56 kb/s conform to the requirements of a balanced direct-coupled interface as specified in CCITT Recommendation V.35, while the control signals conform to EIA Standard RS-232-C.

2. PHYSICAL DESCRIPTION

2.01 The 500A-type DSU (Fig. 1) consists of a transmitter, receiver, control logic, and customer interface circuits mounted on two circuit packs (CPs) interconnected by a flexible cable harness. The CPs are contained in a housing with an aluminum cover and two black plastic faceplates.

2.02 The DSU is approximately 11-1/2 inches wide, 11 inches deep, 4 inches high, and weighs approximately 10-1/2 pounds.

2.03 The DSU will operate in an environment of +40 to +120°F with a relative humidity of less than 95 percent. Surface temperature of the

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Fig. 1—500A-Type Data Service Unit

aluminum cover will be approximately 16°F higher than ambient.

2.04 The DSU has been designed to accommodate individual or multiple applications. For small installations, up to three DSUs may be stacked without exceeding maximum operating temperatures. Installations requiring more than three DSUs will make use of the 48A-type data mounting (590-102-139).

2.05 Power requirements for the self-contained 82A power unit are 105 to 129 volts ac at 57 to 63 Hz, not under control of a switch. Approximately 17 watts of power will be dissipated. A 3-conductor ac power cord is provided with the DSU.

2.06 A slide switch and light emitting diode (LED) assembly may be mounted on either the front or rear faceplate (see 3.30). It is factory-installed on the front faceplate. The assembly contains a 3-position switch and four LED indicators which are designated PWR, NS, LL, and RT on the faceplates.

2.07 The 500A-type DSU contains two CPs. HP1 CP performs the DSU logic functions and is common to all four DSUs. HN1, HN2, HN3, and HN4 CPs are analog boards and are speed-sensitive circuits; therefore, DSU transmission speeds are determined by these CPs. Each DSU will contain one logic board and one analog board as shown in Fig. 2. Table A lists DSU transmission speeds and CPs.

2.08 All customer interface leads of a subrate DSU are terminated in a 25-pin connector. Customer-provided equipment used with a subrate DSU must be terminated in a Cinch or Cannon DB-19604-432 plug and a DB-51226-1 hood, or equivalent. A DSU operating at 56 kb/s uses a 34-pin Winchester or Burndy connector. Customer-provided equipment used with a 56-kb/s DSU must be terminated in a Winchester MRA-34

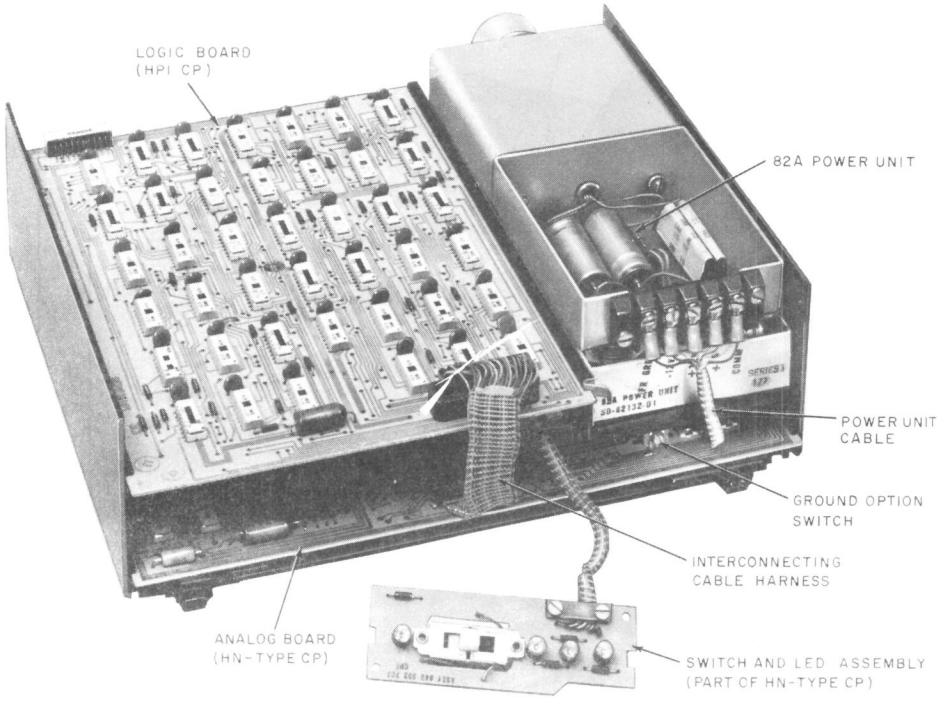


Fig. 2—500A-Type Data Service Unit—Front Internal View

TABLE A

DSU SERVICE BIT RATE AND CIRCUIT PACKS

DSU LIST	DSU SERVICE BIT RATE	ANALOG CP	LOGIC CP
500A-L1/2	2.4 kb/s	HN1	HP1
500A-L1/3	4.8 kb/s	HN2	
500A-L1/4	9.6 kb/s	HN3	
500A-L1/5	56 kb/s	HN4	

P-JTC6-H plug, or equivalent. Refer to Fig. 3 for customer interface location.

2.09 Roller switches S1 and S3 (Fig. 3 and 4) are used to select request to send, line build out network, system status, and circuit assurance options. The ground option is selected by switch S2 (Fig. 2) and the switch and LED assembly and LL spring clip options are set by hand.

3. FUNCTIONAL DESCRIPTION

3.01 This part contains a brief functional description of the transmitter, receiver, and customer interface circuits. The interface leads are described and a functional description of the DSU options is provided.

3.02 The 500A-type DSU provides for transmission and reception of digital data over local transmission facilities. Bipolar pulses, which are defined as positive and negative voltage levels with successive pulses alternating in polarity, are transmitted over 4-wire cable pairs to and from an office channel unit (OCU) located in the SCO. This bipolar voltage level is representative of a binary 1 and a binary 0 where a binary 1 is transmitted as a nominal ± 1.4 volt pulse and binary

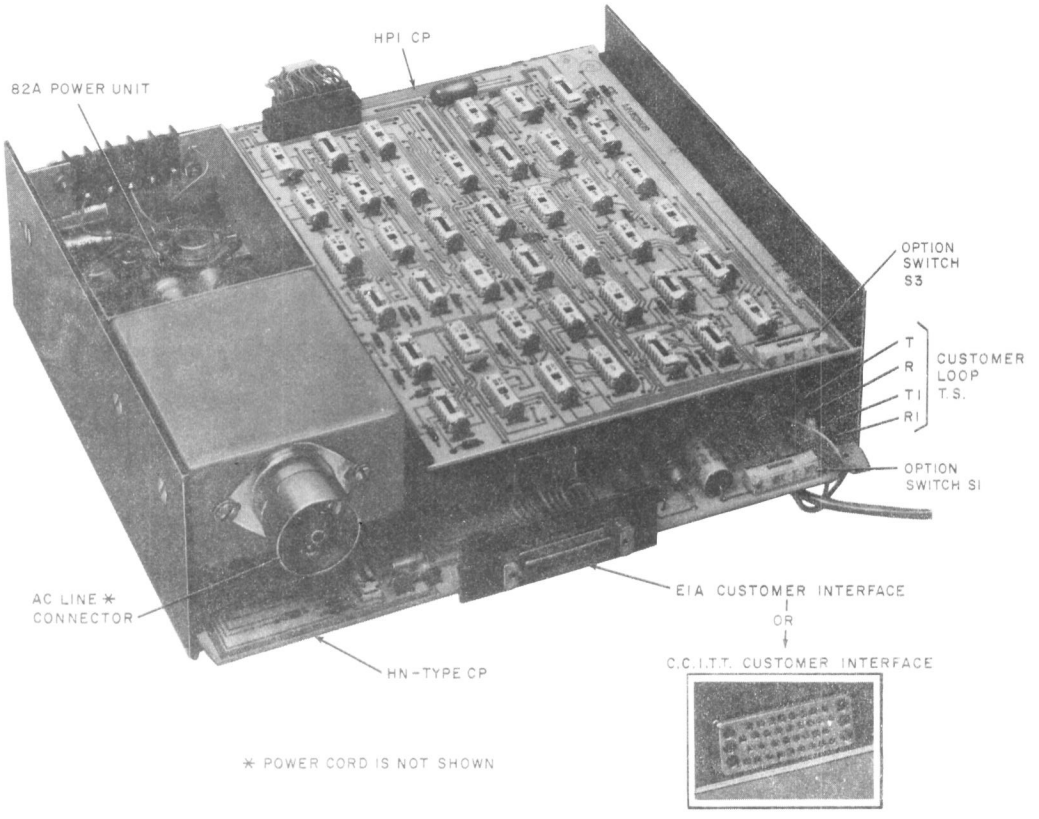


Fig. 3—500A-Type Data Service Unit—Rear Internal View

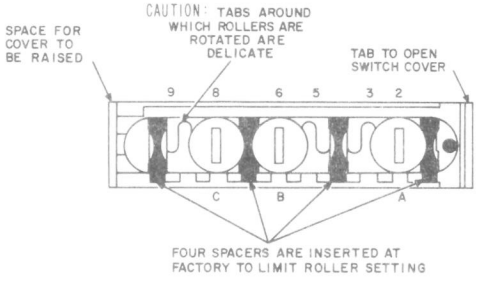


Fig. 4—Detail of Switch for Installing Options

0 is transmitted as zero voltage. The sum of all transmitted voltages must equal zero to prevent dc buildup on the line.

3.03 System control codes are identified by deviations of the preceding bipolar format. These deviations are defined as bipolar violations, where successive bipolar pulses do not alternate in polarity.

A. Transmitter

3.04 Refer to Fig. 5 for a functional block diagram of the 500A-type DSU. The transmitter consists of transmit logic and line driver circuitry, which accepts digital data in the form of positive

and negative voltages from the CPE and transmits balanced, bipolar signals over the local channel. Customer data is encoded by the transmit logic into a format suitable for transmission. Since a long sequence of 0s does not provide transitions to maintain timing recovery, sequences of six or seven consecutive zeros in the data stream, depending on service rate (subrate or 56 kb/s) are replaced with zero suppression codes to maintain synchronization.

3.05 In response to a request-to-send (CA) OFF condition, idle code sequences are formed and applied to the line driver. These idle codes indicate to the remote DSU that no customer data is being transmitted. A delay in the turn-on of clear-to-send (CB), after CA has turned ON, is provided to allow the remote DSU to exit the idle condition and enter the data mode in preparation for data transmission.

3.06 The line driver converts the binary outputs of the transmit logic into a balanced, bipolar signal. This signal is then transformer-coupled to the cable pair.

B. Receiver

3.07 The receiver consists of receive logic, clock recovery, and a line receiver. The line receiver may be subdivided into an analog-to-digital (A/D) converter, and automatic gain control associated with automatic line build-out circuitry. The receiver functions will be discussed in reverse order to simulate signal flow.

3.08 Since local cable pairs may vary in length and gauge, an automatic line build-out network is provided to compensate for these variations. The automatic line build-out network automatically inserts attenuation, which varies with frequency, in order to make the net transmission loss simulate a maximum length of local cable pairs. Because the range of adjustment provided by the network is limited, a fixed line build-out network, which is switch selectable, is needed to insert additional loss in the case of extremely short local cable pairs.

3.09 The automatic gain control (AGC) provides gain and frequency compensation to equalize the cable characteristics of a maximum length cable

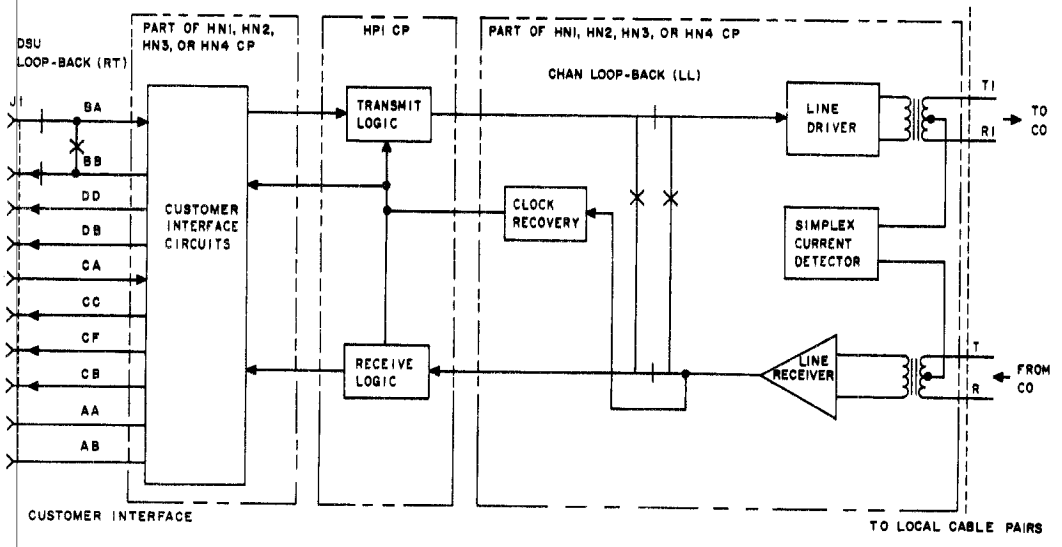


Fig. 5—Functional Block Diagram of 500A-Type Data Service Unit

pair. As a result of the different characteristics relative to cable gauge, the AGC network averages signal attenuation for the range of standard local cable gauges (19 through 26).

3.10 The A/D converter slices the signal to produce a binary representation of the received bipolar signal.

3.11 The clock recovery circuitry consists of a voltage-controlled oscillator connected in a phase-locked loop. A phase comparator synchronizes the oscillator to the received signal timing signal. Thus, a sampling clock is derived from the received bipolar signal and is used to sample the data pulses.

3.12 In the receive logic circuitry, the data stream is sampled, inverted, and the data bits reconstructed to fully occupy each respective time slot. The data stream then passes through a violation detector to recognize bipolar violation sequences (idle code, zero suppression code, DSU loop-back code, and out-of-service code).

3.13 When a bipolar violation sequence occurs, the data stream is examined for the presence of a valid control code by the receive logic. After the detection of three consecutive control codes, the appropriate control state is entered.

3.14 The receiver output logic combines the outputs of the control state circuitry and the installer options to control the customer interface and indicator LEDs as well as other circuits located within the transmit and receive logic.

C. Customer Interface Circuits

3.15 The 500A-type DSU is provided with ten (subrate services) or fourteen (56-kb/s service) interface leads for connection to the CPE. These leads and their corresponding pin numbers are given in Tables B and C. A description of the interface leads is given below with the EIA nomenclature for each lead appearing in parentheses following the lead designation.

3.16 ***Transmitted Data (BA):*** The direction of signal flow on this lead is from the CPE to the DSU. The serial, binary data bits on this lead are generated by the CPE for transmission to the remote CPE. Data bits are transmitted only if the following interface lead conditions are met: CC is ON, CA is ON, and CB is ON. For subrate services, BA meets the requirements of an EIA-type interface, while 56-kb/s service is a balanced direct-coupled signal sent over the BA(A) and BA(B) leads.

3.17 ***Request to Send (CA):*** The direction of signal flow on this lead is from the CPE to the DSU. Signals on this lead are generated by the CPE to turn the local data transmitter ON. An OFF condition on this lead causes the DSU to transmit the idle code sequence, provided CC is ON. A constant ON condition must be maintained whenever the CPE has data ready for transmission.

3.18 ***Serial Clock Receive (DD):*** The direction of signal flow on this lead is from the DSU to the CPE. Signals on this lead provide the CPE with receive signal element timing. For subrate services, DD meets the requirements of an EIA-type interface while 56-kb/s service utilizes a balanced direct-coupled signal sent over the DD(A) and DD(B) leads.

3.19 ***Serial Clock Transmit (DB):*** The direction of signal flow on this lead is from the DSU to the CPE. Signals on this lead provide the CPE with transmit signal element timing. For subrate services, DB meets the requirements of an EIA-type interface while 56-kb/s service utilizes a balanced direct-coupled signal sent over the DB(A) and DB(B) leads. DB is identical to DD.

3.20 ***Received Data (BB):*** The direction of signal flow on this lead is from the DSU to the CPE. Signals on this lead are generated by the receiving DSU in response to the data stream received from the remote DSU. For subrate services, BB meets the requirements of an EIA-type interface, while 56-kb/s service is a balanced direct-coupled signal given serially on the BB(A) and BB(B) leads.

3.21 ***Data Set Ready (CC):*** The direction of signal flow on this lead is from the DSU to the CPE. Signals on this lead are generated by the local DSU to indicate readiness to operate. Once ac power is applied to the DSU, the CC lead is normally in the ON condition. The CC lead will turn OFF under the following conditons:

- The DSU enters the test mode remote terminal (RT) or local line (LL)

TABLE B

SUBRATE 500A-TYPE DSU INTERFACE

INTERFACE PIN NO.	500A-TYPE DSU LEAD		EIA RS-232-C NOMENCLATURE	
	FUNCTION	DESIG	FUNCTION	DESIG
1	Frame Ground	FG	Protective Ground	AA
2	Send Data	SD	Transmitted Data	BA
3	Receive Data	RD	Received Data	BB
4	Request to Send	RS	Request to Send	CA
5	Clear to Send	CS	Clear to Send	CB
6	Data Set Ready	DSR	Data Set Ready	CC
7	Signal Ground	SG	Signal Ground	AB
8	Received Line Signal Detector	RLSD	Received Line Signal Detector	CF
9-14	Not used			
15	Serial Clock Transmit	SCT	Transmitter Signal Element Timing	DB
16	Not used			
17	Serial Clock Receive	SCR	Receiver Signal Element Timing	DD
18-25	Not used			

- The DSU is equipped with the system status option (option XK) and an out-of-service is received.

3.22 ***Received Line Signal Detector (CF):*** The direction of signal flow on this lead is from the DSU to the CPE. Signals on this lead are generated by the local DSU and indicate that data is being received and has been received for an appropriate interval. The CF lead is turned OFF when any of the following conditions exist: out-of-service indication (reception of out-of-service code or loss of signal), CA interface lead of the remote DSU is OFF, or when the DSU is in the RT loop-back mode. When CF lead is OFF, BA interface lead is held in the mark-hold (binary 1) condition.

3.23 ***Clear to Send (CB):*** The direction of signal flow on this lead is from the DSU to the CPE. Signals on this lead are generated by the local DSU to indicate to the CPE readiness to transmit data. CB OFF condition is an indication to the CPE that no data can be transmitted. CB turns ON in response to an ON condition of CA by the CPE after a delay to allow the remote DSU to exit the idle state. With the circuit assurance option (option YQ) installed, the clear-to-send indication is a result of an ON condition on both CA and CF interface leads and the transmitting DSU must have exited the idle state before CB turns ON.

D. Simplex Current Detector

3.24 Reversal of the local channel simplex current by the OCU will operate a polarity-sensitive relay circuit wired between the center taps of the transmit and receive transformers. Operation of this relay will cause a loop-back of the local channel between the line driver and line receiver and will also connect the transmit logic to the receive logic. Functionally, this is the remote CHAN loop-back which is controlled by the serving test center (STC). The customer may achieve the same result by positioning the slide switch to LL, which in this case is called local line loop-back.

E. Switch and LED Assembly

3.25 A slide switch provides control of the loop-back test functions while the LEDs monitor modes. When the switch is positioned to LL (local line loop-back), the transmit and receive

TABLE C

500A-L1/5 (56-KB/S) DSU INTERFACE

INTERFACE CONN. TERM*	500A-L1/5 DSU LEAD		EQUIVALENT NOMENCLATURE		
	FUNCTION	DESIG	FUNCTION	EIA RS-232-C DESIG	CCITT DESIG
A	Frame Ground	FG	Protective Ground	AA	101
B	Signal Ground	SG	Signal Ground	AB	102
C	Request-to-Send	RS	Request-to-Send	CA	105
D	Clear-to-Send	CS	Clear-to-Send	CB	106
E	Data Set Ready	DSR	Data Set Ready	CC	107
F	Received Line Signal Detector	RLSD	Received Line Signal Detector	CF	109
P	Send Data	SD(A)	Transmitted Data	BA(A)	103
S	Send Data	SD(B)	Transmitted Data	BA(B)	103
R	Receive Data	RD(A)	Received Data	BB(A)	104
T	Receive Data	RD(B)	Received Data	BB(B)	104
V	Serial Clock Receive	SCR(A)	Receiver Signal Element Timing	DD(A)	115
X	Serial Clock Receive	SCR(B)	Receiver Signal Element Timing	DD(B)	115
Y	Serial Clock Transmit	SCT(A)	Transmitter Signal Element Timing	DB(A)	114
AA	Serial Clock Transmit	SCT(B)	Transmitter signal Element Timing	DB(B)	114

* All terminals not listed are not used.

paths are looped toward both the SCO and the customer interface. Loop-back tests may then be performed by the STC or from the CPE location. When the switch is positioned to RT (remote terminal loop-back), interface leads BA and BB are connected and disconnected from the CPE. Remote terminal loop-back may also be activated remotely from the STC by transmitting a control code sequence containing bipolar violations. Remote terminal loop-back is called DSU loop-back when originated by the STC. The switch is placed in the center position for normal operation (data mode). A spring clip, provided with the DSU, is placed over the switch when the DSU is used on multipoint lines to prevent the switch from being placed in the LL position. This is a telco option at all stations except the master station.

3.26 The LED assembly indications are as follows:

PWR—Illuminates when ac power is supplied to the DSU and +5 volts dc is available.

NS—Illuminates when no signal is present at the DSU.

LL—Illuminates when the DSU is switched to the LL mode or when the CHAN loop-back code is detected by the simplex current detector.

RT—Illuminates when the DSU is switched to the RT loop-back mode or when the DSU loop-back code is detected by the control code detection circuitry.

F. Customer Options

3.27 DSU 500A-type is provided with three options which may be requested by the customer. The features available as options are described in the following paragraphs.

3.28 ***Signal Ground to Frame Ground (Option YK—Connected, Option YL—Disconnected):*** Installation of this option internally connects signal ground to frame ground.

3.29 ***Request to Send (Option YS—Continuous, Option YT—Switched):*** The YS option is used with CPE which is not capable of turning ON the CA interface lead. With this option installed, the DSU operates as if the CA interface lead is constantly ON. The YT option is used with CPE which is capable of switching on the CA interface lead.

3.30 ***Switch and LED Assembly (Option XN—Installed on Front Panel, Option XM—Installed on Rear Panel):*** This option is used to provide ease of viewing the switch and LED assembly, depending on required mounting position of the DSU.

G. Telco Option

3.31 The DSU is provided with two options which must be selected by the telco engineer for initial installation of the DSU.

3.32 ***LL Spring Clip (Option XO—Installed, Option XP—Not Installed):*** When DSU is used on multipoint lines, the spring clip is placed over the slide switch to prevent its being placed in the LL position.

3.33 ***Line Build-Out Network (Option WV—Installed, Option WW—Removed):*** For DSU installations where the local cable pairs may be too short for proper operation of the line receiver, a line build-out network must be installed to provide additional attenuation. Refer to Section 880-601-115 for information as to when this option should be installed.

4. OPERATION

4.01 This part contains information concerning the manual operation of 500A-type DSU. The DSU has only two modes of operation: the data mode and the loop-back mode.

4.02 Proceed as follows for conducting a manual loop-back test:

(a) For local line loop-back, position the slide switch to LL and observe illumination of respective LED. (Refer to 3.25.)

(b) For remote loop-back, position the slide switch to RT and observe illumination of respective LED.

(c) At completion of loop-back tests, restore the slide switch to the center position.

5. REFERENCES

5.01 Detailed information concerning the 500A-type DSU is contained in CD- and SD-1D235-01.

5.02 The following Bell System Practices (BSPs) are listed for reference.

SECTION	TITLE
314-410-310	Digital Data System—Private Line Local Channel Trouble Analysis
314-410-510	Digital Data System—Private Line Local Channel Test and Requirements
314-901-300	Digital Data System—Serving Test Center—Private Line Circuit—Maintenance Procedures
590-102-139	48A1 Data Mounting—Identification
595-200-180	Digital Data System—500A-Type Data Service Unit (DSU)—Summarizing Specification

SECTION	TITLE
595-200-200	Digital Data System—500A-Type Data Service Unit—Installation and Connections
595-200-300	Digital Data System—500A-Type Data Service Unit—Maintenance
595-200-500	Digital Data System—500A-Type Data Service Unit—Test Procedures
880-601-115	Digital Data System—Engineering Considerations—Customer Loops—Engineering and Maintenance

500A-TYPE DATA SERVICE UNIT
INSTALLATION AND CONNECTIONS
DIGITAL DATA SYSTEM

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1. GENERAL

1.01 This section contains instructions for installing and connecting a 500A-type data service unit (DSU). Installation methods for the associated customer-provided equipment (CPE) are not included.

1.02 This section is reissued to include information concerning the replacement of option switches on circuit packs HN and HP1 with right angle headers. Also included is information concerning the fixed line build-out option (FLBO). Revision arrows are included to emphasize the more significant changes.

1.03 The 500A-type DSU is designed to be operated in an ambient temperature range from 40 to +120°F, with a relative humidity of less than 95 percent.

1.04 The 82A power unit, which is contained inside the DSU, supplies operating voltages of +5, +12, and -12 Vdc. An input of 105 to 129 Vac at a frequency of 57 to 63 Hz is required by the DSU. Each DSU is supplied with a 10-foot power cord for connection to the customer-provided ac source.

2. OPTION INSTALLATION

A. General

2.01 The 500A-type DSU is provided with three customer options and four TELCO options. The options should be specified on the service order or circuit layout record card (CLRC). Refer to Digital Data System—500A-Type Data Service Unit—Description and Operation, Section 595-200-100, for a description of these options. The option settings were initially made using KS-20983-L2 switches. However, the KS-20983-L2 switch is no longer available. Therefore, the option switches (S1 and S3) will be right angle headers on new circuit packs manufactured after 1978.

2.02 ▶Circuit packs (CPs) used in the DSU are given in Table A. For the earlier manufactured CPs that use the KS-20983-L2 switch the HP1 CP contains switch S3, and HN-type CPs contain switches S1 and S2 which are used to select the specific options. The switch locations are shown in Fig. 1 and the options are given in Table B. Figure 2 shows the three sections or rollers: A, B, and C of switches S1 and S3.◀ To access the switch rollers, the hinged protective cover must first be opened by raising it from the end marked with a dot. Each switch section roller is individually adjusted to one of two positions by using the screwdriver provided to ***gently*** rotate the adjustable roller. Switch positions are numbered as shown on the protective cover.

NOTICE
Not for use or disclosure outside the
Bell System except under written agreement



The final position of the roller must be such that it butts up against the spacer and the screwdriver slot is parallel with the spacer.

TABLE A

DSU SERVICE BIT RATE AND CIRCUIT PACKS

DSU LIST	DSU SERVICE BIT RATE	ANALOG CP	LOGIC CP
500A-L1/2	2.4 kb/s	HN1	HP1
500A-L1/3	4.8 kb/s	HN2	
500A-L1/4	9.6 kb/s	HN3	
500A-L1/5	56 kb/s	HN4	

2.03 ⧫For the newer manufactured CPs that use the right angle headers, HP1 CP contains header H2, and HN-type CPs contain switch S1 and header H1 which are used to select the specific options. The switch and header locations are shown in Fig. 3 and the options are given in Table C. Figure 4 is a representation of H1 and H2 showing the ten positions and the shunts. To install options, the shunts are slipped over the two pins which make up one position. Four shunts are provided with the header. One shunt is a spare and should be stored in position 10.⧫

B. Option Installation Procedure

2.04 To gain access to the switch rollers or headers, the front and rear faceplates must be removed. Both faceplates are removed by depressing the two tabs located on the bottom edge and simultaneously pulling outward. To replace

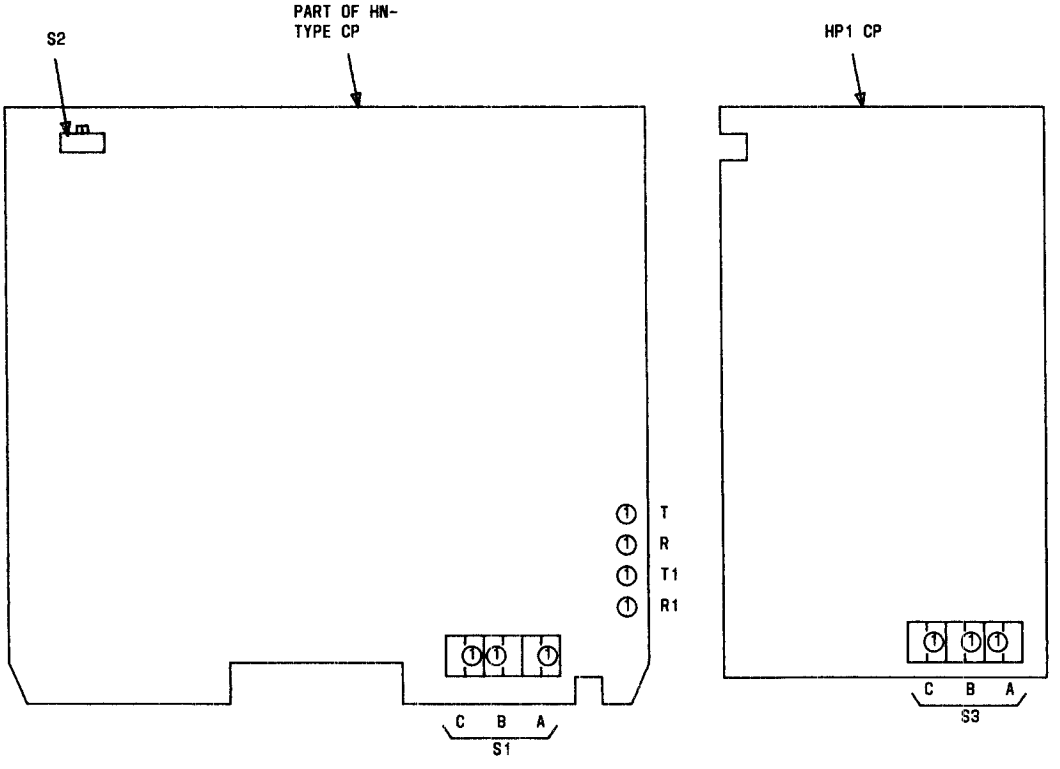


Fig. 1—DSU Option Switches

TABLE B

DSU OPTIONS

	OPTION	FEATURE	SWITCH	SWITCH POSITION	CP
CIRCUIT OPTIONS	WV	FIXED LINE BUILD-OUT NETWORK INSTALLED	S1A	3	HN TYPE
			S1B	5	
			S1C	9	
	WW	FIXED LINE BUILD-OUT NETWORK REMOVED	S1A	2	
			S1B	6	
			S1C	8	
	YK	SIGNAL GROUND CONNECTED TO FRAME GROUND	S2	IN	
	YL	SIGNAL GROUND DISCONNECTED FROM FRAME GROUND		OUT	
	YS	CONTINUOUS REQUEST TO SEND	S3A	2	HPI
	YT	SWITCHED REQUEST TO SEND		3	
	YQ	CIRCUIT ASSURANCE INSTALLED *	S3B	6	
	YR	CIRCUIT ASSURANCE REMOVED		5	
	XK	SYSTEM STATUS INSTALLED *	S3C	9	
	XL	SYSTEM STATUS REMOVED		8	
	*	THESE OPTIONS SHALL NOT BE INSTALLED EXCEPT AS REQUIRED IN OTHER INSTALLATION PRACTICES			
PHYSICAL OPTIONS	XM	SWITCH LED ASSEMBLY INSTALLED TO REAR			HN TYPE
	XN	SWITCH LED ASSEMBLY INSTALLED TO FRONT			
	XO	LL SPRING CLIP INSTALLED			
	XP	LL SPRING CLIP NOT INSTALLED			

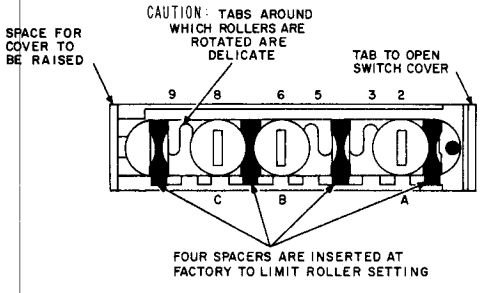


Fig. 2—Detail of Switch for Installing Options

the faceplates, hook the tabs on the aluminum housing into the slots on top and gently snap the bottom edge of the faceplates into position.

2.05 ⧫The FLBO option will be designated OUT or removed when the loop expected measured loss (EML) is 10 dB or more and designated IN or installed when the loop EML is less than 10 dB. The FLBO option must be IN when the actual measured loss (AML) is less than 5 dB and OUT when the AML is greater than 15 dB. When the AML falls between 5 dB and 15 dB, apply the option as shown on the CLRC. The transmission engineer or design group must be notified when any switch setting or header position deviates from the CLRC.⧫

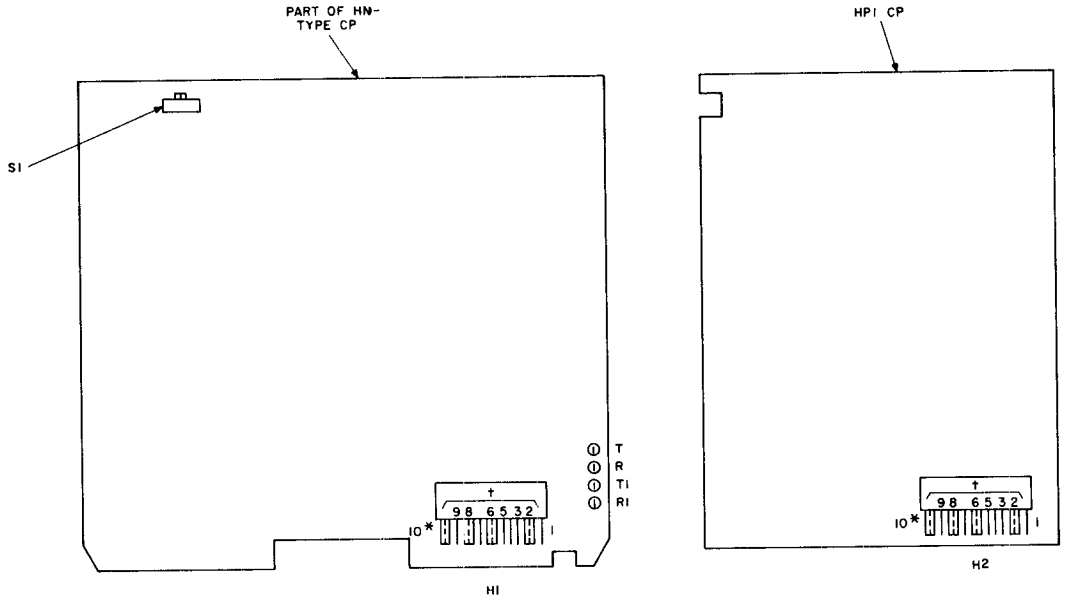


Fig. 3—DSU Option Switch and Headers

3. INSTALLATION AND CONNECTION PROCEDURES

3.01 Cable pairs must be tested in accordance with Digital Data System—Private Line Local Channel—Tests and Requirements, Section 314-410-510, prior to initial installation of the DSU.



Verify that the cable pair terminating resistors used in the above tests are removed prior to DSU installation.

A. Single Installation

3.02 The DSU should be installed on a nearby desk, table, or stand. Care must be used in placement to avoid stray fields from electromechanical equipment. For subrate services, the 500A-type DSU must be located from 1 to 50 feet from the CPE, while the 500A-L1/5 DSU operating at 56 kb/s may be located from 1 to 100 feet from the CPE.

3.03 When making connection to the line facility, the DSU must be located within 9 feet of the connector block in order for the DSU 4-conductor cord (D4BD-49) to reach the connector block.

3.04 The DSU must be located within 10 feet of a customer-provided ac outlet which is not under control of a switch. A power cord is supplied with the DSU and requires an outlet which accepts a plug with two parallel blades and a round grounding pin.

3.05 To minimize inductive interference to data signals on the local channel, the local cable pairs should not be installed within 6 inches of the customer interface cable. If this condition cannot be met, it will be necessary to run the local cable pairs with type-SK (shielded) wire as far as it is carried within 6 inches of the interface cable. Ground the shield at one end only, preferably at the distribution terminal, to prevent a potential difference between the ends of the cable shield.

TABLE C

DSU OPTIONS

		OPTION	FEATURE	POSITION
HN-TYPE CP CIRCUIT OPTIONS	HEADER H1	WV	Fixed line build-out network installed	3
				5
				9
		WW	Fixed line build-out network removed	2
				6
				8
	SWITCH S1	YK	Signal ground connected to frame ground	IN
		YL	Signal ground disconnected from frame ground	OUT
HN-TYPE CP PHYSICAL OPTIONS		XM	Switch led assembly installed to rear	
		XN	Switch led assembly installed to front	
		XO	LL spring clip installed	
		XP	LL spring clip not installed	
HP1 CP CIRCUIT OPTIONS	HEADER H2	YS	Continuous request to send	2
		YT	Switched request to send	3
		YQ	Circuit assurance installed*	6
		YR	Circuit assurance removed	5
		XK	System status installed*	9
		XL	System status removed	8

* These options shall not be installed except as required in other installation practices.

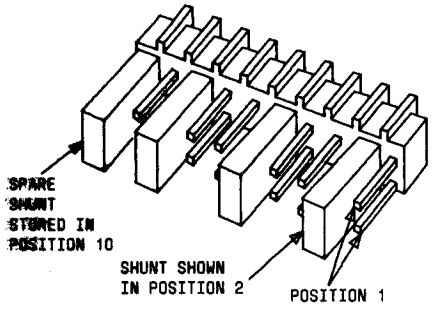


Fig. 4—Detail of Right Angle Header for Installing Options

The DSU is connected to the local channel as shown in Fig. 5.

3.06 A 25-pin connector is provided at the rear of subrate DSUs for connection to CPE. This connector is designed to mate with a customer-provided Cinch or Cannon DB-19604-432 plug equipped with a DB-51226-1 hood, or equivalent. DSUs operating at 56 kb/s have a 34-pin connector at the rear for connection to the CPE. This connector is designed to mate with a customer-provided Winchester MRA-34P-JTC6-H8 plug, or equivalent.

3.07 In DSU installations where access to the front faceplate is limited or where the customer interface connector is facing forward on a shelf or in a cabinet, the switch and light-emitting diode (LED) assembly may be removed from the front faceplate and mounted on the rear faceplate.

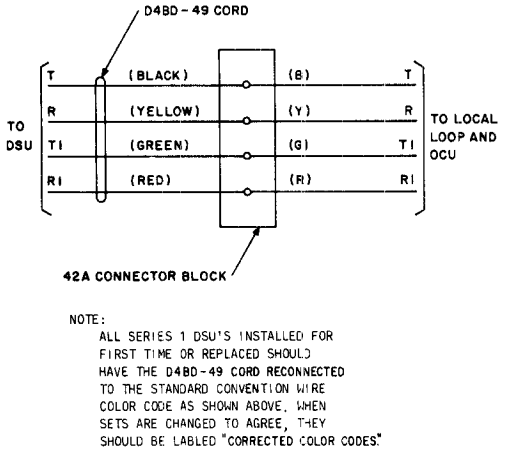


Fig. 5—A Typical Connection Diagram for the 500A-Type DSU (Series 2) Transmission Facility

To relocate the switch and LED assembly, proceed as follows:

(1) Remove both faceplates per paragraph 2.04.

(2) If the cover must be removed, loosen the two cover retaining screws located on the bottom of the DSU and slide the cover forward or backward.

(3) Disconnect the interconnecting cable harness from HP1 CP.

(4) Release the spring clip retaining HP1 CP and slide the CP out of the DSU.

(5) Remove the switch and LED assembly from the front faceplate by using gentle outward pressure on the plastic mounting tabs retaining the assembly.

(6) Install the switch and LED assembly on the rear faceplate by gently depressing the assembly into the appropriate position.

(7) Replace the HP1 CP into the DSU and connect the interconnecting cable harness to HP1.

(8) If the cover was removed, replace the cover by reversing the procedure in Step (2).

(9) Replace both faceplates per paragraph 2.04.

3.08 If the DSU is being used on multipoint lines, the spring clip supplied with the DSU should be positioned over the switch (on the switch and LED assembly) to prevent it from being placed in the LL position.

B. Multiple Installation

3.09 For multiple installations, three DSUs may be stacked without exceeding the maximum internal operating temperature. The four clips supplied with each DSU are used to support the center and top DSUs. They are inserted into the slots provided on the dovetail feet as shown in Fig. 6. When the sets are stacked, the tabs drop into holes provided in the top of the plastic faceplates and provide a secure, stacked arrangement.

3.10 Multiple installations requiring more than three DSUs are handled by means of the 48A-L1/2 data mounting which accepts up to five DSUs. (See Section 590-102-139 for a detailed description of the 48A data mounting.)

3.11 The 500A DSUs must be adapted for mounting in the 48A-L1/2. The L1/2 designation provides bearing plates which are required for mounting the DSU in the data mounting. Figures 7 through 11 depict a 500A DSU being adapted for mounting into the 48A-L1/2 data mounting. The mounting procedure is as follows.

(1) Remove front and rear faceplates per paragraph 2.04.

(2) Remove switch and LED assembly per paragraph 3.07(5).

(3) Remove outer cover from DSU. (The front faceplate, outer cover, and power cord are not used in a multiple arrangement.)

(4) Position switch and LED assembly to rear (connector side) of DSU.

(5) Slide the two bearing plates into the slot on the dovetail feet of the DSU and secure with mounting screws (Fig. 10). A bracket is supplied to fill the space between the bearing

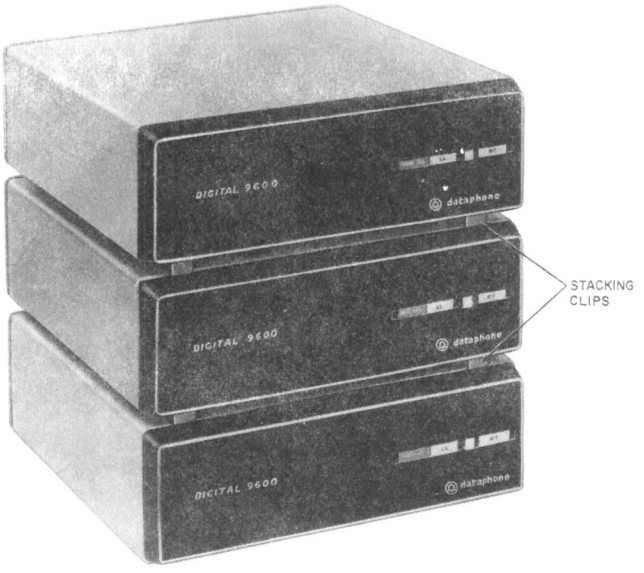


Fig. 6—Multiple Installation—Stacked Arrangement Using Clips for a Maximum of Three DSUs

plate and the DSU chassis and to provide rigidity to the DSU assembly.

(6) Dress the telephone line cord around the bearing plates as shown in Fig. 10.

(7) Insert the DSU (connector side first) into the rear of the data mounting by sliding the bearing plates into the slots in the upper and lower metal strips (Fig. 12 and 13). Make sure the switch and LED assembly clear the opening as the DSU is inserted.

(8) Secure the DSU by moving the lock strip to its leftmost position and tightening the lock-strip screw.

(9) Connect the tip and ring leads of each DSU to the terminal strips (TS-A through TS-E) located on the lower casting at each of the mounting positions as shown in Fig. 14. [Terminal strips are wired to a KS-16784-L4 (50-pin) connector mounted on the right side of the 48A data mounting.]

(10) Install the switch and LED assembly on the rear faceplate per paragraph 3.07(6).

(11) Install the rear faceplate into the 48A data mounting cover plate by engaging the three tabs at the left side of the opening and the two tabs on the faceplate.

(12) Attach the customer interface connector to the DSU and dress the cord with the cable ties located below each DSU (Fig. 13).

(13) Attach the multiple plug power cord, supplied with the 48A-L1/2, to each DSU power supply connector (Fig. 11).

(14) Access to the tip and ring connections is made via the KS-16786-L4 (50-pin) connector located on the right side of the mounting (Fig. 12).

3.12 The DSU is now connected for multiple operation.

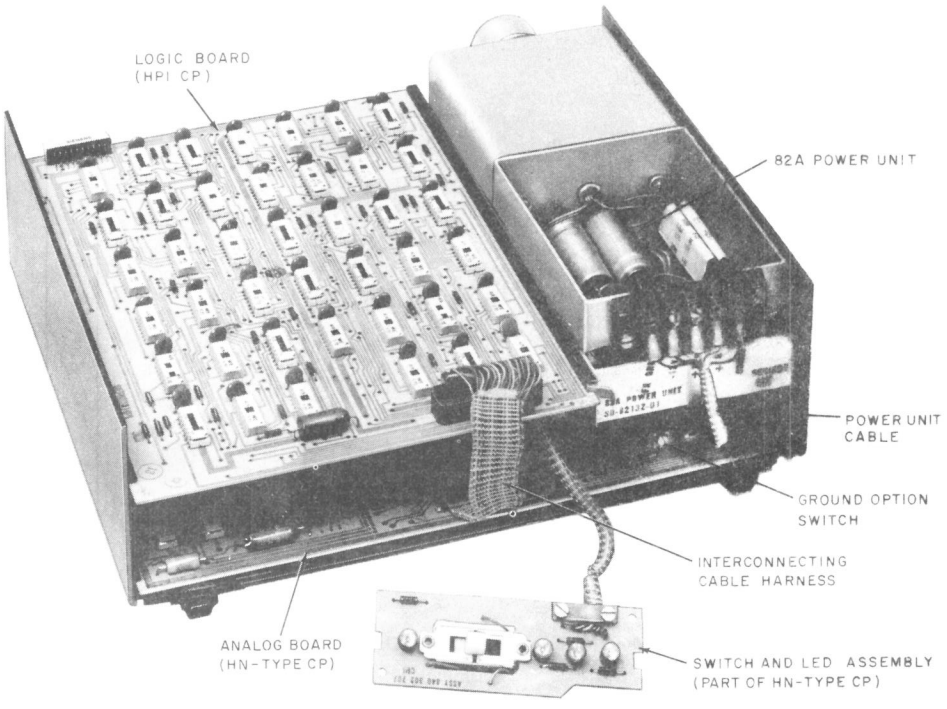


Fig. 7—500A-Type Data Service Unit—Front Internal View

4. TEST REQUIREMENTS

4.01 Perform the following installation tests in the order given and as instructed in Digital Data System—500A-Type Data Service Unit—Test Procedures, Section 595-200-500:

- Local test
- DSU functional test
- Straightaway test.

4.02 Blank labels are shipped attached to the inside of the front faceplate. List codes, customer option information, and other information may be recorded on these labels.

4.03 When DSUs are multiple mounted, the circuit number (CKT NO) and trouble number (TBL NO) for each DSU are written on the label attached to the bottom of each DSU.

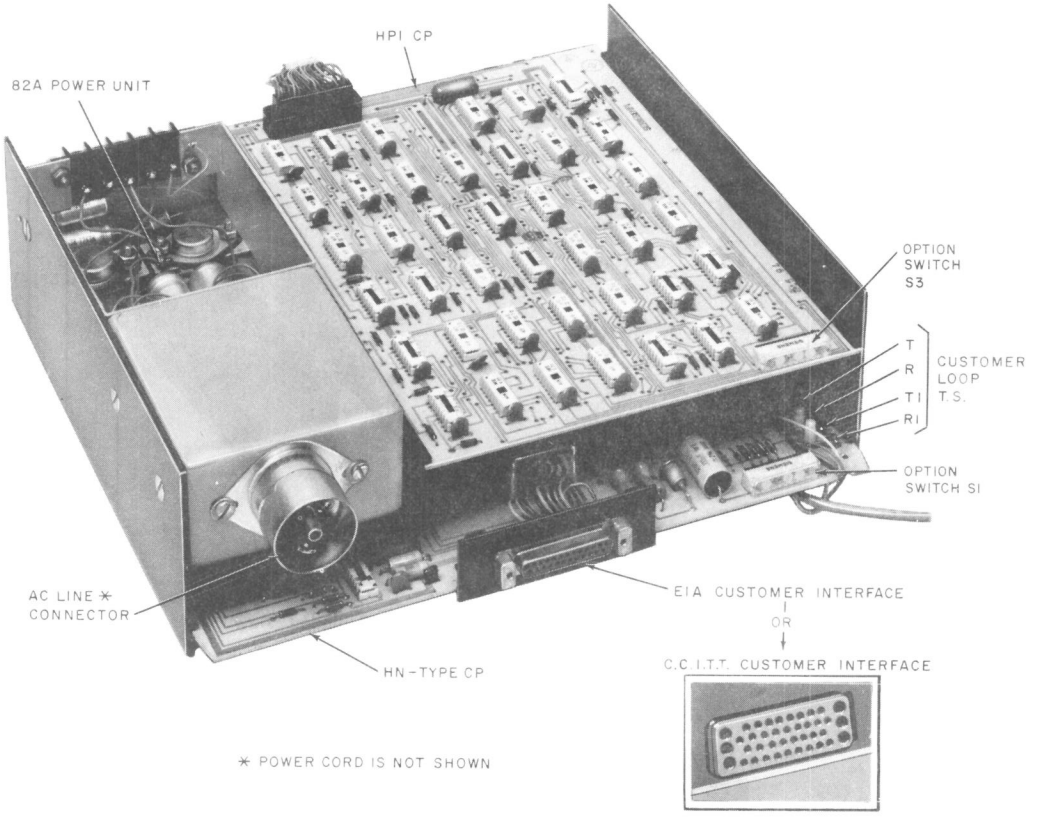


Fig. 8—500A-Type Data Service Unit—Rear Internal View

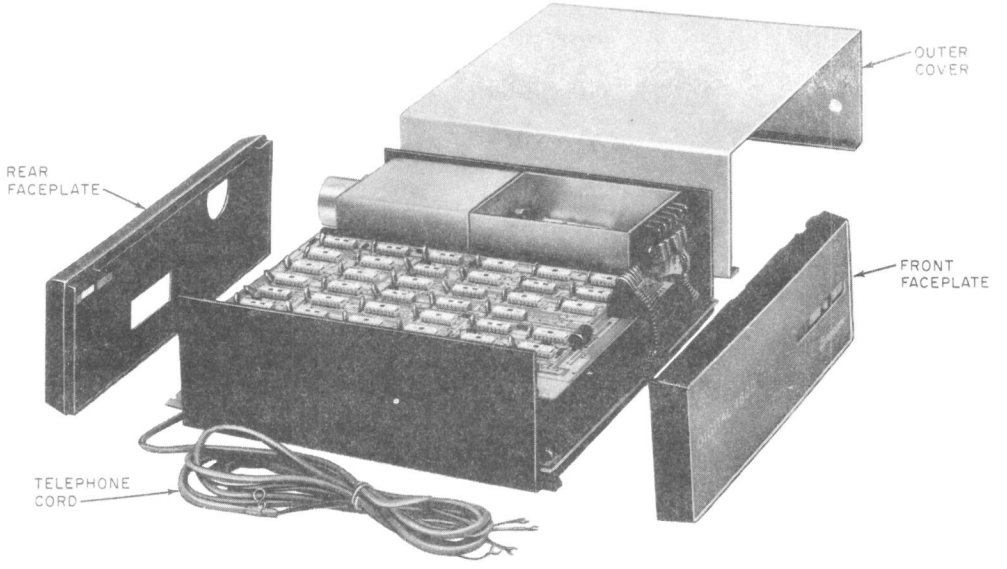


Fig. 9—500A-Type Data Service Unit—Exploded View

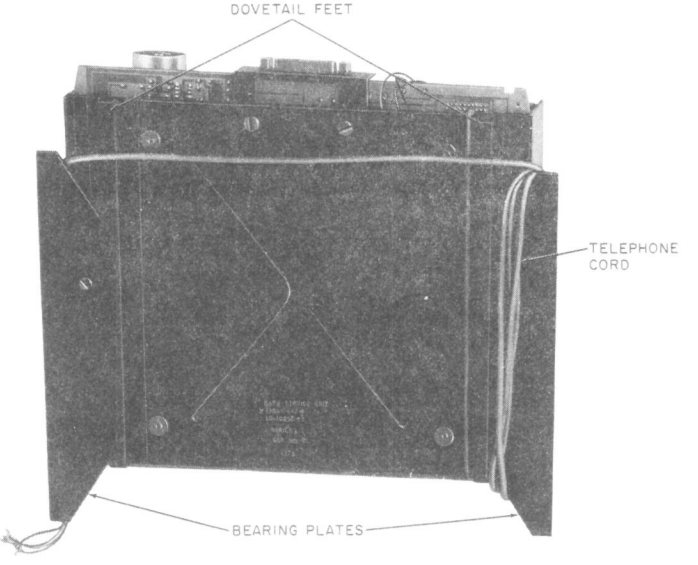


Fig. 10—500A-Type Data Service Unit—Under View Showing Bearing Plates

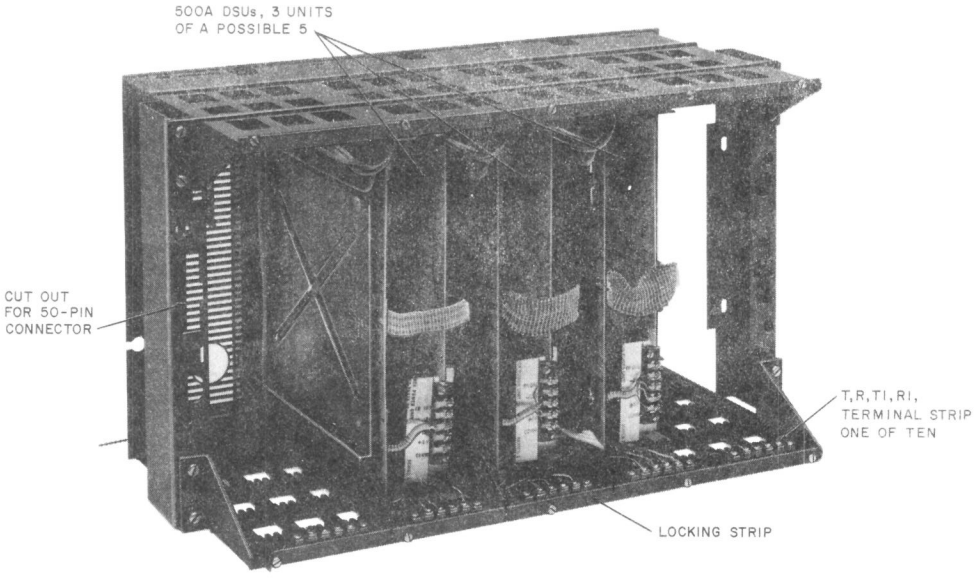


Fig. 11—48A-Type Data Mounting—Rear View Showing Three 500A-Type DSUs Installed

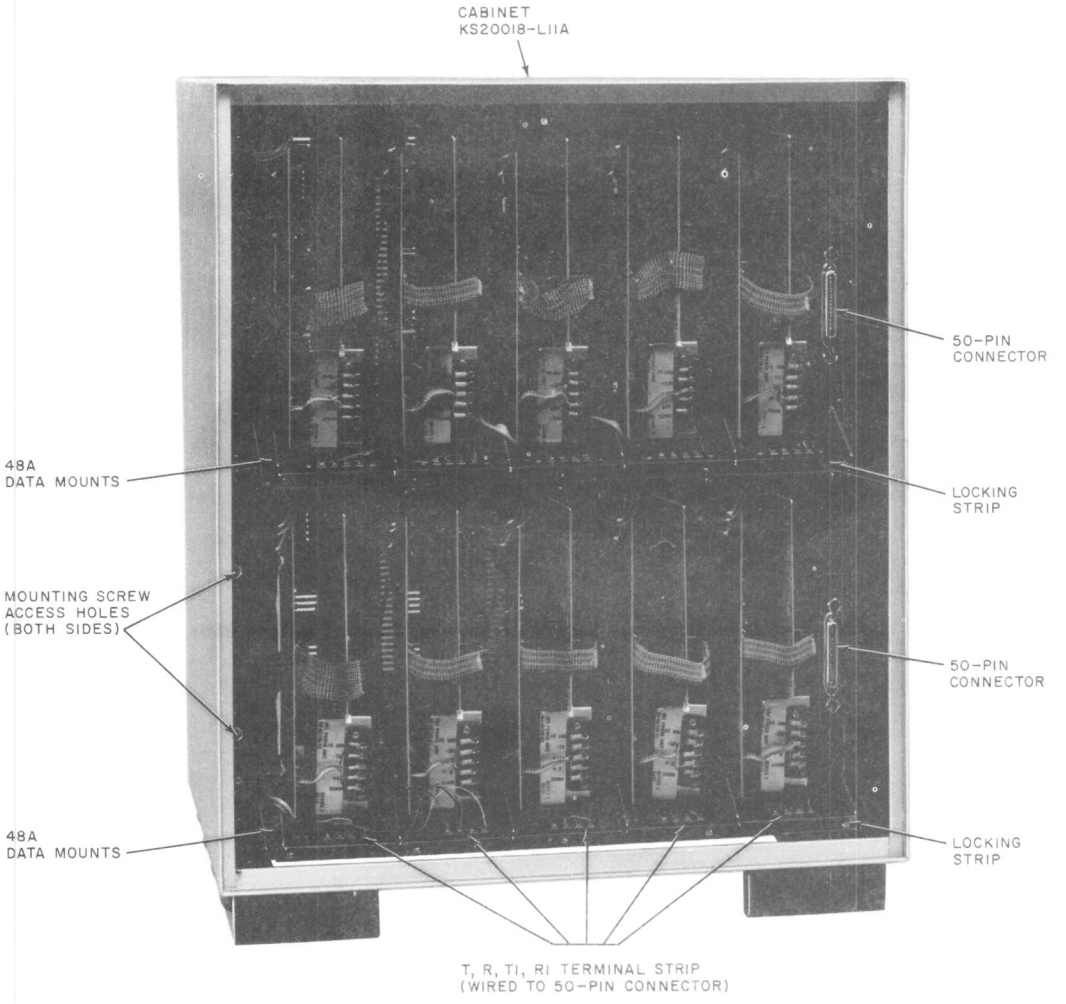


Fig. 12—Rear View—KS-20018-L11A Cabinet

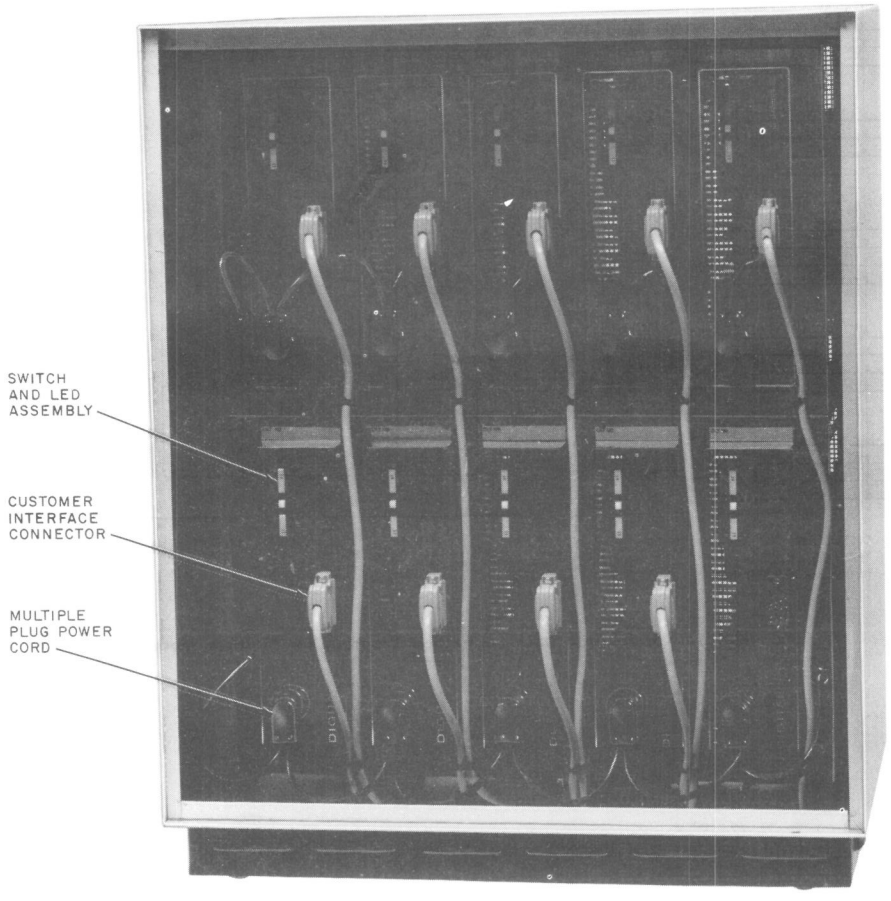


Fig. 13—Front View—KS-20018-L11A Cabinet

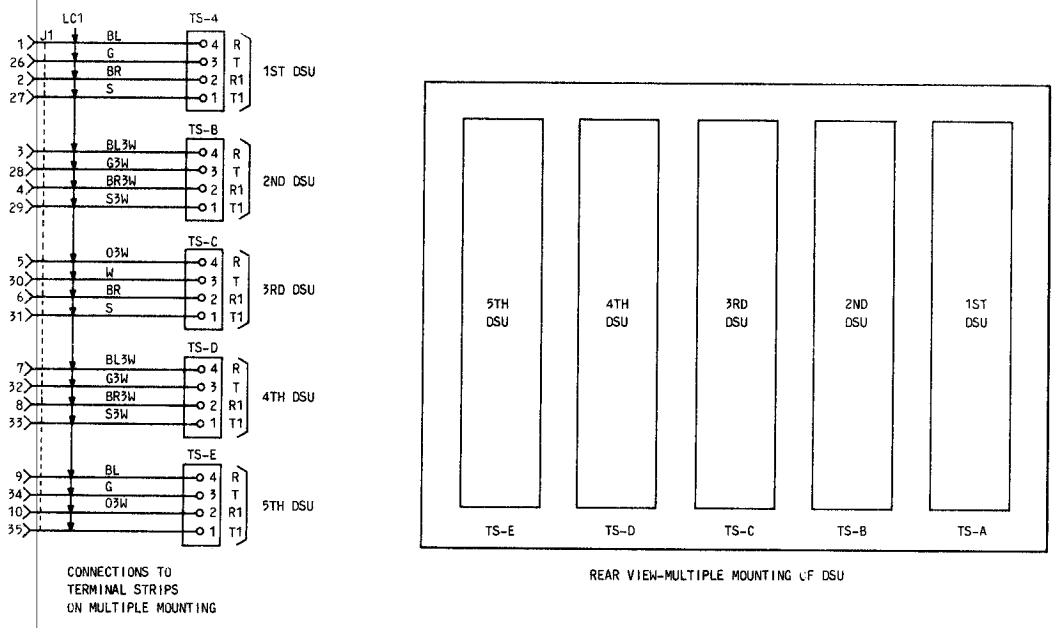


Fig. 14—500A-Type DSU Connection Diagram for Multiple Mounting

DIGITAL DATA SYSTEM
500A-TYPE DATA SERVICE UNIT
TEST PROCEDURES

CONTENTS PAGE

1. GENERAL 1
2. APPARATUS 2
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A. Local Test 4
B. DSU Functional Test 6
C. Straightaway Test 8
4. TEST PROCEDURES—921A DTS . . . 10
A. Local Test 12
B. DSU Functional Test 14
C. Straightaway Test 17

1. GENERAL

1.01 This section contains procedures to be used when testing the 500A-type data service unit (DSU). Procedures for investigating a trouble condition are given in Section 595-200-300, entitled Digital Data System—500A-Type Data Service Unit—Maintenance.

1.02 This section is reissued to remove the "circuit assurance" and "system status" options which were removed before commercial service began. Since this reissue constitutes a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 The tests covered in this section are listed and defined below.

A. Local Test: This is a partial test of the customer interface leads, the DSU transmit and receive logic, and the power supply. In order to perform this test, the DSU must be connected to ac power.

B. DSU Functional Test: This test verifies the operation of circuits within the DSU which control the zero suppression code and idle code generation and detection. The ability of the DSU to transmit and receive data and control codes in conjunction with the associated office channel unit (OCU) is determined by this test. In addition, the DSU is monitored for response to control codes, generated by the serving test center (STC), which determine loopback modes (DSU and CHAN). Voice coordination with the STC is required to perform this test. This voice coordination is not over the digital data system (DDS), but must be via direct distance dialing (DDD).

C. Straightaway Test: The purpose of this test is to evaluate the performance of the DDS channel through an error performance run coordinated with the STC. A maximum of three errors, at any of the data rates (2.4, 4.8, 9.6, and 56 kb/s), in each direction of data transmission during a 15-minute interval is permitted for the DDS channel to be acceptable. Voice coordination with the STC is required to perform this test. This voice coordination is not over DDS, but must be via DDD.

1.04 The tests given in this section are to be performed in the order given for installation testing. For maintenance testing, they may be performed individually or in any combination.

Caution: A dc loop current in excess of 250 mA may damage the DSU/CSU at the station end. Do not use test

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Not for use or disclosure outside the
Bell System except under written agreement

equipment that applies a current greater than 250 mA to the cable pairs, unless the OCU has been removed and the DSU/CSU has been disconnected from the pairs. In addition, a dc voltage in excess of 50 volts applied to repeatered loops can cause damage to the repeater. Do not use test equipment that applies a voltage greater than 50 volts to the cable pair on repeatered loops.

1.05 By performing the local test first, the telephone company (TELCO) employee may locate a minor trouble condition without involvement of the STC. This test ascertains the operation of the DSU power supply and customer interface leads with the exception of the data-set-ready lead.

1.06 Since the service maintenance philosophy for the DSU is immediate replacement with a known operable DSU upon failure of any one test, no remedial action is given in the detailed test procedures to follow. If the replacement DSU fails any one of the installation tests, the cable pairs may be the trouble source and must be analyzed as specified in Section 314-410-310, entitled Digital Data System—Local Loop—Maintenance Procedures.



Customer permission should be obtained to ensure that the data channel is idle prior to conducting any test given in this section.

2. APPARATUS

2.01 This part describes the DTSs that are required at the customer location during installation or maintenance testing.

2.02 The 912A wideband data test set (WDTS) (J79912A-L1/47) is used for testing the wideband 500A-L1/5 DSU (56-kb/s service).

2.03 The 914C DTS (J79914C-L1) is used for testing the subrate 500A-L1/2, 3, 4 DSUs (2.4-, 4.8-, 9.6-kb/s service).

2.04 The 921A DTS (J79921A) can be used in place of the 912A WDTS and the 914C DTS.

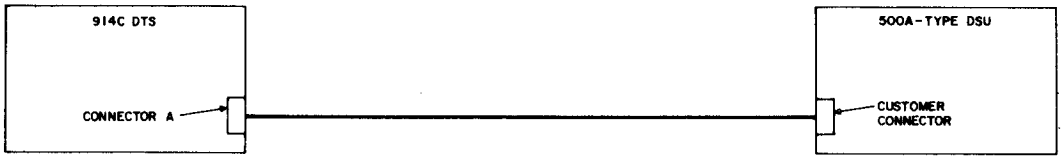
3. TEST PROCEDURES—912A WDTS AND 914C DTS

3.01 This part contains the procedures necessary to perform the tests described in Part 1. The test procedures using a 912A WDTS or 914C DTS are given below; test procedures using a 921A DTS are contained in Part 4.

Initial Test Setup

3.02 The procedures given in this part are to be used for conditioning the test equipment prior to starting any test in this section.

STEP	ACTION	VERIFICATION
	Subrate DSU	
1	Connect the interface connection cable, provided with the 914C DTS, from connector A on the DTS to the customer interface connector of the subrate DSU.	
2	Insert the power plug of the DTS into a 117-volt 60-Hz ac outlet.	
3	Program the DTS with ten matrix pins and position the switches per Fig. 1.	
4	Press the DTS POWER switch.	POWER indicator lighted.



914C DTS MATRIX PROGRAM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	STG	
GRD	●	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	GRD
SD	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	SD
RD	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	RD
SI	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	SI
DSI	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DSI
DS2	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS2
S2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S2
DS3	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS3
TPI	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	TPI
TP2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	TP2
S3	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S3
DS4	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS4
DS5	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS5
S4	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S4
SCT	○	○	○	○	○	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	SCT
S5	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S5
SCR	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	SCR
DS6	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS6
S6	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S6
DS7	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS7
DS8	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS8
S7	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S7
TP3	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	TP3
S8	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S8

914C DTS SWITCH SETTINGS
(ALL OTHER SWITCHES NOT USED)

SWITCH	SETTING
INTERFACE MODE	VOLTAGE
SI	OFF
TEST SET MODE	SER
COUNTER	BIT ERRORS
FUNCTION	OFF
RCV BIT RATE	EXT +
RCV WORD LENGTH	5 I I
WORD SYNC	AUTO
ALL INTERFACE	
SELECTOR SWITCHES	DEPRESSED
TRANSMIT BIT RATE	EXT +
TRANSMIT WORD LENGTH	5 I I
TRANSMIT SIG LEV	±4V

INDICATOR LIGHT DESIGNATIONS

DSI	CLEAR TO SEND
DS2	DATA SET READY
DS3	RECEIVED LINE SIGNAL DETECTOR

Fig. 1—914C DTS Testing Configuration

STEP	ACTION	VERIFICATION
	56-kb/s DSU	
1	Connect the interface cable (CA201) provided with the 912A WDTS from the high-speed interface unit of the WDTS to the customer interface connector of the 56-kb/s DSU.	
2	Insert the power plug of the WDTS into a 117-volt 60-Hz ac outlet.	
3	Position the WDTS controls as in Table A.	
4	Position the WDTS POWER switch to ON.	POWER indicator is lighted.



Take appropriate action as given in Section 010-250-001, entitled Crediting Charges or Test Calls, to ensure that the customer is not billed for test calls. Before starting Test B or C, establish voice communication with the STC and verify that the DSU under test is the correct list code and that customer options specified on the circuit layout record card (CLRC) are installed in the DSU.

3.03 The tests presented in this part should be performed after the DSU has been installed to ensure that the installation is ready to be placed in service.

3.04 A letter a, b, c, etc, added to a step number indicates an action which may or may not be required, depending on local conditions. The condition under which a lettered step should be made is given in the ACTION column.

TABLE A

912A WDTS SWITCH POSITIONS

SWITCH	POSITION
TRANSMIT BIT RATE	EXT
RECEIVE BIT RATE	EXT
TRANSMIT TEST SIGNAL	2047
RECEIVE TEST SIGNAL	2047
OUTPUT	INVERTED
INPUT	INVERTED
WORD SYNC	AUTO
TIMING	0
COUNTER	ON
DATA TERM READY	OFF
REQ TO SEND	OFF
LOCAL TEST	OFF
TEST MODE	OPERATE

A. Local Test

STEP	ACTION	VERIFICATION
	Subrate DSU	
1	If this is the first test, perform initial setup described in paragraph 3.02.	
2	Apply power to the DSU.	PWR indicator is lighted.

STEP	ACTION	VERIFICATION
3	Place the DSU slide switch in position LL.	PWR and LL indicators are lighted. NS and RT indicators are off.
4	Position the 914C DTS switch S1 to ON.	DS1 and DS3 are lighted. DS2 remains off. NO CLOCK and NO DATA indicators are off.
5	Press the DTS counter RESET button.	Counter reads zero errors.
6	Position DTS switch S1 to OFF.	If the DSU is equipped with option YS (continuous request-to-send)— DS1 and DS3 remain lighted. DS2 remains off. If the DSU is equipped with option YT (switched request-to-send)— DS1 and DS3 are off. NO DATA indicator is lighted.
7	If no further tests are to be performed, disconnect the DTS and restore the DSU slide switch to the center position.	
56-kb/s DSU		
1	If this is the first test, perform initial setup described in paragraph 3.02.	
2	Apply power to the DSU.	PWR indicator is lighted.
3	Place the DSU slide switch in position LL.	PWR and LL indicators are lighted. NS and RT indicators are off.
4	Position the 912A WDTS REQ TO SEND switch to ON.	CLEAR TO SEND and RCVD LINE SIG DETR indicators are lighted. DATA SET READY indicator remains off. NO DATA and NO SYNC indicators are off.
5	Position the COUNTER switch to ON and press the reset button located on the counter face.	Counter reads zero errors.
6	Position the REQ TO SEND switch to OFF.	If the DSU is equipped with option YS (continuous request to send)— CLEAR TO SEND and RCVD LINE SIG DETR indicators remain lighted. DATA SET READY indicator remains off. If the DSU is equipped with option YT (switched request to send)— CLEAR TO SEND and RCVD LINE SIG DETR indicators go off.

STEP	ACTION	VERIFICATION
		Counter begins to count errors. NO DATA indicator lights.
7	If no further tests are to be performed, disconnect the WDTS and restore the DSU slide switch to the center position.	

B. DSU Functional Test

Subrate DSU

1	If this is the first test, perform initial setup described in paragraph 3.02.	
2	Apply power to the DSU.	PWR indicator is lighted. NS, LL, and RT indicators are off.
3	Request the STC to transmit repeated idle control code.	
4	Position the 914C DTS switch S1 to ON.	DS1 and DS2 are lighted. DS3 is off.
5	Request the STC to transmit the OCU loopback control code.	After a 1- to 2-second transition interval, NS indicator on the DSU lights.
6	Request the STC to transmit repeated bytes with a "1" inserted in position 8.	NS indicator on DSU goes off. DS3 on DTS lights. (STC receives byte pattern 00000001.)
7	Request the STC to transmit a repeated 511-bit test word.	
8	Reset the DTS counter by momentarily pressing the RESET pushbutton.	Counter reads zero errors during a 10-second interval.
9	Place the DSU slide switch in the RT position.	DS1, DS2, and DS3 indicators on DTS are off. RT indicator on the DSU lights.
10	Request the STC to make a 10-second error check.	
11	Place the DSU slide switch in the center position.	RT indicator is off.
12	Request the STC to transmit the DSU loopback control code.	RT indicator lights.
13	Request the STC to transmit a repeated CHAN loopback control code.	At the DTS— DS1 and DS3 indicators light.

STEP	ACTION	VERIFICATION
		At the DSU— RT indicator is off. LL indicator is lighted.
14	If no further tests are to be performed, disconnect the DTS.	
56-kb/s DSU		
1	If this is the first test, perform initial setup described in paragraph 3.02.	
2	Apply power to the DSU.	PWR indicator is lighted. NS, LL, and RT indicators are off.
3	Request the STC to transmit repeated idle control code.	
4	Position the 912A WDTS REQ TO SEND switch to ON.	DATA SET READY and CLEAR TO SEND indicators lighted. RCVD LINE SIG DETR indicator is off.
5	Request the STC to transmit the OCU loopback control code.	After a 1- to 2-second transition interval, NS indicator on the DSU lights.
6	Request the STC to transmit repeated bytes with a "1" inserted in position 8.	
7	Position the WDTS OUTPUT switch to SPACE.	NS indicator on the DSU goes off. RCVD LINE SIG DETR indicator on the WDTS lights. (STC receives byte pattern 00000001.)
8	Request the STC to transmit a repeated 2047-bit test word.	
9	Position the WDTS COUNTER switch to ON and press the reset pushbutton located on the counter face.	Counter reads zero errors during a 10-second interval.
10	Place the DSU slide switch in the RT position.	At the WDTS— CLEAR TO SEND, DATA SET READY and RCVD LINE SIG DETR indicators are off. RT indicator on the DSU lights.
11	Request the STC to perform a 10-second error check.	
12	Place the DSU slide switch in the center position.	RT indicator goes off.

STEP	ACTION	VERIFICATION
13	Request the STC to transmit the DSU loopback control code.	RT indicator on DSU lights.
14	Request the STC to transmit the CHAN loopback control code.	At the WDTS— CLEAR TO SEND and RCVD LINE SIG DETR indicators are lighted. At the DSU— LL indicator is lighted.
15	If no further tests are to be performed— Disconnect the WDTS and restore the DSU slide switch to the center position.	

C. Straightaway Test

Subrate DSU

1	If this is the first test, perform initial setup described in paragraph 3.02.	
2	Apply power to the DSU.	PWR indicator is lighted. NS, LL, and RT indicators are off.
3	Request the STC to transmit and to check the received 511-bit test word for errors.	
4	Position the 914C DTS switch S1 to ON.	DS1, DS2, and DS3 indicators are lighted.
5	Reset the 914C DTS counter by momentarily pressing the RESET button.	
6	Start timing a 15-minute interval.	Maximum number of errors is three counted by the DTS and three counted by the STC receiver.
7a	If more than three errors are counted on either counter— Reset both counters and start timing another 15-minute interval.	
8b	If more than three errors are counted on either counter within the first 5 minutes of the second attempt— Wait 5 minutes, reset the counters and start another 15-minute interval. ***Note:*** An extraordinary condition, such as a severe electrical storm or an intermittent failure of customer-supplied ac power, may affect the performance of the DDS channel. The straightaway test cannot properly be performed until these conditions have cleared.	

STEP	ACTION	VERIFICATION
9c	If three attempts fail to achieve the 15-minute requirement, the STC must commence troubleshooting the channel in accordance with Section 314-901-300.	
10	Request the STC to perform a 15-minute DSU loopback and a 15-minute CHAN loopback error run, and to record the number of errors counted on the CLRC as a benchmark for future use.	
11	Disconnect the 914C DTS and restore the DSU slide switch to the center position.	
56-kb/s DSU		
1	If this is the first test, perform initial setup described in paragraph 3.02.	
2	Apply power to the DSU.	PWR indicator is lighted. NS, LL, and RT indicators are off.
3	Request the STC to transmit a repeated 2047-bit test word and to check the received 2047-bit test word for errors.	
4	Position the 912A WDTS REQ TO SEND switch to ON.	CLEAR TO SEND, RCVD LINE SIG DETR, and DATA SET READY indicators are lighted.
5	Position the WDTS COUNTER switch to ON.	
6	Reset the WDTS counter by pressing the reset button located on the counter face.	
7	Start timing a 15-minute interval.	Maximum number of errors is three counted by the WDTS and three counted by the STC receiver.
8a	If more than three errors are counted on either counter— Reset both counters and start timing another 15-minute interval.	
9b	If more than three errors are counted on either counter within the first 5 minutes of the second attempt— Wait 5 minutes, reset the counters, and start another 15-minute interval. ***Note:*** An extraordinary condition, such as a severe electrical storm or an intermittent failure of customer-supplied ac power, may	

STEP	ACTION	VERIFICATION
	affect the performance of the DDS channel. The straightaway test cannot properly be performed until these conditions have cleared.	
10c	If three attempts fail to achieve the 15-minute requirement, the STC must commence troubleshooting the channel in accordance with Section 314-901-300.	
11	Request the STC to perform a 15-minute DSU loopback and a 15-minute CHAN loopback error run and to record the number of errors on the CLRC as a benchmark for future use.	
12	Disconnect the WDTS and restore the DSU slide switch to the center position.	

4. TEST PROCEDURES—921A DTS

4.01 This part contains the procedures necessary to perform the tests described in Part 1 using a 921A DTS.

4.02 A letter a, b, c, etc. added to a step number indicates an action which may or may not be required, depending on local conditions. The condition under which a lettered step should be performed is given in the ACTION column. For example steps designated with an "a" apply to subrate DSUs while steps designated "b" apply to 56 kb/s DSUs.

4.03 The procedures given in this part are to be used for conditioning the test equipment prior to starting any of the tests.

STEP	ACTION	VERIFICATION
1	Connect the DTS to the customer interface connector of the DSU using the interface cords provided with the DTS. ***Note:*** The interface cord is equipped with a 37-pin connector on each end. A 6-inch adapter cord matches the interface cord to the interface connector on the DSU.	
2	Verify that all 7 interface selector switches (white bow-tie) on the front of the DTS are in the TERM position.	
3	Insert the power plug of the 921A DTS into a 117-volt 60-Hz ac outlet.	
4a	Subrate DSU— Remove the EIA RS-232-C interface card from the storage area in the DTS. Ensure that all 25 interface lead switches are in the normal position, insert the card into the interface connector and close the latch. (A red dot on	

STEP	ACTION	VERIFICATION
	the switch is visable when the switch is in the normal position.)	
4b	56-kb/s DSU— Remove the CCITT V.35 interface card from the storage area in the DTS. Ensure that all 14 interface lead switches are in the normal position, insert the card into the interface connector and close the latch. (A red dot on the switch is visable when the switch is in the normal position.)	
5	Apply power to DSU.	PWR indicator is lighted.
6	Operate the POWER switch on the 921A DTS to ON.	POWER ON indicator is lighted.
7	Press RST key on the DTS.	Display indicates— 921A VERS #01, (or higher) briefly, then DATA SET : is displayed if the DTS is not defective. If the DTS is defective, TEST FAILED appears on the display and another test set must be obtained to perform these procedures.
8a	Subrate DSU— Select the 500A (subrate) by entering 80 on the DTS input keyboard.	Display indicates— DATA SET : 80.
8b	56-kb/s DSU— Select the 500A (56 kb/s) by entering 81 on the DTS input keyboard. ***Note:*** To delete a wrong entry on the input keyboard, press the backspace arrow.	Display indicates— DATA SET : 81.
9	Press GO key.	Display indicates— BIT RATE !
10a	Subrate DSU— Select subrate service by entering one of the following on the DTS input keyboard— 24 for 2.4-kb/s service 48 for 4.8-kb/s service 96 for 9.6-kb/s service.	Display indicates— BIT RATE : followed by either 24, 48, or 96.
10b	56-kb/s DSU— Select 56-kb/s service by entering 56 on the DTS input keyboard.	Display indicates— BIT RATE : 56.

STEP	ACTION	VERIFICATION
11	Press GO key.	Display indicates— TEST SEQ : Interface indicator DSR is lighted, SCT and SCR ON-OFF indicators are of equal intensity, SD and RD indicators "1" are lighted.



Take appropriate action as given in the Section 010-250-001, entitled Crediting Charges on Test Calls, to ensure that the customer is not billed for test calls. Before starting Test B or C, establish voice communication with the STC and verify that the DSU under test is the correct list code and that customer options specified on the CLRC are installed in the DSU.

4.04 The tests presented in this part should be performed after the DSU has been installed to ensure that the installation is ready to be placed in service.

A. Local Test

STEP	ACTION	VERIFICATION
1	If this is the first test, perform initial setup described in paragraph 4.03.	
2	Place the DSU slide switch in position LL.	PWR and LL indicators on the DSU are lighted. NS and RT indicators on the DSU are off. Interface indicator DSR on the DTS is off.
3	Select the control for the request-to-send (RS) lead by entering 36 on the DTS.	Display indicates— TEST SEQ : 36 RS=? (0 OR 1).
4	Press key number 1.	Display indicates— TEST SEQ : 36 RS=1 (0 OR 1).
5	Select error test (DOT, SPACE, MARK, and PSEUDORANDUM WORD) by entering 55 on DTS.	Display briefly indicates— : 36 RS=1 (0 or 1) 55 then display becomes :
6a	Subrate DSU— Press GO key.	Display briefly indicates— TEST COMPLETE then display becomes— D=DT 0=SP 1=MK 2=2047 5=511 6=63 Interface indicators RS, CS and RLSD on the DTC are lighted; DSR is off.
6b	56 kb/s DSU— Press GO key.	Display briefly indicates— TEST COMPLETE then display becomes— D=DT 0=SP 1=MK 2=2047. Interface indicators RS, CS, and RLSD on the DTC are lighted; DSR is off.

STEP	ACTION	VERIFICATION
7	Press key number 2.	Display indicates— 2047 BIT ERROR TEST, briefly, then 1=BIT ERRORS 2=BLOCK ERRORS is displayed.
8	Press key number 1.	Display indicates— ???? SECONDS.
9	Select 10 seconds by entering 0010 on DTS.	Display indicates— 0010 SECONDS, briefly, then 0000 BITS IN ERROR is displayed. From this point, the DTS counts the number of errors received. At the end of the test, the display indicates TEST COMPLETE, then total SYNC LOSSES, then the total BITS in ERROR, repeatedly. ***Requirement:*** Zero BITS IN ERROR.
10	Press TST key on DTS in order to stop repetition of display in Step 9.	If the DSU is equipped with option YT (switched request-to-send)— Display indicates— TEST COMPLETE, briefly, then TEST SEQ: is displayed. Interface indicators RS, CS, and RLSD on the DTS are off. If the DSU is equipped with option YS (continuous request-to-send)— Display indicates— TEST COMPLETE, briefly, then TEST SEQ: is displayed. Interface indicators CS and RLSD on the DTS are lighted.
11	Restore the DSU slide switch to the center position.	Interface indicator lamp DSR on the DTS is lighted. LL indicator on the DSU is off. If the DSU is equipped with option YS— Interface indicator RLSD on the DTS is off.
12	If no further tests are to be performed, disconnect the DTS as described in Part C, steps 13 through 16. ***Note:*** If it is necessary to perform any of the functions shown below, press the indicated key on the DTS. Restart test----------A key Display time remaining in test---B key Clear display----------C key End test----------D key	

STEP	ACTION	VERIFICATION
	Insert errors into data stream---E key Force out-of-sync condition------F key.	
B.	**DSU Functional Test**	
1	If this is the first test, perform the initial setup described in paragraph 4.03.	
2	Request the STC to transmit repeated idle control code.	
3	Select the control for the RS lead by entering 36 on the DTS.	Display indicates— TEST SEQ : 36 RS=? (0 OR 1).
4	Press key number 1 on DTS then select error test (DOT, SPACE, MARK, and PSEUDORANDUM WORD) by entering 55 on DTS.	Display briefly indicates— TEST SEQ : 36 RS=1 (0 OR 1) 55 then display becomes :
5a	Subrate DSU— Press GO key.	Display briefly indicates— TEST COMPLETE, then D=DT 0=SP 1=MK 2=2047 5=511 6=63 Interface indicators DSR, RS, and CS on the DTS are lighted; RLSD indicator is off.
5b	56 kb/s DSU— Press GO key.	Display briefly indicates— TEST COMPLETE then display becomes— D=DT 0=SP 1=MK 2=2047 Interface indicators DSR, RS, and CS on the DTS are lighted. RLSD indicator is off.
6	Request the STC to transmit the OCU loopback control code.	After a 1- to 2-second transition interval, the NS indicator on the DSU lights.
7	Request the STC to transmit byte pattern 00000001.	The NS indicator on the DSU goes off. Interface indicators DSR, RS, CS, and RLSD on the DTS are lighted.
8	Press key number 0 on DTS.	Display indicates— SPACING BIT ERROR TEST, briefly, then 1=BIT ERRORS 2=BLOCK ERRORS.
9	Press key number 1 on DTS.	Display indicates— ???? SECONDS.
10	Select 10 seconds by entering 0010 on DTS.	Display indicates— 0010 SECONDS, briefly, then 0000 BITS IN ERROR is displayed. From this point, the DTS counts the number of errors received. At the end of the test, the display indicates TEST COMPLETE, then

STEP	ACTION	VERIFICATION
		total SYNC LOSSES, then the total BITS IN ERROR, repeatedly. ***Requirement:*** Zero BITS in ERROR. (STC receives byte pattern 00000001.)
11	At completion of test, press TST key on DTS to stop repetition of display in Step 11. ***Note:*** If it is necessary to perform any of the functions shown below, press the indicated key on the DTS. Restart test----------A key Display time remaining in test---B key Clear display----------C key End test----------D key.	Display indicates— TEST SEQ :
12	Request the STC to transmit a repeated 2047 bit test word.	
13	Select the control for the RS lead by entering 36 on the DTS.	Display indicates— TEST SEQ : 36 RS? (0 or 1).
14	Press key number 1 then select error test (DOT, SPACE, MARK, and PSEUDORANDOM WORD) by entering 55 on the DTS.	Display briefly indicates— TEST SEQ : 36 RS=1 (0 or 1) 55 then display indicates :
15a	Subrate DSU— Press GO key DTS.	If the DSU is equipped with option YT (switched request to send)— Display briefly indicates— TEST COMPLETE then display indicates— D=DT 0=SP 1=MK 2=2047 5=511 6=63 Interface indicators RLSD, RS, and CS on DTS are off. If the DSU is equipped with option YS (continuous request to send)— Display briefly indicates— TEST COMPLETE then display indicates— D=DT 0=SP 1=MK 2=2047 5=511 6=63 Interface indicators RLSD and CS on DTS are lighted; RS is off.
15b	56 kb/s DSU— Press GO key on DTS.	If the DSU is equipped with option YT (switched request to send)— Display briefly indicates— TEST COMPLETE then display indicates—

STEP	ACTION	VERIFICATION
		D=DT 0=SP 1=MK 2=2047 Interface indicators RLSD, RS, and CS on DTS are off. If the DSU is equipped with option YS (continuous request to send)— Display briefly indicates— TEST COMPLETE then display indicates— D=DT 0=SP 1=MK 2=2047 Interface indicators RLSD and CS on DTS are lighted; RS is off.
16	Press key number 2 on DTS.	Display indicates— 2047 BIT ERROR TEST, briefly, then 1=BIT ERRORS 2=BLOCK ERRORS.
17	Press key number 1 on DTS.	Display indicates— ???? SECONDS.
18	Select 10 seconds by entering 0010 on DTS.	Display indicates— 0010 SECONDS, briefly, then 0000 BITS IN ERROR is displayed. From this point, the DTS counts the number of errors received. At the end of the test, the display indicates TEST COMPLETE, then total SYNC LOSSES, then the total BITS IN ERROR, repeatedly. ***Requirement:*** Zero BITS in ERROR. (STC receives 2047 pattern).
	Note: If it is necessary to perform any of the functions shown below, press the indicated key on the DTS. Restart test----------A key Display time remaining in test---B key Clear display----------C key End test----------D key.	
19	Place the DSU slide switch in position RT.	PWR and RT indicators on the DSU are lighted. NS and LL indicators on the DSU are off. Interface indicators RLSD, DSR, and CS on the DTS are off.
20	Request the STC perform a 10 second error run.	***Requirement:*** Zero BITS in ERROR.

STEP	ACTION	VERIFICATION
21	Restore the DSU slide switch to the center position.	RT indicator on the DSU goes off. Interface indicators RLSD, DSR, and CS on the DTS are lighted.
22	Request the STC to transmit the DSU loopback control code.	RT indicator on the DSU lights. Interface indicators RLSD, DSR, and CS on the DTS are off.
23	Request the STC to transmit a repeated CHAN loopback control code.	LL indicator on the DSU lights. RT indicator on the DSU goes off. Interface indicators RLSD and CS on the DTS are lighted.
24	Press TST key on DTS.	Display indicates— TEST SEQ :
25	If no further tests are to be performed, disconnect the DTS as described in Part C, steps 13 through 16.	
C.	**Straightaway Test**	
1	If this is the first test, perform the initial setup described in paragraph 4.03.	
2	Request the STC to transmit a repeated 2047-bit test word.	Interface indicators DSR and RLSD on DTS are lighted.
3	Select the control for the RS lead by entering 36 on the DTS.	Display indicates— TEST SEQ : 36 RS=? (0 OR 1).
4	Press key number 1 on DTS then select error test (DOT, SPACE, MARK, and PSEUDORANDUM WORD) by entering 55 on DTS.	Display briefly indicates— TEST SEQ : 36 RS=1 (0 OR 1) 55 then indicates :
5a	Subrate DSU— Press GO key on DTS.	Display briefly indicates— TEST COMPLETE then indicates— D=DT 0=SP 1=MK 2=2047 5=511 6=63 Interface indicators RLSD, RS, and CS on the DTS are lighted.
5b	56kb/s DSU Press GO key on DTS.	Display briefly indicates TEST COMPLETE then display indicates— D=DT 0=SP 1=MK 2=2047 Interface indicators RLSD, RS, and CS on the DTS are lighted.
6	Press key number 2 on DTS.	Display indicates— 2047 BIT ERROR TEST, briefly, then 1=BIT ERRORS 2=BLOCK ERRORS.

STEP	ACTION	VERIFICATION
7	Press key number 1 on DTS and request STC to reset error counter.	Display indicates— ???? SECONDS.
8	Select 900 seconds by entering 0900 on the DTS.	Display indicates— 0900 SECONDS, briefly, then 0000 BITS in ERROR is displayed. From this point, the DTS counts the number of errors received. At the end of the test, the display indicates TEST COMPLETE, then total SYNC LOSSES, then the total BITS IN ERROR, repeatedly. ***Requirement:*** Maximum number of errors is three counted by the 921A DTS and three counted by the STC KS-20908 DTS.
	Note: If it is necessary to perform any of the functions shown below, press the indicated key on the DTS. Restart test----------A key Display time remaining in test--------B key Clear display----------C key End test----------D key Insert errors in data stream to STC---E key Force out-of-sync condition at STC----F key.	
9	If more than three errors are counted on either counter— Repeat the test by pressing the ***A*** key on the DTS, requesting the STC to reset error counter and time another 900-second interval.	
10	If more than three errors are counted on either counter within the first 5 minutes of the second attempt— Wait 5 minutes. Then repeat the test by pressing the ***A*** key on the DTS, requesting the STC to reset error counter and time another 900-second interval. ***Note:*** An extraordinary condition, such as a severe electrical storm or an intermittent failure of customer-supplied ac power, may affect the performance of the DDS channel. The straightaway test cannot properly be performed until these conditions have cleared.	
11	If three attempts fail to achieve the 900-second requirement, the STC must commence	

STEP	ACTION	VERIFICATION
	troubleshooting the channel in accordance with Section 314-901-300.	
12	Request the STC to perform a 900-second DSU loopback and a 900-second CHAN loopback error run, and to record the number of errors on the CLRC as a benchmark for future use.	
13	Place the POWER switch on the DTS in the OFF position.	POWER ON indicator on the DTS goes off.
14	Remove the DTS adapter cable from the customer interface connector on the DSU.	
15	If no further tests are to be performed, reconnect the DSU to the CPE.	
16a	Subrate DSU— Remove the E1A RS-232-C interface card from the DTS and place in the proper storage area.	
16b	56-kb/s DSU— Remove the CCITT V.35 interface card from the DTS and place it in the proper storage area.	

500B-TYPE DATA SERVICE UNIT
DESCRIPTION AND OPERATION
DIGITAL DATA SYSTEM

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1. GENERAL

1.01 This section contains information concerning the description and operation of the 500B-type data service unit, hereafter referred to as the DSU. Other than a description of interface signals and customer options, information pertaining to the associated customer-provided equipment (CPE) is not given.

1.02 Whenever this section is reissued, the reason(s) for reissue will be given in this paragraph.

1.03 The 500B DSU was developed to establish the 550A-Type Channel Service Unit (CSU) as the sole, standard interface for the Digital Data System (DDS). The 500B DSU has the service terminating and maintenance functions removed and contains only the signal processing functions, test capabilities, and customer interface functions previously contained in the 500A-type DSU. The maintenance/terminating functions are in a separately provided CSU.

1.04 The DSU is intended for full-duplex operation in 4-wire private line (PL) applications. It provides the CPE with access to synchronous DDS. The DSU accepts serial, unipolar data from the customer and transmits baseband, bipolar signals over the local channel to the serving central office (SCO).

1.05 The 500B-type DSU is apparatus-coded with respect to customer data rates as follows:

500B-L1/2—operates at 2.4 kb/s

500B-L1/3—operates at 4.8 kb/s

500B-L1/4—operates at 9.6 kb/s

500B-L1/5—operates at 56 kb/s.

All DSUs operating at speeds other than 56 kb/s will be referred to as subrate DSUs.

1.06 The customer interface provided by a subrate 500B-type DSU is compatible with the electrical characteristics of EIA Standards RS-232-C and RS-334. The data and clock signals of a 500B-L1/5 DSU operating at 56 kb/s is compatible with the requirements of a balanced direct-coupled interface as specified in CCITT Recommendation V.35, while the control signals are compatible with EIA Standard RS-232-C.

2. PHYSICAL DESCRIPTION

2.01 The 500B-type DSU (Fig. 1) consists of a transmitter, a receiver, a control logic, and

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customer interface circuits mounted on two circuit packs (CPs) interconnected by a flexible cable harness. The CPs are contained in a housing with an aluminum cover and two black plastic faceplates.

2.02 The DSU is approximately 11-1/2 inches wide, 11 inches deep, and 4 inches high and weighs approximately 10-1/2 pounds.

2.03 The DSU will operate in an environment of +40 to +120°F with a relative humidity of less than 95 percent. Surface temperature of the aluminum cover will be approximately 16°F higher than ambient.

2.04 The DSU has been designed to accommodate individual or multiple applications. For small installations, up to three DSUs may be stacked without exceeding maximum operating temperatures. Installations requiring more than three DSUs will make use of the 48A-type data mounting (Section 590-102-139).

2.05 Power requirements for the self-contained 82C power unit are 105 to 129 volts alternating current at 57 to 63 Hz, not under control of a switch. Approximately 17 watts of power will be dissipated. A 3-conductor ac power cord is provided with the DSU.

2.06 A slide switch and light emitting diode (LED) assembly may be mounted on either the front or rear faceplate (paragraph 3.28). It is factory-installed on the front faceplate. The assembly contains a 3-position switch and four LED indicators

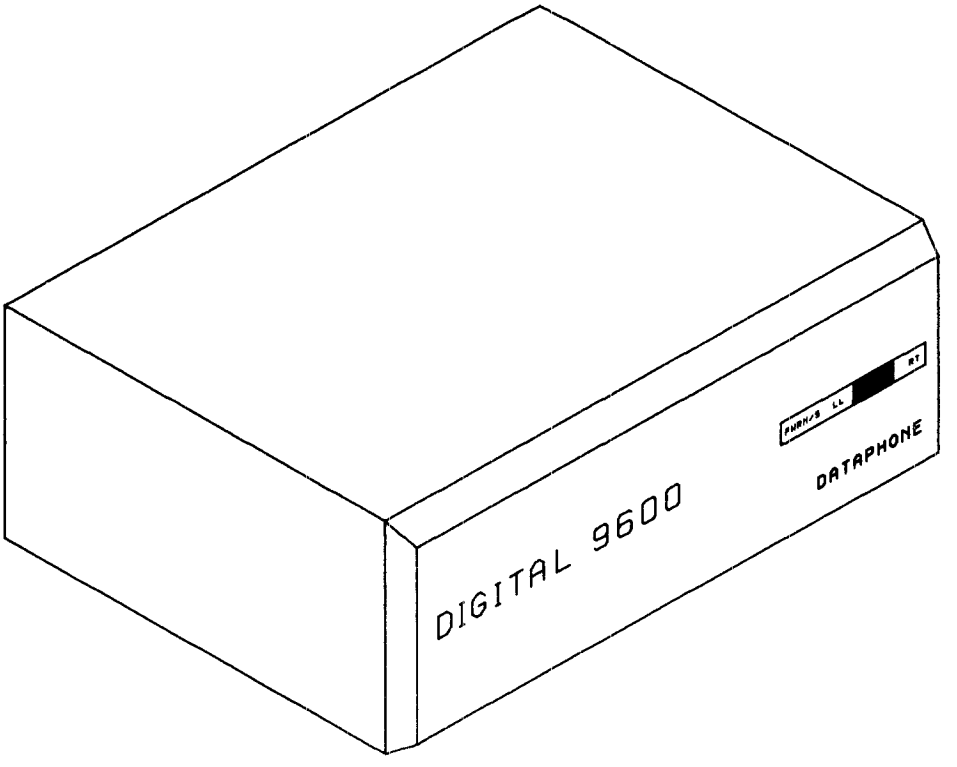


Fig. 1—500B-Type Data Service Unit

which are designated PWR, NS, LL, and RT on the faceplates.

2.07 The 500B-type DSU contains two CPs. HP1 CP performs the DSU logic functions and is common to all four DSUs. HN13, HN14, HN15, and HN16 CPs are analog boards and are speed-sensitive circuits; therefore, DSU transmission speeds are determined by these CPs. Each DSU will contain one logic board and one analog board as shown in Fig. 2. Table A lists DSU transmission speeds and CPs.

TABLE A

DSU SERVICE BIT RATE AND CIRCUIT PACKS

DSU LIST	DSU SERVICE BIT RATE	ANALOG CP	LOGIC CP
500B-L1/2	2.4 kb/s	HN13	HP1
500B-L1/3	4.8 kb/s	HN14	
500B-L1/4	9.6 kb/s	HN15	
500B-L1/5	56 kb/s	HN16	

2.08 All customer interface leads of a subrate DSU are terminated in a 25-pin connector. Customer provided equipment used with a subrate DSU must be terminated in a Cinch or Cannon DB-19604-432 plug and a DB-51226-1 hood, or equivalent. A DSU operating at 56 kb/s uses a 34-pin Winchester or Burndy connector. Customer-provided equipment used with a 56-kb/s DSU must be terminated in a Winchester MRA-34 P-JTC6-H plug, or equivalent. Refer to Fig. 3 for customer interface location.

2.09 A 15-pin connector is provided at the rear of all 500B DSUs (regardless of the data speed) for connection to a 550A-type CSU. A 7-foot M6BA cord, which has a male plug on each end, connects to the 15-pin female connector of the DSU and to the female connector on the CSU. This cord can be ordered in 25-, 50-, 75-, and 100-foot lengths.

2.10 Header switches and S3 (Fig. 3 and 4) are used to select request-to-send, system status, and circuit assurance options. The ground option is selected by switch S2 (Fig. 2), and the switch and LED assembly and LL spring clip options are set by hand.

3. FUNCTIONAL DESCRIPTION

3.01 This part contains a brief functional description of the transmitter, receiver, and customer interface circuits. The interface leads are described and a functional description of the DSU options is provided.

3.02 The 500B-type DSU provides for transmission and reception of digital data over local transmission facilities. Bipolar pulses, which are defined as positive and negative voltage levels with successive pulses alternating in polarity, are transmitted over 4-wire cable pairs, to and from a CSU located at the customer premises. This bipolar voltage level is representative of a binary 1 and a binary 0 where a binary 1 is transmitted as a nominal ±1.4 volt pulse and binary 0 is transmitted as zero voltage. The sum of all transmitted voltages must equal zero to prevent dc buildup on the line.

3.03 System control codes are identified by deviations of the preceding bipolar format. These deviations, where successive bipolar pulses do not alternate in polarity, are defined as bipolar violations.

A. Transmitter

3.04 Refer to Fig. 5 for a functional block diagram of the 500B-type DSU. The transmitter consists of transmit logic and line driver circuitry, which accepts digital data in the form of positive and negative voltages from the CPE and transmits balanced, bipolar signals to the CSU. Customer data is encoded by the transmit logic into a format suitable for transmission. Since a long sequence of zeros does not provide transitions to maintain timing recovery, sequences of six or seven consecutive zeros in the data stream, depending on service rate (subrate or 56 kb/s), are replaced with zero suppression codes to maintain synchronization.

3.05 In response to a request-to-send (CA) OFF condition, idle code sequences are formed and applied to the line driver. These idle codes indicate to the remote DSU that no customer data is being transmitted. A delay in the turn-on of clear-to-send (CB), after CA has turned ON, is provided to allow the remote DSU to exit the idle condition and enter the data mode in preparation for data transmission.

3.06 The line driver converts the binary outputs of the transmit logic into a balanced, bipolar sig-

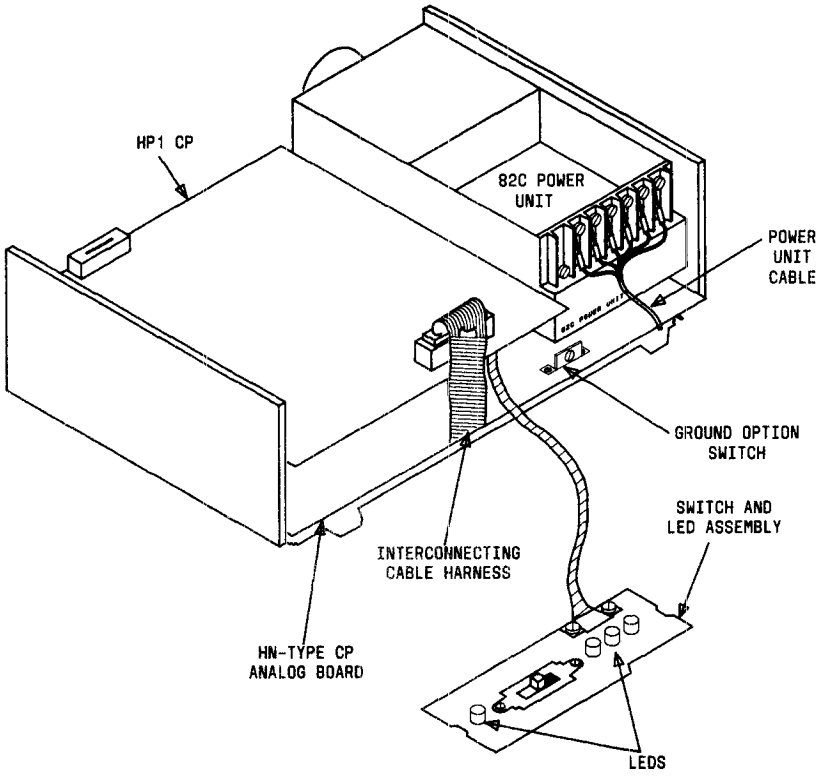


Fig. 2—500B-Type Data Service Unit—Front Internal View

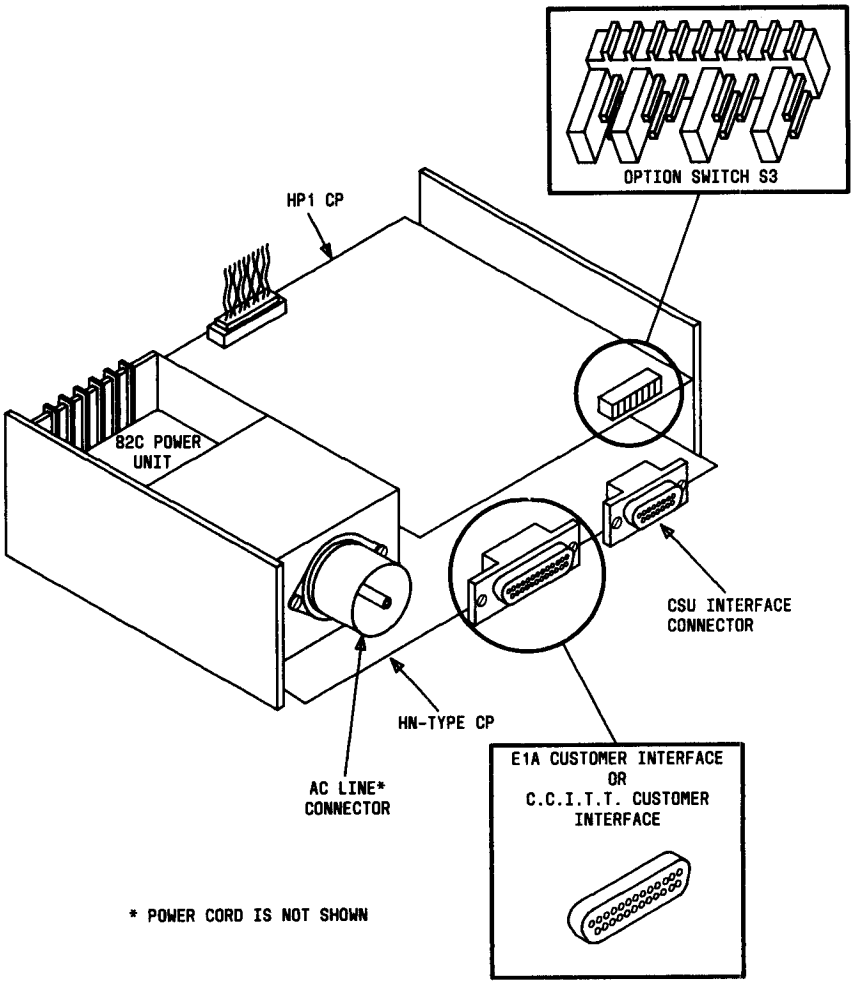


Fig. 3—500B-Type Data Service Unit—Rear Internal View

nal. This signal is then transmitted to the CSU via the M6BA cord.

B. Receiver

3.07 The receiver consists of receive logic, clock recovery, and line receiver. The line receiver acts like a bipolar to unipolar converter in that the line signals can be converted from a single rail, bipolar signal to a dual rail, unipolar signal format.

3.08 The clock recovery circuitry consists of a voltage-controlled oscillator connected in a phase-locked loop. A phase comparator synchronizes the oscillator to the received signal timing signal. Thus,

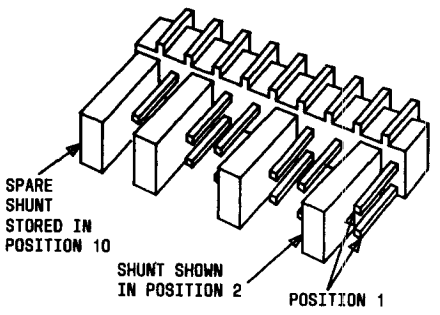


Fig. 4—Detail of Right Angle Header for Installing Options

a sampling clock is derived from the received bipolar signal and is used to sample the data pulses.

3.09 In the receive logic circuitry, the data stream is sampled and inverted and the data bits reconstructed to fully occupy each respective time slot. The data stream then passes through a violation detector to recognize bipolar violation sequences (idle code, zero suppression code, DSU loopback code, and out-of-service code).

3.10 When the bipolar violation sequence occurs, the data stream is examined for the presence of a valid control code by the receive logic. After the detection of three consecutive control codes, the appropriate control state is entered.

3.11 The receiver output logic combines the outputs of the control state circuitry and the installer options to control the customer interface and indicator LEDs as well as other circuits located within the transmit and receive logic.

C. Customer Interface Circuits

3.12 The 500B-type DSU is provided with ten (subrate services) or fourteen (56-kb/s service) interface leads for connection to the CPE. These leads and their corresponding pin numbers are given in Tables B and C. A description of the interface leads is given below with the EIA nomenclature for each lead appearing in parentheses following the lead designation.

3.13 ***Transmitted Data (BA):*** The direction of signal flow on this lead is from the CPE to the DSU. The serial, binary data bits on this lead are generated by the CPE for transmission to the remote CPE. Data bits are transmitted only if the following

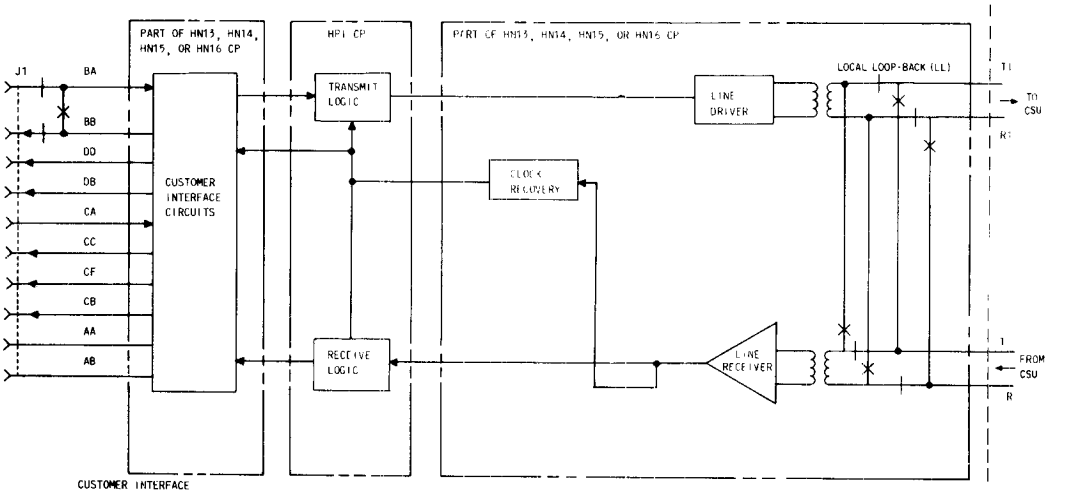


Fig. 5—Functional Block Diagram of 500B-Type Data Service Unit

TABLE B

SUBRATE 500B-TYPE DSU INTERFACE

INTERFACE PIN NO.	500B-TYPE DSU LEAD		EIA RS-232-C NOMENCLATURE	
	FUNCTION	DESIG	FUNCTION	DESIG
1	Frame Ground	FG	Protective Ground	AA
2	Send Data	SD	Transmitted Data	BA
3	Receive Data	RD	Received Data	BB
4	Request to Send	RS	Request to Send	CA
5	Clear to Send	CS	Clear to Send	CB
6	Data Set Ready	DSR	Data Set Ready	CC
7	Signal Ground	SG	Signal Ground	AB
8	Received Line Signal Detector	RLSD	Received Line Signal Detector	CF
9-14	Not used			
15	Serial Clock Transmit	SCT	Transmitter Signal Element Timing	DB
16	Not used			
17	Serial Clock Receive	SCR	Receiver Signal Element Timing	DD
18-25	Not used			

interface lead conditions are met: CC is ON, CA is ON, and CB is ON. For subrate services, BA meets the requirements of an EIA-type interface while 56-kb/s service is a balanced direct-coupled signal sent over the BA(A) and BA(B) leads.

3.14 ***Request to Send (CA):*** The direction of signal flow on this lead is from the CPE to the DSU. Signals on this lead are generated by the CPE to turn the local data transmitter ON. An OFF condition on this lead causes the DSU to transmit the idle code sequence, provided CC is ON. A constant ON condition must be maintained whenever the CPE has data ready for transmission.

3.15 ***Serial Clock Receive (DD):*** The direction of signal flow on this lead is from the DSU to the CPE. Signals on this lead provide the CPE with receive signal element timing. For subrate services, DD meets the requirements of an EIA-type interface while 56-kb/s service utilizes a balanced direct-coupled signal sent over the DD(A) and DD(B) leads.

3.16 ***Serial Clock Transmit (DB):*** The direction of signal flow on this lead is from the DSU to the CPE. Signals on this lead provide the CPE with transmit signal element timing. For subrate services, DB meets the requirements of an EIA-type interface while 56-kb/s service utilizes a balanced direct-coupled signal sent over the DB(A) and DB(B) leads. DB is identical to DD.

3.17 ***Received Data (BB):*** The direction of signal flow on this lead is from the DSU to the CPE. Signals on this lead are generated by the receiving DSU in response to the data stream received from the remote DSU. For subrate services, BB meets the requirements of an EIA-type interface while 56-kb/s service is a balanced direct-coupled signal given serially on the BB(A) and BB(B) leads.

3.18 ***Data Set Ready (CC):*** The direction of signal flow on this lead is from the DSU to the CPE. Signals on this lead are generated by the local DSU to indicate readiness to operate. Once ac power is applied to the DSU, the CC lead is normally in the ON condition. The CC lead will turn OFF under the following conditions:

- The DSU enters the test mode remote terminal (RT) or local line (LL)

TABLE C

500B-L1/5 (56-KB/S) DSU INTERFACE

INTERFACE CONN TERM (NOTE)	500B-L1/5 DSU LEAD		EQUIVALENT NOMENCLATURE		
	FUNCTION	DESIG	FUNCTION	EIA RS-232-C DESIG	CCITT DESIG
A	Frame Ground	FG	Protective Ground	AA	101
B	Signal Ground	SG	Signal Ground	AB	102
C	Request to Send	RS	Request-to-Send	CA	105
D	Clear to Send	CS	Clear-to-Send	CB	106
E	Data Set Ready	DSR	Data Set Read	CC	107
F	Received Line Signal Detector	RLSD	Received Line Signal Detector	CF	109
P	Send Data	SD(A)	Transmitted Data	BA(A)	103
S	Send Data	SD(B)	Transmitted Data	BA(B)	103
R	Receive Data	RD(A)	Received Data	BB(A)	104
T	Receive Data	RD(B)	Received Data	BB(B)	104
V	Serial Clock Receive	SCR(A)	Receiver Signal Element Timing	DD(A)	115
X	Serial Clock Receive	SCR(B)	Receiver Signal Element Timing	DD(B)	115
Y	Serial Clock Transmit	SCT(A)	Transmitter Signal Element Timing	DB(A)	114
AA	Serial Clock Transmit	SCT(B)	Transmitter Signal Element Timing	DB(B)	114

Note: All terminals not listed are not used.

- The DSU is equipped with the system status option (option XK) and an out-of-service is received.

3.19 ***Received Line Signal Detector (CF):*** The direction of signal flow on this lead is from the DSU to the CPE. Signals on this lead are generated by the local DSU and indicate that data is being received and has been received for an appropiate interval. The CF lead is turned OFF when any of the following conditions exist: out-of-service indication (reception of out-of-service code or loss of signal), CA interface lead of the remote DSU is OFF, or the DSU is in the RT loopback mode. When CF lead is OFF, BA interface lead is held in the mark-hold (binary 1) condition.

3.20 ***Clear to Send (CB):*** The direction of signal flow on this lead is from the DSU to the CPE. Signals on this lead are generated by the local DSU to indicate to the CPE readiness to transmit data. The CB OFF condition is an indication to the CPE that no data can be transmitted. The CB turns ON in response to an ON condition of CA by the CPE after a delay to allow the remote DSU to exit the idle state. With the circuit assurance option (option YQ) installed, the clear-to-send indication is a result of an ON condition on both CA and CF interface leads, and

the transmitting DSU must have exited the idle state before CB turns ON.

D. Switch and LED Assembly

3.21 A slide switch provides control of the loopback test functions, while the LEDs monitor modes. When the switch is positioned to LL (local line loopback), the transmit and receive paths are looped toward both the CSU and the customer interface. Loopback tests may then be performed by the Serving Test Center (STC) or from the CPE location. When the switch is positioned to RT (remote terminal loopback), interface leads BA and BB are connected and disconnected from the CPE. Remote terminal loopback may also be activated remotely from the STC by transmitting a control code sequence containing bipolar violations. Remote terminal loopback is called DSU loopback when originated by the STC. The switch is placed in the center position for normal operation (data mode). A spring clip, provided with the DSU, is placed over the switch when the DSU is used on multipoint lines to prevent the switch from being placed in the LL position. This is a telephone company (TELCO) option at all stations except the master station.

3.22 The LED assembly indications are as follows:

PWR—Illuminates when ac power is supplied to the DSU and +5 volts direct current is available.

NS—Illuminates when no signal is present at the DSU, ie, when the CSU is in the channel loopback mode.

LL—Illuminates when the DSU is switched to the LL mode.

RT—Illuminates when the DSU is switched to the RT loopback mode or when the DSU loopback code is detected by the control code detection circuitry.

E. Customer Options

3.23 The DSU 500B-type is provided with five options which may be requested by the customer. The features available as options are described in the following paragraphs.

3.24 ***Request to Send (Option YS—Continuous, Option YT—Switched):*** The YS option is used with CPE, which is not capable of turning ON the CA interface lead. With this option installed, the DSU operates as if the CA interface lead is constantly ON. The YT option is used with CPE, which is capable of switching on the CA interface lead.

3.25 ***Circuit Assurance (Option YQ—Installed, Option YR—Removed):*** With this option, the clear-to-send indication is a result of an on condition on both the request-to-send circuit and receive line signal detector circuit. The clear-to-send circuit turns on only after the clear-to-send timing delay has expired in response to the request-to-send circuit turning on, and the received line signal detector is on in response to receipt of the noncontrol mode digital data stream. If the request-to-send circuit has been on for a time interval greater than the clear-to-send timing delay or if the permanent request-to-send option is used, the clear-to-send circuit follows the received line signal detector circuit.

3.26 ***System Status (Option XK—Installed, Option XL—Removed):*** With this option, the data set ready circuit turns off when an out-of-service indication is given to the DSU. This option enables the customer to identify the idle mode as the condition where the data set ready circuit is on and the received line signal detector circuit is off.

3.27 ***Signal Ground to Frame Ground (Option YK—Connected, Option YL—Disconnected):*** Installation of this option internally connects signal ground to frame ground.

3.28 ***Switch and LED Assembly (Option XN—Installed on Front Panel, Option XM—Installed on Rear Panel):*** This option is used to provide ease of viewing the switch and LED assembly, depending on required mounting position of the DSU.

F. TELCO Option

3.29 The DSU is provided with one option which must be selected by the TELCO engineer for initial installation of the DSU.

3.30 ***LL Spring Clip (Option XO—Installed, Option XP—Not Installed):*** When DSU is used on multipoint lines, the spring clip is placed over the slide switch to prevent its being placed in the LL position.

4. OPERATION

4.01 This part contains information concerning the manual operation of 500B-type DSU. The DSU

has only two modes of operation: data mode and loopback mode.

4.02 Proceed as follows for conducting a manual loopback test:

(a) For local line loopback, position the slide switch to LL and observe illumination of respective LED. (See paragraph 3.21.)

(b) For remote loopback, position the slide switch to RT and observe illumination of respective LED.

(c) At completion of loopback tests, restore the slide switch to the center position.

5. REFERENCES

5.01 Detailed information concerning the 500B-type DSU is contained in CD- and SD-7C325-01.

5.02 The following Bell System Practices are listed for reference.

SECTION	TITLE
314-410-310	Digital Data System, Local Loop, Maintenance Procedures
314-410-510	Local Loop, Tests and Requirements, Digital Data System
314-901-300	2-Point and Multipoint Private Line Circuit, Maintenance Procedures, Digital Data System
590-102-139	48A-Type Data Mounting, Identification
595-200-180	Digital Data System, 500A-Type Data Service Unit (DSU), Summarizing Specification
595-200-201	500B-Type Data Service Unit, Installation and Connections, Digital Data System
595-200-301	500B-Type Data Service Unit, Maintenance, Digital Data System
595-200-501	500B-Type Data Service Unit, Test Procedures, Digital Data System
880-601-115	Engineering Guideline, Local Loops, Digital Data System

500B-TYPE DATA SERVICE UNIT
INSTALLATION AND CONNECTIONS
DIGITAL DATA SYSTEM

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4. TEST REQUIREMENTS 5

1. GENERAL

1.01 This section contains instructions for installing and connecting a 500B-type data service unit (DSU). Installation methods for the associated customer-provided equipment (CPE) are not included.

1.02 Whenever this section is reissued, the reason(s) for reissue will be given in this paragraph.

1.03 The 500B-type DSU is designed to be operated in an ambient temperature range from 40° to +120°F, with a relative humidity of less than 95 percent.

1.04 The 82C power unit, which is contained inside the DSU, supplies operating voltages of +5, +12, and −12 Vdc. An input of 105 to 129 Vac at a frequency of 57 to 63 Hz is required by the DSU. Each DSU is supplied with a 10-foot power cord for connection to the customer-provided ac source.

2. OPTION INSTALLATION

A. General

2.01 The 500B-type DSU is provided with five customer options and one telephone company (TELCO) option. The options should be specified on the service order or circuit layout record card (CLRC). Refer to Section 595-200-101, 500B-Type Data Service Unit—Description and Operation, for a description of these options.

B. Option Installation Procedure

2.02 Circuit pack (CP) HP1 contains a right angle header H1, and HN-type CPs contain switch S1. The switch and header locations are shown in Fig. 1. To gain access to the header, the front and rear faceplates must be removed. Both faceplates are removed by depressing the two tabs located on the bottom edge and simultaneously pulling outward. To replace the faceplates, hook the tabs on the aluminum housing into the slots on top and gently snap the bottom edge of the faceplates into position.

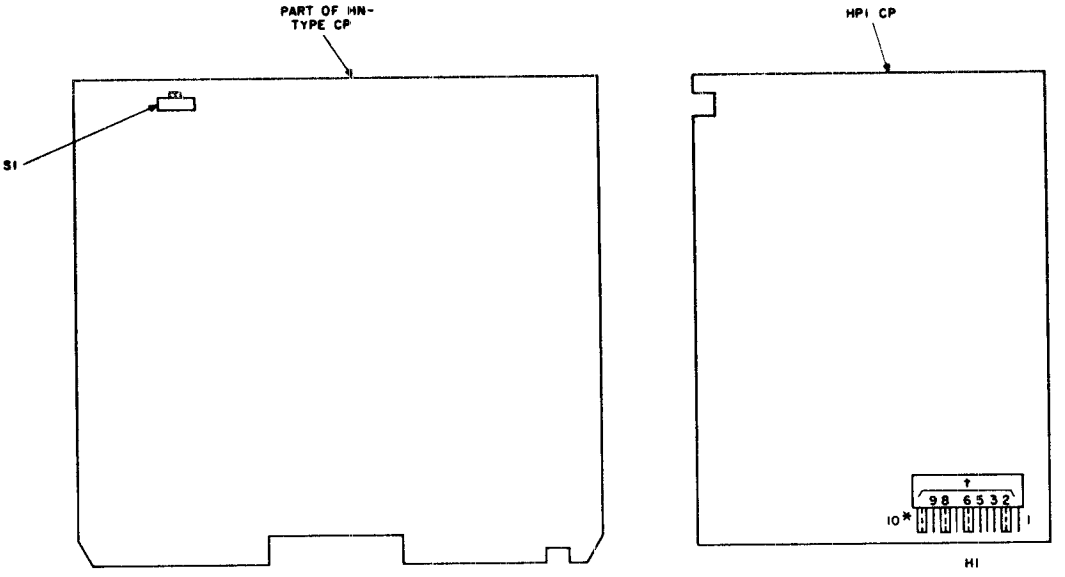
2.03 Figure 2 is a representation of H1 and shows the ten positions and the shunts. To install options listed in Table A, slip the shunts over the two pins which make up one position. Four shunts are provided with the header. One shunt is a spare and should be stored in position 10.

3. INSTALLATION AND CONNECTION PROCEDURES

A. Single Installation

3.01 The DSU must be installed within 100 feet of its associated channel service unit (CSU). Care must be used in placement to avoid stray fields

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* POSITION 10 IS RESERVED FOR SPARE SHUNT
† THESE NUMBERS ARE NOT ON HEADER. THEY ARE SHOWN HERE FOR REFERENCE ONLY.

Fig. 1—DSU Option Switch and Headers

from electromechanical equipment. For subrate services, the 500B-type DSU must be located from 1 to 50 feet from the CPE, while the 500B-L1/5 DSU operating at 56 kb/s may be located from 1 to 100 feet from the CPE.

3.02 The DSU must be located within 10 feet of a customer-provided ac outlet which is not under control of a switch. A power cord is supplied with the DSU and requires an outlet which accepts a plug with two parallel blades and a round grounding pin.

3.03 A 25-pin connector is provided at the rear of subrate DSUs for connection to CPE. This connector is designed to mate with a customer-provided Cinch or Cannon DB-19604-432 plug equipped with a DB-51226-1 hood, or equivalent. The DSUs operating at 56 kb/s have a 34-pin connector at the rear for connection to the CPE. This connector is designed to mate with a customer-provided Winchester MRA-34P-JTC6-H8 plug, or equivalent.

3.04 A 15-pin connector is provided at the rear of all 500B DSUs (regardless of the data speed) for connection to a 550A-type CSU. A 7-foot M6BA cord, which has a male plug on each end, connects to the 15-pin female connector of the DSU and to the female connector on the CSU. This cord can be ordered in 25-, 50-, 75-, and 100-foot lengths.

3.05 In DSU installations where access to the front faceplate is limited or where the customer interface connector is facing forward on a shelf or in a cabinet, the switch and light-emitting diode (LED) assembly may be removed from the front faceplate and mounted on the rear faceplate. To relocate the switch and LED assembly, proceed as follows:

(1) Remove both faceplates per paragraph 2.02.

(2) If the cover must be removed, loosen the two cover retaining screws located on the bottom of the DSU and slide the cover forward or backward.

TABLE A

DSU OPTIONS

	OPTION	TELCO/CUSTOMER REQUESTED	FEATURE	POSITION
HN-Type CP Circuit Option (Switch S1)	YK	Customer	Signal ground connected to frame ground	IN
	YL		Signal ground disconnected from frame ground	OUT
HN-Type CP Physical Options	XM	Customer	Switch led assembly installed to rear	
	XN		Switch led assembly installed to front	
	XO	TELCO	LL spring clip installed	
	XP		LL spring clip not installed	
HP1 CP Circuit Options (Header H1)	YS	Customer	Continuous request to send	2
	YT		Switched request to send	3
	YQ	Customer	Circuit assurance installed	6
	YR		Circuit assurance removed	5
	XK	Customer	System status installed	9
	XL		System status removed	8

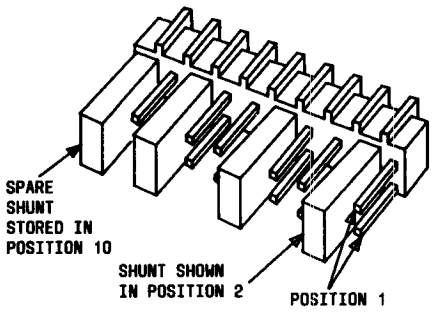


Fig. 2—Detail of Right Angle Header for Installing Options

(3) Disconnect the interconnecting cable harness from HP1 CP.

(4) Release the spring clip retaining HP1 CP and slide the CP out of the DSU.

(5) Remove the switch and LED assembly from the front faceplate by using gentle outward pressure on the plastic mounting tabs retaining the assembly.

(6) Install the switch and LED assembly on the rear faceplate by gently depressing the assembly into the appropriate position.

(7) Replace the HP1 CP in the DSU and connect the interconnecting cable harness to HP1.

(8) If the cover was removed, replace the cover by reversing the procedure in Step (2).

(9) Replace both faceplates per paragraph 2.02.

3.06 If the DSU is being used on multipoint lines, the spring clip supplied with the DSU should be positioned over the switch (on the switch and LED assembly) to prevent it from being placed in the LL position.

B. Multiple Installation

3.07 For multiple installations, three DSUs may be stacked without exceeding the maximum internal operating temperature. The four clips supplied with each DSU are used to support the center and top DSUs. They are inserted into the slots provided on the dovetail feet as shown in Fig. 3. When the sets are stacked, the tabs drop into holes provided in the top of the plastic faceplates and provide a secure, stacked arrangement.

3.08 Multiple installations requiring more than three DSUs are handled by means of the 48A-L1/2 data mounting. (See Section 590-102-139 for a detailed description of the 48A data mounting.) The 500B DSU and its associated CSU are mounted in separate 48A data mountings and are located within 100 feet of each other.

3.09 The 500B DSUs must be adapted for mounting in the 48A-L1/2. The L1/2 designation provides bearing plates which are required for mounting the DSU in the data mounting. Figures 4 through 8 depict a 500B DSU being adapted for mounting into the 48A-L1/2 data mounting. The mounting procedure is as follows:

(1) Remove front and rear faceplates per paragraph 2.02.

(2) Remove switch and LED assembly per paragraph 3.05(5).

(3) Remove outer cover from DSU. (The front faceplate, outer cover, and power cord are not used in a multiple arrangement.)

(4) Position switch and LED assembly to rear (connector side) of DSU.

(5) Slide the two bearing plates into the slot on the dovetail feet of the DSU and secure with mounting screws (Fig. 7). A bracket is supplied to fill the space between the bearing plate and the DSU chassis and to provide rigidity to the DSU assembly.

(6) Insert the DSU (connector side first) into the rear of the data mounting by sliding the bearing plates into the slots in the upper and lower metal strips (Fig. 8). Make sure the switch and LED assembly clear the opening as the DSU is inserted.

(7) Secure the DSU by moving the lock strip to its leftmost position and tightening the lock-strip screw (Fig. 9).

(8) Install the switch and LED assembly on the rear faceplate per paragraph 3.05(6).

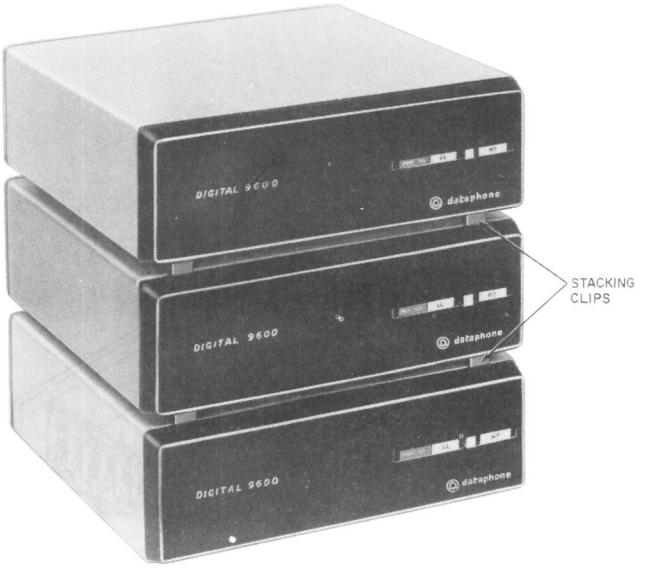


Fig. 3—Multiple Installation—Stacked Arrangement Using Clips for a Maximum of Three DSUs

(9) Install the rear faceplate into the 48A data mounting cover plate by engaging the three tabs at the left side of the opening and the two tabs on the faceplate.

(10) Attach the customer interface connector to the DSU and dress the cord with the cable ties located below each DSU (Fig. 10).

(11) Attach the multiple plug power cord, supplied with the 48A-L1/2, to each DSU power supply connector (Fig. 10).

3.10 The DSU is now connected for multiple operation.

4. TEST REQUIREMENTS

4.01 Perform the following installation tests in the order given and as instructed in Section 595-200-501, 500B-type Data Service Unit—Test Procedures, Digital Data System.

- Local test
- DSU functional test
- Straightaway test.

4.02 Blank labels are shipped attached to the inside of the front faceplate. List codes, customer option information, and other information may be recorded on these labels.

4.03 When DSUs are multiple mounted, the circuit number (CKT No.) and trouble number (TBL No.) for each DSU are written on the label attached to the bottom of each DSU.

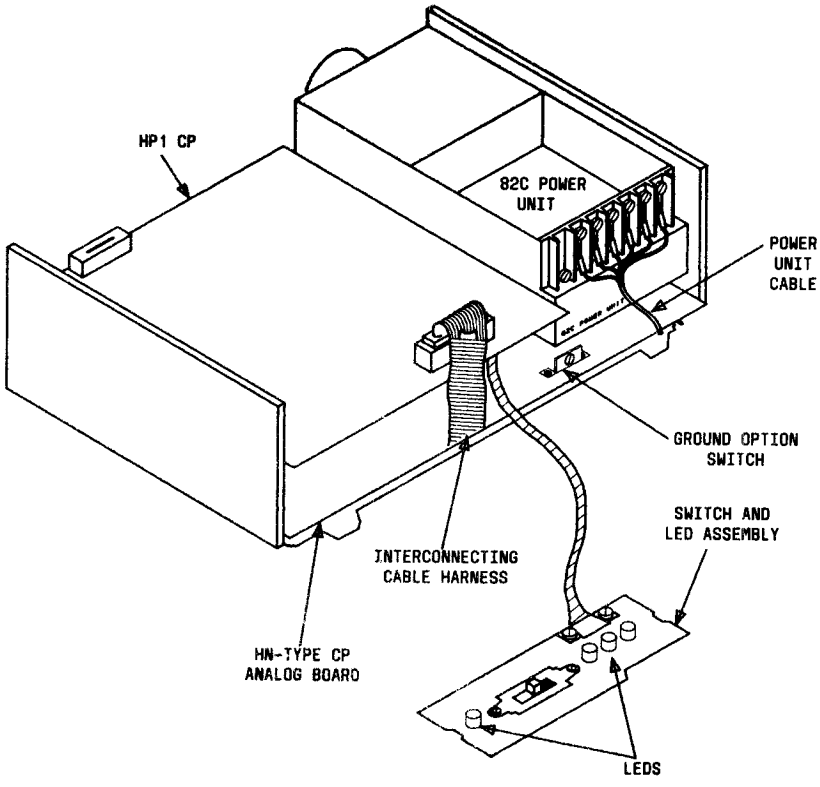


Fig. 4—500B-Type Data Service Unit—Front Internal View

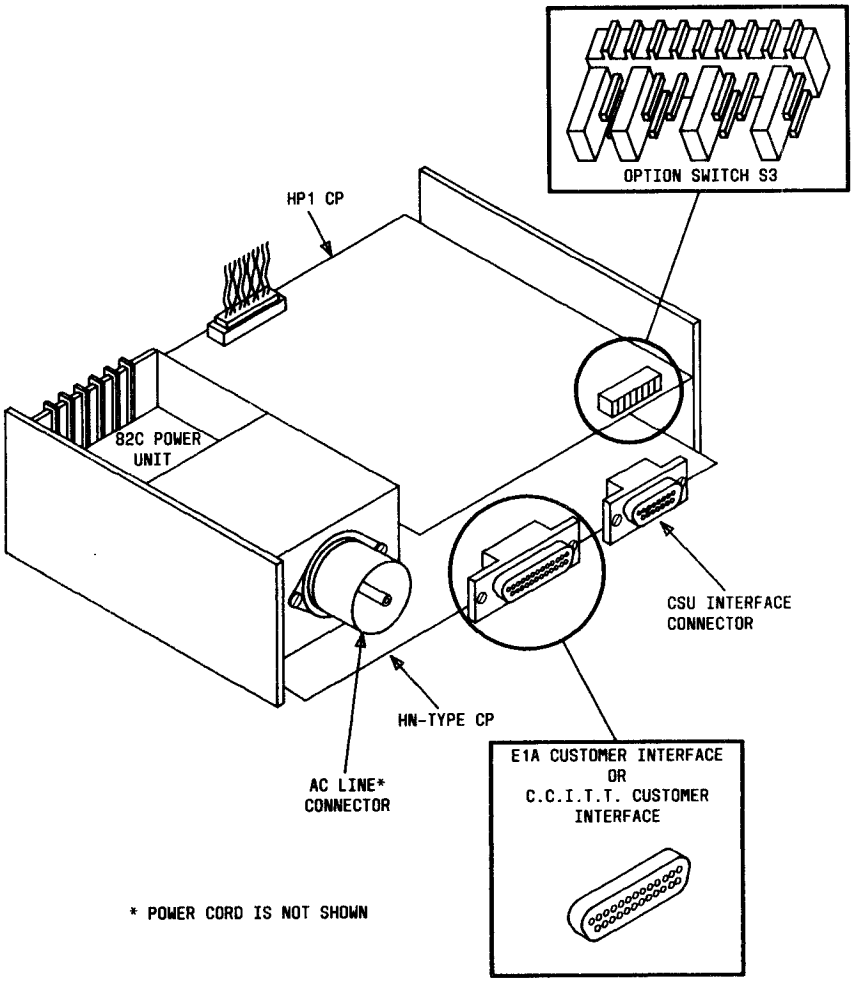


Fig. 5—500B-Type Data Service Unit—Rear Internal View

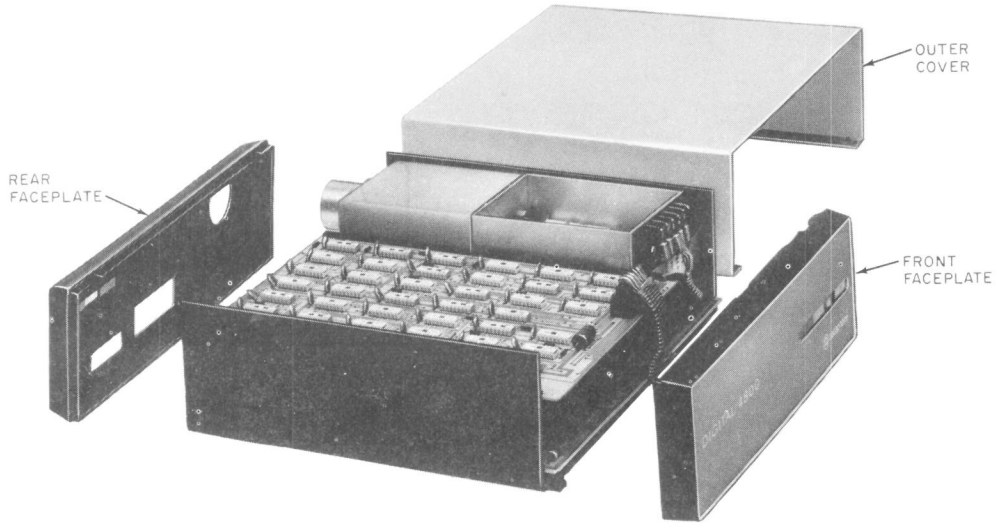


Fig. 6—500B-Type Data Service Unit—Exploded View

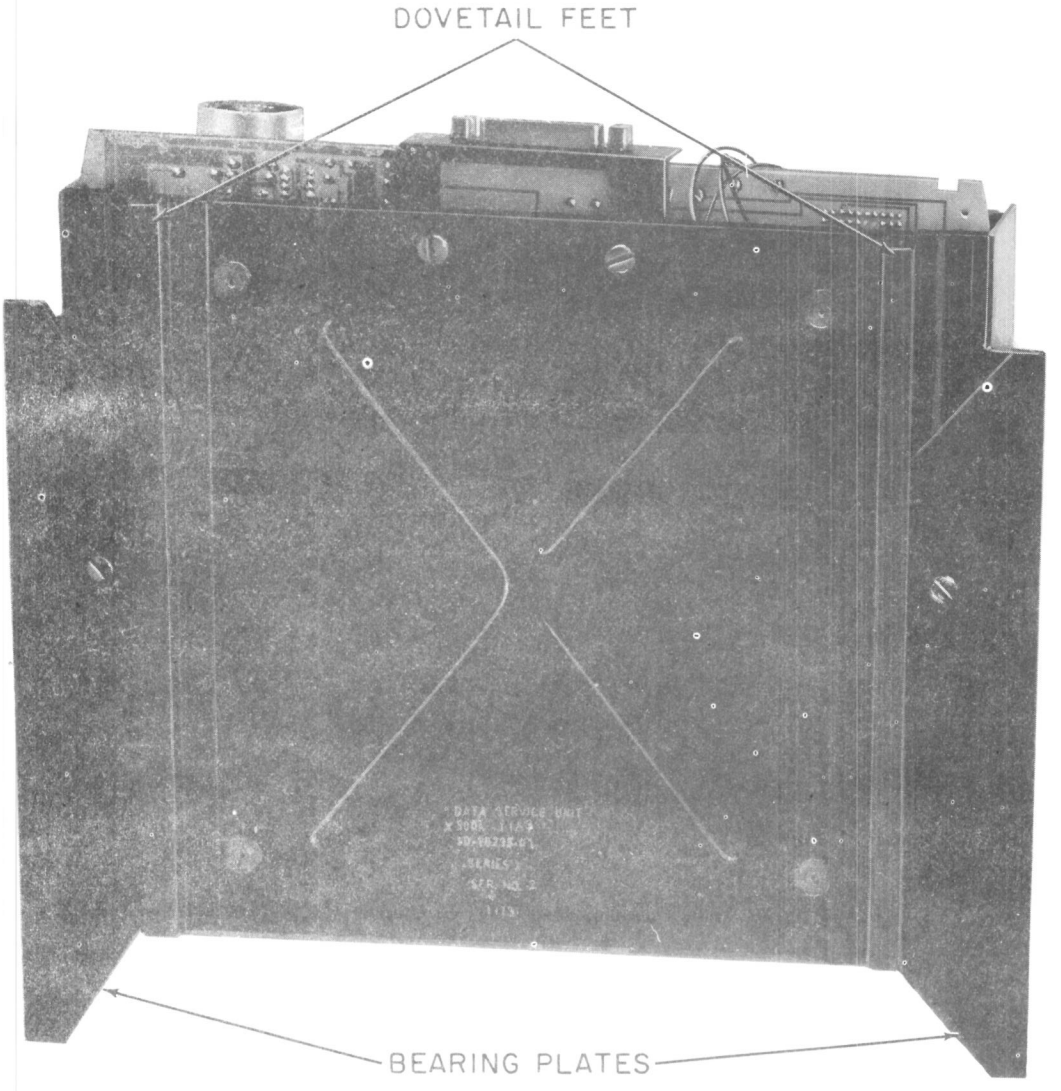


Fig. 7 — 500B-Type Data Service Unit—Under View Showing Bearing Plates

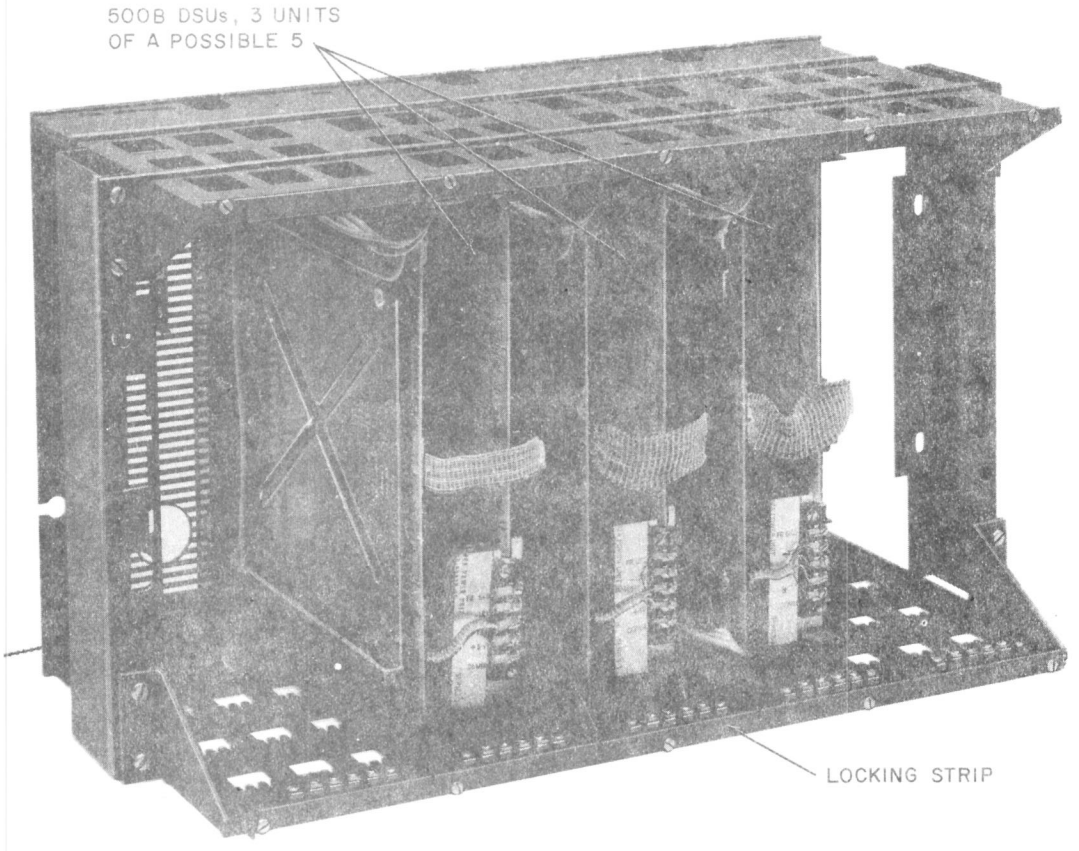


Fig. 8 — 48A-Type Data Mounting—Rear View Showing Three 500B-Type DSUs Installed

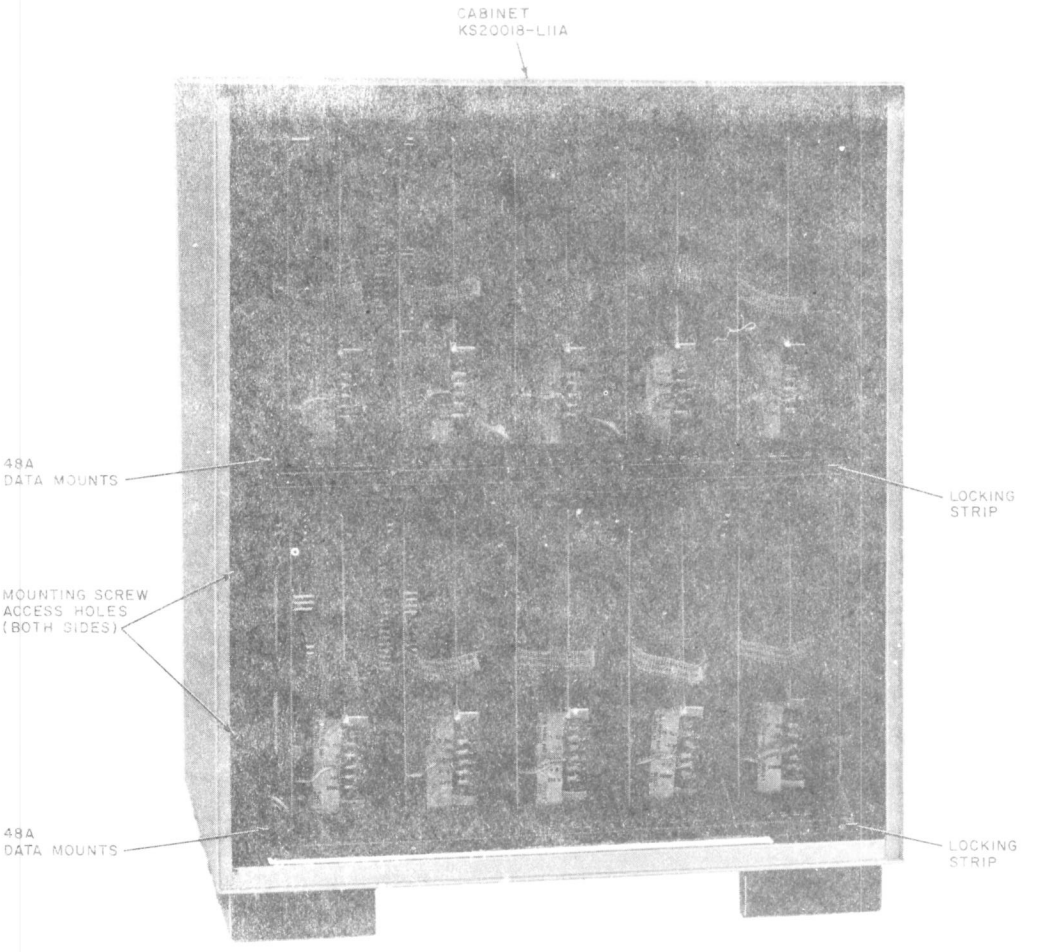


Fig. 9—Rear View—KS-20018-L11A Cabinet

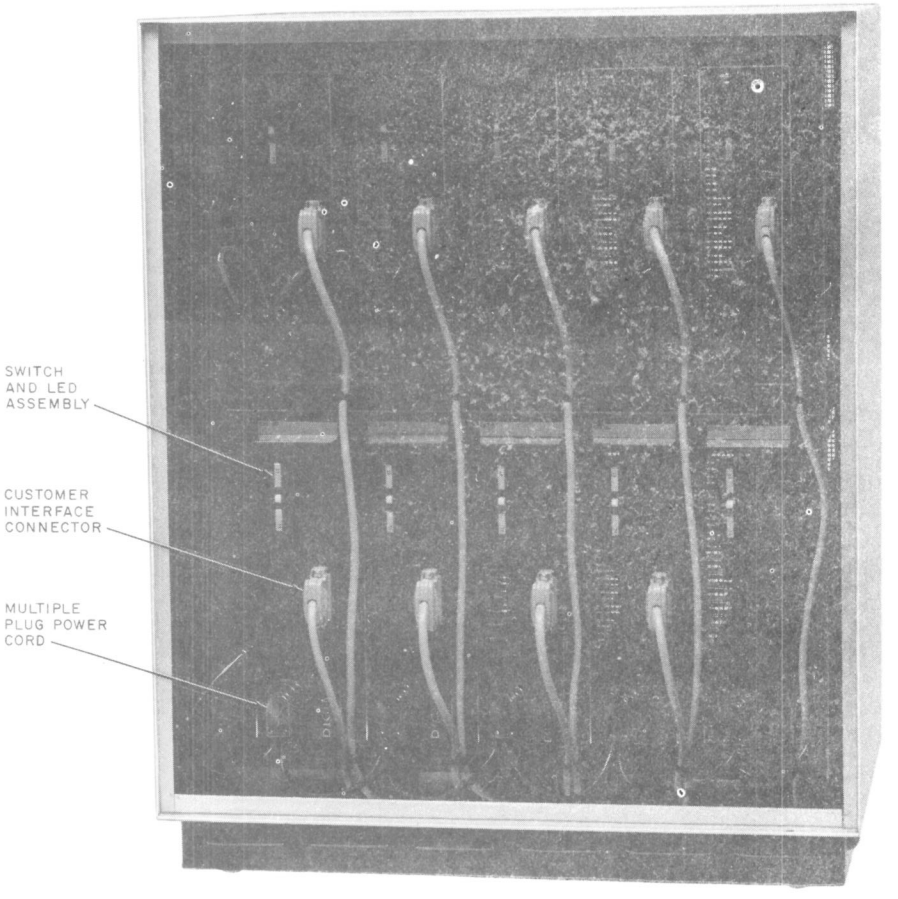


Fig. 10—Front View—KS-20018-L11A Cabinet

500B-TYPE DATA SERVICE UNIT

MAINTENANCE

DIGITAL DATA SYSTEM

1. GENERAL

1.01 This section contains information concerning the maintenance of the 500B-type data service unit (DSU). Use of this section will coordinate the efforts of the telephone company (TELCO) employee with the efforts of the serving test center (STC) to locate and correct trouble involving the DSU.

1.02 Whenever this section is reissued, the reason(s) for reissue will be given in this paragraph.

Maintenance Policy

1.03 When a trouble condition has been isolated to an individual DSU by use of the DSU loopback test and, if necessary, by the maintenance procedures given in Section 314-410-310, the defective DSU must immediately be replaced with a DSU in proper operating condition.



No repair of the DSU should be attempted at the customer location.

1.04 Table A lists the recommended number of DSUs for ***each*** service rate to be stocked as maintenance spares.

1.05 If the dispatch of a TELCO employee to the DSU location becomes necessary, the employee should take along a replacement DSU which is equipped with options specified on the circuit layout record card and of the same list code currently installed at that location. In addition, a data test set (DTS [914C DTS for subrate service, 912A wideband data test set WDTS for 56-kb/s service or 921A DTS for all speeds]) should be available for complete testing of the DDS channel.

TABLE A

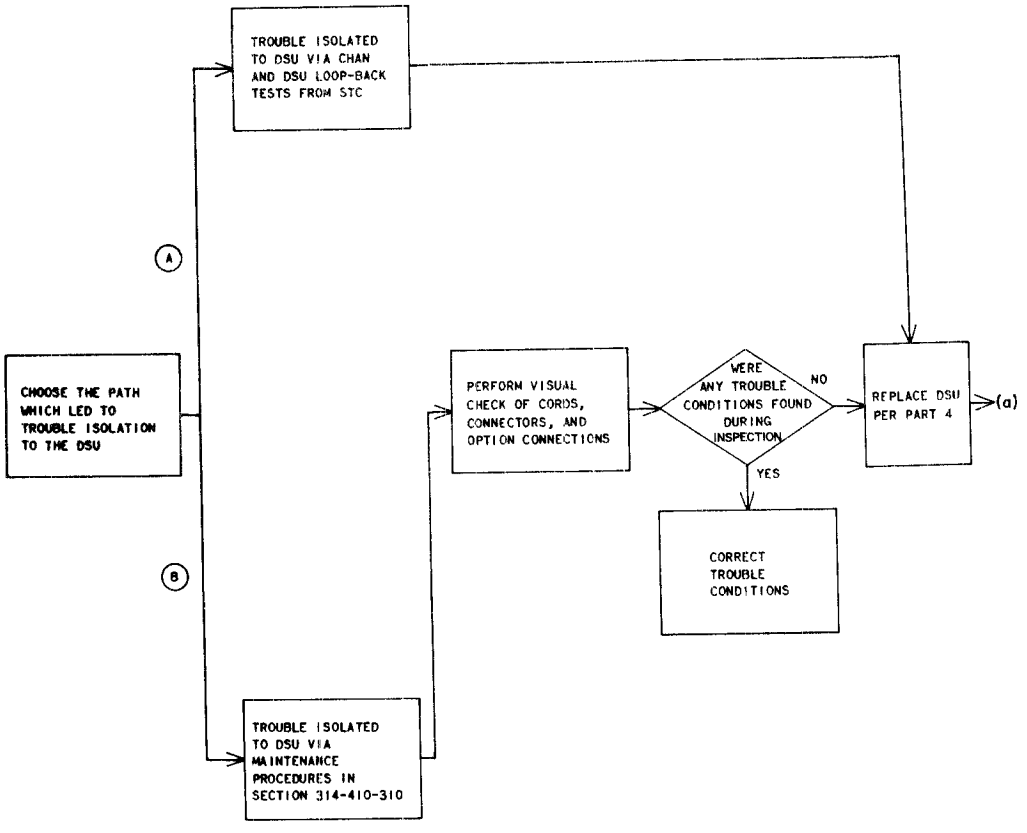
OPERATIONAL DSUs IN MAINTENANCE TERRITORY	RECOMMENDED SPARE DSUs
1-9	2
10-35	3
36-55	4
56-100	5
Over 100	Max. 5% of operational DSUs

2. MAINTENANCE AIDS

2.01 The following maintenance aids are provided for the performance of maintenance procedures included in this section.

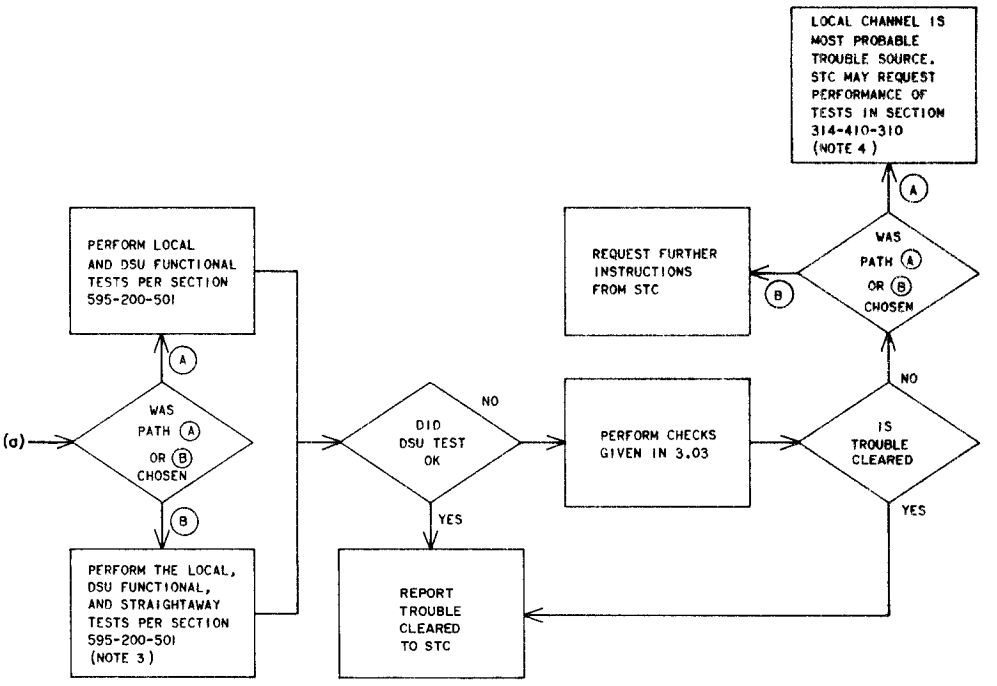
NUMBER	TITLE
SD-7C325-01 CD-7C325-01	Data Systems—Digital Data System Station—500B-Type Data Service Unit
PUB 41450	Technical Reference—Digital Data System—Data Service Unit—Interface Specifications

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NOTES:
1. THIS FLOWCHART IS FOR USE WHEN EITHER (A) PERFORMANCE OF THE DSU LOOP-BACK TEST PROVES UNSUCCESSFUL AND PERFORMANCE OF THE CHAN LOOP-BACK TEST PROVES SUCCESSFUL, OR (B) WHEN PERFORMANCE OF THE OCU LOOP-BACK TEST AND LOCAL CHANNEL TESTS PROVES SUCCESSFUL BUT PERFORMANCE OF THE CHAN LOOP-BACK TEST PROVES UNSUCCESSFUL.
2. TROUBLE ANALYSIS PROCEDURE FOR THE LOCAL CHANNEL CAN BE FOUND IN SECTION 314-410-310.

Fig. 1 — Trouble-Clearing Procedure for 500B-Type DSU (Sheet 1 of 2)



3. THE STRAIGHTAWAY TEST IS INTENDED TO VERIFY RELIABLE ERROR PERFORMANCE OF THE COMPLETE LOCAL SERVICE CONNECTION. THE PERFORMANCE OF THE TEST FOLLOWING MAINTENANCE REPLACEMENT OF THE DSU IS RECOMMENDED, PARTICULARLY WHEN THE MAINTENANCE ACTION IS IN RESPONSE TO AN INTERMITTENT OR HIGH ERROR RATE TROUBLE REPORT.
4. THIS STEPS ASSUMES THE REPLACEMENT DSU IS IN PROPER OPERATING CONDITION.

Fig. 1 — Trouble-Clearing Procedure for 500B-Type DSU (Sheet 2 of 2)

SECTION	TITLE
314-410-310	Digital Data System—Private Line Local Channel—Trouble Analysis
314-410-510	Local Loop—Test and Requirements, Digital Data System
314-901-300	Serving Test Center—Private Line Circuit—Maintenance Procedures, Digital Data System
314-901-500	Serving Test Center—Private Line Circuit—Test Procedures, Digital Data System
595-200-101	500B-Type Data Service Unit—Description and Operation, Digital Data System
595-200-201	500B-Type Data Service Unit—Installation and Connections, Digital Data System
595-200-501	500B-Type Data Service Unit—Test Procedures, Digital Data System.

2.02 The following equipment is required to perform the tests indicated in this section.

(a) Test equipment for subrate service

- 914C Data Test Set (J79914C-L1) or 921A Data Test Set (J79921AL2)

(b) Test equipment for 56-kb/s service

- 912A Wideband Data Test Set (J79912A-L1/47) or 921A Data Test Set (J79921AL2).

2.03 The test procedures referred to in this section are contained in Section 595-200-501 and are listed as follows:

- Local Test
- DSU Functional Test
- Straightaway Test.

3. MAINTENANCE ACTIVITIES

3.01 When investigating a trouble report, proceed as indicated in Fig. 1 and the following text. Upon arrival at the customer location, the TELCO employee should make a quick visual inspection of the DSU. Verify that the PWR light-emitting diode (LED) is illuminated and that the switch on the faceplate is in the center position. Check also for other possible causes of trouble, such as cable and connector defects. If this initial check does not reveal a trouble condition, the DSU is immediately assumed to be defective and must be replaced as described in Part 4 of this Section.

3.02 The installation procedures given in Section 595-200-201 should be followed to install the replacement DSU and the test procedures given in Section 595-200-501 should be performed (in the sequence given) to facilitate testing of the replacement DSU.

3.03 If trouble persists after the replacement DSU is installed and tested, perform the following:

(a) Check that options installed in the DSU agree with the options specified on the service order.

(b) Confirm that the business machine has been tested and checks satisfactorily.

(c) Check for cord and connector defects

(d) Check for intermittent trouble in the station wiring.

4. MAINTENANCE PROCEDURES

4.01 This part contains the procedure to be performed when replacing a defective DSU.

4.02 Replace the defective DSU as follows:

(1) Disconnect the ac power cord.

(2) Disconnect the customer interface cord.

(3) Disconnect the M6BA cord.

(4) Install the replacement DSU per Section 595-200-201.

(5) Test the replacement DSU per Section 595-200-501.

500B-TYPE DATA SERVICE UNIT

TEST PROCEDURES

DIGITAL DATA SYSTEM

CONTENTS PAGE

1. GENERAL 1

2. APPARATUS 2

3. TEST PROCEDURES—912A WDTS AND 914C DTS 2

A. Local Test 5

B. DSU Functional Test 6

C. Straightaway Test 9

4. TEST PROCEDURES—921A DTS 11

A. Local Test 13

B. DSU Functional Test 15

C. Straightaway Test 18

1. GENERAL

1.01 This section contains procedures to be used when testing the 500B-type data service unit (DSU). Procedures for investigating a trouble condition are given in Section 595-200-301, entitled 500B-Type Data Service Maintenance, Digital Data System

1.02 Whenever this section is reissued the reason(s) for reissue will be given in this paragraph.

1.03 The tests covered in this section are listed and defined below.

(a) ***Local Test:*** This is a partial test of the customer interface leads, the DSU transmit and receive logic, and the power supply. In order to perform this test, the DSU must be connected to ac power.

(b) ***DSU Functional Test:*** This test verifies the operation of circuits within the DSU which control the zero suppression code and idle code generation and detection. The ability of the DSU to transmit and receive data and control codes in conjunction with the associated channel service unit (CSU) and office channel unit (OCU) is determined by this test. In addition, the DSU is monitored for response to control codes, generated by the serving test center (STC), which determine loopback modes (DSU and CHAN). Voice coordination with the STC is required to perform this test. This voice coordination is not over the digital data system (DDS), but must be via the public switched network (PSN).

(c) ***Straightaway Test:*** The purpose of this test is to evaluate the performance of the DDS channel through an error performance run coordinated with the STC. If a 15-minute Straightaway Test using the CSU was made, only an abbreviated Straightaway Test using the DSU is necessary. A maximum of one error, at any of the data rates (2.4, 4.8, 9.6, and 56 kb/s), in each direction of data transmission during a 5-minute interval is permitted for the DDS channel to be acceptable. Voice coordination with the STC is required to perform this test. This voice coordination is not over DDS, but must be via PSN.

1.04 The tests given in this section are to be performed in the order given for installation testing. For maintenance testing, they may be performed individually or in any combination.

1.05 By performing the local test first, the telephone company (TELCO) employee may locate a minor trouble condition without involvement of the STC. This test ascertains the operation of the DSU power supply and customer interface leads with the exception of the data-set-ready lead.

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1.06 Since the service maintenance philosophy for the DSU is immediate replacement with a known operable DSU upon failure of any one test, no remedial action is given in the detailed test procedures to follow. If the replacement DSU fails any one of the installation tests, the cable pairs may be the trouble source and must be analyzed as specified in Section 314-410-310, entitled Digital Data System—Local Loop—Maintenance Procedures.



Customer permission should be obtained to ensure that the data channel is idle prior to conducting any test given in this section.

2. APPARATUS

2.01 This part describes the DTSs that are required at the customer location during installation or maintenance testing.

2.02 The 912A wideband data test set (WDTS [J79912A-L1/47]) is used for testing the wideband 500B-L1/5 DSU (56-kb/s service).

2.03 The 914C DTS (J79914C-L1) is used for testing the subrate 500B-L1/2, 3, 4 DSUs (2.4-, 4.8-, 9.6-kb/s service).

2.04 The 921A DTS (J79921A) can be used in place of the 912A WDTS and the 914C DTS.

2.05 The 500B-type DSU can also be tested using the Automated Bit Access Test System (ABATS). ABATS test procedures for the 500B-type DSU are given in Sections 314-901-530 and 314-901-531.

3. TEST PROCEDURES—912A WDTS AND 914C DTS

3.01 This part contains the procedures necessary to perform the tests described in Part 1. The test procedures using a 912A WDTS or 914C DTS are given below; test procedures using a 921A DTS are contained in Part 4.

Initial Test Setup

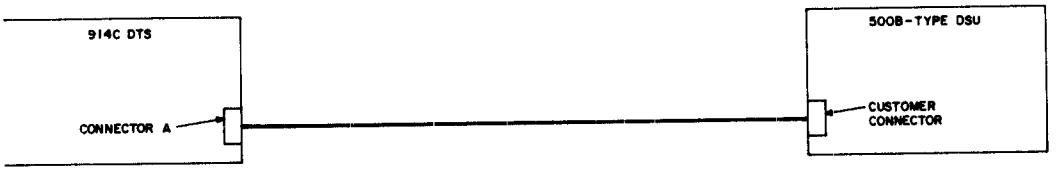
3.02 The procedures given in this part are to be used for conditioning the test equipment prior to starting any test in this section.

STEP	ACTION	VERIFICATION
	Subrate DSU	
1	Connect the interface connection cable, provided with the 914C DTS, from connector A on the DTS to the customer interface connector of the subrate DSU.	
2	Insert the power plug of the DTS into a 117-volt 60-Hz ac outlet.	
3	Program the DTS with ten matrix pins and position the switches per Fig. 1.	
4	Press the DTS POWER switch.	POWER indicator is lighted.

STEP	ACTION	VERIFICATION
	56-kb/s DSU	
1	Connect the interface cable (CA201) provided with the 912A WDTS from the high-speed interface unit of the WDTS to the customer interface connector of the 56-kb/s DSU.	
2	Insert the power plug of the DTS into a 117-volt 60-Hz ac outlet.	
3	Position the WDTS controls as in Table A.	
4	Position the WDTS POWER switch to ON.	POWER indicator is lighted.



Take appropriate action as given in Section 010-250-001, entitled Crediting Charges or Test Calls, to ensure that the customer is not billed for test calls. Before starting Test B or C, establish voice communication with the STC and verify that the DSU under test is the correct list code and that customer options specified on the circuit layout record card (CLRC) are installed in the DSU.



914C DTS MATRIX PROGRAM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	STG	
GRD	●	o	o	o	o	o	●	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	GRD
SD	o	●	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	SD
RD	o	o	●	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	RD
SI	o	o	o	●	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	SI
DSI	o	o	o	o	●	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	DSI
DS2	o	o	o	o	o	●	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	DS2
S2	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	S2
DS3	o	o	o	o	o	o	o	●	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	DS3
TPI	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	TPI
TP2	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	TP2
S3	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	S3
DS4	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	DS4
DS5	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	DS5
S4	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	S4
SCT	o	o	o	o	o	o	o	o	o	o	o	o	o	o	●	o	o	o	o	o	o	o	o	o	o	o	SCT
S5	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	S5
SCR	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	●	o	o	o	o	o	o	o	o	o	SCR
DS6	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	DS6
S6	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	S6
DS7	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	DS7
DS8	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	DS8
S7	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	S7
TP3	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	TP3
S8	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	S8
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	STG	

914C DTS SWITCH SETTINGS
(ALL OTHER SWITCHES NOT USED)

	SWITCH	SETTING
	INTERFACE MODE	VOLTAGE
	S1	OFF
	TEST SET MODE	SER
	COUNTER	BIT ERRORS
	FUNCTION	OFF
RCV	BIT RATE	EXT +
RCV	WORD LENGTH	511
	WORD SYNC	AUTO
	ALL INTERFACE	
	SELECTOR SWITCHES	DEPRESSED
	TRANSMIT BIT RATE	EXT +
	TRANSMIT WORD LENGTH	511
	TRANSMIT SIG LEV	±4V

INDICATOR LIGHT DESIGNATIONS

DS1	CLEAR TO SEND
DS2	DATA SET READY
DS3	RECEIVED LINE SIGNAL DETECTOR

Fig. 1—914C DTS Testing Configuration

TABLE A

912A WDTS SWITCH POSITIONS

SWITCH	POSITION
TRANSMIT BIT RATE	EXT
RECEIVE BIT RATE	EXT
TRANSMIT TEST SIGNAL	2047
RECEIVE TEST SIGNAL	2047
OUTPUT	INVERTED
INPUT	INVERTED
WORD SYNC	AUTO
TIMING	0
COUNTER	ON
DATA TERM READY	OFF
REQ TO SEND	OFF
LOCAL TEST	OFF
TEST MODE	OPERATE

3.03 The tests presented in this part should be performed after the DSU has been installed to ensure that the installation is ready to be placed in service.

3.04 A letter a, b, c, etc, added to a step number indicates an action which may or may not be required, depending on local conditions. The condition under which a lettered step should be made is given in the ACTION column.

A. Local Test

STEP	ACTION	VERIFICATION
	Subrate DSU	
1	If this is the first test, perform initial setup described in paragraph 3.02. ***Note:*** There should not be anything connected to the 15-pin CSU interface connector.	
2	Apply power to the DSU.	PWR indicator is lighted.
3	Place the DSU slide switch in position LL.	PWR and LL indicators are lighted. NS and RT indicators are off.
4	Position the 914C DTS switch S1 to ON.	DS1 and DS3 are lighted. DS2 remains off. NO CLOCK and NO DATA indicators are off.
5	Press the DTS counter RESET button.	Counter reads zero errors.
6	Position DTS switch S1 to OFF.	If the DSU is equipped with option YS (continuous request-to-send)— DS1 and DS3 remain lighted. DS2 remains off. If the DSU is equipped with option YT (switched request-to-send)— DS1 and DS3 are off. NO DATA indicator is lighted.

STEP	ACTION	VERIFICATION
7	If no further tests are to be performed, disconnect the DTS and restore the DSU slide switch to the center position.	
	56-kb/s DSU	
1	If this is the first test, perform initial setup described in paragraph 3.02. ***Note:*** There should not be anything connected to the 15-pin CSU interface connector.	
2	Apply power to the DSU.	PWR indicator is lighted.
3	Place the DSU slide switch in position LL.	PWR and LL indicators are lighted. NS and RT indicators are off.
4	Position the 912A WDTS REQ TO SEND switch to ON.	CLEAR TO SEND and RCVD LINE SIG DETR indicators are lighted. DATA SET READY indicator remains off. NO DATA and NO SYNC indicators are off.
5	Position the COUNTER switch to ON and press the reset button located on the counter face.	Counter reads zero errors.
6	Position the REQ TO SEND switch to OFF.	If the DSU is equipped with option YS (continuous request-to-send)— CLEAR TO SEND and RCVD LINE SIG DETR indicators remain lighted. DATA SET READY indicator remains off. If the DSU is equipped with option YT (switched request-to-send)— CLEAR TO SEND and RCVD LINE SIG DETR indicators go off. Counter begins to count errors. NO DATA indicator lights.
7	If no further tests are to be performed, disconnect the WDTS and restore the DSU slide switch to the center position.	

B. DSU Functional Test

Subrate DSU

1	If this is the first test, perform initial setup described in paragraph 3.02. ***Note:*** The DSU should be connected to a CSU via the M6BA cord.	

STEP	ACTION	VERIFICATION
2	Apply power to the DSU.	PWR indicator is lighted. NS, LL, and RT indicators are off.
3	Request the STC to transmit repeated idle control code.	
4	Position the 914C DTS switch S1 to ON.	DS1 and DS2 are lighted. DS3 is off.
5	Request the STC to transmit the OCU loopback control code.	After a 1- to 2-second transition interval, NS indicator on the DSU lights.
6	Request the STC to transmit repeated bytes with a "1" inserted in position 8.	NS indicator on DSU goes off. DS3 on DTS lights. (STC receives byte pattern 00000001.)
7	Request the STC to transmit a repeated 511-bit test word.	
8	Reset the DTS counter by momentarily pressing the RESET pushbutton.	Counter reads zero errors during a 10-second interval.
9	Place the DSU slide switch in the RT position.	DS1, DS2, and DS3 indicators on DTS are off. RT indicator on the DSU lights.
10	Request the STC to make a 10-second error check.	
11	Place the DSU slide switch in the center position.	RT indicator is off.
12	Request the STC to transmit the DSU loopback control code.	RT indicator lights.
13	Request the STC to transmit a repeated CHAN loopback control code.	At the DTS— DS3 indicator light remains off. DS1 and DS2 indicators light. At the DSU— RT indicator is off. NS indicator is lighted.
14	If no further tests are to be performed, disconnect the DTS.	

56-kb/s DSU

1	If this is the first test, perform initial setup described in paragraph 3.02.	

STEP	ACTION	VERIFICATION
	Note: The DSU should be connected to a CSU via the M6BA cord.	
2	Apply power to the DSU.	PWR indicator is lighted. NS, LL, and RT indicators are off.
3	Request the STC to transmit repeated idle control code.	
4	Position the 912A WDTS REQ TO SEND switch to ON.	DATA SET READY and CLEAR TO SEND indicators lighted. RCVD LINE SIG DETR indicator is off.
5	Request the STC to transmit the OCU loopback control code.	After a 1- to 2-second transition interval, NS indicator on the DSU lights.
6	Request the STC to transmit repeated bytes with a "1" inserted in position 8.	
7	Position the WDTS OUTPUT switch to SPACE.	NS indicator on the DSU goes off. RCVD LINE SIG DETR indicator on the WDTS lights. (STC receives byte pattern 00000001.)
8	Request the STC to transmit a repeated 2047-bit test word.	
9	Position the WDTS COUNTER switch to ON and press the reset pushbutton located on the counter face.	Counter reads zero errors during a 10-second interval.
10	Place the DSU slide switch in the RT position.	At the WDTS— CLEAR TO SEND, DATA SET READY and RCVD LINE SIG DETR indicators are off. RT indicator on the DSU lights.
11	Request the STC to perform a 10-second error check.	
12	Place the DSU slide switch in the center position.	RT indicator goes off.
13	Request the STC to transmit the DSU loopback control code.	RT indicator on DSU lights.
14	Request the STC to transmit the CHAN loopback control code.	At the WDTS— RCVD LINE SIG DETR indicator remains off. CLEAR TO SEND and DATA SET READY indicators are lighted

STEP	ACTION	VERIFICATION
		At the DSU— NS indicator is lighted. RT indicator is off.
15	If no further tests are to be performed— Disconnect the WDTS and restore the DSU slide switch to the center position.	

C. Straightaway Test

Subrate DSU

1	If this is the first test, perform initial setup described in paragraph 3.02.	
2	Apply power to the DSU.	PWR indicator is lighted. NS, LL, and RT indicators are off.
3	Request the STC to transmit and to check the received 511-bit test word for errors.	
4	Position the 914C DTS switch S1 to ON.	DS1, DS2, and DS3 indicators are lighted.
5	Reset the 914C DTS counter by momentarily pressing the RESET button.	
6	Start timing at 5-minute interval.	Maximum number of errors is one counted by the DTS and one counted by the STC receiver.
7a	If more than one error is counted on either counter— Reset both counters and start timing another 5-minute interval.	
8b	If more than one error is counted on either counter within the first 5 minutes of the second attempt— Wait 5 minutes, reset the counters and start another 5-minute interval. ***Note:*** An extraordinary condition, such as a severe electrical storm or an intermittent failure of customer-supplied ac power, may affect the performance of the DDS channel. The straightaway test cannot properly be performed until these conditions have cleared.	
9c	If one attempt fails to achieve the 5-minute requirement, the STC must commence troubleshooting the channel in accordance with Section 314-901-300.	

STEP	ACTION	VERIFICATION
10	Request the STC to perform a 5-minute DSU loopback and a 5-minute CHAN loopback error run, and to record the number of errors counted on the CLRC as a benchmark for future use.	
11	Disconnect the 914C DTS and restore the DSU slide switch to the center position.	
56-kb/s DSU		
1	If this is the first test, perform initial setup described in paragraph 3.02.	
2	Apply power to the DSU.	PWR indicator is lighted. NS, LL, and RT indicators are off.
3	Request the STC to transmit a repeated 2047-bit test word and to check the received 2047-bit test word for errors.	
4	Position the 912A WDTS REQ TO SEND switch to ON.	CLEAR TO SEND, RCVD LINE SIG DETR, and DATA SET READY indicators are lighted.
5	Position the WDTS COUNTER switch to ON.	
6	Reset the WDTS counter by pressing the reset button located on the counter face.	
7	Start timing at 5-minute interval.	Maximum number of errors is one counted by the WDTS and one counted by the STC receiver.
8a	If more than one error is counted on either counter— Reset both counters and start timing another 5-minute interval.	
9b	If more than one error is counted on either counter within the first 5 minutes of the second attempt— Wait 5 minutes, reset the counters, and start another 5-minute interval. ***Note:*** An extraordinary condition, such as a severe electrical storm or an intermittent failure of customer-supplied ac power, may affect the performance of the DDS channel. The straightaway test cannot properly be performed until these conditions have cleared.	

STEP	ACTION	VERIFICATION

4. TEST PROCEDURES—921A DTS

4.01 This part contains the procedures necessary to perform the tests described in Part 1 using a 921A DTS.

4.02 A letter a, b, c, etc, added to a step number indicates an action which may or may not be required, depending on local conditions. The condition under which a lettered step should be performed is given in the ACTION column. For example steps designated with an "a" apply to subrate DSUs while steps designated "b" apply to 56 kb/s DSUs.

4.03 The procedures given in this part are to be used for conditioning the test equipment prior to starting any of the tests.

STEP	ACTION	VERIFICATION
1	Connect the DTS to the customer interface connector of the DSU using the interface cords provided with the DTS. ***Note:*** The interface cord is equipped with a 37-pin connector on each end. A 6-inch adapter cord matches the interface cord to the interface connector on the DSU.	
2	Verify that all interface selector switches (white bow-tie) on the front of the DTS are in the NORM position.	
3	Insert the power plug of the 921A DTS into a 117-volt 60-Hz ac outlet.	
4a	Subrate DSU— Remove the EIA RS-232-C interface card from the storage area in the DTS. Ensure that all 25 interface lead switches are in the normal position, insert the card into the interface connector and close the latch. (A red dot on the switch is visable when the switch is in the normal position.)	

STEP	ACTION	VERIFICATION
4b	56-kb/s DSU— Remove the CCITT V.35 interface card from the storage area in the DTS. Ensure that all 14 interface lead switches are in the normal position, insert the card into the interface connector and close the latch. (A red dot on the switch is visable when the switch is in the normal position.)	
5	Apply power to DSU.	PWR indicator is lighted.
6	Operate the POWER switch on the 921A DTS to ON.	POWER ON indicator is lighted.
7	Press RST key on the DTS.	Display indicates— 921A VERS #01, (or higher) briefly, then DATA SET : is displayed if the DTS is not defective. If the DTS is defective, TEST FAILED appears on the display and another test set must be obtained to perform these procedures.
8a	Subrate DSU— Select the 500B (subrate) by entering 80 on the DTS input keyboard.	Display indicates— DATA SET : 80.
8b	56-kb/s DSU— Select the 500B (56 kb/s) by entering 81 on the DTS input keyboard.	Display indicates— DATA SET : 81.
	Note: To delete a wrong entry on the input keyboard, press the backspace arrow.	
9	Press GO key.	Display indicates— BIT RATE !
10a	Subrate DSU— Select subrate service by entering one of the following on the DTS input keyboard— 24 for 2.4-kb/s service 48 for 4.8-kb/s service 96 for 9.6-kb/s service.	Display indicates— BIT RATE : followed by either 24, 48, or 96.
10b	56-kb/s DSU— Select 56-kb/s service by entering 56 on the DTS input keyboard.	Display indicates— BIT RATE : 56.
11	Press GO key.	Display indicates— TEST SEQ : Interface indicator DSR is lighted, SCT and SCR ON-OFF indicators are of equal intensity, SD and RD indicators "1" are lighted.



Take appropriate action as given in the Section 010-250-001, entitled Crediting Charges on Test Calls, to ensure that the customer is not billed for test calls. Before starting Test B or C, establish voice communication with the STC and verify that the DSU under test is the correct list code and that customer options specified on the CLRC are installed in the DSU.

4.04 The tests presented in this part should be performed after the DSU has been installed to ensure that the installation is ready to be placed in service.

A. Local Test

STEP	ACTION	VERIFICATION
1	If this is the first test, perform initial setup described in paragraph 4.03. ***Note:*** There should not be anything connected to the 15-pin CSU interface connector.	
2	Place the DSU slide switch in position LL.	PWR and LL indicators on the DSU are lighted. NS and RT indicators on the DSU are off. Interface indicator DSR on the DTS is off.
3	Select the control for the request-to-send (RS) lead by entering 36 on the DTS.	Display indicates— TEST SEQ : 36 RS=? (0 OR 1).
4	Press key number 1.	Display indicates— TEST SEQ : 36 RS=1 (0 OR 1).
5	Select error test (DOT, SPACE, MARK, and PSEUDORANDUM WORD) by entering 55 on DTS.	Display briefly indicates— TEST SEQ : 36 RS=1 (0 or 1) 55 then display becomes :
6a	Subrate DSU— Press GO key.	Display briefly indicates— TEST COMPLETE then display becomes— D=DT 0=SP 1=MK 2=2047 5=511 6=63 Interface indicators RS, CS and RLSD on the DTC are lighted; DSR is off.
6b	56 kb/s DSU— Press GO key.	Display briefly indicates— TEST COMPLETE then display becomes— D=DT 0=SP 1=MK 2=2047. Interface indicators RS, CS, and RLSD on the DTC are lighted; DSR is off.

STEP	ACTION	VERIFICATION
7	Press key number 2.	Display indicates— 2047 BIT ERROR TEST, briefly, then 1=BIT ERRORS 2=BLOCK ERRORS is displayed.
8	Press key number 1.	Display indicates— ???? SECONDS.
9	Select 10 seconds by entering 0010 on DTS.	Display indicates— 0010 SECONDS, briefly, then 0000 BITS IN ERROR is displayed. From this point, the DTS counts the number of errors received. At the end of the test, the display indicates TEST COMPLETE, then total SYNC LOSSES, then the total BITS in ERROR, repeatedly. ***Requirement:*** Zero BITS IN ERROR.
10	Press TST key on DTS in order to stop repetition of display in Step 9.	If the DSU is equipped with option YT (switched request-to-send)— Display indicates— TEST COMPLETE, briefly, then TEST SEQ: is displayed. Interface indicators RS, CS, and RLSD on the DTS are off. If the DSU is equipped with option YS (continuous request-to-send)— Display indicates— TEST COMPLETE, briefly, then TEST SEQ: is displayed. Interface indicators CS and RLSD on the DTS are lighted and RS indicator is off.
11	Restore the DSU slide switch to the center position.	Interface indicator lamp DSR on the DTS is lighted. LL indicator on the DSU is off. If the DSU is equipped with option YS— Interface indicator RLSD on the DTS is off.
12	If no further tests are to be performed, disconnect the DTS as described in Part C, Steps 13 through 16. ***Note:*** If it is necessary to perform any of the functions shown below, press the indicated key on the DTS.	

STEP	ACTION	VERIFICATION
1	Restart test----------A key Display time remaining in test---B key Clear display----------C key End test----------D key Insert errors into data stream---E key Force out-of-sync condition------F key.	
B.	**DSU Functional Test**	
1	If this is the first test, perform the initial setup described in paragraph 4.03. ***Note:*** The DSU should be connected to a CSU via the M6BA cord.	
2	Request the STC to transmit repeated idle control code.	
3	Select the control for the RS lead by entering 36 on the DTS.	Display indicates— TEST SEQ : 36 RS=? (0 OR 1).
4	Press key number 1 on DTS then select error test (DOT, SPACE, MARK, and PSEUDORANDUM WORD) by entering 55 on DTS.	Display briefly indicates— TEST SEQ : 36 RS=1 (0 OR 1) 55 then display becomes :
5a	Subrate DSU— Press GO key.	Display briefly indicates— TEST COMPLETE, then D=DT 0=SP 1=MK 2=2047 5=511 6=63 Interface indicators DSR, RS, and CS on the DTS are lighted; RLSD indicator is off.
5b	56 kb/s DSU— Press GO key.	Display briefly indicates— TEST COMPLETE then display becomes— D=DT 0=SP 1=MK 2=2047 Interface indicators DSR, RS, and CS on the DTS are lighted. RLSD indicator is off.
6	Request the STC to transmit the OCU loopback control code.	After a 1- to 2-second transition interval, the NS indicator on the DSU lights.
7	Request the STC to transmit byte pattern 00000001.	The NS indicator on the DSU goes off. Interface indicators DSR, RS, CS, and RLSD on the DTS are lighted.
8	Press key number 0 on DTS.	Display indicates— SPACING BIT ERROR TEST, briefly, then 1=BIT ERRORS 2=BLOCK ERRORS.

STEP	ACTION	VERIFICATION
9	Press key number 1 on DTS.	Display indicates— ???? SECONDS.
10	Select 10 seconds by entering 0010 on DTS.	Display indicates— 0010 SECONDS, briefly, then 0000 BITS IN ERROR is displayed. From this point, the DTS counts the number of errors received. At the end of the test, the display indicates TEST COMPLETE, then total SYNC LOSSES, then the total BITS IN ERROR, repeatedly. ***Requirement:*** Zero BITS in ERROR. (STC receives byte pattern 00000001.)
11	At completion of test, press TST key on DTS to stop repetition of display in Step 11.	Display indicates— TEST SEQ :

Note: If it is necessary to perform any of the functions shown below, press the indicated key on the DTS.

1 Restart test----------A key
Display time remaining in test---B key
Clear display----------C key
End test----------D key.

12	Request the STC to transmit a repeated 2047 bit test word.	
13	Select the control for the RS lead by entering 36 on the DTS.	Display indicates— TEST SEQ : 36 RS? (0 or 1).
14	Press key number 1 then select error test (DOT, SPACE, MARK, and PSEUDORANDOM WORD) by entering 55 on the DTS.	Display briefly indicates— TEST SEQ : 36 RS=1 (0 or 1) 55 then display indicates :
15a	Subrate DSU—	If the DSU is equipped with option YT (switched request-to-send)— Interface indicators RS and CS on DTS are off. RLSD indicator is on. If the DSU is equipped with option YS (continuous request-to-send)— Interface indicators RLSD and CS on DTS are lighted; RS is off.

STEP	ACTION	VERIFICATION
15b	56 kb/s DSU—	If the DSU is equipped with option YT (switched request-to-send)— Interface indicators RS and CS on DTS are off. RLSD indicator is on. If the DSU is equipped with option YS (continuous request-to-send)— Interface indicators RLSD and CS on DTS are lighted; RS is off.
15c	Press GO key on DTS	Display briefly indicates TEST COMPLETE then display indicates—D = DT 0 = SP 2 = 2047
16	Press key number 2 on DTS.	Display indicates— 2047 BIT ERROR TEST, briefly, then 1=BIT ERRORS 2=BLOCK ERRORS.
17	Press key number 1 on DTS.	Display indicates— ???? SECONDS.
18	Select 10 seconds by entering 0010 on DTS.	Display indicates— 0010 SECONDS, briefly, then 0000 BITS IN ERROR is displayed. From this point, the DTS counts the number of errors received. At the end of the test, the display indicates TEST COMPLETE, then total SYNC LOSSES, then the total BITS IN ERROR, repeatedly. ***Requirement:*** Zero BITS in ERROR. (STC receives 2047 pattern).

Note: If it is necessary to perform any of the functions shown below, press the indicated key on the DTS.

1 Restart test----------A key
Display time remaining in test---B key
Clear display----------C key
End test----------D key.

19	Place the DSU slide switch in position RT.	PWR and RT indicators on the DSU are lighted. NS and LL indicators on the DSU are off. Interface indicators RLSD, DSR, and CS on the DTS are off.
20	Request the STC perform a 10 second error run.	***Requirement:*** Zero BITS in ERROR.
21	Restore the DSU slide switch to the center position.	RT indicator on the DSU goes off. Interface indicators RLSD, DSR, and CS on the DTS are lighted.

STEP	ACTION	VERIFICATION
22	Request the STC to transmit the DSU loopback control code.	RT indicator on the DSU lights. Interface indicators RLSD, DSR, and CS on the DTS are off.
23	Request the STC to transmit a repeated CHAN loopback control code.	NS indicator on the DSU lights. RT indicator on the DSU goes off. Interface indicators RLSD on the DTS remains off. DSR indicator lights.
24	Press TST key on DTS.	Display indicates— TEST SEQ :
25	If no further tests are to be performed, disconnect the DTS as described in Part C, Steps 13 through 16.	
C. Straightaway Test		
1	If this is the first test, perform the initial setup described in paragraph 4.03.	
2	Request the STC to transmit a repeated 2047-bit test word.	Interface indicators DSR and RLSD on DTS are lighted.
3	Select the control for the RS lead by entering 36 on the DTS.	Display indicates— TEST SEQ : 36 RS=? (0 OR 1).
4	Press key number 1 on DTS then select error test (DOT, SPACE, MARK, and PSEUDORANDUM WORD) by entering 55 on DTS.	Display briefly indicates— TEST SEQ : 36 RS=1 (0 OR 1) 55 then indicates :
5a	Subrate DSU— Press GO key on DTS.	Display briefly indicates— TEST COMPLETE then indicates— D=DT 0=SP 1=MK 2=2047 5=511 6=63 Interface indicators RLSD, RS, and CS on the DTS are lighted.
5b	56kb/s DSU Press GO key on DTS.	Display briefly indicates TEST COMPLETE then display indicates— D=DT 0=SP 1=MK 2=2047 Interface indicators RLSD, RS, and CS on the DTS are lighted.
6	Press key number 2 on DTS.	Display indicates— 2047 BIT ERROR TEST, briefly, then 1=BIT ERRORS 2=BLOCK ERRORS.

STEP	ACTION	VERIFICATION
7	Press key number 1 on DTS and request STC to reset error counter.	Display indicates— ???? SECONDS.
8	Select 900 seconds by entering 0900 on the DTS.	Display indicates— 0900 SECONDS, briefly, then 0000 BITS in ERROR is displayed. From this point, the DTS counts the number of errors received. At the end of the test, the display indicates TEST COMPLETE, then total SYNC LOSSES, then the total BITS IN ERROR, repeatedly. ***Requirement:*** Maximum number of errors is three counted by the 921A DTS and three counted by the STC KS-20908 DTS.

Note: If it is necessary to perform any of the functions shown below, press the indicated key on the DTS.

1 Restart test----------A key
Display time remaining in test--------B key
Clear display----------C key
End test----------D key
Insert errors in data stream to STC---E key
Force out-of-sync condition at STC----F key.

9 If more than three errors are counted on either counter—
Repeat the test by pressing the ***A*** key on the DTS, requesting the STC to reset error counter and time another 900-second interval.

10 If more than three errors are counted on either counter within the first 5 minutes of the second attempt—
Wait 5 minutes. Then repeat the test by pressing the ***A*** key on the DTS, requesting the STC to reset error counter and time another 900-second interval.

Note: An extraordinary condition, such as a severe electrical storm or an intermittent failure of customer-supplied ac power, may affect the performance of the DDS channel. The straightaway test cannot properly be performed until these conditions have cleared.

11 If three attempts fail to achieve the 900-second requirement, the STC must commence troubleshooting the channel in accordance with Section 314-901-300.

STEP	ACTION	VERIFICATION
12	Request the STC to perform a 900-second DSU loopback and a 900-second CHAN loopback error run, and to record the number of errors on the CLRC as a benchmark for future use.	
13	Place the POWER switch on the DTS in the OFF position.	POWER ON indicator on the DTS goes off.
14	Remove the DTS adapter cable from the customer interface connector on the DSU.	
15	If no further tests are to be performed, reconnect the DSU to the CPE.	
16a	Subrate DSU— Remove the EIA RS-232-C interface card from the DTS and place in the proper storage area.	
16b	56-kb/s DSU— Remove the CCITT V.35 interface card from the DTS and place it in the proper storage area.	

DIGITAL DATA SYSTEM
550A-TYPE CHANNEL SERVICE UNIT
DESCRIPTION

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1. GENERAL

1.01 This section contains physical and functional descriptions of the 550A-type channel service unit (CSU). Information pertaining to the associated customer-provided equipment (CPE) is not given. However, descriptions of interface signals and customer options are provided.

1.02 This section is reissued to include information on multiple mounting installations and a change in option designation. Since this revision constitutes a general revision, arrows ordinarily used to denote changes have been omitted.

1.03 The CSU is used only on the digital data system (DDS) and is primarily intended for full-duplex operation in 4-wire applications. It provides the CPE with access to the synchronous DDS while providing maintenance testing capability for the DDS with equalization and loop loss. For additional information, refer to the section entitled Digital Data System—Private Line Service—Overall Description (314-900-100). In order to interface with the CSU, the CPE must provide clock recovery and generate and detect DDS network control codes. The CSU accepts serial data in modified bipolar format from the CPE and transmits it over the local pair to the serving central office. Serial, modified bipolar signals are received by the CSU from the serving central office via the local cable pair and transmitted to the CPE. All transmission on the local channel is at the service bit rate.

1.04 The CSU provides a customer interface consisting of the following six leads:

- Two leads, status indicator and ground, which conform electrically to Electronic Industries Association (EIA) Standard RS-232-C. The status indicator (SI) lead is a control lead and the ground (GRD) lead provides ground return for the SI lead.

- Four data leads, DT, DR, DT1, and DR1. These leads provide a balanced, 135-ohm interface but do not conform to EIA standards.

1.05 The 550A-type CSU is apparatus-coded with respect to customer data rates as follows:

- 550A-L1/2—operates at 2.4 kb/s
- 550A-L1/3—operates at 4.8 kb/s
- 550A-L1/4—operates at 9.6 kb/s
- 550A-L1/5—operates at 56 kb/s.

2. PHYSICAL DESCRIPTION

2.01 The 550A-type CSU (Fig. 1) consists of a housing, power unit, and two circuit packs (CPs) interconnected by a flexible cable harness. The CPs are mounted in a gray plastic housing with a black plastic snap-on cover.

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2.02 The CSU is approximately 8 inches wide, 5 inches high, and 2-3/4 inches deep; it weighs approximately 3-1/2 pounds.

2.03 The CSU will operate in an environment of +40 to +120°F with a relative humidity of less than 95 percent.

2.04 Power requirements for the self-contained 96A power unit are 105 to 129 volts ac at 57 to 63 Hz. The CSU is equipped with a 3-foot, 3-conductor power cord for connection to a customer-provided ac outlet which is not under control of a switch.

2.05 Two light-emitting diode (LED) indicators are visible through the CSU cover and have the following designations: TST, PWR.

2.06 For customer locations where access to the customer interface connector is restricted, the CSU may be mounted with the power cord and interface connector on either the right or left side. After mounting, the cover is replaced so that the lettering is right side up.

2.07 The CSU may be adapted for multiple installation. In the event that a multiple installation is required, refer to Section 595-100-200, 550A-Type Channel Service Unit—Installation.

2.08 Each CSU list code contains an HR-type transmitter CP and an HR-type receiver CP with speed sensitive circuits. The CSU list codes, with corresponding bit rates and HR-type transmitter and receiver CPs, are given in Table A.

2.09 All customer interface leads of the CSU are terminated in a 15-pin female connector. CPE to be used with the CSU must be equipped with a cable terminated in a CINCH DAMA-15-P plug (or equivalent).

2.10 The fixed line build-out (FLBO) network is located on the receiver CP and is switched into or out of the circuit (see 3.16) by means of switch S1 as shown in Fig. 2.

2.11 The signal ground option (see 3.15) screw switch (S2) is also located on the receiver CP as shown in Fig. 3.

3. FUNCTIONAL DESCRIPTION

3.01 This part contains a brief functional description of the CSU transmitting and receiving circuitry. Descriptions of the interface leads and CSU options are also provided.

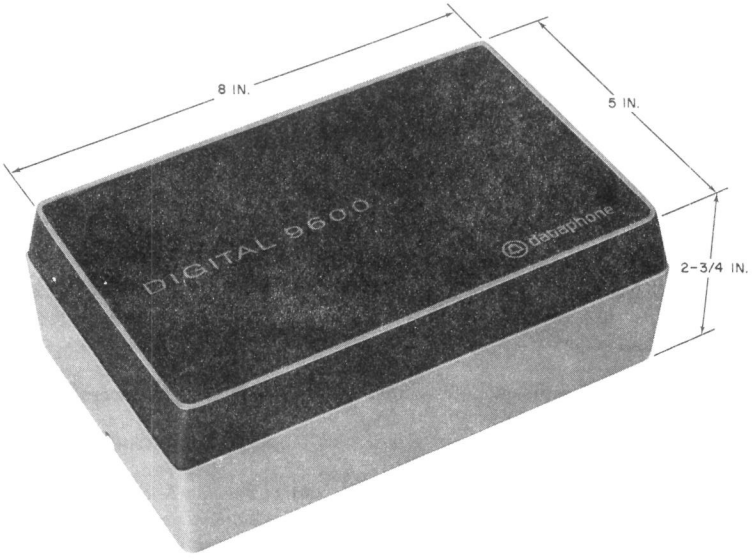


Fig. 1—550A-Type Channel Service Unit

TABLE A

CSU SERVICE BIT RATE AND CIRCUIT PACKS

CSU LIST CODE	SERVICE BIT RATE	TRANSMITTER CP	RECEIVER CP
550A-L1/2	2.4 kb/s	HR1	HR5
550A-L1/3	4.8 kb/s	HR2	HR6
550A-L1/4	9.6 kb/s	HR3	HR7
550A-L1/5	56 kb/s	HR4	HR8

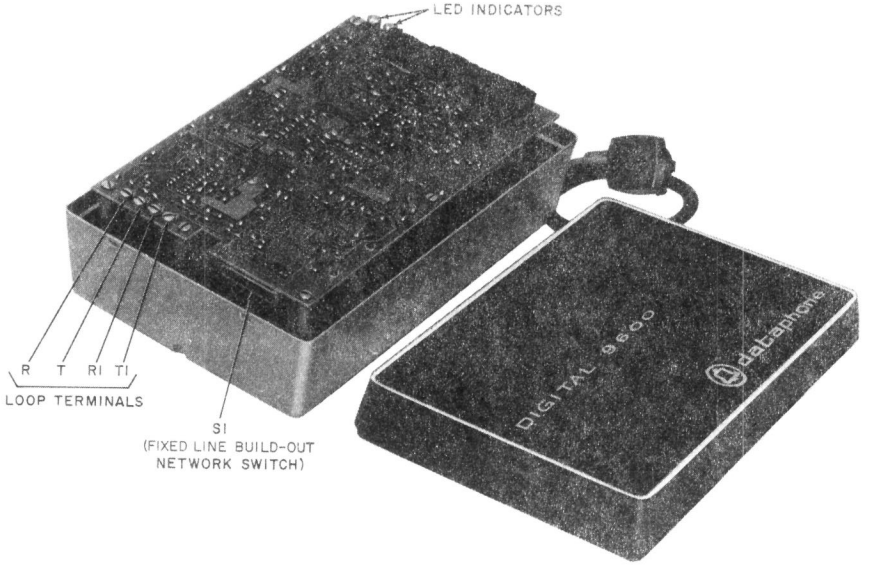


Fig. 2—550A-Type Channel Service Unit—Cover Removed

3.02 The 550A-type CSU provides for full-duplex transmission of data, in modified bipolar format, over local transmission facilities. In normal bipolar format, a binary zero is transmitted as zero volts and a binary one is transmitted as either a positive or negative pulse opposite in polarity to the previous binary one. The DDS modifies this format so that network control codes incorporate bipolar violations where two successive ones have the same polarity. To avoid dc buildup on the line, each bipolar violation has a polarity opposite that of the previous violation, thus making the sum of the signal voltages equal to zero.

A. Transmitter

3.03 Refer to Fig. 4 for a functional block diagram of the 550A-type CSU. The transmitter consists of a bipolar terminator and a line driver. Bipolar customer data of nominal 1.4 volts peak amplitude at 135-ohm termination is applied to DT1 and DR1. The bipolar pulses pass through the normally closed loop-back relay contacts and are transformer coupled to the bipolar terminator. The data signals are sliced, restored to a controlled ± 1.4 volt transmission level, and applied to a low-pass transmit filter. The filter prevents the

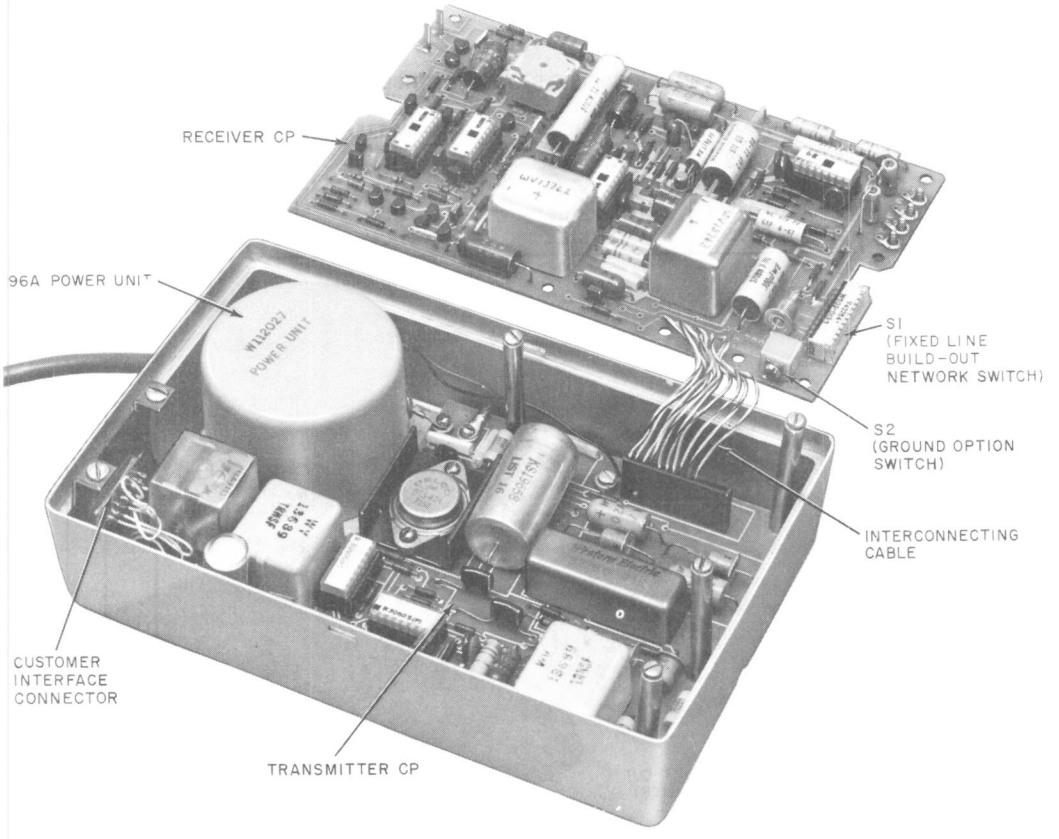


Fig. 3—550A-Type Channel Service Unit—Internal View

transmission of unnecessary high-frequency energy over the channel. From the filter, the data signals are amplified and transformer coupled to the local cable pairs of the local channel.

B. Receiver

3.04 The CSU receiver consists of a switch selectable FLBO network, a multistage amplifier, a slicer, and a bipolar driver. The amplifier includes line equalization and an automatic line build-out (ALBO) network. The receiver functions will be discussed in reverse order to simulate signal flow.

3.05 Since local cable pairs may vary in length and gauge, an ALBO network is provided to compensate for these variations. The ALBO network automatically inserts attenuation which varies with frequency in order to make the net transmission loss simulate a maximum length of local cable pairs. Because the range of adjustment provided by the ALBO network is limited, a switch-selectable FLBO network is needed. The FLBO network provides additional loss in cases where cable pairs have such a low transmission loss that the ALBO network cannot insert enough attenuation to simulate a maximum length of local cable pairs.

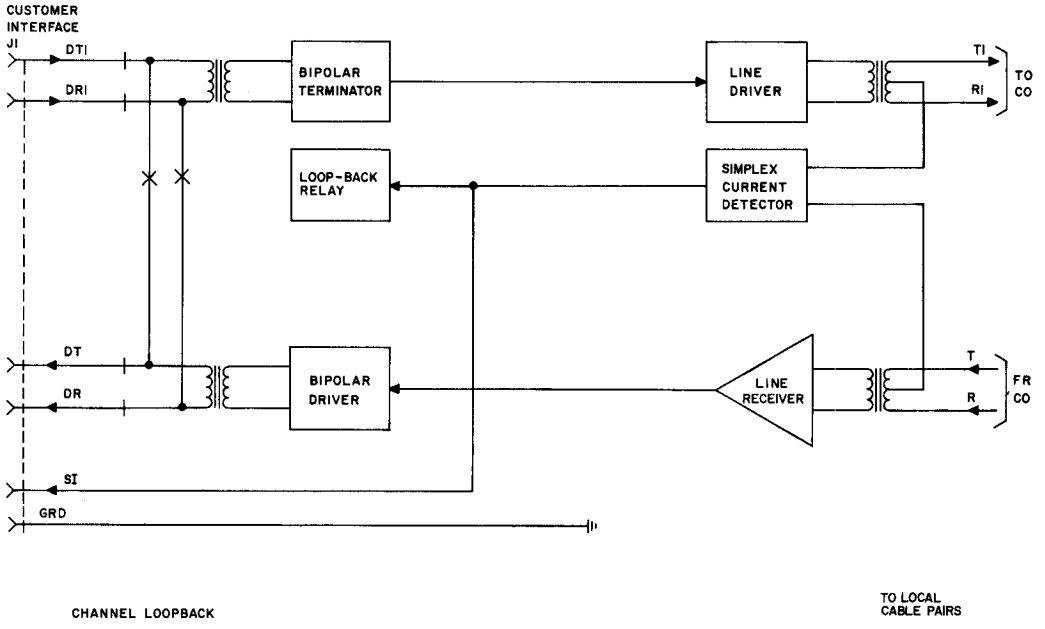


Fig. 4—550A-Type CSU Functional Block Diagram

3.06 The amplifier provides gain and frequency compensation to equalize the loss of a maximum length cable pair. The combination of the AGC and line build-out network provides equalization for a cable loss characteristic which is the average of the loss characteristics of standard cable pair gauges (19 through 22).

3.07 The slicer establishes a reference level for the signal input to the bipolar driver. The data signals are converted to controlled amplitude pulses before being transformer coupled to DT and DR interface leads.

C. Simplex Current Detector

3.08 Reversal of the local channel simplex current by the Office Channel Unit (OCU) will operate a polarity-sensitive relay circuit (located on the transmitter CP) wired between the center taps of the transmit and receive transformers. Operation of this relay will cause a loop-back of the local channel at the customer interface and simultaneously disconnect the CPE. Functionally, this is the remote CHAN loop-back which is controlled by the serving test center (STC).

D. Interface Leads

3.09 The 550A-type CSU is provided with six interface leads for connection to the CPE. These leads and corresponding pin numbers are given in Table B.

3.10 ***Transmitted Data (DT1 and DR1):*** The direction of signal flow on these leads is from the CPE to the CSU. The balanced, modified bipolar data signals on these leads are generated by the CPE for transmission to the distant CPE. The CSU will transmit data only if the SI interface lead presents a positive voltage to the CPE.

3.11 ***Received Data (DT and DR):*** The direction of signal flow on these leads is from the CSU to the CPE. Balanced, modified bipolar data signals are presented to the CPE. The customer

TABLE B

550A-TYPE CSU INTERFACE

INTERFACE PIN NO.	550A-TYPE CSU LEAD	DESIG-NATION
1	Ground	GRD
2	Status Indicator	SI
3	Received Data	DT
4	Received Data	DR
5	Transmitted Data	DT1
6	Transmitted Data	DR1
7-15	Not Used	

is responsible for extracting timing, detecting DDS network control codes, and processing the data.

3.12 ***Status Indicator (SI):*** The direction of signal flow on this lead is from the CSU to the CPE. The SI lead conforms to the electrical characteristics of EIA Standard RS-232-C. When the CSU is connected to ac power and is not in a test mode, a positive voltage is present on the SI lead. A negative voltage on the SI lead indicates to the CPE that the CSU is in the remote test mode (CHAN loop-back) and data cannot be transmitted or received. If no voltage is present, either a power OFF or CSU malfunction is indicated.

3.13 ***Signal Ground (GRD):*** This lead provides a ground return for the SI interface lead. The GRD lead may be optionally disconnected (3.15) from frame ground which is provided through the CSU power cord, local codes permitting.

E. LED Indicators

3.14 Two LEDs are located on the receiver circuit board and give the following indications:

- PWR—This LED is illuminated when ac power is supplied to the CSU and 8.2 volts dc is available from the 96A power unit.
- TST—This LED is illuminated when the STC has remotely looped the CSU interface for testing.

F. Signal Ground Option (Option YK—Connected, Option YL—Disconnected)

3.15 The factory-installed signal ground option (option YK) internally connects signal ground to frame ground. This may be removed (option YL) on customer request subject to local noise conditions, ground potentials, and local safety regulations.

G. Fixed Line Build-Out Option (Option WV—Installed, Option WW—Removed)

3.16 The CSU is provided with an FLBO network (option WV) which must be switched into or out of the circuit by the telephone company (telco) employee on initial installation of the CSU. If the ALBO network cannot compensate for local loop loss, the FLBO network must be switched into the circuit to provide additional attenuation. Installation or removal of this option will be specified on the circuit layout record card by the circuit design engineer.

4. REFERENCES

4.01 Documents listed in this section contain information pertaining to the 550A-type CSU.

4.02 The following Bell System Practices are listed for reference.

SECTION	TITLE
314-410-310	Digital Data System—Private Line Local Channel—Trouble Analysis
314-410-510	Digital Data System—Private Line Local Channel—Tests and Requirements
314-900-100	Digital Data System—Private Line Service—Overall Description
314-900-300	Digital Data System—Private Line Service—Overall Maintenance

SECTION	TITLE
314-901-300	Digital Data System—Serving Test Center—Private Line Circuit—Maintenance Procedures
590-102-139	48A1 Data Mounting—Identification
595-100-150	Digital Data System—550A-Type Channel Service Unit—Test Access Arrangement
595-100-180	Digital Data System—550A-Type Channel Service Unit (CSU)—Summarizing Specification
595-100-200	Digital Data System—550A-Type Channel Service Unit—Installation and Connections
595-100-300	Digital Data System—550A-Type Channel Service Unit—Maintenance
595-100-500	Digital Data System—550A-Type Channel Service Unit Test Procedures
880-601-115	Digital Data System—Local Loops—Engineering Guidelines

4.03 The following technical reference contains descriptive information pertinent to the DDS.

PUB. 41021	Digital Data System—Description and Channel Interface Specifications

4.04 Additional detailed information pertaining to the 550A-type CSU is contained in CD- and SD-1D234-01.

DIGITAL DATA SYSTEM
550A-TYPE CHANNEL SERVICE UNIT
INSTALLATION AND CONNECTIONS

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B. Option Installation Procedures . . 3
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A. Single Installation 3
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1. GENERAL

1.01 This section contains instructions for installing and connecting a 550A-type channel service unit (CSU). Installation methods for the associated customer-provided equipment (CPE) are not included.

1.02 This section is reissued to include information concerning the replacement of option switch S1 on receiving circuit pack HR5, 6, 7, or 8 with a right angle header. Also included is information concerning the fixed line build-out option (FLBO). Revision arrows are included to emphasize the more significant changes.

1.03 The 550A-type CSU is designed to be operated in an ambient temperature range from 40 to +120°F, with a relative humidity of less than 95 percent.

1.04 The 96A power unit, which is contained inside the CSU, supplies operating voltages to the circuitry in the CSU. An input of 105 to 129 Vac at a frequency of 57 to 63 Hz is required by the CSU. It also requires approximately 10 watts of ac power. Each CSU is supplied with a 3-foot power cord for connection to the customer-provided ac source.

1.05 A small screwdriver is supplied with the CSU to install the options before installation.

2. OPTION INSTALLATIONS

A. General

2.01 The 550A-type CSU (see Fig. 1) is provided with a signal-to-ground option and a FLBO network option which must be installed or removed prior to placing the CSU in service. Options to be installed or removed should be specified on the service order or circuit layout record card (CLRC).

2.02 ▶The FLBO option setting was initially made using a KS-20983-L2 switch. However, this switch is no longer available. Therefore, the option switch (S1) will be a right angle header on new receiving circuit packs manufactured after 1978. The designation of switch S1 is changed to H1. The designation of switch S2 (which controls the grounding option) is changed to S1.◀

2.03 Installation of the FLBO network option becomes necessary if the local loop loss is less than can be compensated for by the automatic line build-out (ALBO) network. ▶The FLBO option will be designated OUT or removed when the loop expected measured loss (EML) is 10 dB or more and designated IN or installed when the loop EML is less than 10 dB. The FLBO option must be IN when the actual measured loss (AML) is less than 5 dB and OUT when the AML is greater than 15 dB. When the AML falls between 5 dB and 15 dB, apply the option as shown on the CLRC. The

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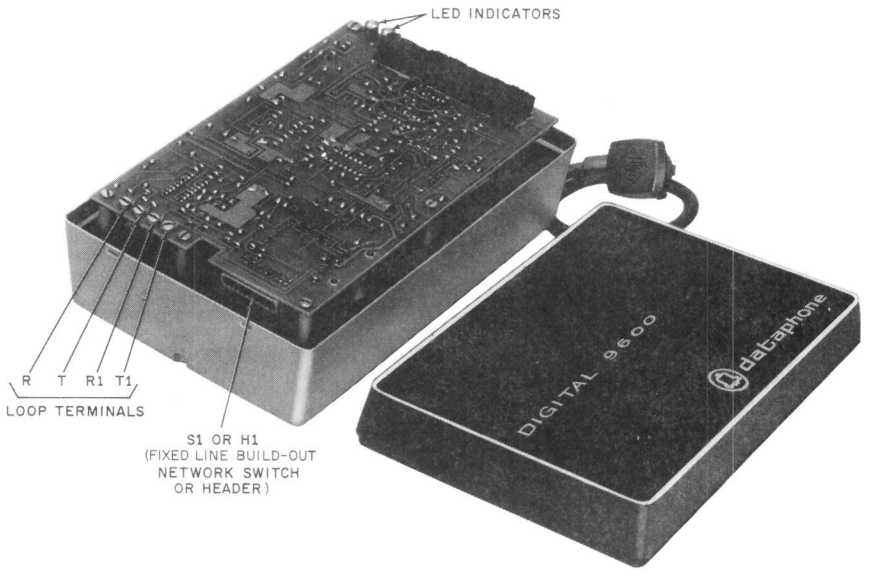


Fig. 1—550A-Type CSU—Cover Removed

transmission engineer or design group must be notified when any switch setting or header position deviates from the CLRC.◀ The signal-to-ground option is installed to connect signal ground to frame ground. For additional information concerning the CSU options, refer to Section 595-100-100, Digital Data System—500A-Type Channel Service Unit—Description.

2.04 ▶The earlier manufactured receiving circuit pack (HR5, 6, 7, 8, depending on list code of the CSU) contains a KS-20983-L2 switch (S1) for installing or removing the FLBO network option and a screw switch (S2) which controls the grounding option.◀

2.05 Figure 2 shows the three sections or rollers: A, B, and C of switch S1. To access the switch rollers, the hinged protective cover must first be opened by pulling it from the end marked with a dot. Each switch roller is individually adjusted to one of two positions by using the provided screwdriver to ***gently*** rotate the adjustable roller. Switch positions are numbered as shown on protective cover.



The final position of the roller must be such that it butts up against the spacer; the screwdriver slot is parallel with the spacer.

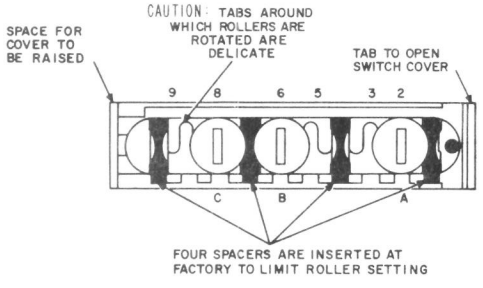


Fig. 2—Detail of Switch for Installing Options

2.06 ▶For the newer manufactured receiving circuit pack (HR5, 6, 7, or 8, depending on the list code of the CSU) a header (H1) for installation or removing the FLBO network option and a screw

switch (S1) which controls the grounding option is used.◀

2.07 Figure 3 shows header H1 which has ten positions with the tenth position used as a spare. To install options, the shunts are slipped over the two pins which make up one position. Four shunts are provided with the header. One shunt is the spare and is stored in position 10.

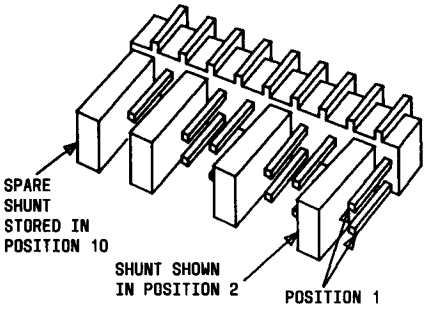


Fig. 3—▶Detail of Header for Installing Options◀

B. Option Installation Procedures

2.08 The CSU cover must be removed in order to gain access to the switches (or header and switch) for installing or removing the FLBO network option and the signal-to-ground option. Remove the cover of the CSU by inserting a small tip screwdriver, such as a KS-6854, under the cover at the connector end and gently lifting up. This will flex the basepan, releasing the holding tabs. To replace the cover, hook the tabs on one side of the cover into the basepan and snap the cover into position.

2.09 ▶When the older receiving circuit pack is used, install the ground and FLBO options per the service order or CLRC in accordance with Fig. 4. When the newer receiving circuit pack is used, install the ground and FLBO options per the service order or CLRC in accordance with Fig. 5 and Table A.◀

3. INSTALLATION AND CONNECTION PROCEDURES

3.01 Prior to CSU installation, the local cable pairs must pass the tests given in Section 314-410-510, Digital Data System—Private Line Local Channel—Tests and Requirements.



Verify that the cable pair terminating resistors used in the above tests are removed prior to DSU installation.

A. Single Installation

3.02 The 550A-type CSU is intended for wall mounting in accordance with local procedures. The CSU should be installed between 1 and 100 feet from the CPE. The CSU should not be installed closer than 1 foot from the CPE to avoid stray fields radiated from electromechanical equipment.

3.03 In CSU installations where access to the customer interface connector will be restricted, the CSU can be mounted with the interface connector and power cord on either the right or left of the CSU. After mounting, the cover is replaced so the lettering is right side up.

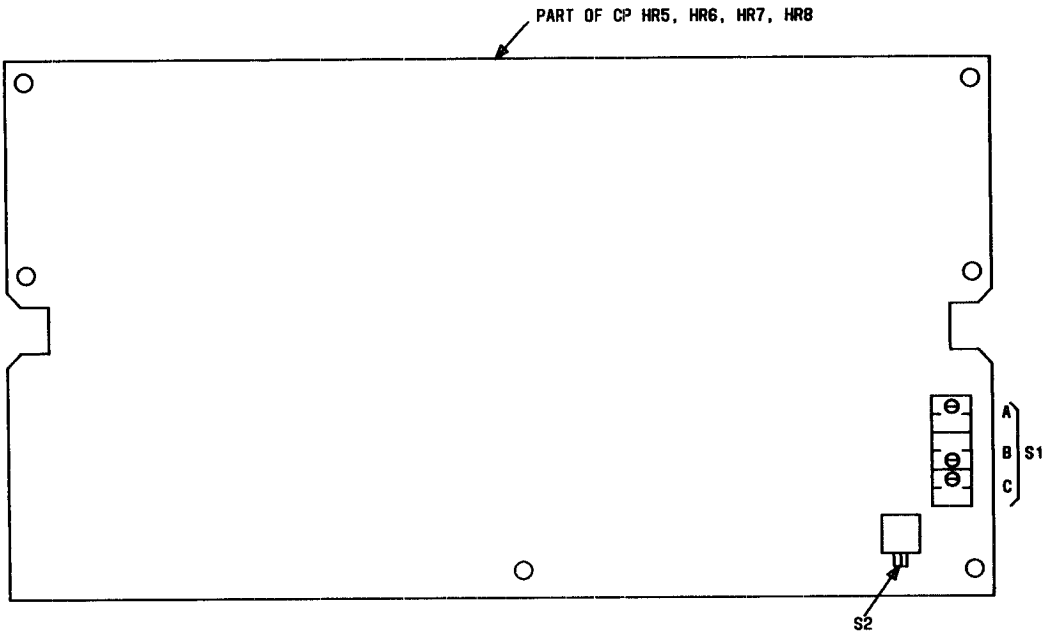
3.04 The CSU must be located within 3 feet of a customer-provided ac outlet that is not under control of a switch. The power cord supplied with the CSU requires an ac outlet which accepts a plug with two parallel blades and a round grounding pin.

3.05 A 15-pin connector is provided by the CSU for connection to the CPE. This connector is designed to mate with a customer-provided Cinch-Dama-15-P plug, or equivalent.

3.06 To minimize inductive interference to data signals on the local loop, the local loop cable should not be installed within 6 inches of the customer interface cable. If this condition cannot be met, it will be necessary to run the line to the local loop with type-SK (shielded) wire as far as it is carried (within 6 inches of the interface cable). Ground the shield at one end only, preferably at the distribution terminal to prevent a potential difference between the ends of the cable shield.

3.07 To install a CSU, proceed as follows:

(1) Install the ground and FLBO network options in accordance with the service order or CLRC and Part 2 of this section.



CSU OPTION SWITCH POSITIONS			
SWITCH	SWITCH POSITION	FEATURE	OPTION
S1A	3	FIXED LINE BUILD-OUT NETWORK INSTALLED	WV
S1B	5		
S1C	9		
S1A	2	FIXED LINE BUILD-OUT NETWORK REMOVED	WW
S1B	6		
S1C	8		
S2	IN	SIGNAL GROUND CONNECTED TO FRAME GROUND	YK
	OUT	SIGNAL GROUND DISCONNECTED FROM FRAME GROUND	YL

Fig. 4—CSU Options and Switch Positions

(2) Use two appropriate screws and mount the CSU in the selected position on the wall or other semipermanent flat surface.

(3) Run the necessary length of TELCO-provided, 4-conductor drop wire to interconnect the CSU with the cable distribution terminals. Route the drop wire through the small hole located below the loop terminals of the CSU. The transmit pair (T1 and R1) and the receive pair (T and R) are located as shown in Fig. 6.

B. Multiple Installation

3.08 For multiple installations requiring up to ten CSUs, a 48A-L1/3 data mounting may be mounted in a KS-20018-L12A cabinet or standard 23-inch framework. When 11 to 20 CSUs are

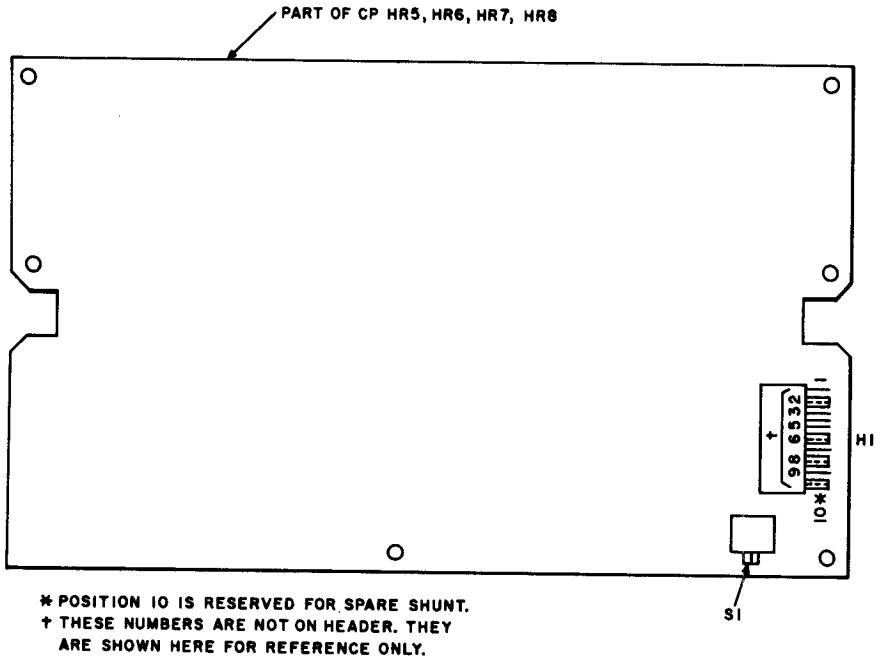


Fig. 5—CSU Options and Switch-Header Positions

required, two 48A-L1/3 data mountings may be installed in a KS-20018-L11A cabinet or standard 23-inch framework. (See Section 590-102-139 for a detailed description of the 48A data mounting.)

3.09 The 550A CSU must be adapted for mounting in the 48A-L1/3 data mounting. The L1/3 code provides a mounting plate which is required for mounting two CSUs in the data mounting (Fig. 7). If more than two CSUs are to be mounted, additional plates (one per two CSUs) must be ordered. The mounting procedure is as follows:

(1) Remove the black plastic cover.

(2) Secure the CSU to the mounting plate (supplied as part of L1/3 data mount) by utilizing two mounting holes in lower CSU case. (Each mounting plate accommodates two CSUs.)

(3) Dress the power cord around the CSU and plug it into the outlet on the CSU mounting plate.

(4) Connect the TELCO-provided, 4-conductor wire to T, R, T1, and R1 terminals on the CSU and allow sufficient length to connect the other end to the terminal strip on the data mounting after the CSU is in place.

(5) Insert the CSU into the rear of the data mounting by sliding the mounting plate into the slots in the upper and lower strips (Fig. 8).

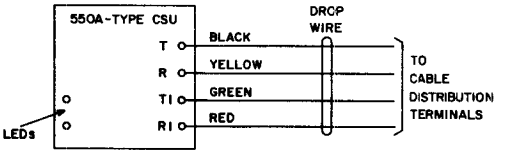
(6) Secure the CSU by moving the lock strip to its leftmost position and tightening the lock-strip screw.

(7) Connect the four tip and ring leads to the terminal strip located on the casting at each of the mounting positions. The upper CSUs connect to the upper terminal strips (TS-F, TS-G, TS-H, TS-J, TS-K) while the lower CSUs connect to the lower terminal strips (TS-A through TS-E) as shown in Fig. 9. [Terminal strips are wired to KS-16786-14 (50-pin) connector mounted on the right side of the data mounting.]

TABLE A

CSU OPTION POSITIONS

		OPTION	FEATURE	POSITION
HR CP CIRCUIT OPTIONS	HEADER H1	WV	Fixed line build-out network installed	3
				5
				9
		WW	Fixed line build-out network removed	2
				6
				8
	SWITCH S1	YK	Signal ground connected to frame ground	IN
		YL	Signal ground dis-connected from frame ground	OUT



NOTE:
EARLIER INSTALLATIONS MAY HAVE USED NON-CONVENTION WIRE COLOR CODES AS FOLLOWS: TI - BLACK; RI - YELLOW; T - GREEN; R - RED. WHEN SETS ARE EXCHANGED FOR ANY REASON, THE STANDARD CONVENTION WIRE COLOR CODES AS SHOWN ABOVE SHOULD BE USED AND NECESSARY CORRECTIONS SHOULD BE MADE AT THE CABLE DISTRIBUTION TERMINALS.

Fig. 6—550A-Type CSU Connection Diagram

(8) Attach the customer interface connector to the CSU (accessible through the cutouts in the front of the data mounting) and use adjacent cable ties to dress excess cable.

(9) Attach the multiple plug power cord (part of the 48A-L1/3) to each CSU power supply connector located on the front of each mounting plate as shown in Fig. 10.

4. TEST REQUIREMENTS

4.01 Perform the following installation tests in the order given and as instructed in Section 595-100-500, Digital Data System—550A-Type Channel Service Unit—Test Procedures:

- CSU functional test
- CHAN loopback error performance test.

4.02 Complete the factory-supplied identification label which is located on the inside of the plastic cover of each CSU.

4.03 When the CSUs are multiple mounted, the circuit number (CKT NO) and trouble number (TBL NO) for each CSU is written on the label attached to the front of the 48A-L1/3 mounting as shown in Fig. 10. The list number (LIST NO) for each CSU may be added to the label if desired.

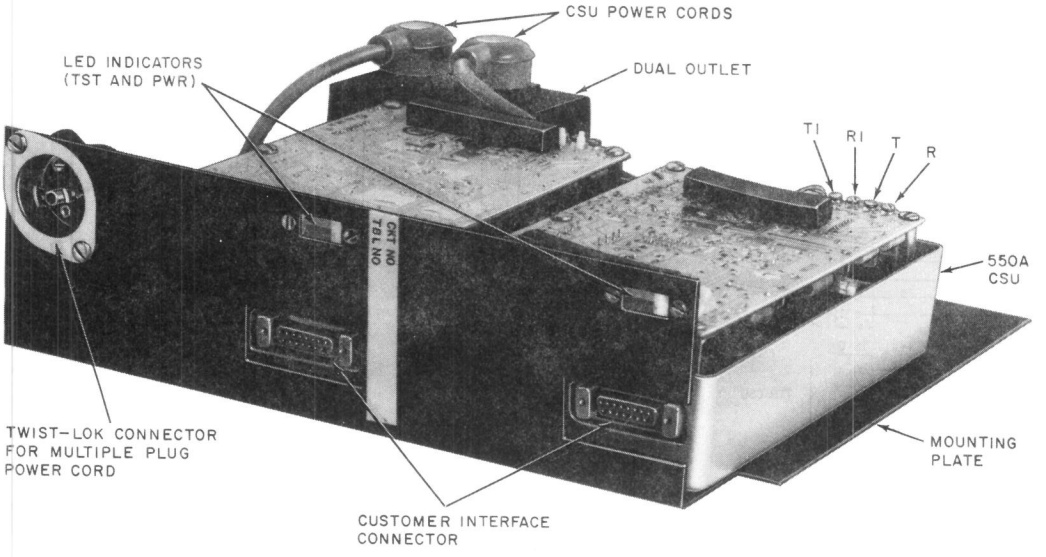


Fig. 7—Mounting Plate With Two CSUs

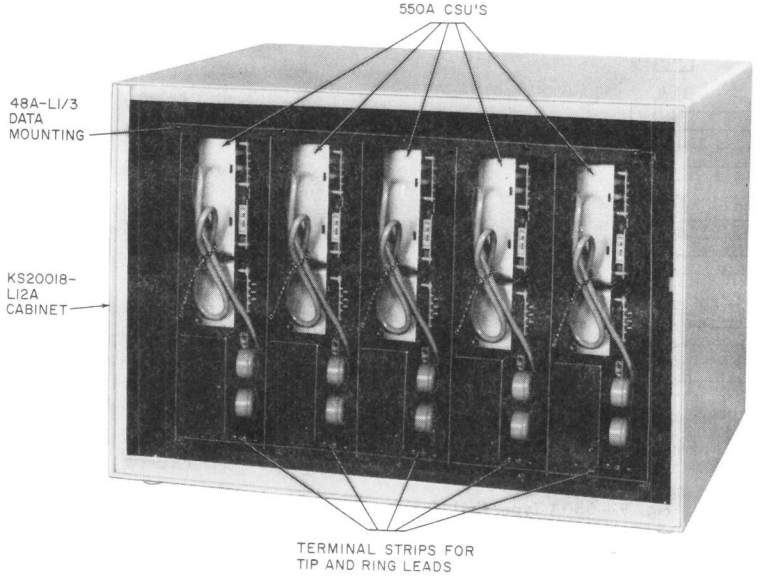
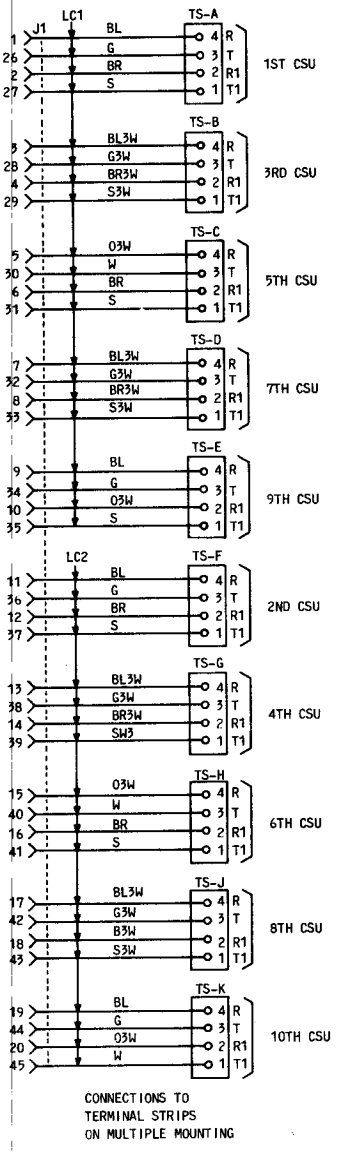
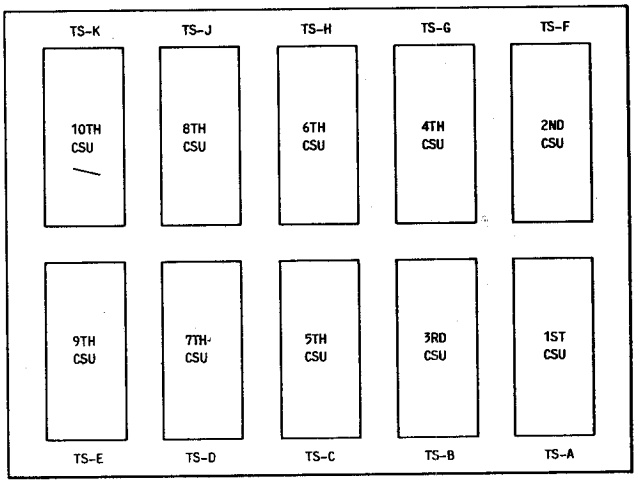


Fig. 8—Rear View—Multiple Mounting of CSU





REAR VIEW - MULTIPLE MOUNTING OF CSU

Fig. 9—550A-Type CSU Connection Diagram for Multiple Mounting

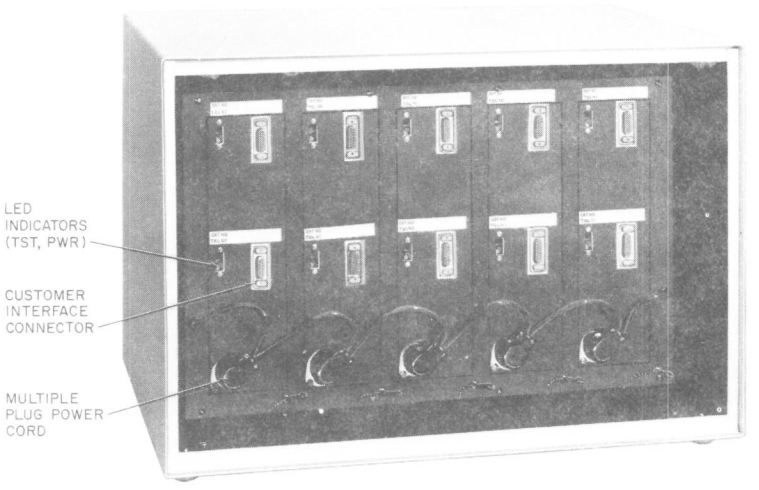


Fig. 10—Front View—KS-20018-L12A Cabinet

DIGITAL DATA SYSTEM

550A-TYPE CHANNEL SERVICE UNIT

TEST PROCEDURES

1. GENERAL

1.001 This addendum supplements Section 595-100-500, Issue 4. Place this pink sheet ahead of Page 1 of the section.

1.002 This addendum is issued to add a caution note to prevent possible equipment damage when tests are made on the customer cable pairs.

2. CHANGES TO SECTION

2.001 On page 1, after paragraph 1.04, add the following caution:

Caution: A dc loop current in excess of 250 mA may damage the DSU/CSU at the station end. Do not use test equipment that applies a current greater than 250 mA to the cable pairs, unless the OCU has been removed and the DSU/CSU has been disconnected from the pairs. In addition, a dc voltage in excess of 50 volts applied to repeatered loops can cause damage to the repeater. Do not use test equipment that applies a voltage greater than 50 volts to the cable pair on repeatered loops.

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DIGITAL DATA SYSTEM

550A-TYPE CHANNEL SERVICE UNIT

TEST PROCEDURES

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1. GENERAL 1

2. APPARATUS 2

3. TEST PROCEDURES 2

A. CSU Functional Test Using 914A DTS 2

B. CSU Functional Test Using 921A DTS 5

C. CSU Straightaway Test Using 921A DTS 8

1. GENERAL

1.01 This section contains the procedures to be used when testing the 550A-type channel service unit (CSU). Procedures for investigating a trouble condition are given in Section 595-100-300, entitled Digital Data System—Channel Service Unit—Maintenance.

1.02 This section is reissued to provide information on version 2 of the 921A data test set (DTS) and additional information on the test requirements. Since this is a general revision, arrows ordinarily used to denote changes have been omitted.

1.03 The tests covered in this section are listed and defined as follows.

- ***CSU Functional Test:*** This test verifies operation of the CSU power supply, while a partial test of customer interface leads is also accomplished.

- ***CSU Straightaway Test:*** The purpose of this test is to evaluate the performance of the digital data system (DDS) channel through an error performance run. A maximum of 3-bit errors counted at the serving test center (STC) and 3-bit errors counted at the station during a 15-minute interval is permitted for the DDS channel to be acceptable. This test also verifies operation of the CSU by measuring the isochronous distortion present at the CSU interface.

1.04 The tests given in this section are to be performed in the order given for installation testing. For maintenance testing, the tests may be performed individually or in any combination. The tests are designed to verify that the 550A-type CSU has been properly installed and is operative with the DDS. For maintenance purposes, the tests will isolate equipment malfunctions and evaluate the overall performance of the CSU. Each test procedure given in this section requires voice coordination with the STC.

1.05 Upon failure of any one test, the maintenance philosophy for the CSU is immediate replacement with a known operable CSU of the same speed and equipped with the same options. Therefore, no remedial action is given in the test procedures to follow. If the replacement CSU fails any one of the tests, the cable pairs or associated central office transmission equipment may be the trouble source and must be analyzed as specified in Section 314-410-310, entitled Digital Data System—Local Loop—Maintenance Procedures.



Customer permission should be obtained to ensure that the data channel is idle prior to conducting any test given in this section.

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2. APPARATUS

2.01 The apparatus required to perform the CSU functional test (Test A) is as follows:

- 914C DTS (J79914C-L1)

and

- Auxiliary cabling supplied with the DTS must include a short adapter cord (ED-73578)

and

- VOM (KS-16979-L1), or equivalent, meter with frequency response good to 28 kHz

or

- 921A DTS (J79921A).

2.02 A 921A DTS is the only test equipment required at the customer location to perform the CSU straightaway test.

3. TEST PROCEDURES

3.01 The test procedures presented in this part should be performed after the CSU has been installed to ensure that the installation is ready to be placed in service. In addition, the telephone company (telco) employee should, if possible, assure that data can be transmitted and received between the local and remote customer terminals.

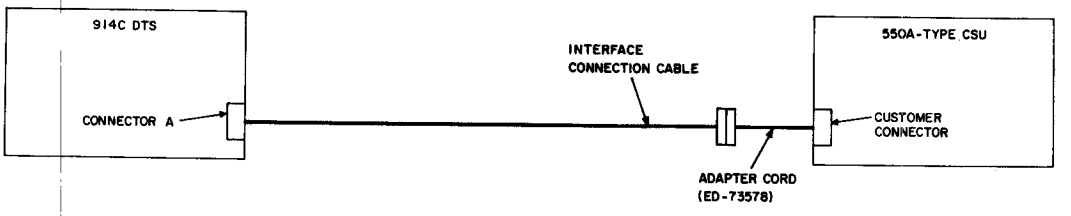


Take appropriate action as given in Section 010-250-001, entitled Crediting Charges on Test Calls, to ensure that the customer is not billed for test calls. Before starting either test, establish voice communication with the STC and verify that the DSU under test is the correct list code and that customer options specified on the circuit layout record card (CLRC) are installed in the DSU.

A. CSU Functional Test Using 914A DTS

3.02 The following procedure provides information on testing a CSU using a 914 Data Test Set.

STEP	ACTION	VERIFICATION
1	Construct an adapter cable by attaching the interface connection cable supplied with the DTS to the short adapter cord (ED-73578), also provided with the DTS.	
2	Connect adapter cord end of adapter cable to the customer interface connector on the CSU, and the other end to connector A on the DTS.	
3	Insert the DTS power plug into a 117-volt 60-Hz ac outlet.	
4	Program the DTS with seven matrix pins and position the switches in accordance with Fig. 1.	
5	Press the DTS POWER switch.	POWER indicator is lighted.
6	Ensure that the CSU is supplied with a source of 117-volt 60-Hz ac power.	At the CSU— PWR indicator is lighted. At the DTS— DS1 indicator is lighted.



914C DTS MATRIX PROGRAM

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	STG	
GRD	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	GRD
SD	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	SD
RD	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	RD
SI	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	SI
DSI	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DSI
DS2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS2
S2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S2
DS3	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS3
TPI	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	TPI
TP2	○	○	●	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	TP2
S3	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S3
DS4	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS4
DS5	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS5
S4	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S4
SCT	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	SCT
S5	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S5
SCR	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	SCR
DS6	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS6
S6	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S6
DS7	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS7
DS8	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS8
S7	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S7
TP3	○	○	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	TP3
S8	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S8
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	STG	

914C DTS SWITCH SETTINGS
(ALL OTHER SWITCHES NOT USED)

SWITCH	SETTING
INTERFACE MODE	VOLTAGE
OUTPUT (TP3)	OFF
TEST SET MODE	SER
COUNTER	BIT ERRORS
RCV BIT RATE	EXT +
ALL INTERFACE SELECTOR SWITCHES	DEPRESSED
TRANSMIT BIT RATE	EXT +

INDICATOR LIGHT DESIGNATIONS

DSI	STATUS INDICATOR

Fig. 1—914C DTS Testing Configuration

STEP	ACTION	VERIFICATION
7	Place the VOM function switch in the DCV 30 position.	
8	Place the VOM polarity reversing switching the + (positive) position.	
9	Connect + test lead and - test lead of VOM to TP1 and GRD, respectively, on DTS.	VOM indicates between 5 and 8 Vdc.
10	Remove matrix pin connecting DS1 and connector pin 2.	VOM indicates between 7 and 9 Vdc.
11	Disconnect the + test lead of the VOM from TP1.	
12	Place the VOM polarity reversing switch in the - (negative) position.	
13	Request the STC to transmit a repeated CHAN loopback control code and to compare the received data to the transmitted data.	TST indicator on CSU is lighted. DS1 lamp on DTS is off.
14	Reconnect the + test lead of the VOM to TP1 on the DTS.	VOM indicates between -7 and -9 Vdc.
15	Reinsert DTS matrix pin connecting DS1 and connector pin 2.	VOM indicates between -5 and -8 Vdc.
16	Disconnect the VOM test leads.	
17	Place the VOM function switch in the ACV 15 position.	
18	Connect the VOM test leads across TP2 and TP3 of the DTS.	VOM indicates zero Vac.
19	Request the STC to transmit all "1s" data.	VOM indicates between 1 and 2 Vac. TST indicator on CSU is off. DS1 indicator on DTS is lighted.
20	Request the STC to transmit the office channel unit (OCU) loopback code.	VOM indicates zero Vac.
21	Request the STC to transmit a repeated zero suppression code (00000001).	
22	Request the STC to transmit repeated idle control code.	STC receives repeated idle control code.
23	Remove DTS adapter from customer interface connector on CSU.	

STEP	ACTION	VERIFICATION
24	If no further test are to be performed, reconnect the CSU to the CPE.	

3.03 Perform the following steps to make a functional test of the CSU using a 921A Data Test Set.

B. CSU Functional Test Using 921A DTS

STEP	ACTION	VERIFICATION
1	Connect the DTS to the customer interface connector on the CSU using the interface cords provided with the DTS. ***Note:*** The interface cord is equipped with a 37-pin connector on each end. A 6-inch adapter cord matches the interface cord to the 15-pin interface connector on the CSU.	
2	Verify that all 37 DCE-interface selector switches (white bow-tie) on the front of the DTS are in the TERM position.	
3	Insert the 921A DTS power cord plug into a 117-volt 60-Hz ac outlet.	
4	Remove the 550 CSU interface card from the storage area in the DTS and ensure that all interface lead switches are in the TERM position.	
5	Insert the interface card into the slot on the right side of the DTS and close the latch.	
6	Operate the POWER switch on the 921A DTS to ON.	POWER ON indicator is lighted.
7	Press RST key on the DTS.	Display indicates— 921A VERS #01 (or higher) then indicates DATA SET: if the DTS is not defective. If the DTS is defective, TEST FAILED appears on the display.
8	Select the 550A CSU by entering 50 on the DTS input keyboard. ***Note:*** To delete a wrong entry on the input keyboard, press the backspace arrow.	Display indicates— DATA SET: 50.

STEP	ACTION	VERIFICATION
9	Press GO key.	Display indicates— BIT RATE:
10	Select the CSU service rate by entering one of the following on the DTS input keyboard: • 24 for 2.4-kb/s service • 48 for 4.8-kb/s service • 96 for 9.6-kb/s service • 56 for 56-kb/s service.	Display indicates— BIT RATE: followed by either 24, 48, 96 or 56.
11	Press GO key. ***Note:*** If GO or TST key is pressed at an unauthorized point in a test, the test is terminated and the DTS recycles to this step.	Display indicates— TEST SEQ:
12	Ensure that the CSU is supplied with a source of 117-volt 60-Hz ac power.	PWR indicator on CSU lighted.
13	Request the STC to transmit a repeated CHAN loopback control code and to compare the received data to the transmitted data.	Interface indicator DSR is off TST indicator on CSU is lighted.
14	Request the STC to transmit a repeated zero suppression code (00000001) for this part of the test.	
15	Select DDS zero suppression code by entering 62 on the DTS.	Display indicates— TEST SEQ: 62.
16	Press GO key.	Display indicates—ZERO: May briefly show ENTERED=00 DROPPED=00. The DTS displays the number of times the zero suppression code in entered and dropped. ***Requirement:*** The final display shows the number for ENTERED is one more than the number indicated as DROPPED STC receives zero data.
17	Request the STC to transmit repeated idle control code.	

STEP	ACTION	VERIFICATION
18	Press GO key.	Display briefly indicates—TEST INTERRUPTED then indicates TEST SEQ:
19	Select DDS idle control code by entering 63 on the DTS.	Display indicates— TEST SEQ: 63.
20	Press GO key.	Display indicates— IDLE: May briefly show ENTERED=00 DROPPED=00. The DTS displays the number of times the idle control code is entered and dropped. ***Requirement:*** The final display shows the number for entered is one more than the number indicated as DROPPED. STC receives idle control code.
21	Press GO key.	Display indicates—TEST INTERRUPTED then indicates TEST SEQ:
22	Request the STC to transmit out-of-sync code (mux out-of-sync).	
23	Select DDS out-of-sync code by entering 64 on the DTS.	Display indicates— TEST SEQ: 64.
24	Press GO key.	Display indicates— OOS: May briefly show ENTERED=00 DROPPED=00. The DTS displays the number of times the out-of-sync code is entered and dropped. ***Requirement:*** The final display shows the number for ENTERED is one more than the number indicated as dropped.
25	Press GO key.	Display indicates—TEST INTERRUPTED then indicates TEST SEQ:
26	Select DDS NOT READY (CSA) control code by entering 65 on the DTS.	Display indicates— TEST SEQ: 65.
27	Press GO key.	Display indicates— SENDING CSA. STC receives NOT READY control code (01111010). ***Note:*** Since the NOT READY control code is used only in SDDS, if the channel being tested is a private line channel using an HL1,

STEP	ACTION	VERIFICATION
		HL2, HL3, or HL3 OCU CP, the STC will not receive the NOT READY control code (01111010).
28	If no additional tests are to be made place the DTS POWER switch in the OFF position.	POWER ON indicator on DTS is off.
29	Remove DTS adapter cable from customer interface connector on the CSU.	
30	If no further tests are to be performed, reconnect the CSU to the CPE.	
31	Remove the 550 CSU interface board from the DTS and place in the proper storage area.	

3.04 Perform the following steps to make a straightaway test of the CSU using a 921A Data List Set.

C. CSU Straightaway Test Using 921A DTS

STEP	ACTION	VERIFICATION
1	Connect the DTS to the customer interface connector on the CSU using the interface cords provided with the DTS. ***Note:*** The interface cord is equipped with a 37-pin connector on each end. A 6-inch adapter cord matches the interface cord to the 15-pin interface connector on the CSU.	
2	Verify that all 37 DCE-interface selector switches (white bow-tie) on the front of the DTS are in the TERM position.	
3	Insert the 921A DTS power cord plug into a 117-volt 60-Hz ac outlet.	
4	Remove the 550 CSU interface card from the storage area in the DTS and ensure that all interface lead switches are in the TERM position.	
5	Insert the interface card into the slot on the right side of the DTS and close the latch.	
6	Operate the POWER switch on the 921A DTS to ON.	POWER ON indicator is lighted.
7	Press RST key on the DTS.	Display indicates— 921A VERS #01 (or higher) briefly, then

STEP	ACTION	VERIFICATION
		indicates DATA SET: if the DTS is not defective. If the DTS is defective, TEST FAILED appears on the display.
8	Select the 550A CSU by entering 50 on the DTS input keyboard. ***Note:*** To delete a wrong entry on the input keyboard, press the backspace arrow.	Display indicates— DATA SET: 50.
9	Press GO key.	Display indicates— BIT RATE:
10	Select the CSU service rate by entering one of the following on the DTS input keyboard: ● 24 for 2.4-kb/s service ● 48 for 4.8-kb/s service ● 96 for 9.6-kb/s service ● 56 for 56-kb/s service.	Display indicates— BIT RATE: followed by either 24, 48, 96 or 56.
11	Press GO key. ***Note:*** If GO or TST key is pressed at an unauthorized point in a test, the test is terminated and the DTS recycles to this step.	Display indicates— TEST SEQ:
12	Request the STC to transmit 2047-bit word.	
13	Select error test (DOT, SPACE, MARK, and PSEUDORANDOM WORD) by entering 55 on the DTS.	Display indicates— TEST SEQ: 55.
14	Press GO key.	Subrate CSU— Display indicates— SELECT ERROR TEST, briefly, then D=DT 0=SP 1=MK 2=2047 5=511 6=63 is displayed. 56-kb/s CSU— Display indicates— SELECT ERROR TEST, briefly, then D=DT 0=SP 1=MK 2=2047 is displayed.
15	Press key number 2.	Display indicates— 1 = BIT ERRORS 2 = BLOCK ERRORS.

STEP	ACTION	VERIFICATION
16	Press key number 1.	Display indicates— ???? SECONDS.
17	Select 15 minutes by entering 0900 on the DTS.	Display indicates— 0900 SECONDS, briefly, then 0000 BITS in ERROR is displayed. From this point, the DTS counts the number of errors received. At the end of the test, the display indicates TEST COMPLETE, then total SYNC LOSSES, and then the total BITS IN ERROR, repeatedly. ***Requirement:*** Maximum number of errors is three counted by the 921A DTS and three counted by the STC KS-20908 DTS.

KEY	FUNCTION
A	Restart test
B	Display time remaining in test
C	Clear display
D	End test
E	Insert errors into the data stream
F	Force out-of-sync

Note 1: If sync is lost during test, right portion of display flashes OSYN. If this occurs, test must be restarted by pressing key ***A.***

Note 2: To perform the following functions, press associated key.

18	If more than three errors are counted on either counter— Repeat the test by pressing the ***A*** key on the DTS, requesting the STC to reset error counter and timing another 900-second interval.	Same as Step 17.
19	If more than three errors are counted within the first 5 minutes of the second attempt— Wait 5 minutes. Then repeat the test by pressing the ***A*** key on the DTS, requesting the STC to reset error counter and timing another 900-second interval.	Same as Step 17.

STEP	ACTION	VERIFICATION
	Note: An extraordinary condition, such as a severe electrical storm or an intermittent failure of customer-supplied ac power, may affect the performance of the DDS channel. The straightaway test cannot properly be performed until these conditions have cleared.	
20	If three attempts fail to achieve the 900-second requirement, the channel must be rejected as unsuitable for customer service. Refer to Section 595-100-300 for appropriate action.	
21	Press TST key on DTS to stop repetition of display.	Display indicates— TEST SEQ:
22	Select isochronous distortion test by entering 78 on the DTS.	Display indicates— TEST SEQ: 78.
23	Press GO key. ***Note 1:*** The interval between measurements or display updates may be as long as 20 seconds. To indicate that the test is in progress, assignable LED 1 will flash. ***Note 2:*** An * may appear as the first character in the message. This is a result of receiving, during one measurement interval, 25 or more pulses classified by the DTS as invalid and discarded from the measurement. EXCESS DP will be displayed if the number of invalid pulses equals or exceeds 1000.	Display indicates— ISO DIS LE= % PULSES= %. When enough data is gathered for the first measurement, the blanks will be filled and LE (leading edge) may change to TE (trailing edge). ***Requirement:*** The ISO DIS reading should not be greater than 28%.
24	Request the STC to perform a 15-minute CHAN loopback error run. The number of errors counted by the STC should be recorded on the circuit layout record card (CLRC) as a benchmark for future use.	
25	Place the DTS POWER switch in the OFF position.	POWER ON indicator on DTS is off.
26	Remove DTS adapter cable from customer interface connector on the CSU.	
27	If no further tests are to be performed, reconnect the CSU to the CPE.	
28	Remove the 550 CSU interface board from the DTS and place in the proper storage area.	

551A-TYPE CHANNEL SERVICE UNIT

DESCRIPTION

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1. GENERAL 1
2. PHYSICAL DESCRIPTION 2
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4. OPTIONS 5
5. REFERENCES 5

1. GENERAL

1.01 This section contains a physical and functional description of a 551A-type channel service unit (CSU) and auxiliary circuitry. This section does not contain a description of customer provided equipment (CPE) used with the CSU.

1.02 Whenever this section is reissued, the reason(s) for reissue will be given in this paragraph. The contents of this section were formerly contained in Section 595-105-100.

1.03 The CSU, Fig. 1, is located on customer premises and provides the customer with a transmit and receive pair using the standard T1 bipolar signal format. The customer's data signal must satisfy the pulse density and zero sequence constraints dictated by the T1 facilities. Circuitry is provided to monitor the customer's data input and, if necessary, add pulses (all 1s) to meet the requirements of the T1 facilities.

1.04 The CSU provides the following features:

- Bipolar return-to-zero balanced to ground zero dc component interface between the CPE equipment and the 1.544-Mb/s digital line
- Monitors the input data and, when necessary, adds pulses (ones)
- Removes bipolar violations
- Regeneration of the transmitted data and termination of the T1 line or T1 repeatered loop
- A fault locating jack to aid in testing repeaters on the T1 line
- An order wire jack for communication with the T1 test bay
- Jacks for manually looping the CSU and aiding in maintenance testing
- Dc activated remote loopback relay.

1.05 The 551A-type CSU consists of a chassis, a 4019DA or 4019DL signal monitor, a 206- or 236-type T1 office repeater, a 598-type fault locating filter (optional), and a remote loopback relay. The CSU also contains jacks for use during testing of the signal monitor or office repeater.

1.06 The 4019DA or 4019DL signal monitor receives the signal from the CPE, monitors the pulse density of the data stream, and provides visual indications when the number of pulses (ones) in the data stream falls below the T1 line requirements.

1.07 The 206- or 236-type repeater interfaces with the T1 line and provides regeneration of received data. The 598-type fault locating filter is necessary if the repeater is to be tested remotely from a T1 test bay.

1.08 The remote test relay is used to loop the transmit and receive leads at the customer interface, so that the line can be tested remotely from a T1 test bay.

1.09 The CSU is normally line powered from the central office (CO). For cases where the line is too long to be powered from the CO, provision is made

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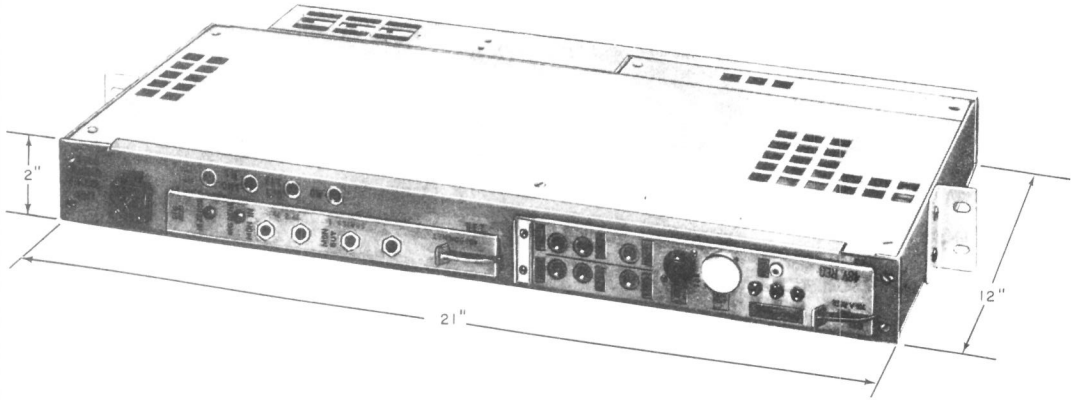


Fig. 1—551A Channel Service Unit—Front View

to power the CSU and a portion of the T1 line from the customer end using locally provided power supplies.

1.10 The CSU is intended to be installed on a 23-inch relay rack or in a KS-20018-type cabinet. The rear cover of the CSU must be removed in order to gain access to the strapping, power, and line terminals on the rear of the CSU.

2. PHYSICAL DESCRIPTION

2.01 This part contains a physical description of a 551A-type CSU and items that comprise a CSU.

2.02 A 551A-type CSU consists of an aluminum chassis, including top and rear cover, that houses two plug-in circuit modules, a remote test relay, a fault locating filter (optional), and miscellaneous circuitry (Fig. 2).

2.03 The CSU weighs approximately 7-1/2 pounds and has external dimensions of approximately 2 inches high, 21 inches wide, and 12 inches deep.

2.04 The CSU is designed to operate over a temperature range of +40 to +120°F with a relative humidity of less than 95 percent.

2.05 The front of the CSU chassis contains a fuse holder (−48V) and four 239AM-type jacks (SM IN, SM OUT, FLT LOC, and OW). Four pin jacks (MON IN and MON OUT) are equipped on the 4019DL. The fuse holder contains a 70G (1/2 amp) fuse that is used when the CSU and T1 line is powered by a −48V power supply from the CSU end. The SM IN and SM OUT jacks provide access to the CSU transmit input and receive output. The FLT LOC jack allows connection to the fault locating lines, and the OW jack allows connection to the order wire lines. The faceplate of the signal monitor circuit module contains two light-emitting diodes (LEDs) for visual monitoring purposes. The MON IN and MON OUT jacks provide a high impedance test access of the DS1 line towards CPE.

2.06 The rear of the CSU contains the following connectors and connection terminals.

Note: The numbers preceding the descriptions below correspond to the numbers in Fig. 3.

(1) A 15-pin KS-19087-L1 customer interface connector (J3) that connects to the CPE via a customer-provided cord.

(2) A P-3304-SCC plug (P8) that mates with an S-3304-ABT jack (J8) located on the rear cover.

(3) A 7-station terminal block (TB3) that connects the fault locate pair to the fault locate (FLT LOC) jack. The terminal block also connects the

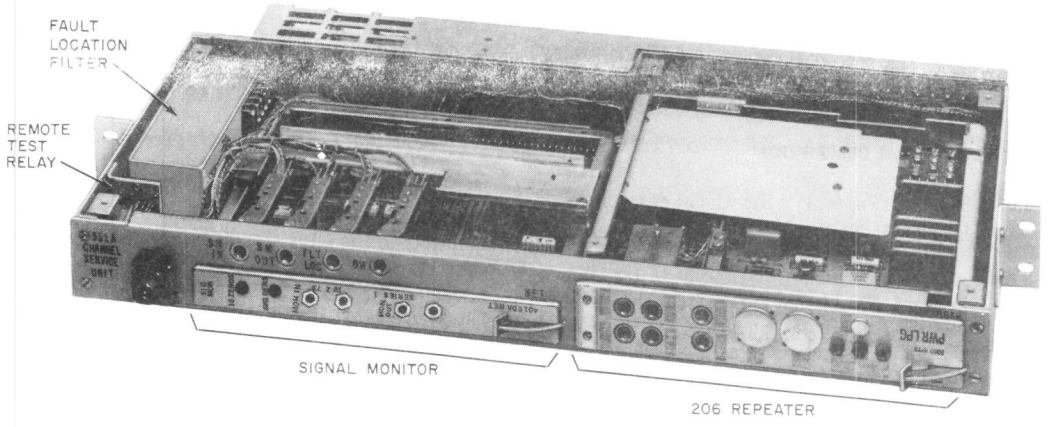


Fig. 2—551A CSU—Cover Removed

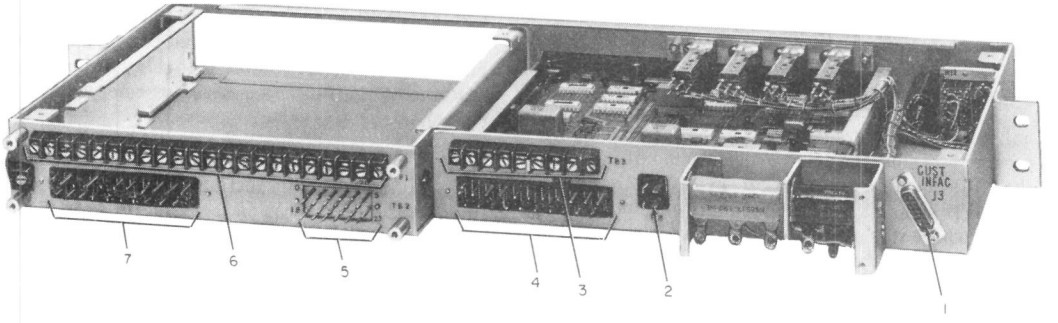


Fig. 3—551A CSU—Rear View With Covers Removed

598-type fault locate filter (optional) to the FLT LOC jack and to the 206- or 236-type repeater.

(4) A 21-pin 902A jack (J2) that provides connection to the 4019DA or 4019DL network.

(5) A 24-pin wire-wrap terminal board (TB2) that is used to make option connections concerning powering arrangements.

(6) A 20-station terminal board (TB1) that connects the T1 line to the 206- or 236-type repeater and connects the signal monitor to the signal monitor out (SM OUT) and signal monitor in (SM IN) jacks. The terminal board also connects the remote test relay to the remote test pair and the order wire to order wire pair. Fuse alarm leads have also been provided to give a visual and/or audible indication when the 48V fuse is blown.

(7) A 21-pin 902A jack (J1) that provides connection to the 206- or 236-type repeater.

2.07 The rear cover on the CSU contains an interlock that disconnects station power from the

CSU when the cover is removed. Aluminum angle brackets are attached to the sides of the CSU chassis so that the CSU can be installed in a 23-inch relay rack or in a KS-20018-type cabinet.

3. FUNCTIONAL DESCRIPTION

3.01 This part contains a functional description of the operation of a 551A-type CSU.

3.02 A block diagram of a 551A-type CSU is shown in Fig. 4. The bipolar signal from the CPE enters the bipolar-to-binary converter, via the SM IN jacks and remote test relay contacts, where the signal is converted to a logic level signal. This signal is used in the clock recovery and data regenerator to control the phase and frequency of an oscillator producing a 1.544-MHz clock. The clock is then used to regenerate the data signal.

3.03 The regenerated signal is applied to the average density monitor and is also delayed by three bits and then applied to the binary-to-bipolar converter and to the 16-zero detector and indicator.

3.04 The average density monitor determines the average "ones" density in the transmitted signal; and, if the average "ones" density falls below a prescribed value, the average density monitor causes the all 1s pulse generator to generate an all 1s signal. The all 1s signal is sent to the binary-to-bipolar converter where it is converted to bipolar format and is sent to the repeater in place of the data signal. The average density indicator illuminates for approximately one-fourth of a second each time the average density monitor triggers the all 1s generator.

3.05 The 16-zero detector and indicator circuitry counts the number of consecutive zeros in the data stream; and, when 16 zeros are counted, the 16-zero indicator illuminates for approximately one-fourth of a second.

3.06 The binary-to-bipolar converter converts the logic level input signals, from the 3-bit delay and all 1s generator, to bipolar format for transmission to the 206- or 236-type repeater.

3.07 The data signal is transformer coupled to the T1 bipolar line through a 1500-foot artificial line section in the transmit section of the 206- or 236-type repeater. Jacks are provided in the repeater transmit line, between the signal monitor circuitry and the repeater circuitry, to allow monitoring of the transmitted signal (MON), terminating the signal (X OUT), or transmitting a test signal (L IN).

3.08 The signal received from the bipolar T1 line enters the 206- or 236-type repeater and is terminated through a 1500-foot artificial line section. The signal is reshaped and amplified by the regenerator and then transformer coupled, by the signal monitor, to the CPE through the remote test relay contacts and the SM OUT jack. Jacks are also provided in the repeater receive line to allow monitoring the regenerated signal (MON), terminating the signal (R OUT), or transmitting a test signal to the signal monitor (X IN). These jacks are connected between the repeater circuitry and the signal monitor circuitry.

3.09 The remote test relay is energized by applying a voltage to the remote test pair at the CO. Operation of the remote test relay requires a minimum of 15 volts at 20 mA at the CSU. When the relay is energized, the transmit and receive pairs to the CPE are opened and are looped at the customer interface for remote testing from the CO. A make-and-break contact of the remote test relay also provides a status of the relay (energized or released) to the customer.

3.10 The fault location filter is located in the CSU to allow remote testing of the repeater from the CO. The fault location jack and order wire jack are used for maintenance and communication purposes, respectively, during testing.

3.11 The 551A-type CSU is normally line powered from the CO. In cases where the length of the local cable pair must be extended beyond the maximum length that can be powered by the CO, provision has been made to power the CSU and part of the bipolar line from the station location. Four power supplied voltages may be used at the station location, −48 Vdc, +130 Vdc, 178 Vdc (−48 and +130), and 260 Vdc (−130 and +130). Maximum use of the CO battery supplies should be made, however, before considering powering from the station location. The 551A CSU requires 140 mA power on the line. If a 236-type repeater is used, it must be a looping repeater optioned for series powering. Table A lists the different powering arrangements and the type of repeater required for each arrangement. For additional information on 206- or 236-type repeaters, refer to Section 365-200-101.

3.12 The 551A CSU when equipped with a 4019DL network operates the same as if equipped with the 4019DA network but with the following enhancements. The 4019DL network contains a timing recovery circuit which is much more tolerant to jitter than the 4019DA network. The circuitry in the 4019DL consists of an LC timing recovery circuit and an automatic switch which contains logic gates as the switch elements (Fig. 4). During normal operation, the LC timing recovery circuit is switched into the circuit. Should the customer's signal be removed or degrade to a point where the average density monitor operates, the LC timing recovery circuit will be switched out and the crystal controlled oscillator will be switched into the circuit. This assures that the transmitted line signal is within satisfactory frequency limits for the line and also provides a clock signal if no input signal is present.

4. OPTIONS

4.01 The 551A-type CSU options are described below. The options provide for installation of the 598-type fault location filter in the CSU and various powering arrangements.

- Option M— Provides a resistor to terminate the fault location pair.
- Option N—Provides for an improved grounding arrangement for line powered CSU applications
- Option R—Used to connect the CSU and the fault locate pair to the 598-type fault location filter when the filter is installed in the CSU.
- Option S—Terminates the wire pair from the CSU and the fault locate pair that normally connect to the 598-type fault location filter when the 598-type fault location filter is not installed in the CSU.
- Option T— Connects the supply to the CSU circuitry when a −48 Vdc station supply has to be used at the station location.
- Options V, W, and X—Connect the supply to the CSU circuitry when a +130 Vdc station supply has to be used at the station location.
- Options T and X—Connect the +130 Vdc supply and the −48 Vdc supply to the CSU circuitry when a 178-Vdc station supply has to be used at the station location.
- Options W, X, and Y—Connect the +130 Vdc supply and the −130 Vdc supply to the CSU circuitry when a 260-Vdc station supply has to be used at the station location.
- Option Z—Is factory-provided and is used when the CSU power is supplied over the T1 line from the CO.

5. REFERENCES

5.01 This part provides a list of documents containing additional information concerning the 551A-type CSU.

5.02 For detailed information concerning the 551A-type CSU, refer to the following circuit descriptions (CDs) and schematic drawings (SDs):

DRAWING	TITLE
CD- & SD-1D248-01	551A-L1 Channel Service Unit
CD- & SD-3C367-01	236-Type Repeaters
CD- & SD-97095-01	206A Through 206G Office Repeaters
CD- & SD-97095-02	206H, J, K, L, M, and N Office Repeaters

5.03 The following Bell System Practices contain information concerning the 551A-type CSU:

SECTION	TITLE
365-200-101	Digital Transmission Systems, T1 Digital Line, Repeater Description
595-105-180	551A Channel Service Unit For 4-Wire Digital Data Transmission, Summarizing Specification
314-646-200	551A-Type Channel Service Unit, Installation and Connections
314-646-300	551A-Type Channel Service Unit, Maintenance
314-646-500	551A-Type Channel Service Unit, Test Procedures

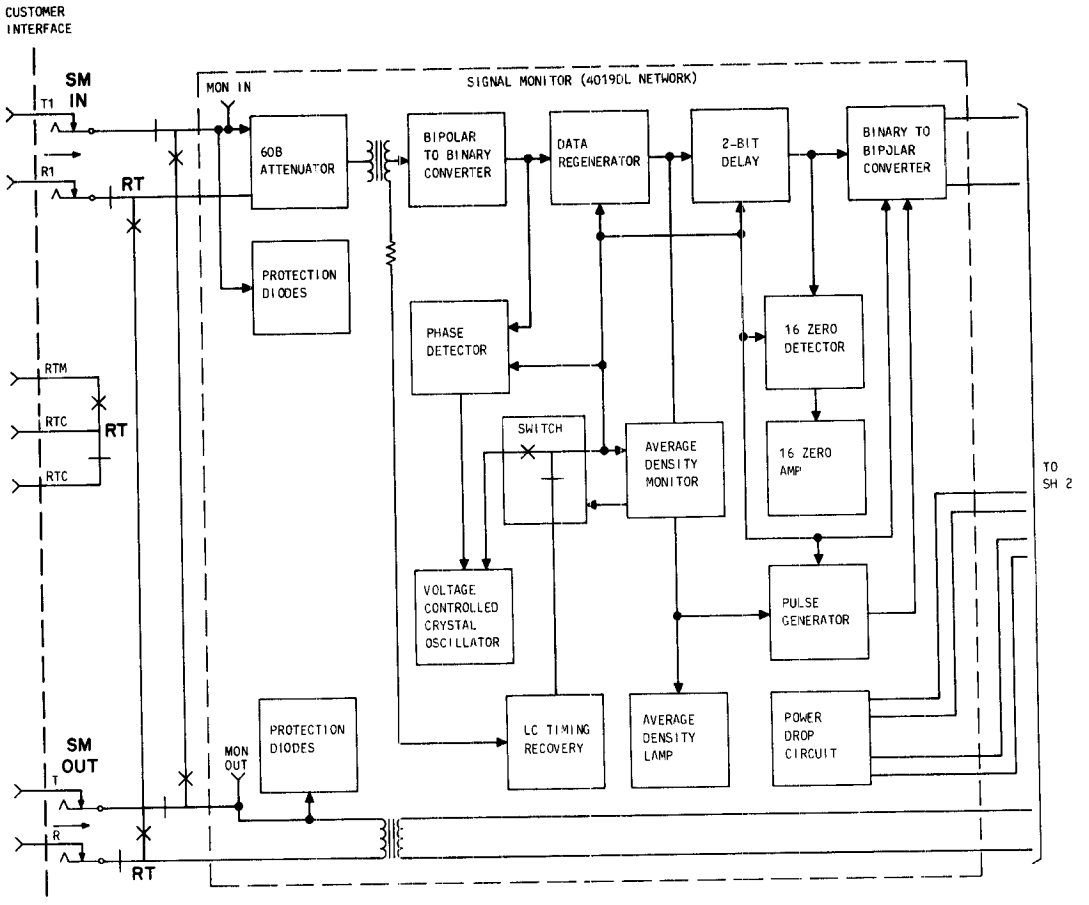


Fig. 4—551A Line Powered CSU—Block Diagram (Sheet 1 of 2)

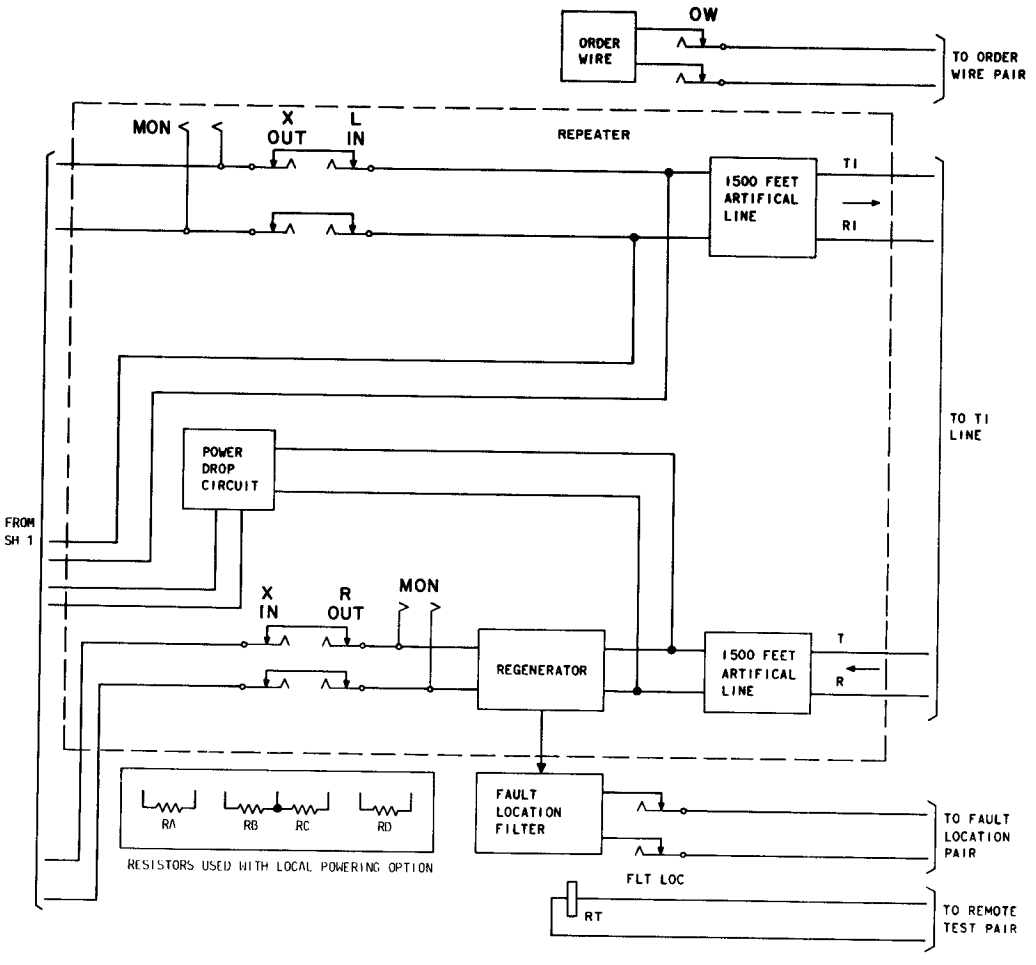


Fig. 4—551A Line Powered CSU—Block Diagram (Sheet 2 of 2)

TABLE A

T1 REPEATER REQUIRED IN CSU FOR DIFFERENT SPAN LINE VOLTAGES

T1 REPEATER	MODE OF OPERATION (NOTE)	BATTERY ASSIGNMENT		TOTAL SPAN LINE VOLTAGE
		CENTRAL OFFICE	STATION	
206D or 206K	Looping	−48 +130 +130, −48 +130, −130		48 130 178 260
206A or 206H	Powering	−48 +130 +130, −48 +130, −130	−48 −48 −48 −48	96 178 226 308
206B or 206J	Powering	+130 +130, −48 +130, −130 +130 +130, −48 +130, −130 +130 +130, −48 +130, −130	+130 +130 +130 +130, −48 +130, −48 +130, −48 +130, −130 +130, −130 +130, −130	260 308 390 308 356 438 390 438 520
236AA	Looping	−48 +130 +130, −48 +130, −130		48 130 178 260
236AA	Powering	−48 +130 +130, −48 +130, −130 −48 +130 +130, −48 +130, −130 −48 +130 +130, −48 +130, −130 −48 +130 +130, −48 +130, −130	−48 −48 −48 −48 +130 +130 +130 +130 +130, −48 +130, −48 +130, −48 +130, −48 +130, −130 +130, −130 +130, −130 +130, −130	96 178 226 308 178 260 308 390 226 308 356 438 308 390 438 520
236AB	Looping	−48 +130 +130, −48 +130, −130		48 130 178 260
206A or 206H	Looping	−48 +130 +130, −48 +130, −130		48 130 178 260
206B or 206J	Looping	130 130, −48 130, −130		130 178 260

Note: When a repeater is used in a looping mode, power for the line is provided by the remote end of the system. When a powering repeater is used, line power is provided by the local end of the system. In either case, the local repeater can be powered in series with the line repeater or separately from a local −48 volt source and can be selected by options contained on the repeater.

551A-TYPE CHANNEL SERVICE UNIT
INSTALLATION AND CONNECTIONS

1. GENERAL

1.01 This section contains information concerning the installation and connection of a 551A-type channel service unit (CSU), Fig. 1. This section also contains option installation information and a list of tests to be performed at time of installation.

1.02 Whenever this section is reissued, the reason(s) for reissue will be given in this paragraph. The contents of this section were formerly contained in Section 595-105-200.

1.03 Refer to Section 590-010-200, Data Sets—General Installation and Connection Information.

1.04 The CSU can be installed in a KS-20018-type cabinet or in a 23-inch relay rack. The CSU will operate in an ambient temperature range of +40 to 120°F and a relative humidity less than 95 percent.

1.05 The CSU is normally line powered and is not provided with a power supply. A power supply must be provided if line power is not utilized. Refer to the option discussion to aid in proper power selection.

1.06 To gain access to the terminal boards, option terminals, and fault location filter, it is necessary to remove the top and rear covers. To remove the top cover, remove the six retaining screws and lift off the top. To remove the rear cover, remove the six retaining screws and slide off the rear cover.

1.07 A 598-type fault location filter must be installed in the CSU if the repeater is to be tested from a remote location.

2. OPTIONS

2.01 The 551A CSU is provided with a number of options which must be installed prior to placing the CSU in service.

2.02 The S option is provided in manufacture and should be installed when the 598 fault location

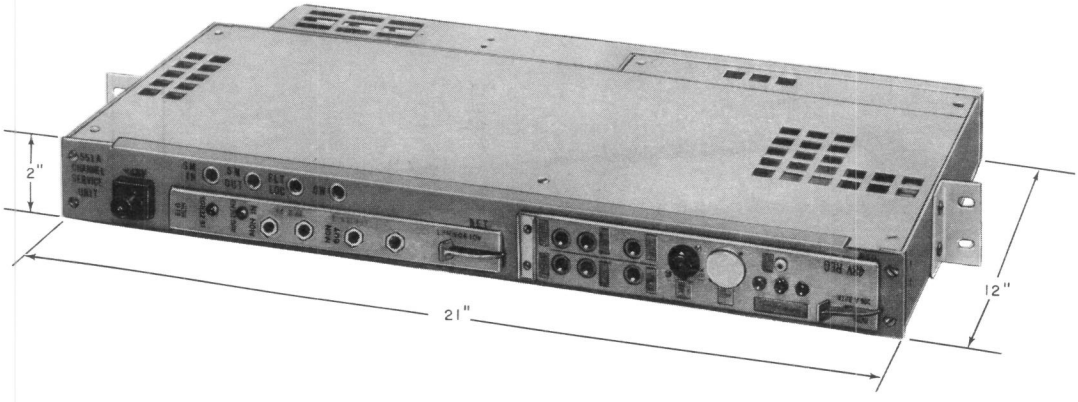


Fig. 1 — 551A Channel Service Unit

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filter is ***not*** used. When the 598 fault location filter is used, the S option should be removed and the R option installed. The M option is also provided in manufacture and must be used when the fault location pair is terminated at the 551A CSU. The M option may be used with option S or R and is always used at the terminating end of the circuit. Option N provides for an improved grounding arrangement for line powered CSU applications, but may also be used when the line is station powered. Refer to Fig. 2 and Table A.

2.03 The 551A CSU is usually line powered and equipped with 206- or 236-type repeaters. The 206-type repeater is normally wired for option Z. The 236-type repeater must be wired for X option in order to supply 140 mA to the line. In cases where it is necessary to extend the local loop beyond the central office powering capability, the CSU and part of the line can be powered at the customer's end by locally provided power supplies. If required, these auxiliary power supplies must be locally engineered. Powering options are provided by installing the power strapping. Refer to Table A for the strapping connection and Table B for the specific option or combination of options required for the powering combinations.



Before the 206-type repeater is installed, it must be equipped with the proper 836-type network as determined by the T1 line requirements.

2.04 The 206- or 236-type repeater must be ordered separately and inserted into jack J1. Refer to Tables C, D, and E for aid in selecting the correct repeater and repeater options for the particular application. The 206 or 236 repeater options are provided by turning down the specified option screws fully clockwise (IN position). Option screws not specified should be in the up position (two complete turns counterclockwise).

3. INSTALLATION

3.01 The 551A CSU is designed to mount in a 23-inch relay rack or a KS-20018 cabinet. The two required 841570815 mounting brackets are factory provided.

3.02 The chassis accepts, on a plug-in basis, the 4019DA or 4019DL signal monitor and 206- or 236-type repeater. The 206 or 236 repeater is not part of the 551A CSU and must be ordered separately.

3.03 A 598-type fault location filter is provided on an optional basis (Fig. 3). The fault location filter is not part of the 551A CSU and must be ordered separately. The particular code of the fault location filter is determined by the T1 line installation. To install the fault location filter, remove the top and rear covers and the 4019DA or 4019DL circuit pack. Connect the four spade tipped leads (stored in the chassis) to the terminal board on the filter. Dress the

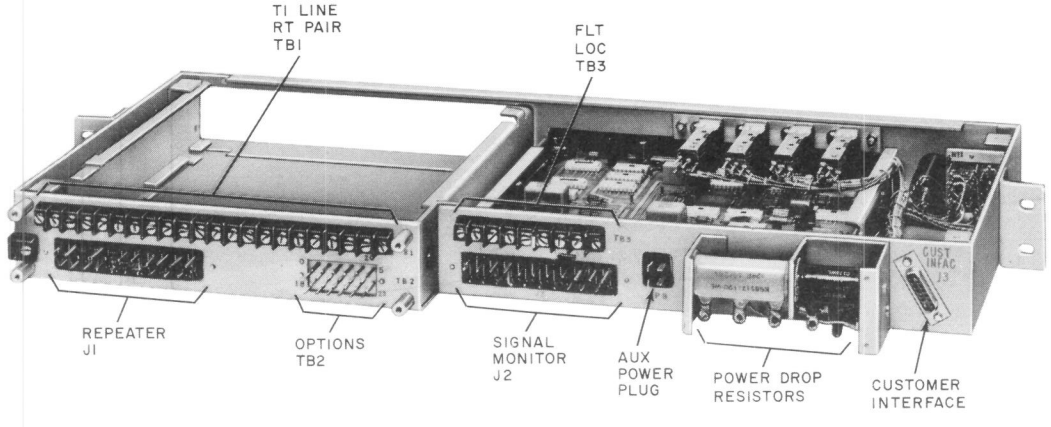


Fig. 2—551A CSU—Rear View With Covers Removed

TABLE A

551A CSU OPTION CONNECTIONS

OPTION	FEATURE	CONNECTION	
		FROM	TO
M	Fault Location Line Termination	TB3:6	TB3:7 through 1000Ω resistor (See Fig. 4)
N	Station powered*	TB1:13 TB1:14	TB1:GRD TB2:GRD
R	598-type fault location filter installed	Terminal 1† Terminal 2† Terminal 3† Terminal 4†	TB3:7 TB3:6 TB3:5 TB3:4
S	598-type fault location filter not installed	TB3:4	TB3:5
T	Station powered*	TB2:6 TB2:8 TB2:9	TB2:7 TB2:10 TB2:13
V		TB2:9	TB2:11
W		TB2:6	TB2:10
X		TB2:0 TB2:1 TB2:2	TB2:5 TB2:4 TB2:3
Y		TB2:9	TB2:12
Z	Line powered	TB2:3 TB2:5	TB2:9 TB2:10

* These options are used singly or in combination to provide for station power supplies as shown in Table B.

‡ These terminals are located on the 598-type fault location filter. Four wires have been provided and stored in the CSU for this option.

TABLE B

STATION POWER OPTIONS

STATION POWER	OPTIONS
–48 Vdc	T
+130 Vdc	V, W, X
+130 Vdc –48 Vdc	T, X
+130 Vdc –130 Vdc	W, X, Y

opposite ends of these wires through the holes provided in the chassis and terminate the spade tips on TB3. Refer to Table A, R option, for correct wiring. Discard the screws supplied with the 598 fault location filter and use the screws supplied with the CSU. Locate the filter in the proper position and secure by installing one screw in each standoff.

4. CONNECTION

4.01 The 551A CSU connection to the T1 lines, order wire, and remote test pair (when provided) is made by screw connection to TB1 (Fig. 2 and 4). Connection to the fault location pair is made by screw connection to TB3. It will be necessary to remove the rear cover to gain access to TB1 and TB3.

4.02 The customer interface connections are made at the rear of the CSU (J3). The CSU is equipped with a subminiature 15-pin female connector, DA-15S. The customer interface cable should be terminated in a 15-pin subminiature connector equipped with a right-angle hood and sliding lock assembly that will mate and lock with the connector on the CSU. The maximum cable distance between the customer provided equipment and the CSU is 500 feet, nominally 24-gauge shielded twisted pair.

4.03 Replace all CSU covers. Perform the procedure specified in paragraph 1.06 in reverse order.

5. TEST

5.01 After the CSU has been installed, it should be tested to determine if it is operating properly. Perform the remote loopback test, repeater test using the fault locating pair from the remote location, and end-to-end test. Refer to Section 595-105-500 for the test procedures.

TABLE C

POWERING CONDITIONS FOR THE 236AA, 236AB, AND 206-TYPE REPEATERS

		POWER OPTION	POWERING CONDITION	REPEATER OPTION SCREWS (NOTE)
Office Repeater Powered In Series With line Repeaters	At Powering Office*	1	Bidirectional System	
			Unidirectional System† — First Shelf of Power Loop; Office Repeater Powered in Series with Receive Line Repeaters	C, E, K‡
		7	Unidirectional System† — First Shelf of Power Loop; Office Repeater Powered in Series with Transmit Line Repeaters	B, D, G‡
		2	Unidirectional System† — Second Shelf of Power Loop; Office Repeater Powered in Series with Receive Line Repeaters	A, G, M
	At Power Looping Office	3	Bidirectional System	D, K
		1	Unidirectional System† — First Shelf of Power Loop; Office Repeater Powered in Series with Receive Line Repeaters	C, E, K‡
		7	Unidirectional System† — First Shelf of Power Loop; Office Repeater Powered in Series with Transmit Line Repeaters	B, D, G‡
		2	Unidirectional System† — Second Shelf of Power Loop; Office Repeater Powered in Series with Receive Line Repeaters	A, G, M
Office Repeater Powered Separately From Line Repeaters	At Power Office*	4	Bidirectional System	
			Unidirectional System† — First Shelf of Power Loop	B, E, H, N
		5	Unidirectional System† — Second Shelf of Power Loop	A, F, H, N
	At Power Looping Office	6	Bidirectional System	H, J, N
		4	Unidirectional System† — First Shelf of Power Loop	B, E, H, N
		5	Unidirectional System† — Second Shelf of Power Loop	A, F, H, N

Note: Powering conditions are provided by turning down option screws on switch S101, as specified, to maximum clockwise position. Option screws not specified should remain in up position (two complete turns counterclockwise).

* 236AA, 206A, 206H, 206B, and 206J only.

† In a unidirectional system, two office repeaters are required to complete the power loop.

‡ When the office repeaters are powered in series with the line at both ends, these options must be used in pairs at both ends. When office repeaters in only one of the two offices are powered in series with the line, options C, E, K on the first shelf and A, G, M on the second shelf result in one power loop having two more Zener power supplies than the other. Whereas options B, D, G on the first shelf and A, G, M on the second shelf result in both power loops having an equal number of Zener power supplies. However, when options B, D, G and A, B, M are used, the loss of either power loop will affect both directions of transmission. This is not true when using options C, E, K and A, G, M.

TABLE D

POWERING OPTIONS FOR THE 236AA and 236AB REPEATERS

OFFICE BATTERY (NOTE)	OPTIONS REQUIRED	
	SELECTOR BLOCK S201	SWITCH S202
−48V and battery ret*	Open	Y
+130V & battery ret*	R	Z
+130V and −48V	Open	Z
+130V and −130V	Open	Z

Note: Office battery voltages are selected, as required, per SD-97095-02.

* When using −48V and battery return, F201 must be replaced with a dummy fuse. When using +130V and battery return, F202 must be replaced with a dummy fuse.

TABLE E

CURRENT OPTION FOR THE 236AA AND 236B REPEATERS

NOMINAL LINE CURRENT	OPTION, SWITCH S-203
140 mA	X

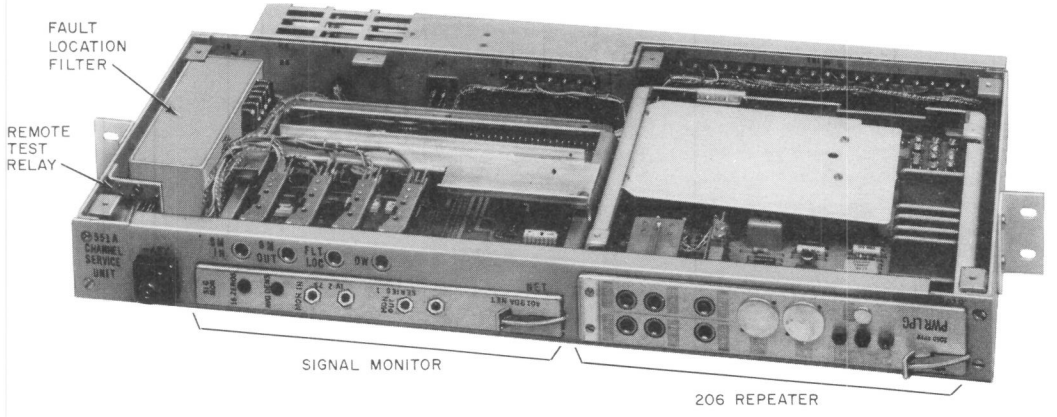


Fig. 3—551A CSU—Cover Removed

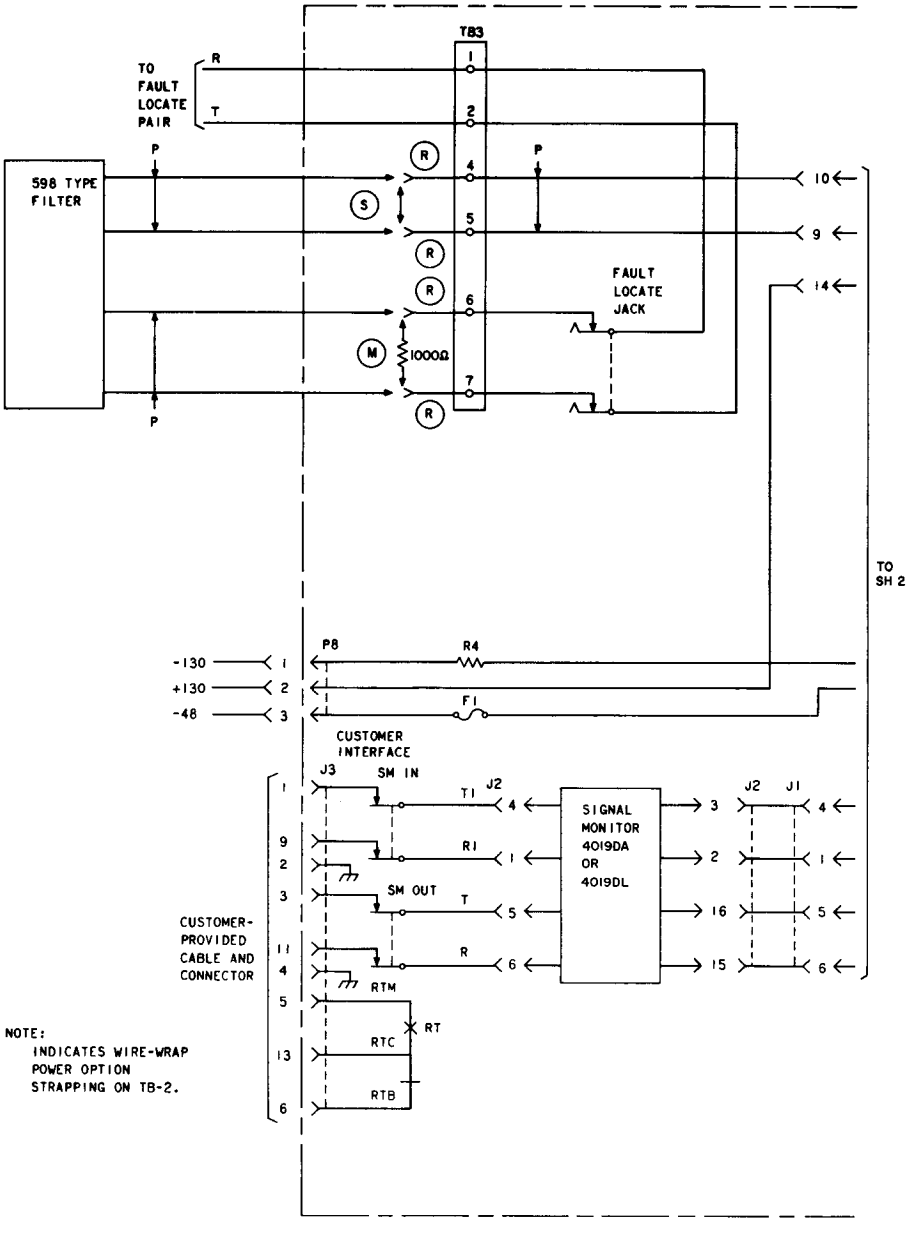


Fig. 4—551A CSU—Connection Diagram (Sheet 1 of 2)

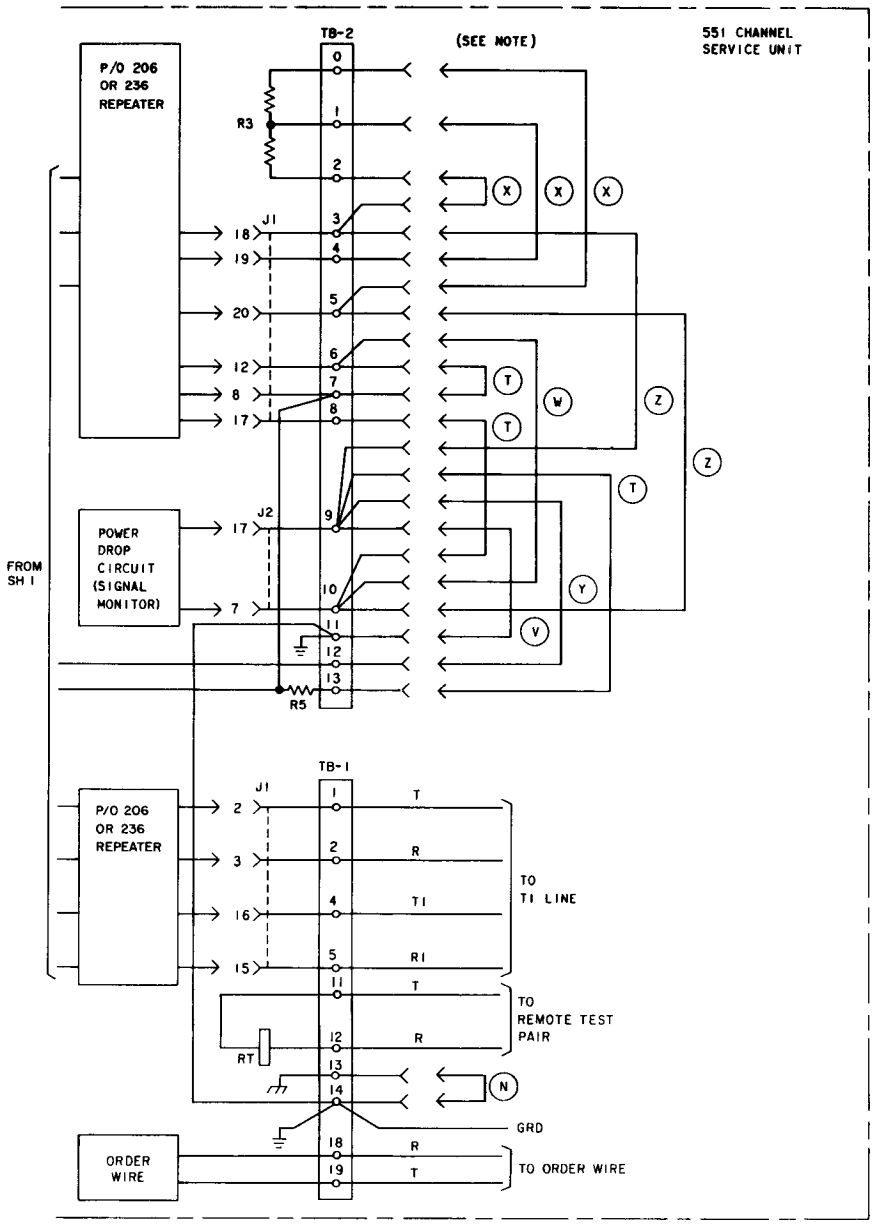


Fig. 4—551A CSU—Connection Diagram (Sheet 2 of 2)

551A-TYPE CHANNEL SERVICE UNIT

TEST PROCEDURES

1. GENERAL

1.01 This section describes the test procedures to be used when installing and troubleshooting the 551A-type channel service unit (CSU).

1.02 Whenever this section is reissued, the reason(s) for reissue will be given in this paragraph. The contents of this section were formerly contained in Section 595-105-500.

1.03 This procedure assumes that the T1 repeatered line has been installed and tested in accordance with Section 365-200-300.

1.04 There are no initial alignments or adjustments to be made in the CSU; however, visually verify that the proper 206- or 236-type repeater (equipped with the correct power options) and line build-out (LBO) network (206-type only) are installed in accordance with the service order.

1.05 This section describes three categories of testing: (1) CSU loopback, (2) line loopback, and (3) station to central office (CO). Either No. 1 or No. 2 or both of the first two test procedures should be used to verify an installation, and all three may be used as an aid in trouble isolation.

2. CSU LOOPBACK TEST

2.01 The CSU loopback test checks the repeater and signal monitor circuitry by remotely looping the transmit pair to the receive pair at the customer interface and transmitting test signals. The loopback test may be established by operating the remote test relay or by manually patching the SM-IN jack to the SM-OUT jack on the CSU (Fig. 1).

2.02 The actual test is performed at the CO; however, the proper operation of the remote test relay should be verified during installation.

2.03 The following equipment is required:

- One Bowmar error rate test set, model 271B or 271C, or equivalent
- One 3P7D cord
- Two 3P7C cords
- One KS-14510 volt-ohm-milliammeter, or equivalent.

Note: For this test, the 3P7D cord and the KS-14510 meter are used at the customer premises. The error rate test set is used at the CO.

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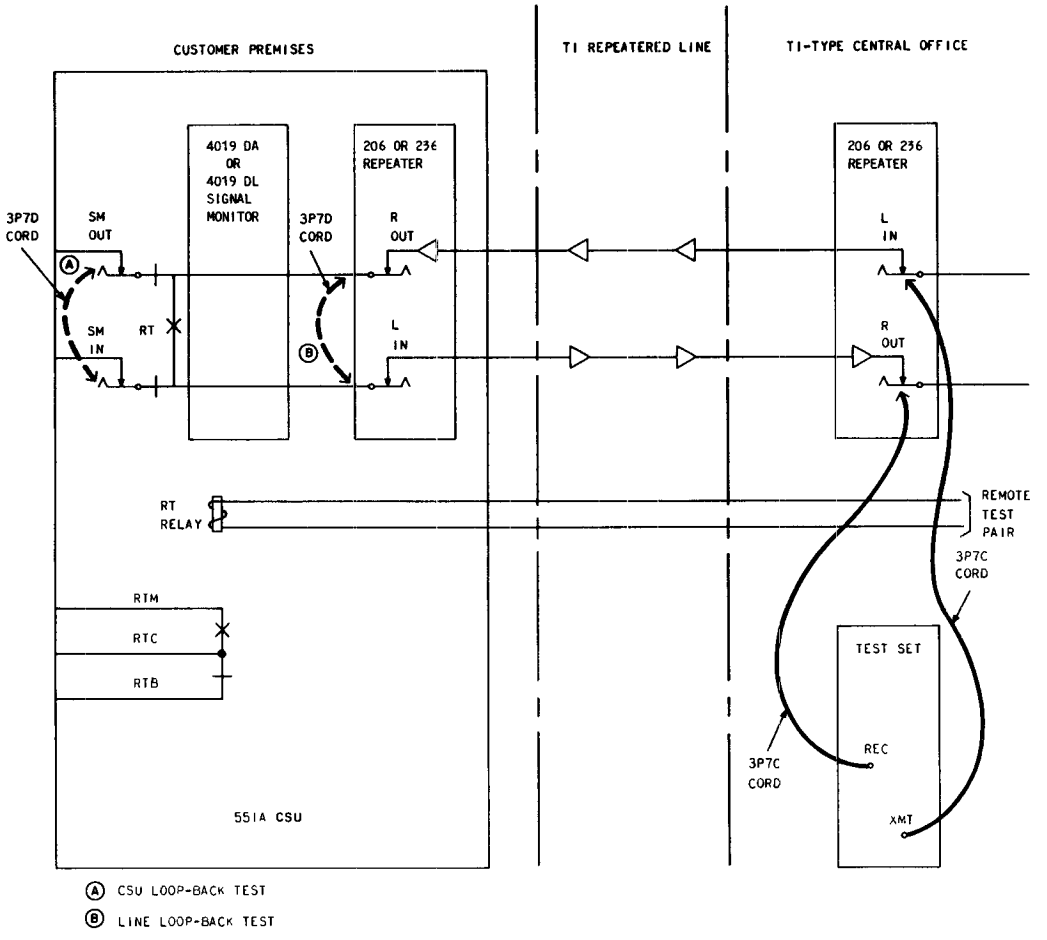


Fig. 1—Remote Loopback Test

STEP	PROCEDURE
1	Establish voice contact with the CO that will be performing the test.
2	Request the CO to operate the remote test relay by applying the proper voltage to the associated remote test control pair (at least 15 Vdc at the CSU terminals).
3	Verify proper operation of the remote test relay by measuring the resistance between RTM and RTC of the CUSTOMER INTERFACE at the CSU (pins 5 and 13 of J3). This measurement should be less than 2 ohms.

STEP	PROCEDURE

Note: If the remote test feature is not provided, the CSU can be looped by patching the SM-IN jack to the SM-OUT jack using a 3P7D cord. (See Fig. 1.)

4 At the T1-type CO, set the controls on the error rate test set as follows:

- Set POWER switch to ON. Observe that the POWER lamp lights.
- Set MODE switch to ERRORS.
- Set INDIVIDUAL/ERROR SECONDS switch to ERROR SECONDS.
- Set SYNC MODE switch to AUTO.
- Disregard the SELF TEST switch.
- Set DISPLAY INTERVAL (SEC) switch to HOLD.
- Set COUNT INTERVAL (BITS) to timed (straight down).
- Set COUNT INTERVAL (MIN) to 15-minute position.

5 Patch one of the four DS1-OUTPUT jacks on the error rate test set to the L IN jack on the CO repeater. (See Fig. 1.)

6 Patch the R OUT jack on the CO repeater to the DS1-INPUT jack on the error rate test set. (See Fig. 1.)

7 To start test, momentarily operate the RESET/RESYNC switch and reset COUNT INTERVAL (MIN) switch if necessary.

8 Verify that the duration of the test is 15 minutes.

9 At the completion of the test, observe the RECEIVE STATUS indicator lamps for the following indications:

- NO DATA—extinguished
- LOST DATA—extinguished
- NO SYNC—extinguished
- LOST SYNC—extinguished
- LOST POWER—extinguished
- OVERFLOW—extinguished

STEP	PROCEDURE
	• COUNT—lighted during test—extinguished at end of test.
10	Observe the display window. If the count exceeds 30 error seconds for the 15-minute test, the test fails.
11	On the CSU, observe that both the AVG DENS and the 16 ZERO indicators are extinguished.
12	Remove the 3P7D patching cord between SM-OUT and SM-IN (if installed).
13	Remove the customer interface cable from the CSU or insert dummy plug in SM-IN jack. ***Note:*** Removing the customer interface cable or inserting a dummy plug conditions the CSU to send an all 1s pattern.
14	On the test set at the CO, change the setting of the two MODE switches and the COUNT INTERVAL (BITS) switch: • Set VIOLATIONS/ERRORS switch to VIOLATIONS • Set INDIVIDUAL/ERROR SECONDS switch to INDIVIDUAL • Set COUNT INTERVAL (BITS) to 10^8.
15	To start test, momentarily operate the RESET/RESYNC switch.
16	Verify that the duration of the test is approximately 1 minute.
17	Observe the RECEIVE STATUS indicator lamps for the following indications: • NO DATA—extinguished • LOST DATA—extinguished • NO SYNC—on • LOST SYNC—on • LOST POWER—extinguished • OVERFLOW—extinguished • COUNT—lighted during test—extinguished at end of test.
18	Observe the display window on the test set. If the count exceeds 50 error seconds for the test period, or if NO DATA or LOST DATA indicators light, the test fails.
19	Observe that both the 16 ZERO and AVG DENS indicators on the CSU are lighted. If these indicators are not lighted, the test fails.

3. STATION TO T1-TYPE CENTRAL OFFICE

3.01 This test checks the CSU and the channel between the CSU and the CO. This procedure is used when the system under test receives a DS-1 test signal from an independent source at the far end, such as a second error rate test set or a quasi-random signal source, J98710R-1.

3.02 The following equipment is required:

- Two Bowmar error rate test sets, model 271B or 271C, or equivalent (one at the customer premises and one at the CO)
- Four 3P7C cords (two at the CO and two at the customer premises).

3.03 ***Procedure:*** Perform Steps 1 through 8 simultaneously from the CO and the CSU. After the results of the test are noted, perform Steps 9 through 16. In Steps 14 and 15, observe only the test set at the CO. In Step 16, observe the 16 ZERO and AVG DENS indicators on the CSU.

STEP	PROCEDURE
1	Establish voice contact with the CO that will be performing the test.
2	Request the CO to connect the test set as shown in Fig. 2.
3	At the customer premises, connect the CSU to the test set as shown in Fig. 2.
4	Set the controls on both test sets as follows: • Set the POWER switch to ON. Observe that the POWER lamp lights. • Set MODE switch to ERRORS. • Set INDIVIDUAL/ERROR SECONDS switch to ERROR SECONDS. • Set SYNC MODE switch to AUTO. • Disregard the SELF TEST switch. • Set DISPLAY INTERVAL (SEC) switch to HOLD. • Set COUNT INTERVAL (BITS) to timed (straight down). • Set COUNT INTERVAL (MIN) to 15-minute position.
5	To start test, momentarily operate the RESET/RESYNC switch and reset COUNT INTERVAL (MIN) switch, if necessary.

STEP	PROCEDURE

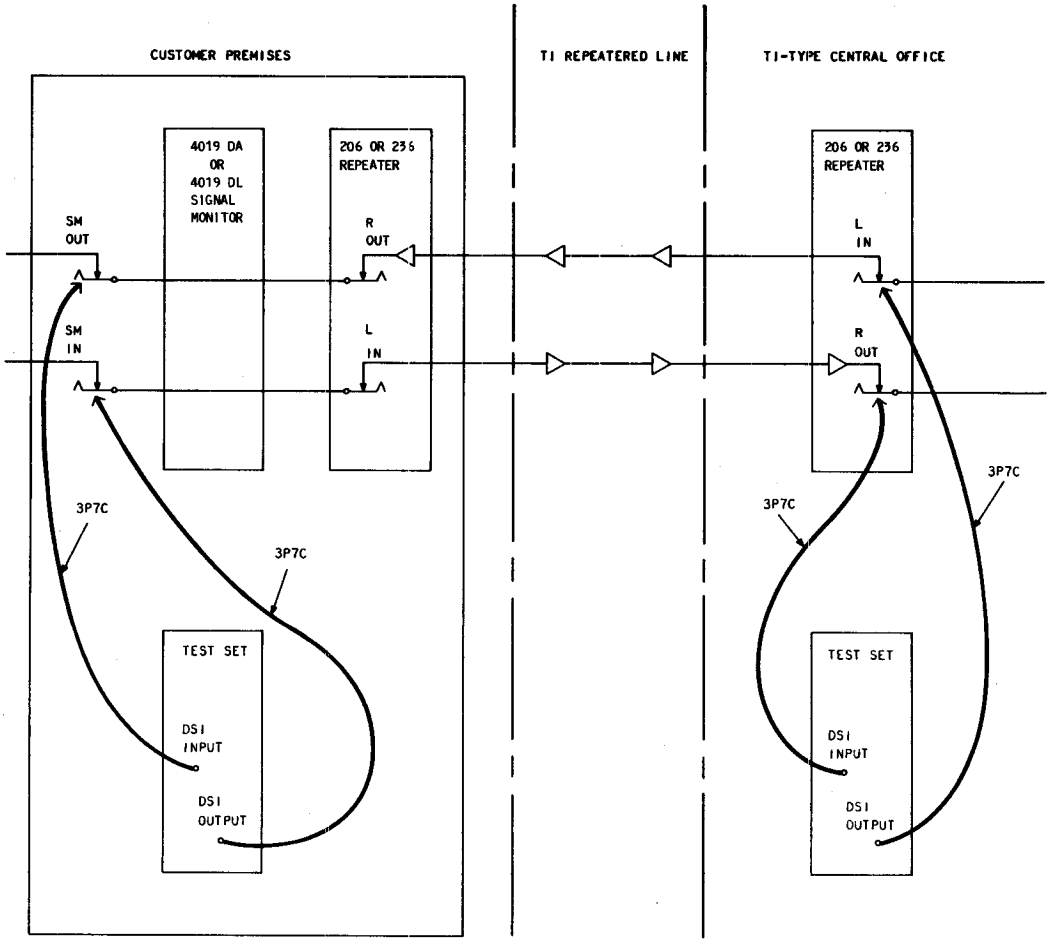


Fig. 2—Station to Central Office Testing

STEP	PROCEDURE
6	Verify that the duration of the test is 15 minutes.
7	At the completion of the test, observe the RECEIVE STATUS indicator lamps for the following indications: • NO DATA—extinguished • LOST DATA—extinguished • NO SYNC—extinguished • LOST SYNC—extinguished • LOST POWER—extinguished • OVERFLOW—extinguished • COUNT—lighted during test—extinguished at end of test.
8	Observe the display window. If the count exceeds 30 error seconds for the 15-minute test, the test fails.
9	Remove the 3P7C cord from the test set DS1-OUTPUT to the SM-IN jack on the CSU.
10	Remove the customer interface cable from the CSU or insert dummy plug in SM-IN jack. ***Note:*** Removing the customer interface cable or inserting a dummy plug conditions the CSU to send an all 1s pattern.
11	On the test set at the CO, change the setting of the two MODE switches and the COUNT INTERVAL (BITS) switch: • Set VIOLATIONS/ERRORS switch to VIOLATIONS • Set INDIVIDUAL/ERROR SECONDS switch to INDIVIDUAL • Set COUNT INTERVAL (BITS) switch to 10^8.
12	To start test, momentarily operate the RESET/RESYNC switch.
13	Verify that the duration of the test is approximately 1 minute.
14	Observe the RECEIVE STATUS indicator lamps for the following indications: • NO DATA—extinguished • LOST DATA—extinguished • NO SYNC—on

STEP	PROCEDURE
	• LOST SYNC—on • LOST POWER—extinguished • OVERFLOW—extinguished • COUNT—lighted during test—extinguished at end of test.
15	Observe the display window on the test set. If the count exceeds 50 error seconds for the test period, or if NO DATA or LOST DATA indicators light, the test fails.
16	Observe that both the 16 ZERO and AVG DENS indicators on the CSU are lighted. If these indicators are not lighted, the test fails.

4. LINE LOOPBACK TEST

4.01 The line loopback test checks the repeater and T1 repeatered line by looping the transmit pair to the receive pair at the repeater in the CSU and transmitting test signals. This test provides a method of isolating a trouble to the T1 line or CSU. The actual test is performed at the CO. The loopback is made manually by patching the R OUT jack to the L IN jack on the repeater (Fig. 1).

4.02 The following equipment is required:

- One Bowmar error rate test set, model 271B or 271C, or equivalent
- One 3P7D cord.

Note: For this test, the 3P7D cord is used at the customer premises. The error rate test set is used at the CO.

STEP	PROCEDURE
1	Establish voice contact with the CO that will be performing the test.
2	On the CSU repeater, strap R-OUT jack to L IN jack using a 3P7D cord (Fig. 1).
3	At the T1-type CO, set the controls on the error rate test set as follows: • Set POWER switch to ON. Observe that the POWER lamp lights. • Set MODE switch to ERRORS. • Set INDIVIDUAL/ERROR SECONDS switch to ERROR SECONDS. • Set SYNC MODE switch to AUTO.

STEP	PROCEDURE
	• Disregard the SELF TEST switch. • Set DISPLAY INTERVAL (SEC) switch to HOLD. • Set COUNT INTERVAL (BITS) to timed (straight down). • Set COUNT INTERVAL (MIN) to 15-minute position.
4	Patch one of the four DS1-OUTPUT jacks on the error rate test set to the L IN jack on the CO repeater. (See Fig. 1.)
5	Patch the R OUT jack on the CO repeater to the DS1-INPUT jack on the error rate test set. (See Fig. 1.)
6	To start test, momentarily operate the RESET/RESYNC switch.
7	Verify that the duration of the test is 15 minutes.
8	At the completion of the test, observe the RECEIVE STATUS indicator lamps for the following indications: • NO DATA—extinguished • LOST DATA—extinguished • NO SYNC—extinguished • LOST SYNC—extinguished • LOST POWER—extinguished • OVERFLOW—extinguished • COUNT—lighted during test—extinguished at end of test.
9	Observe the display window. If the count exceeds 30 error seconds for the 15-minute test, the test fails.

Part 5

Part 5 — Data Auxiliary Sets 800-Type

DESCRIPTION	NUMBER
DAS 828D (Installation)	598-089-100 (5-10)
DAS 829 (Description)	598-082-100 (5-12)
DAS 829 (Installation)	598-082-200 (5-14)
DAS 829 (Test)	598-082-500 (5-15)
DAS 830D (Identification)	598-083-107 (5-16)
DAS 837A-L1 (Notes)	(5-20)

DATA AUXILIARY SET 828D

DESCRIPTION AND INSTALLATION

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2. PHYSICAL DESCRIPTION 1
3. FUNCTIONAL DESCRIPTION 4
4. INSTALLATION 4

1. GENERAL

1.01 The 828D-L1 data auxiliary set (DAS) is used to provide the necessary lamp relays and interface wiring transpositions to interconnect referral telephones to a DS 407-type multiple data station. Telephone types 630DAM or 831CM (rotary dial) and 2630DAM or 2831CM (TOUCH-TONE® dial) may be used for the call referral arrangement, but they should not be intermixed within a station. KS-19252-L1 bridging adpaters are used as necessary to add telephones.

1.02 When this section is reissued, the reason for reissue will be presented in this paragraph.

1.03 Following is a list of data sets with which the 828D-L1 DAS is used:

DS 407A

DS 407AR

DS 407B

DS 407BR

DS 407C

DS 407CR

2. PHYSICAL DESCRIPTION

2.01 The DAS measures about 6.9 inches wide by 7.5 inches high by 4.6 inches deep, and weighs about 5-1/2 pounds (Fig. 1 and 2). For proper operation of the relays, the DAS must be mounted on a wall or other vertical surface with the attached cable coming out of the bottom.

2.02 The DAS can be operated in an environment having a temperature range of 40 to 120°F and a relative humidity range of 20 to 95 percent.

2.03 A 67B1 power unit and a 20B2 power unit are required to supply 10 volts ac and 24 volts dc, respectively to light the lamps and operate the relays. The power units are not supplied with the DAS and must be ordered separately. The ac power cords for the 67B1 and 20B2 power units must also be ordered separately. Following is a list of available power cords:

Length (Ft)	Part No.
1.5	P40J326
2.0	P40J327
4.0	P40J328
6.0	P40J329
12.0	P40J099

2.04 The 67B1 power unit measures about 7.37 inches long by 5.75 inches wide by 5.25 inches deep and is designed for wall mounting. An input receptacle is provided to accept any of the above listed cords, which are provided with a 3-conductor molded female plug.

2.05 The 20B2 power unit measures about 9.25 inches high by 8.75 inches wide by 5 inches deep and is designed for wall mounting.

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Fig. 1—828D Data Auxiliary Set With Cover

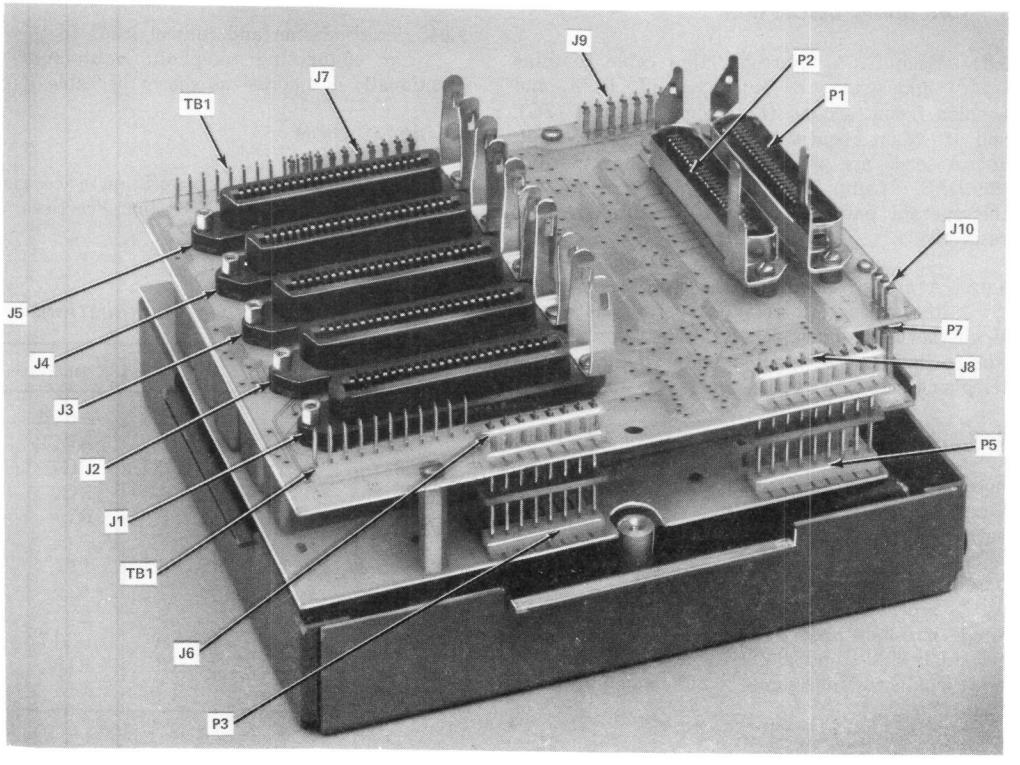


Fig. 2—828D Data Auxiliary Set With Cover Removed

2.06 Connections between the DAS, data mounting(s), and bridging adapters are made by using B25A cable. This cable should not exceed 1000 feet in length per branch.

3. FUNCTIONAL DESCRIPTION

3.01 Each B25A interconnecting cable contains eight groups of four leads (T, R, A, and L) plus frame ground (FG), signal ground (SG), and attendant request control (ARC). The T, R, and A leads are straight-through connections in the DAS. Lamp leads L1 through L16 provide the operate paths for relays K1 through K16, respectively.

3.02 A ground on any of the lamp leads causes the appropriate relay to operate, closing its single normally open contact, thus supplying 10 Vac to light the designated lamp on the referral telephone set.

3.03 All relays in the DAS are WE 323A relays. Each relay contact is capable of passing the necessary current to light a maximum of sixteen lamps, if a referral telephone set is provided for each line.

3.04 The attendant request control (ARC) lead provides the operate path for relay K17. A single normally open contact is available between terminals TB2-1 and TB2-2 for customer operation of a visual or audible signal to indicate an incoming call.

3.05 Leads not used by the data station are brought out on terminals of TB1 and TB2 to provide access to the remaining telephone set connections. These connections are shown in Table A.

3.06 Transmission and control leads to the line or connecting telephone equipment are functionally designated as shown in Table B.

4. INSTALLATION

4.01 Install the 407-type data station in accordance with apropriate Bell System Practices.

TABLE A

UNUSED TELEPHONE SET CONNECTIONS

TB1	DESIG	TB2	DESIG
1	A18	1	ARC1
2	L18	2	ARC2
3	LG18	3	RG1
4	R19	4	RG2
5	T19	5	R17
6	A19	6	T17
7	L19	7	A17
8	LG19	8	L17
9	BZ	9	LG17
10	BZ1	10	R18
		11	T18

TABLE B

TRANSMISSION AND CONTROL LEAD DESIGNATIONS

DESIG	MEANING
T	Tip
R	Ring
A	"A" lead control from telephone set
L	Lamp control to telephone set
ARC	Attendant request control lead to telephone set
FG	Frame ground
SG	Signal ground
BZ	External buzzer
RG	External ringer

4.02 Mount the 828D DAS vertically on a wall or other convenient location, keeping in mind the 1000 foot limitation of the B25A cable. The mounting location of the DAS should be chosen in proximity to a source of customer-supplied 117 Vac 60 Hz power that is not under control of a switch.

4.03 Mount the 67B1 and 20B2 power units near the DAS and power source.

4.04 Wire the power units to TB3 on the DAS as shown in Fig. 3 and 4. Do not connect the power units to the ac power source at this time.

4.05 Follow installation instructions in one of the four following paragraphs that corresponds to the particular installation being made.

4.06 ***Installation Using DS 407A, AR, B, or BR With 630DAM or 2630DAM Referral Telephone Set(s):*** Interconnect the DAS to the data station as shown in Fig. 5 using B25A cable. Mount the KS-19252-L1 bridging adapters and interconnect with the DAS using B25A cable. Connect the referral telephone set(s) to the bridging adapters.

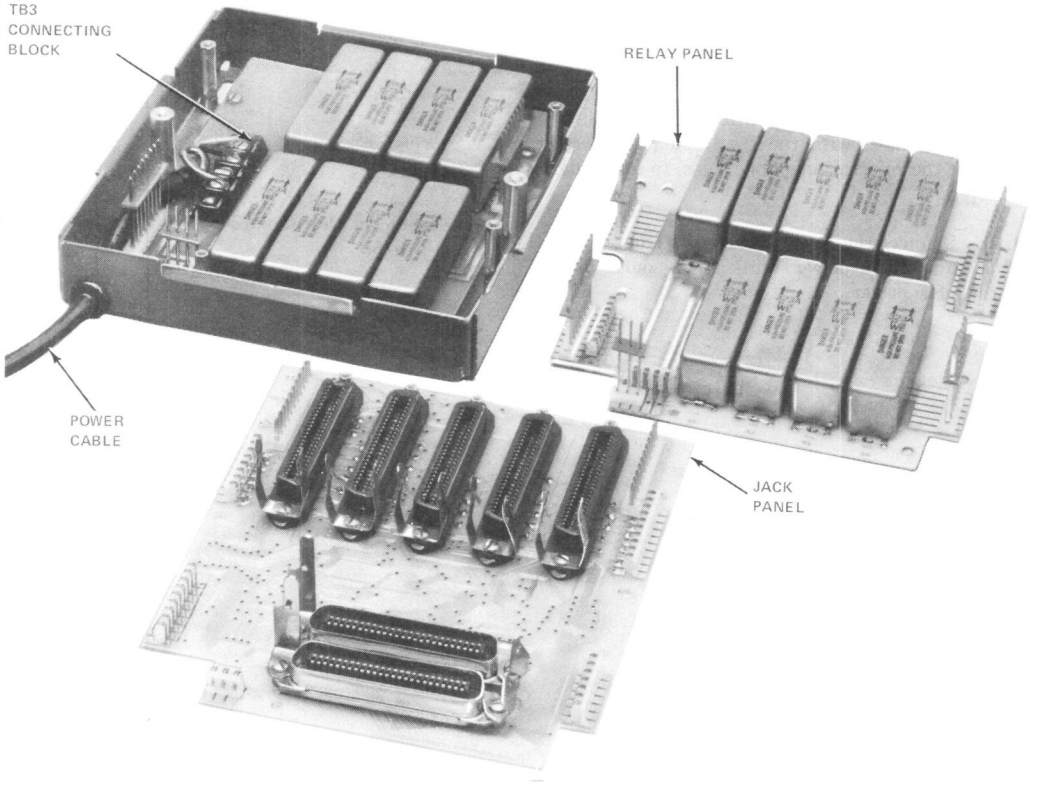


Fig. 3—828D Data Auxiliary Set Showing Connecting Block

4.07 ***Installation Using DS 407A, AR, B, or BR With 831CM or 2831CM Referral Telephone Set(s):*** Interconnect the DAS to the data station as shown in Fig. 6 using B25A cable. Mount the KS-19252-L1 bridging adapters and interconnect with the DAS using B25A cable. Connect the referral telephone set(s) to the bridging adapters.

4.08 ***Installation Using DS 407C or CR With 630DAM or 2630DAM Referral Telephone Set(s):*** Interconnect to the data station as shown in Fig. 7 using B25A cable. Mount the KS-19252-L1 bridging adapters and interconnect with the DAS using B25A cable. Connect the referral telephone set(s) to the bridging adapters.

4.09 ***Installation Using DS 407C or CR With 831CM or 2831CM Referral Telephone Set(s):*** Interconnect the DAS to the data station as shown in Fig. 8 using B25A cable. Mount the KS-19252-L1 bridging adapters and interconnect with the DAS using B25A cable. Connect the referral telephone set(s) to the bridging adapters.

4.10 Connect the power connectors from the 67B1 and 20B2 power units to a source of 117 Vac 60 Hz power.

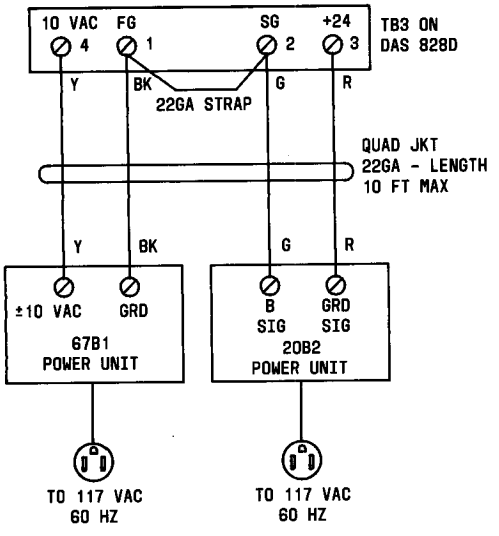


Fig. 4—Power Unit Connections to Data Auxiliary Set 828D

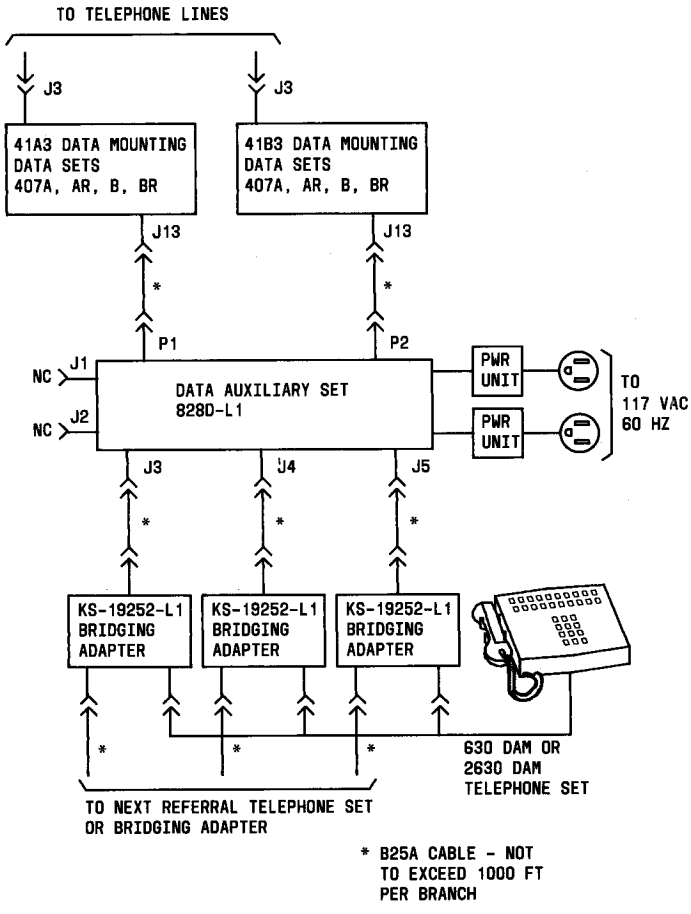


Fig. 5—407A, AR, B, or BR Data Station Arrangement Using 630DAM or 2630DAM Referral Telephone Set

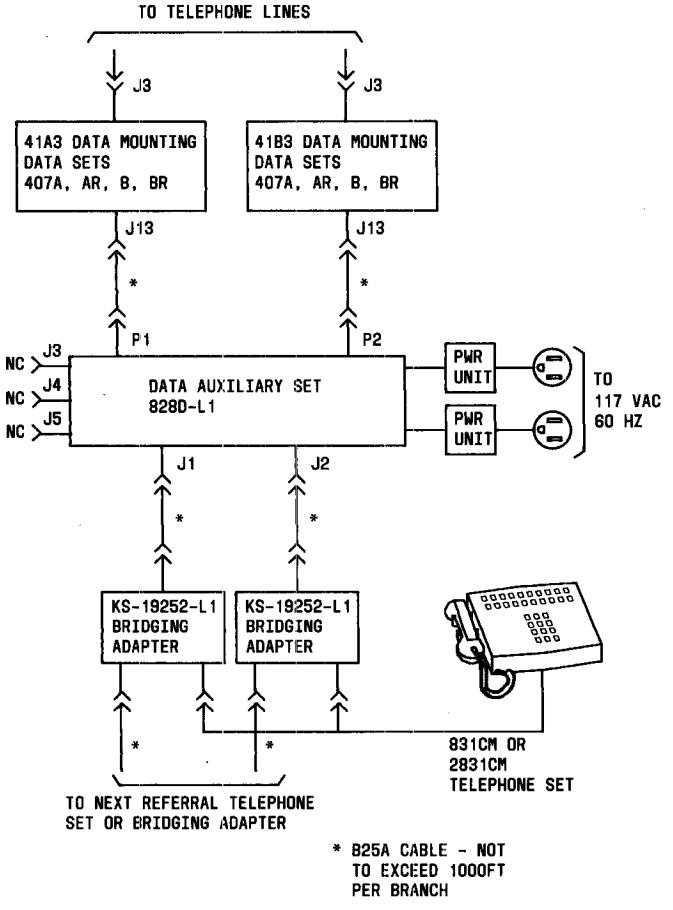


Fig. 6—407A, AR, B, or BR Data Station Arrangement Using 831CM or 2831CM Referral Telephone Set

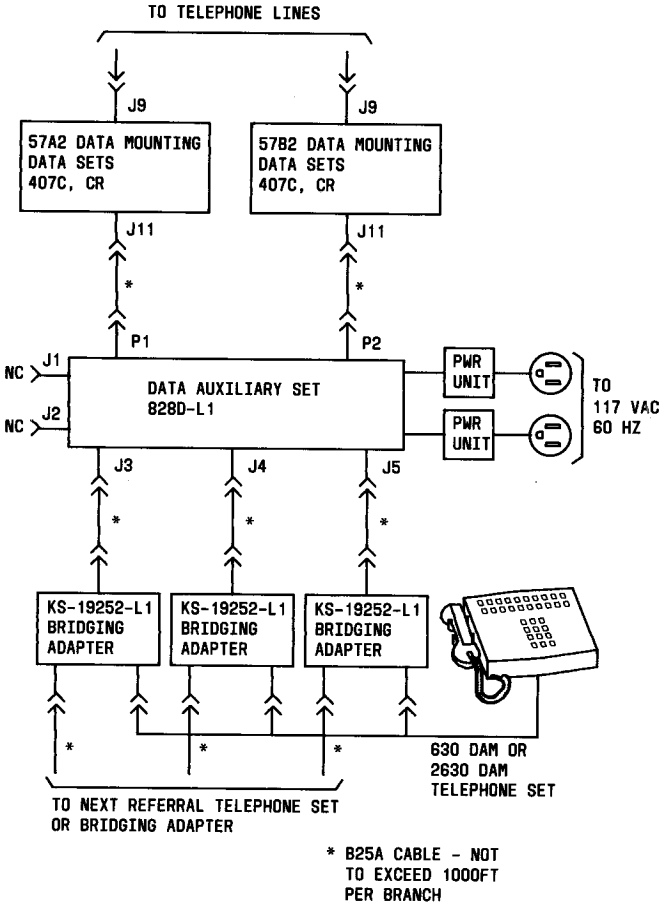


Fig. 7—407C or CR Data Station Arrangement Using 630DAM or 2630DAM Referral Telephone Set

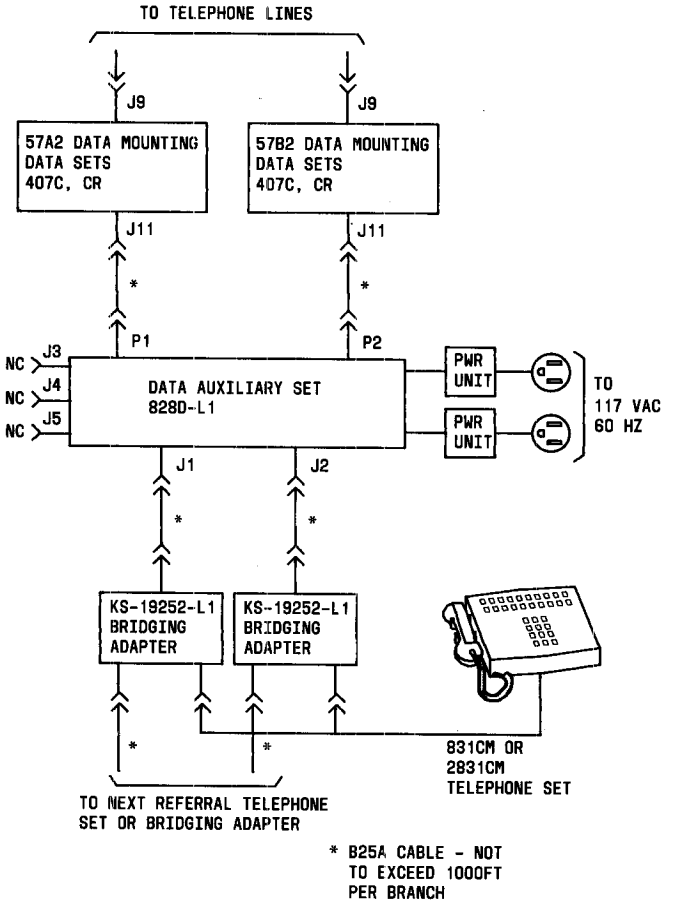


Fig. 8—407C or CR Data Station Arrangement Using 831CM or 2831CM Referral Telephone Set

DATA AUXILIARY SET 829-TYPE
CHANNEL INTERFACE UNITS
VOICEBAND PRIVATE LINE CHANNELS
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1. GENERAL

1.01 This section contains the description of data auxiliary set (DAS) 829-type and the supplementary data units and data mountings. Data auxiliary set 829-type functions as a channel interface unit (CIU) to provide a prewired and tested standard termination for 4-wire private line voiceband data channels. Basic station arrangements use the DAS 829-type CIU to provide 4-wire data only service. Other station arrangements use the DAS 829-type CIU and the supplementary apparatus to provide 4-wire data with alternate voice, dial backup, and switched dial backup service. Two-wire data only and data with alternate voice service are also provided.

1.02 This section is reissued to add information on the 48ER1, 48FR1, and 48G1 data units and the 44A2, 46A2, 46C2, 59A1, and 62A1 data mountings. Since this reissue is a general revision, arrows normally used to indicate changes have been omitted.

1.03 A choice of six codes for the DAS 829-type CIU provides proper termination of channels having various loop facilities.

- DAS 829A-L1 or L1A for short loops.
- DAS 829B-L1 or L1A for longer nonloaded loops.
- DAS 829C-L1 or L1A for longer loaded loops.

1.04 A choice of seven data units combined with a DAS 829-type CIU provides the following features:

- 48A1 data unit for 4-wire or 2-wire alternate voice service.

- 48B1 data unit for 4-wire dial backup service with manual dialing.

- 48C1 data unit (switching matrix) for switching any one of four 4-wire modems to either one of two 4-wire dial backup channels.

- 48D1 data unit (interface adapter) for use with a 46C1 or 46C2 and/or 46B1 data mounting to concentrate control leads in an 18- or 30-button CALL DIRECTOR® key telephone set.

- 48ER1 data unit for 4-wire dial backup service with manual or automatic dialing. This data unit complies with all requirements of the FCC Registration Program. The registration number for the 48ER1 data unit is AS593M-67751-PC-E. The ringer equivalence number for each line is 0.5A.

- 48FR1 data unit for 4-wire dial backup service with automatic answering. This data unit complies with all requirements of the FCC Registration Program. The registration number for the 48FR1 data unit is AS593M-67757-PC-E. The ringer equivalence number for each line is 0.5A.

- 48G1 data unit for 2-wire to 4-wire conversion.

1.05 A choice of seven types of data mountings houses single or multiple arrangements of DAS 829-type CIUs and/or 48-type data units without any change in wiring.

- 44A1 or 44A2 data mounting houses one DAS 829-type CIU.

- 45A1 data mounting houses one DAS 829-type CIU or one DAS 829-type CIU with the following data units: one 48A1 or 48B1, or one 48A1 and one 48B1.

- 46A1 or 46A2 data mounting houses up to eight DAS 829-type CIUs.

- 46B1 data mounting houses up to eight 48A1 or 48G1 data units.

- 46C1 data mounting houses one or two 48B1 data units and up to six 48C1 data units.

- 46C2 data mounting houses one or two 48B1 or 48ER1 data units and up to six 48C1 data units.

- 59A1 data mounting houses one DAS 829-type CIU or one DAS 829-type CIU with the following data units: one 48A1, 48B1, 48ER1, 48FR1, or 48G1; or one 48A1 and one 48B1, 48ER1, or 48G1.

- 62A1 data mounting houses one DAS 829-type CIU or one DAS 829-type CIU and one 48G1 data unit.

DATA ONLY SERVICE

1.06 The DAS 829-type CIU when used with the proper data mounting but without the supplementary data units provides 4-wire data only service. The DAS 829-type CIU also provides a loopback mode of operation to permit testing of the transmission facilities from a remote test center. A 48G1 data unit can be used with the DAS 829-type CIU to provide 2-wire data only service.

1.07 The DAS 829-type CIU provides a prewired and tested standard termination for 4-wire private line voiceband data channels. The CIU is available in six codes for proper termination of channels having the following loop facilities:

- DAS 829A-L1 and L1A for short nonloaded or loaded loops when no gain is required in the transmit or receive paths.

- DAS 829B-L1 and L1A for longer nonloaded loops that require gain in the receive path.

- DAS 829C-L1 and L1A for longer loaded loops that require gain in the receive path and extensive amplitude equalization.

The three L1A codes provide all the functions of the corresponding L1 codes and also provide the following functions: (1) data only service on 8-dB channels, (2) operation from a -48 Vdc power source, (3) visual indication of loopback, and (4) provision for disabling loopback by use of special data mountings.

1.08 The DAS 829A-L1, 829B-L1, and 829C-L1 CIUs are for use on channels with an end-to-end loss of 16 dB and a modem transmit

power of 0 dBm. The DAS 829A-L1A, 829B-L1A, and 829C-L1A CIUs are for use on channels with an end-to-end loss of either 8 or 16 dB. The 8-dB channels are limited to data only service since the supplementary data units required for alternate voice and/or dial backup service are designed for use on standard 16-dB channels only. The functions provided by the six CIU codes are summarized in Table A.

1.09 The DAS 829-type CIU provides two line pairs for 4-wire transmission and an additional line pair for line status. The line status pair is controlled by a normally-closed contact in the CIU and supplies a signal at the interface that can be used by the associated modem to control an Electronic Industries Association (EIA) circuit. When the EIA RS-232-C standard 25-pin interface is used, the line status pair can be used by the associated modem to control the data set ready signal (EIA CC circuit). When the EIA RS-449 standard 37-pin interface is used, the line status pair can be used by the associated modem to control the data mode signal (EIA DM circuit). An open line status pair provides a not-in-data indication when the CIU is in the loopback mode (facility loopback).

1.10 Housing for a single DAS 829-type CIU is provided by the 44A1 and 44A2 data mountings. The 45A1, 59A1, and 62A1 data mountings can also provide housing for a single DAS 829-type CIU but are not normally used for this purpose in data only service. Multiple housing for up to eight DAS 829-type CIUs is provided by the 46A1 and 46A2 data mountings. Housing for a single DAS 829-type CIU with a single 48G1 data unit is provided by the 62A1 data mounting. The 59A1 data mounting can also provide housing for a single DAS 829-type CIU with a single 48G1 data unit but is not normally used for this purpose in 2-wire data only service. Multiple housing for up to eight 48G1 data units is provided by the 46B1 data mounting. The 44A2 data mounting provides all the functions of the 44A1 data mounting and also provides screw terminal access to the simplex pair of the 4-wire metallic facilities. The 46A2 data mounting provides all the functions of the 46A1 data mounting and also provides the following functions: (1) connector access to the simplex pair of the 4-wire metallic facilities and (2) operation from a -24 or -48 Vdc power source.

1.11 If the DAS 829-type CIU requires a 24 Vac power source, the 44A1, 44A2, 45A1, 46A1, 46A2, 59A1, and 62A1 data mountings can be used. If the CIU requires a -24 or -48 Vdc power source, the 44A1, 44A2, 46A2, and 62A1 data mountings can be used. If the 48G1 data unit requires a 24 Vac power source for data only service, the 46B1, 59A1, and 62A1 data mountings can be used. If the 48G1 data unit requires a -24 or -48 Vdc power source, only the 62A1 data mounting can be used. Special arrangements that require disabling of CIU loopback must provide their own data mounting.

1.12 A simplified functional diagram for 4-wire data only service is shown in Fig. 1.

(a) In the normal (data) mode, the modem is connected to the 4-wire metallic facilities through the normally-closed contacts of the LB1 relay in the DAS 829-type CIU. Data transmission can take place over the 4-wire metallic facilities as indicated by a line status signal to the modem.

(b) In the loopback mode, operation of the LB1 relay in the DAS 829-type CIU disconnects the modem from the 4-wire metallic facilities and loops back the receive pair to the transmit pair through a loopback amplifier in the CIU. The 4-wire metallic facilities are now reserved for test purposes and are not available for data transmission as indicated by a line status signal to the modem.

1.13 A simplified functional diagram for 2-wire data only service is shown in Fig. 2. The DAS 829-type CIU operates in the same manner as described in paragraph 1.12 for 4-wire data only service. The 48G1 data unit converts the 2-wire channel from the modem into a 4-wire channel.

1.14 The 48G1 data unit provides the following functions:

- Balanced hybrid circuit consisting of a modem transmit and receive port, a station transmit port, and a station receive port.
- Gain in the station transmit port to offset hybrid and insertion losses in the transmit path.

TABLE A

FUNCTIONS PROVIDED BY THE DAS 829-TYPE CIU

FUNCTION	829A-L1	829B-L1	829C-L1	829A-L1A	829B-L1A	829C-L1A
Level adjustment in the transmit and receive paths:						
Attenuation in the transmit path	X	X	X	X	X	X
Attenuation in the receive path	X	X	X	X	X	X
Gain in the receive path		X	X		X	X
Amplitude equalization in the transmit and receive paths: Slope equalization:						
150-ohm line impedance		X			X	
600-ohm line impedance	X	X	*	X	X	*
1200-ohm line impedance	X	X	*	X	X	*
359A or 359K equalizer equivalent*			X			X
Tone operated loopback at equal transmission levels:						
For 8-dB channels				X	X	X
For 16-dB channels	X	X	X	X	X	X
Visual indication of loopback				X	X	X
Improved loopback control logic				X	X	X
Provision for disabling loopback†				X	X	X
Not-in-data indication to modem	X	X	X	X	X	X
Sealing current option	X	X	X	X	X	X
Hazardous voltage protection	X	X	X			
Improved hazardous voltage protection				X	X	X
Test and monitor jacks in transmit and receive circuits	X	X	X	X	X	X
TRANS MON jack connected directly to DT1 and DR1 leads				X	X	X
Handle to facilitate removal of CIU				X	X	X
Provision for central office operation (−48 Vdc supply)				X	X	X
Power source						
24 Vac	X	X	X	X	X	X
−24 Vdc	X	X	X	X	X	X
−48 Vdc				X	X	X

* The 359A equalizer equivalent provides a 1200-ohm line impedance.
The 359K equalizer equivalent provides a 600-ohm line impedance.

† Not available through use of a standard data mounting.

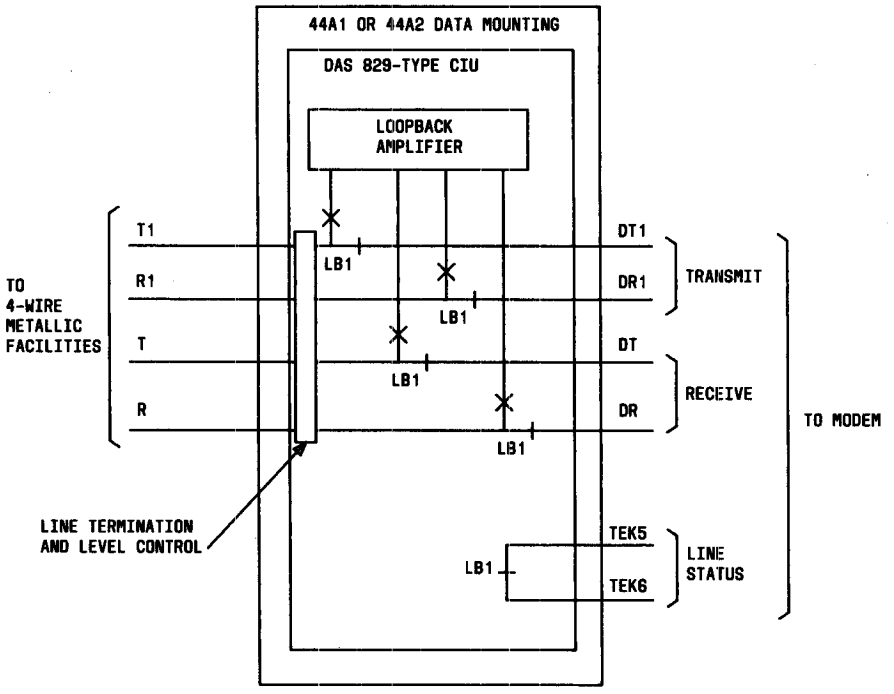


Fig. 1—4-Wire Data Only Service—Simplified Functional Diagram

- Gain in the station receive port to offset hybrid and insertion losses in the receive path.
- Test and monitor jacks in the modem port.
- Power supply option permitting operation from a 24 Vac, -24 Vdc, or -48 Vdc supply.

ALTERNATE VOICE AND DIAL BACKUP SERVICE

1.15 The 48A1, 48B1, 48ER1, 48FR1, and 48G1 data units, when used with the DAS 829-type CIU and the proper data mountings, provide the following arrangements:

- 4-wire data with alternate voice—This service is provided by a CIU with a 48A1 data unit.
- 2-wire data with alternate voice—This service is provided by a CIU with both a 48A1 and a 48G1 data unit.
- 4-wire data with dial backup (manual dialing)—This service is provided by a CIU with a 48B1 data unit.
- 4-wire data with dial backup (manual or automatic dialing)—This service is provided by a CIU with a 48ER1 data unit.
- 4-wire data with dial backup (automatic answering)—This service is provided by a CIU with a 48FR1 data unit.
- 4-wire data with alternate voice and dial backup—This service is provided by a CIU with both a 48A1 and a 48B1 or 48ER1 data unit.

1.16 The 48A1 data unit provides the switching, signaling, and transmission circuitry required to add alternate voice service to 4-wire or 2-wire private line data service. The 48B1 or 48ER1 data unit provides the switching, ring detection, and

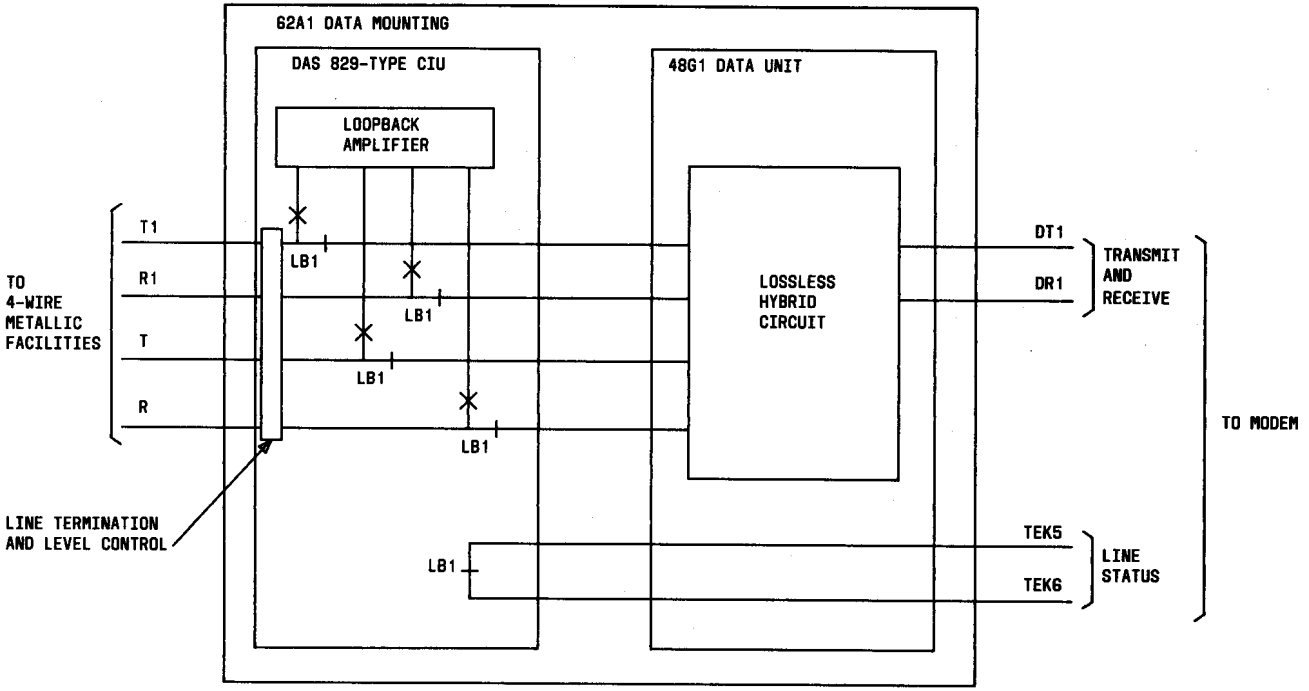


Fig. 2—2-Wire Data Only Service—Simplified Functional Diagram

transmission circuitry required to add 4-wire dial backup service to 4-wire private line data or data with alternate voice service. The 48ER1 data unit is a registered replacement for the 48B1 data unit and provides all the functions of the 48B1 data unit except 4-dB slope equalization. The 48ER1 data unit also permits automatic dialing at the originating station of a 4-wire dial backup channel and enables the originating station to operate with an unattended terminating station. The 48FR1 data unit is a registered data unit that provides the switching, ring detection, and transmission circuitry required for automatic answering at the unattended terminating station.

1.17 Housing for one CIU, one CIU with one 48A1 or one 48B1 data unit, or one CIU with one 48A1 and one 48B1 data unit is provided by the 45A1 data mounting. Housing for one CIU; one CIU with one 48A1, 48B1, 48ER1, 48FR1, or 48G1 data unit; or one CIU with one 48A1 and one 48B1, 48ER1, or 48G1 data unit is provided by the 59A1 data mounting. Multiple housing for up to eight CIUs is provided by the 46A1 or 46A2 data mounting. Multiple housing for up to eight 48A1 or 48G1 data units is provided by the 46B1 data mounting. The 59A1 data mounting is a replacement for the 45A1 data mounting and provides all the functions of the 45A1 data mounting. The 59A1 data mounting also provides the following functions: (1) housing for a 48ER1, 48FR1, or 48G1 data unit, (2) use of a customer- or modem-provided contact for control of the 48ER1 or 48FR1 data unit, and (3) screw terminal access to the simplex pair of the 4-wire metallic facilities.

1.18 A simplified functional diagram for 4-wire data with alternate voice and/or dial backup service is shown in Fig. 3.

(a) In the normal (data) mode, the modem is connected to the 4-wire metallic facilities (4-wire private line) through the normally-closed contacts of the LB1 relay in the DAS 829-type CIU, the TK relay in the 48A1 data unit (if alternate voice service is provided), and the A relay in the 48B1, 48ER1, or 48FR1 data unit (if dial backup service is provided). Data transmission can take place over the 4-wire private line as indicated by a line status signal to the modem.

(b) In the alternate voice mode, operation of the TK relay in the 48A1 data unit disconnects the modem and connects the key telephone set to the private line. The private line is now reserved for voice transmission and is not available for data transmission as indicated by a line status signal to the modem.

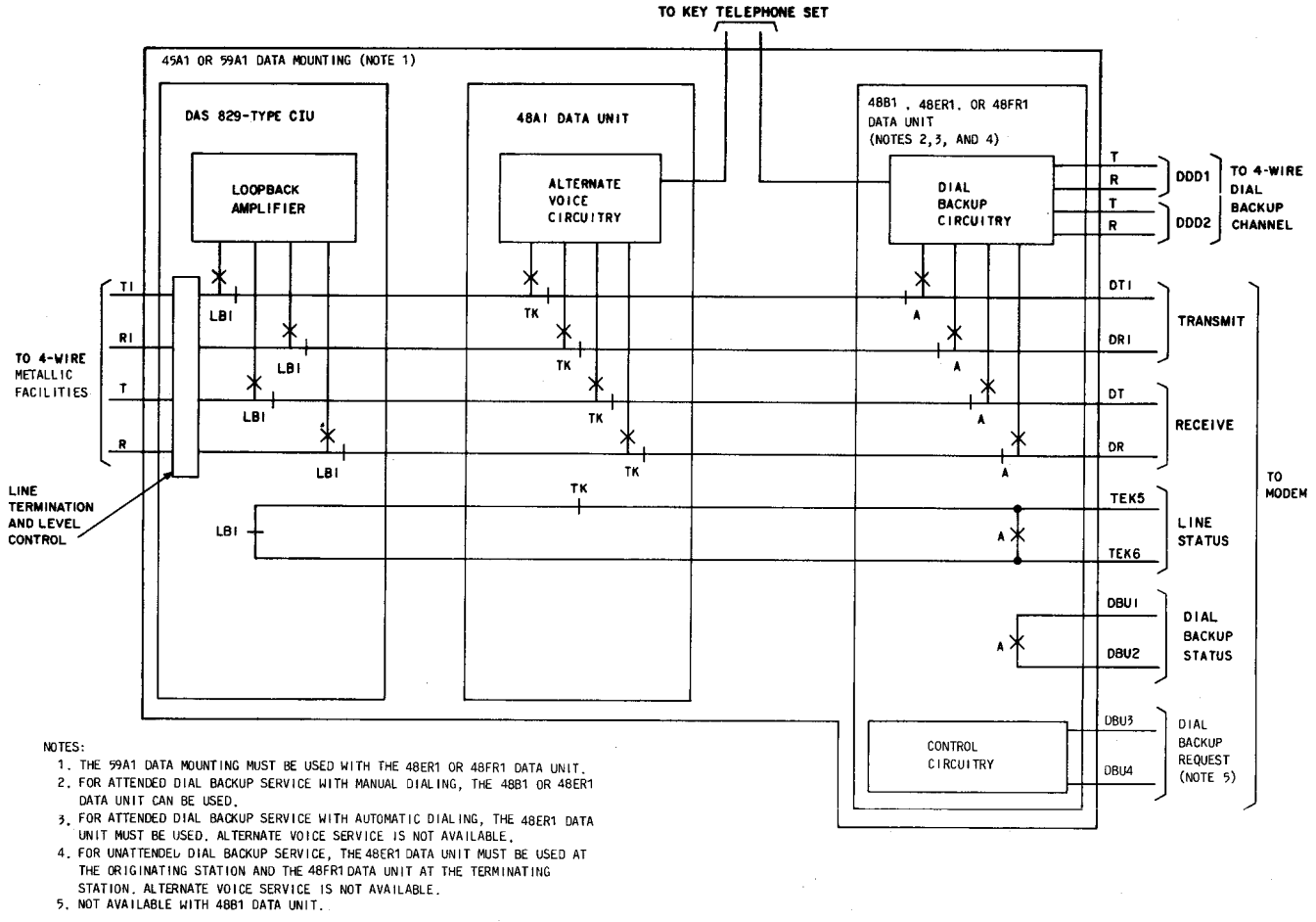
(c) In the dial backup mode, operation of the A relay in the 48B1, 48ER1, or 48FR1 data unit transfers the modem from the 4-wire private line to the 4-wire dial backup channel. Data transmission can now take place over the 4-wire dial backup channel as indicated by line status and dial backup status signals to the modem.

(d) When unattended dial backup is provided, the customer can control the operational mode of the 48ER1 or 48FR1 data unit through use of a dial backup request pair. A customer- or modem-provided contact is required for this remote control. A contact closure indicates a dial backup channel is requested. At present, Bell System modems do not provide for control of the dial backup request pair.

> ***Note:*** In the future, it is expected that Bell System modems will be available that provide for control of the dial backup request pair. These modems will have the EIA RS-449 standard 37-pin interface. The EIA select standby (SS) circuit can then be used for control of the dial backup request pair. The dial backup status pair can then be used for control of the EIA standby indicator (SB) circuit.

1.19 Four types of 4-wire single channel arrangements with dial backup service can be provided. The type of arrangement used is determined by the type of operation required at each station (attended or unattended). When attended operation is provided at the local and distant stations, alternate voice service over the private line channel can be provided. The four types of 4-wire single channel arrangements are as follows:

- Attended call origination and answer at Stations A and B.
- Attended call origination at Station A, unattended call answer at Station B.
- Attended call origination and answer at Station A, unattended call origination and answer at Station B.



NOTES:

1. THE 59A1 DATA MOUNTING MUST BE USED WITH THE 48ER1 OR 48FR1 DATA UNIT.
2. FOR ATTENDED DIAL BACKUP SERVICE WITH MANUAL DIALING, THE 48B1 OR 48ER1 DATA UNIT CAN BE USED.
3. FOR ATTENDED DIAL BACKUP SERVICE WITH AUTOMATIC DIALING, THE 48ER1 DATA UNIT MUST BE USED. ALTERNATE VOICE SERVICE IS NOT AVAILABLE.
4. FOR UNATTENDED DIAL BACKUP SERVICE, THE 48ER1 DATA UNIT MUST BE USED AT THE ORIGINATING STATION AND THE 48FR1 DATA UNIT AT THE TERMINATING STATION. ALTERNATE VOICE SERVICE IS NOT AVAILABLE.
5. NOT AVAILABLE WITH 48B1 DATA UNIT.

Fig. 3—4-Wire Data With Alternate Voice and/or Dial Backup Service—Simplified Functional Diagram

- Unattended call origination and answer at Stations A and B.

  (a) For attended call origination and answer at Stations A and B, the equipment required at the two stations is shown in Fig. 4. To set up a dial backup channel between the two stations in both transmit and receive directions, two calls must be established between lines DDD1 and DDD2 and the lines placed on hold. Both calls can be manually originated by either attended station or the first call can be manually originated by one station and the second call by the other station. However, line DDD1 at Station A must be connected to line DDD2 at Station B and line DDD2 at Station A to line DDD1 at Station B. If the stations are equipped with 48B1 dial backup units, the first call can be originated on line DDD1 or DDD2. If the stations are equipped with 48ER1 dial backup units, the first call must be originated on line DDD2.

  (b) For attended call origination at Station A, unattended call answer at Station B, the equipment required at the two stations is shown in Fig. 5. To set up a dial backup channel between the two stations in both transmit and receive directions, two calls must be established between lines DDD1 and DDD2 and the lines placed on hold. Both calls are manually originated by the attended station (Station A) and automatically answered by the unattended station (Station B). The second call must be completed within a timed interval after completion of the first call. Line DDD1 at Station A must be connected to Line DDD2 at Station B and line DDD2 at Station A to line DDD1 at Station B. The first call must be originated on line DDD2.

  (c) For attended call origination and answer at Station A, unattended call origination and answer at Station B, the equipment required at the two stations is shown in Fig. 6. To set up a dial backup channel between the two stations in both transmit and receive directions, two calls must be established between lines DDD1 and DDD2 and the lines placed on hold. The first call is manually originated by the attended station (Station A) on line DDD2 and automatically answered by the unattended station (Station B) on line DDD1. The second call is automatically originated by a single number dialer (station dial) at Station B on line DDD2 and manually answered by Station A on line DDD1.

  (d) For unattended call origination and answer at Stations A and B, the equipment required at the two stations is shown in Fig. 7. To set up a dial backup channel between the two stations in both transmit and receive directions, two calls must be established between lines DDD1 and DDD2 and the lines placed on hold. The first call is automatically originated by a single number dialer or an automatic calling unit (ACU) at unattended Station A on line DDD2 and automatically answered by unattended Station B on line DDD1. The second call is automatically originated by a single number dialer at Station B on line DDD2 and automatically answered at Station A on line DDD1.

1.20 A simplified functional diagram for 2-wire data with alternate voice service is shown in Fig. 8. The DAS 829-type CIU and the 48A1 data unit operate in the same manner as described in paragraph 1.18 for 4-wire data with alternate voice service. The 48G1 data unit converts the 2-wire channel from the modem into a 4-wire channel.

1.21 The 48A1 data unit provides the following functions:

- Alternate voice service for modems over a 4-wire or 2-wire private line through the interface of a DAS 829-type CIU.
- A 4-wire to 2-wire conversion to interface with a 2-wire key telephone set.
- 2600-Hz manual ringdown signaling.
- Control of station equipment through use of a key telephone set.
- Audible ringback signal.

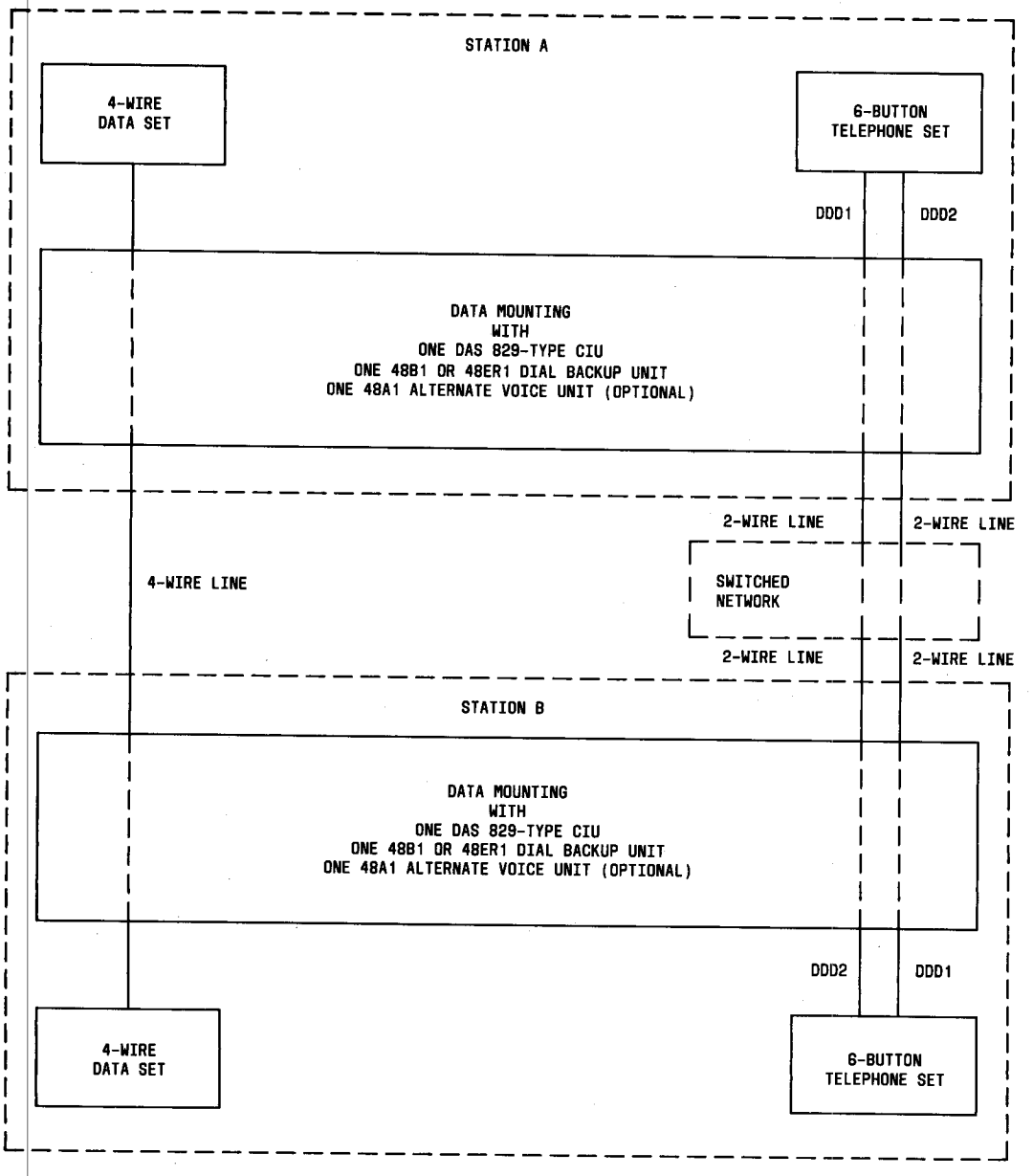


Fig. 4—4-Wire Single Channel Arrangement—Attended Call Origination and Answer at Stations A and B

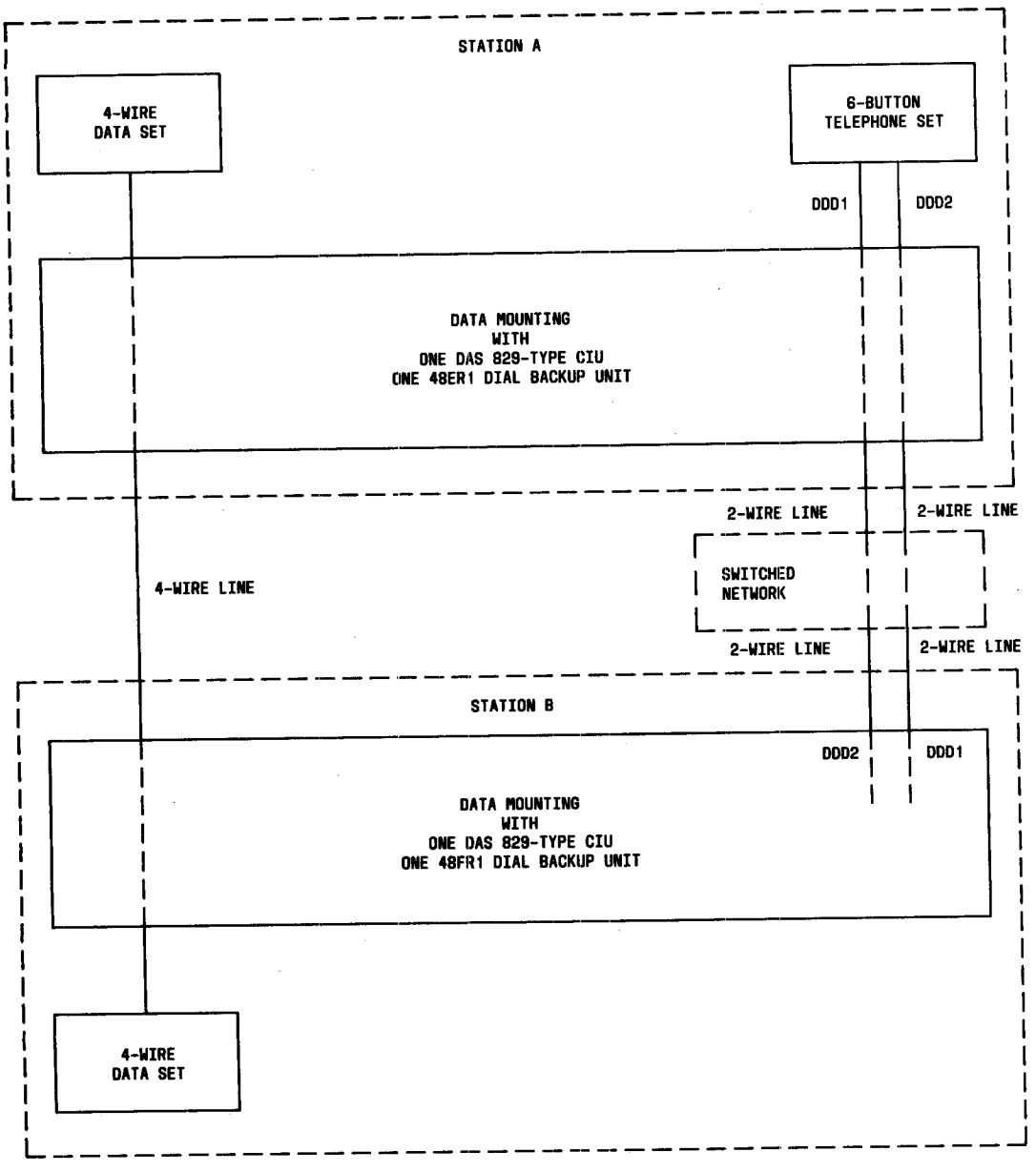


Fig. 5—4-Wire Single Channel Arrangement—Attended Call Origination at Station A, Unattended Call Answer at Station B

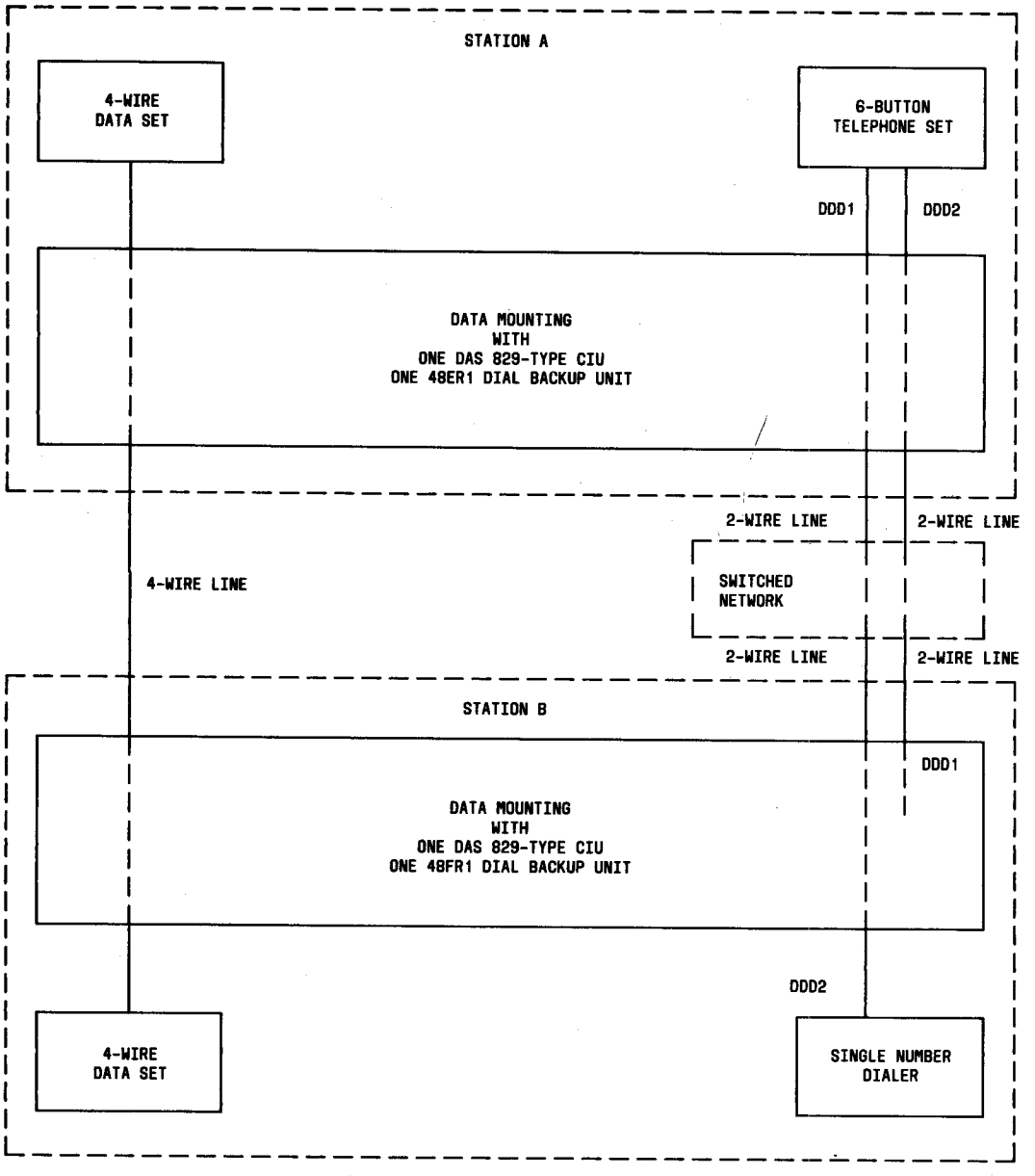


Fig. 6—4-Wire Single Channel Arrangement—Attended Call Origination and Answer at Station A, Unattended Call Origination and Answer at Station B

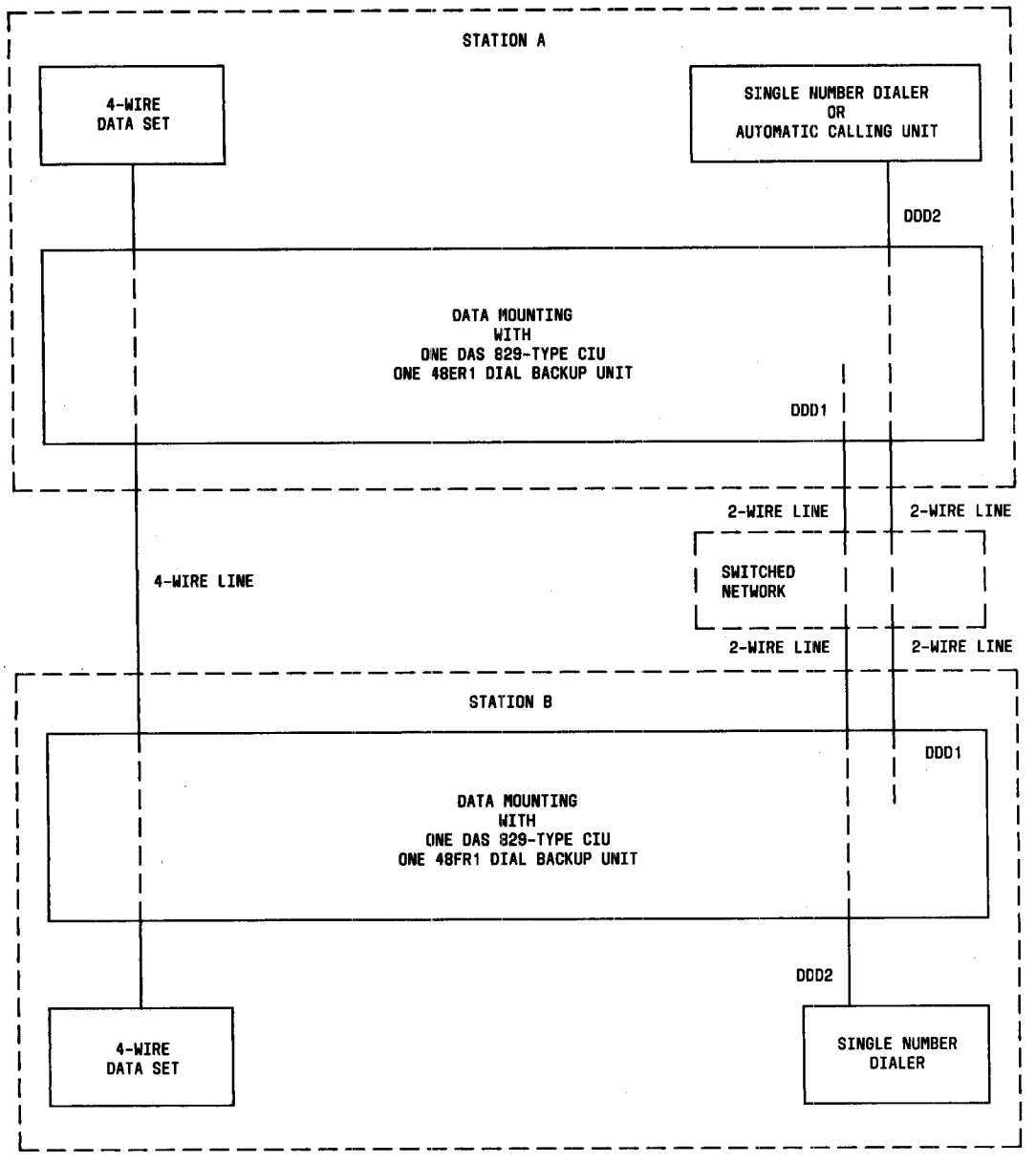


Fig. 7—4-Wire Single Channel Arrangement—Unattended Call Origination and Answer at Stations A and B

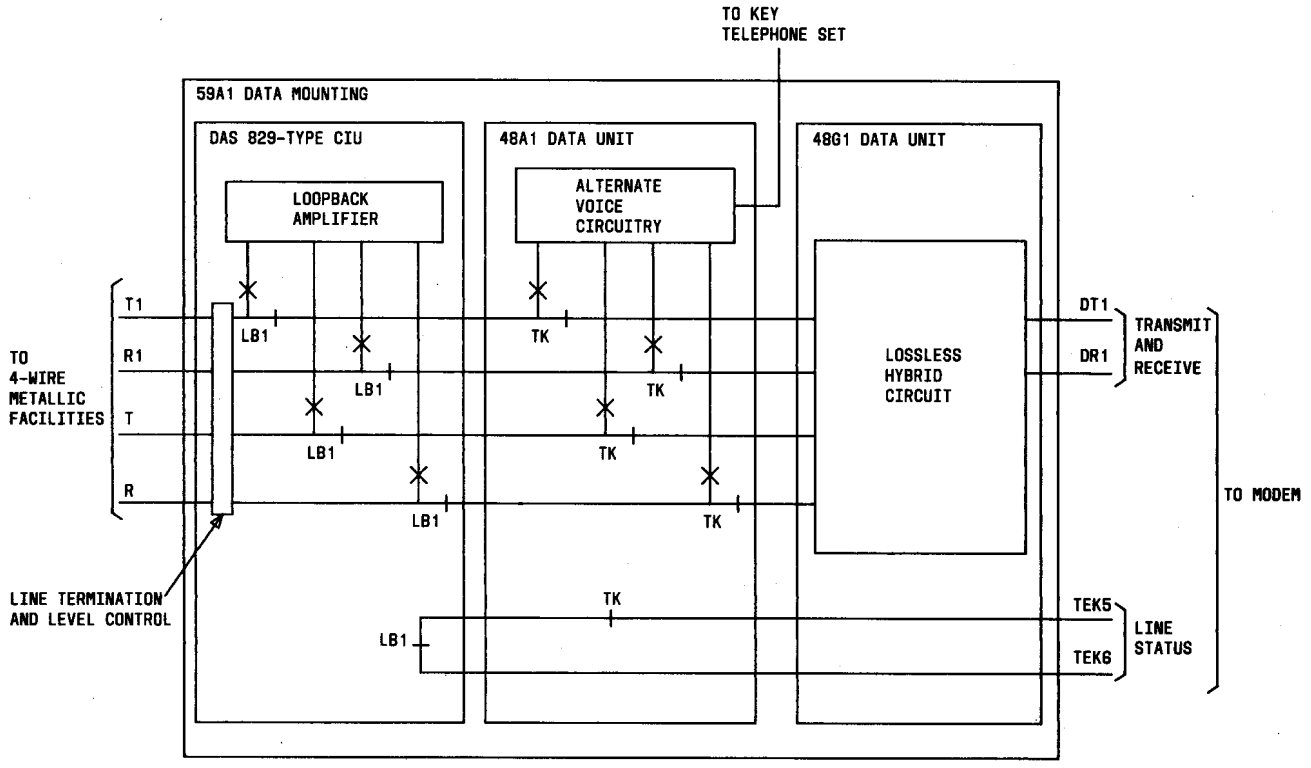


Fig. 8—2-Wire Data With Alternate Voice Service—Simplified Functional Diagram

- 2600-Hz ring detector controlling audible and lamp indications provided by the key telephone set.
- Locked-in ring detection.
- Control of a not-in-data signal to modem.

1.22 The 48B1 data unit provides the following functions:

- 4-wire dial backup service for Bell System modems interfacing with a DAS 829-type CIU.
- Termination for a 4-wire dial backup channel consisting of two 2-wire switched network (dial-up) lines.
- Transfer of modem interface to either a 4-wire private line or a 4-wire dial backup channel through use of a key telephone set.
- Variable gain on backup receive pair to control level of received signal.
- Optional 4-dB slope equalizer on backup receive pair.
- Variable attenuation on backup transmit pair to control level of transmitted signal.
- Control of a not-in-data signal to modem.
- Control of a dial backup signal to modem.
- Key telephone set lamp indication of dial backup mode.
- Ring detection and key telephone set lamp indication on each dial-up line.
- Line surge protection.
- Impedance matching (600-ohm modem to 900-ohm dial-up line).

1.23 The 48ER1 data unit provides the following functions:

- 4-wire dial backup service for modems interfacing with a DAS 829-type CIU.
- Protective circuit to enable connection of nonregistered modems to a 4-wire dial backup channel consisting of two 2-wire switched network (dial-up) lines.
- Variable gain on backup receive pair to control level of received signal.
- Signal power limiter on backup transmit pair to enable connection of nonregistered modems to a 4-wire dial backup channel.
- Variable gain on backup transmit pair to control level of transmitted signal.
- Control of a not-in-data signal to modem.
- Control of a dial backup signal to modem.
- Lamp indication of dial backup mode.
- Hazardous voltage protection.
- Impedance matching (600-ohm modem to 600-ohm dial-up line).
- Transmitter to send start and stop signals to a 48FR1 data unit. Transmitter and associated logic control an unattended dial backup terminating station.
- Manual dialing option providing the following:

  (a) Transfer of modem interface to either a 4-wire private line or a 4-wire dial backup channel through use of a key telephone set.

  (b) Ring detection and key telephone set lamp indication on each dial-up line.

  (c) Attendant origination of calls through use of a key telephone set.

- Automatic dialing option providing the following:

  (a) Origination of a 4-wire dial backup channel under control of a locking key provided as part of 48ER1 data unit or under control of a customer- or modem-provided contact closure.

(b) Control of a 43A or 53A station dial or partial control of a DAS 801CR-L1/2 automatic calling unit (ACU).

(c) Ring detection under control of internal logic.

(d) Transfer of modem interface to a 4-wire dial backup channel through use of internal logic.

(e) Release from dial backup mode under control of a locking key provided as part of 48ER1 data unit or under control of a customer- or modem-provided contact closure.

- Test jacks on modem side of 4-wire dial backup channel.

1.24 The 48FR1 data unit provides the following functions:

- Telco-provided unattended 4-wire dial backup service for modems interfacing with a DAS 829-type CIU.
- Protective circuit to enable connection of nonregistered modems to a 4-wire dial backup channel consisting of two 2-wire switched network (dial-up) lines.
- Variable gain on backup receive pair to control level of received signal.
- Signal power limiter on backup transmit pair to enable connection of nonregistered modems to a 4-wire dial backup channel.
- Variable gain on backup transmit pair to control level of transmitted signal.
- Control of a not-in-data signal to modem.
- Control of a dial backup signal to modem.
- Lamp indication of dial backup mode.
- Hazardous voltage protection.
- Impedance matching (600-ohm modem to 600-ohm dial-up line).
- Receiver to detect start and stop signals transmitted by a 48ER1 data unit. Receiver and associated logic enable control of an unattended dial backup terminating station.
- Loop-current monitor providing for release from dial backup mode when an interruption of loop current exceeding 5 ms is detected.
- Two-minute timer and associated logic providing for release from dial backup mode when terminating station is improperly accessed.
- Release key providing for manual release from dial backup mode when dial backup channel is lost due to a system malfunction; eg, loss of carrier facilities constitutes a system malfunction.
- Transfer of modem interface to a 4-wire private line when a stop signal is received on dial-up line 2.
- Dial-up lines placed on-hook when a stop signal is received on dial-up line 2.
- Automatic answering, 48FR1 data unit enabled option always permits unattended operation of a dial backup terminating station.
- Automatic answering, customer enabled option permits customer control of a dial backup terminating station. A customer- or modem-provided contact closure enables normal unattended operation of the station. When the contact is open, a dial backup channel cannot be established.
- Unattended operation (two calls answered within a timed interval option) providing the following:

(a) Ring detection under control of internal logic.

(b) Logic associated with dial-up line 1 assures that line 1 answers any incoming call, by tripping ringing with a line-holding coil.

(c) Logic associated with dial-up line 2 assures that line 2 answers any incoming

call, by tripping ringing with a line-holding coil, when dial-up line 1 is on hold.

(d) Transfer of modem interface to a 4-wire dial backup channel at end of a start signal received on dial-up line 2. Receipt of start signal completes calling sequence.

- Unattended operation (automatic call back option) providing the following:

(a) Ring detection under control of internal logic.

(b) Logic associated with dial-up line 1 assures that line 1 answers any incoming call, by tripping ringing with a line-holding coil.

(c) Logic associated with dial-up line 2 assures that line 2 goes off-hook, starting a 43A or 53A station dial, when dial-up line 1 is off-hook for at least 5 seconds. Line 2 is placed on hold when station dial completes dialing.

(d) Transfer of modem interface to a 4-wire dial backup channel at end of a start signal received on dial-up line 2. Receipt of start signal completes calling sequence.

- Test jacks on modem side of 4-wire dial backup channel.

1.25 The standard channel interface arrangements using the 48ER1 and 48FR1 data units have the following advantages over other currently available arrangements:

- The transmit channel of the 48ER1 and 48FR1 data units provides a signal power limiter. The signal power limiter ensures that the 48ER1 and 48FR1 data units satisfy the transmission requirements of the FCC Registration Program. Therefore, nonregistered modems can be connected to the switched network through use of the 48ER1 and 48FR1 data units.

- The 48ER1 and 48FR1 data units provide for a new service. The 48ER1 data unit provides the signaling and logic functions required for the originating station of a 4-wire dial backup channel having automatic dialing and/or automatic answering capabilities. The 48FR1 data unit provides the signaling and logic functions required for the terminating station of a 4-wire dial backup channel having automatic answering capabilities.

- Customer-provided modems can be connected to a 4-wire dial backup channel through use of the 48ER1 and 48FR1 data units.

SWITCHED DIAL BACKUP SERVICE

1.26 The 48B1 or 48ER1, 48C1, and 48D1 data units, when used with the DAS 829-type CIUs and the proper data mountings, provide 4-wire switched dial backup service. Alternate voice service can be added by use of the 48A1 data unit. These multiple channel arrangements use a CALL DIRECTOR key telephone set to control a maximum of 23 modems to provide 4-wire data, alternate voice, switched dial backup, or a combination of these services.

1.27 The 48C1 data unit provides a 2-by-4 switching matrix that can connect any one of four modems to either one of two 4-wire dial backup channels terminated by 48B1 or 48ER1 data units. The 48D1 data unit provides an interface adapter for use with a 46C1 data mounting to concentrate control of 48A1, 48B1 or 48ER1, and 48C1 data units in an 18- or 30-button CALL DIRECTOR key telephone set.

1.28 Housing for up to eight DAS 829-type CIUs is provided by the 46A1 or 46A2 data mounting. Housing for up to eight 48A1 data units is provided by the 46B1 data mounting. Housing for one or two 48B1 data units and up to six 48C1 data units is provided by the 46C1 or 46C2 data mounting. Housing for one or two 48ER1 data units and up to six 48C1 data units is provided by the 46C2 data mounting. The 48D1 data unit is rack mounted and does not require housing. The 46C2 data mounting is a replacement for the 46C1 data mounting and provides all the functions of the 46C1 data mounting.

1.29 A simplified functional diagram for 4-wire switched dial backup service is shown in Fig. 9.

(a) In the normal (data) mode, modem No. 1 is connected to 4-wire metallic facilities No. 1 (4-wire private line No. 1) through the normally-closed

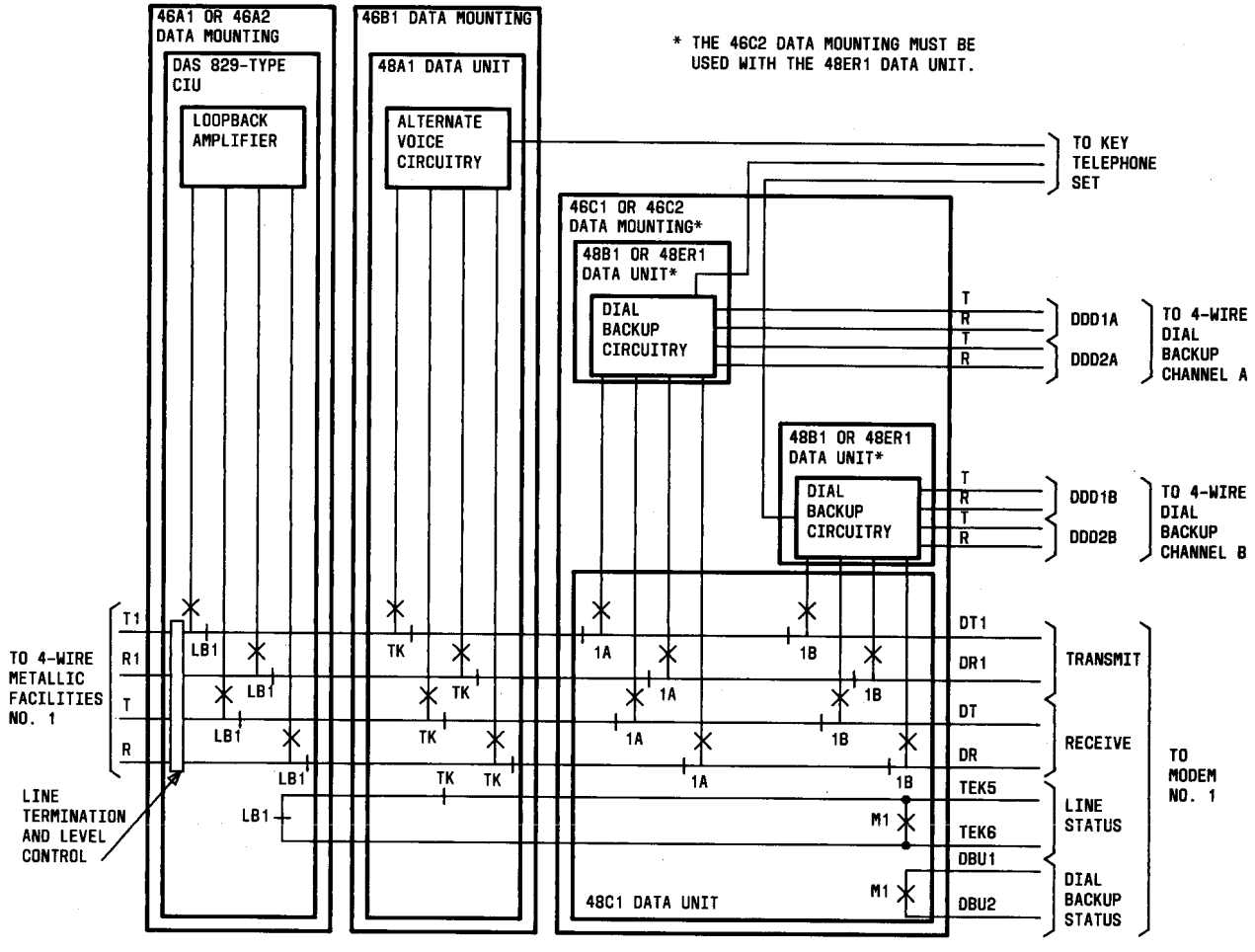


Fig. 9—4-Wire Switched Dial Backup Service—Simplified Functional Diagram for Modem No. 1

contacts of the LB1 relay in the DAS 829-type CIU, the TK relay in the 48A1 data unit (if alternate voice service is provided), and the 1A and 1B relays (the 1A, 1B, and M1 relays are provided for the first of four modems terminating in a 48C1 data unit) in the 48C1 data unit. Data transmission can take place over the 4-wire private line as indicated by a line status signal to the modem.

(b) In the alternate voice mode, operation of the TK relay in the 48A1 data unit disconnects the modem and connects the key telephone set to the 4-wire private line. The 4-wire private line is now reserved for voice transmission and is not available for data transmission as indicated by a line status signal to the modem.

(c) In the dial backup mode, operation of the 1A or 1B relay in the 48C1 data unit transfers modem No. 1 from 4-wire private line No. 1 to 4-wire dial backup channel A or B, respectively. Data transmission can now take place over the selected dial backup channel as indicated by line status and dial backup status signals (the M1 relay is operated when either the 1A or 1B relay is operated) to the modem.

1.30 The 48C1 data unit provides the following functions:

- 4-wire switched dial backup service for modems interfacing with a DAS 829-type CIU when used with a 48B1 data unit housed in a 46C1 or 46C2 data mounting or with a 48ER1 data unit housed in a 46C2 data mounting, and with a 48D1 data unit connected to an 18- or 30-button CALL DIRECTOR key telephone set.
- A 2-by-4 switching matrix to connect any one of four modems to either one of two 4-wire dial backup channels.
- Direct connection to a 48D1 data unit.
- Control of a not-in-data signal to modem.
- Control of a dial backup signal to modem.

1.31 The 48D1 data unit provides the following functions:

- Direct connection to up to three 46B1 data mountings containing a maximum of twenty-three 48A1 data units.
- Direct connection to up to six 48C1 data units housed in a 46C1 or 46C2 data mounting.
- Direct connection to a 46C1 or 46C2 data mounting when 4-wire dial backup service is required.
- Concentrated connection to a maximum of twenty-three modems to provide dial backup status signals to the modems if required.
- Direct connection to an 18- or 30-button CALL DIRECTOR key telephone set.

1.32 The multiple arrangements for 4-wire dial backup service described in this section have the following advantages over other currently available arrangements:

- One or two 4-wire dial backup channels can provide dial backup service for a maximum of twenty-three 4-wire private lines.
- Fewer key telephone sets are required for control of 4-wire dial backup and/or alternate voice service.
- Greater flexibility of station arrangements through use of plug-in circuit packs.

2. PHYSICAL DESCRIPTION

DATA MOUNTINGS

2.01 The data mountings provide single and multiple housing for the plug-in circuit packs (CIUs and data units) used with 4-wire private lines to provide data, alternate voice, dial backup, and switched dial backup service. Data and alternate voice service are provided for 2-wire private lines. The data mountings also provide the required connection facilities. The data mountings that provide a single housing (44A1, 44A2, 45A1, 59A1, and 62A1) can be mounted on a desk, shelf, or wall. The data mountings that provide a multiple housing (46A1, 46A2, 46B1, 46C1, and 46C2) require rack mounting or mounting in KS-20018-type cabinets.

A. 44A1 and 44A2 Data Mountings

2.02 The 44A1 and 44A2 data mountings (Fig. 10) are the same except the backplane. The 44A1 or 44A2 data mounting provides a housing for a single DAS 829-type CIU. The data mounting consists of a housing, a 6-foot power cord (840807028), and a 24-Vac wall-mounted transformer (KS-21239-L1 or L4). The data mounting can also operate from a -24 or -48 Vdc power source.

2.03 The backplane (Fig. 11) of the 44A1 data mounting contains a 50-pin connector and the screw terminals for connecting to 4-wire metallic facilities, a 24-Vac transformer, and a manual loopback key. Connector P1 connects to a single modem. The backplane (Fig. 12) of the 44A2 data mounting is the same as the backplane of the 44A1 data mounting except that two screw terminals have been added to provide access to the simplex pair of the 4-wire metallic facilities.

2.04 The 44A1 or 44A2 data mounting is 2-1/4 inches high, 5-3/4 inches wide, and 11 inches deep. The data mounting weighs 2-1/8 pounds.

2.05 The 44A1 or 44A2 data mounting can be used as a free standing unit on a desk or shelf or can be wall mounted using a separately ordered 193A backboard (Fig. 13).

B. 45A1 Data Mounting

2.06 The 45A1 data mounting provides a housing for a single DAS 829-type CIU or one of the following combinations:

- A CIU and a 48A1 data unit for 4-wire data with alternate voice service.
- A CIU and a 48B1 data unit for 4-wire data with dial backup service.
- A CIU plus a 48A1 data unit and a 48B1 data unit for 4-wire data with alternate voice and dial backup service (Fig. 14).

Note: The 48A1 data unit must be installed first in the 45A1 data mounting and removed last due to the physical location of circuit components on the data unit.

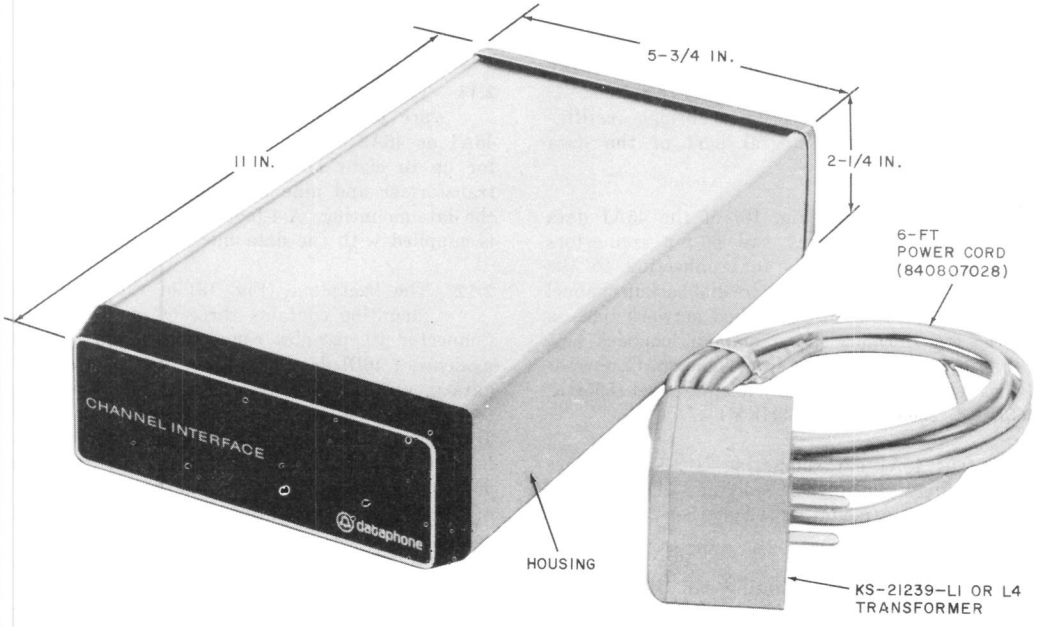


Fig. 10—44A1 or 44A2 Data Mounting—Front View

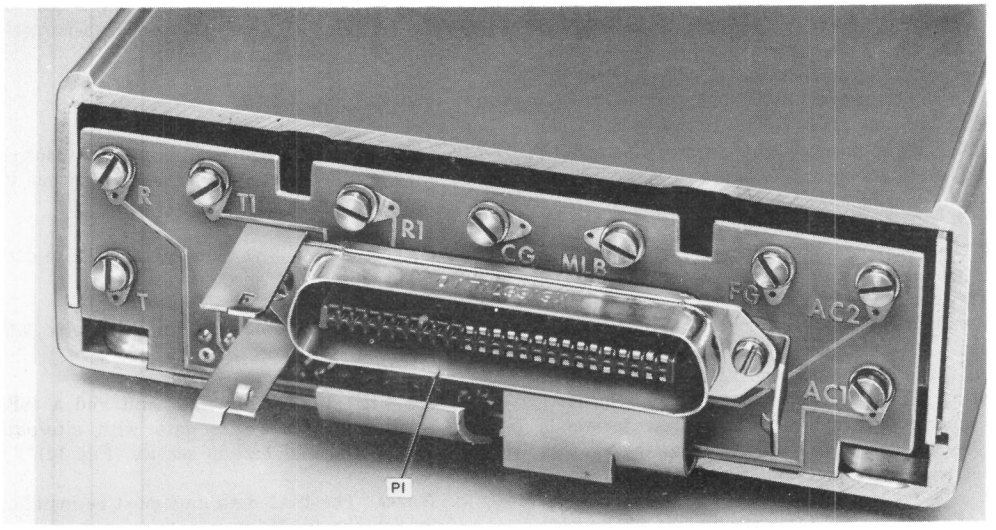


Fig. 11—44A1 Data Mounting—Rear View

2.07 The 45A1 data mounting (Fig. 15) consists of a housing, a 6-foot power cord (840807028), and a 24-Vac wall-mounted transformer (KS-21362-L1) with an 18-inch power cord. A bridge rectifier power supply is an integral part of the data mounting.

2.08 The backplane (Fig. 16) of the 45A1 data mounting contains two 50-pin connectors and the screw terminals for connecting to the 4-wire metallic facilities, a 4-wire dial backup channel consisting of two 2-wire switched network lines, a 24-Vac transformer, and a manual loopback key. Connector P1 connects to a single modem. Connector J4 connects to a 6-button key telephone set (565HK, 565HKM, 2565HK, or 2565HKM).

2.09 The 45A1 data mounting is 2-11/16 inches high, 10-1/2 inches wide, and 12-1/4 inches deep. The data mounting weighs 5-1/2 pounds.

2.10 The 45A1 data mounting can be used as a free standing unit on a desk or shelf or can be wall mounted using a separately ordered 193A backboard (Fig. 13).

C. 46A1 and 46A2 Data Mountings

2.11 The 46A1 and 46A2 data mountings (Fig. 17) are the same except the backplane. The 46A1 or 46A2 data mounting provides a housing for up to eight DAS 829-type CIUs. A 24-Vac transformer and nine fuses are integral parts of the data mounting. A 4-foot power cord (840339907) is supplied with the data mounting.

2.12 The backplane (Fig. 18) of the 46A1 data mounting contains three 50-pin connectors. Connector P1 permits connection to up to eight modems, a 46B1 data mounting, or a 46C1 or 46C2 data mounting. Connector J9 permits connection to up to eight 4-wire metallic facilities. Connector J10 permits connection to up to eight manual loopback keys. The backplane (Fig. 19) of the 46A2 data mounting is the same as the backplane of the 46A1 data mounting except as follows: (1) connector J11 has been added to permit connection to the simplex pair of up to eight 4-wire metallic facilities, (2) two screw terminals have been added to permit connection to a -24 or -48 Vdc power source, and (3) two plug-in option straps have been added to permit operation from the internal 24-Vac

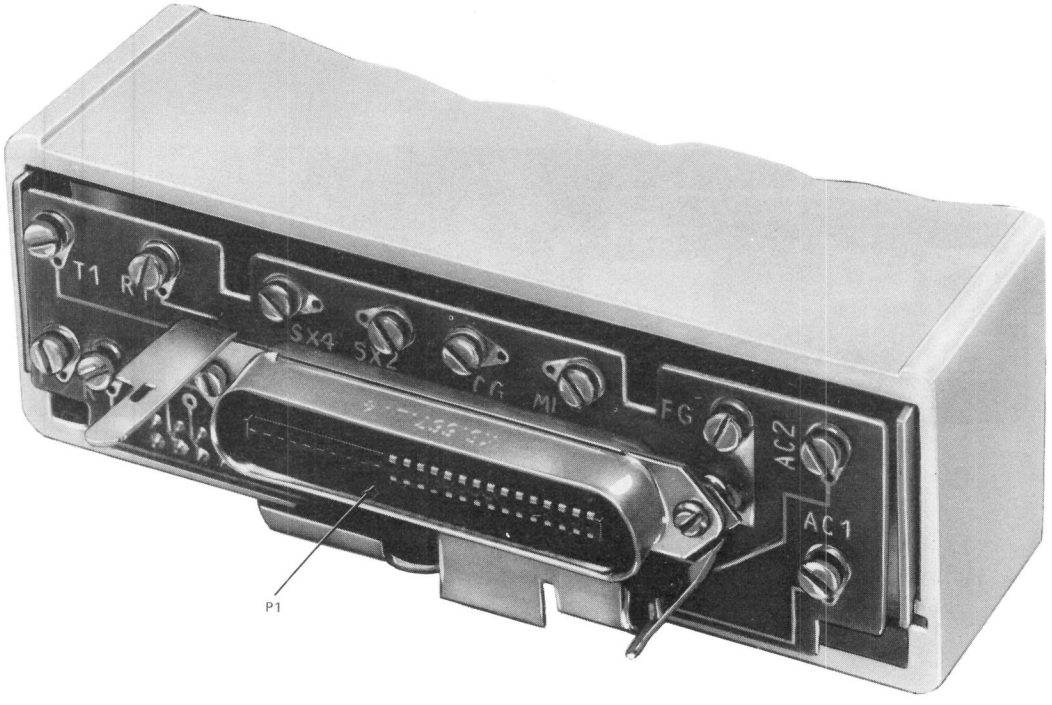


Fig. 12—44A2 Data Mounting—Rear View

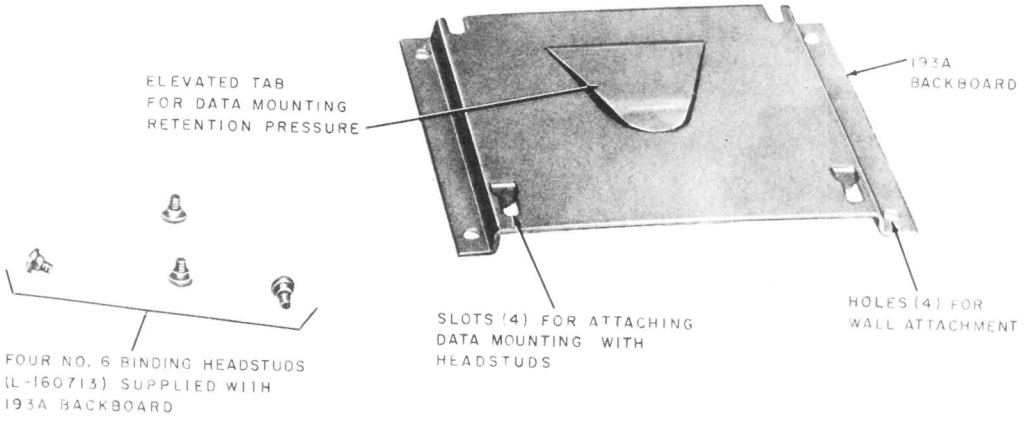


Fig. 13—193A Backboard

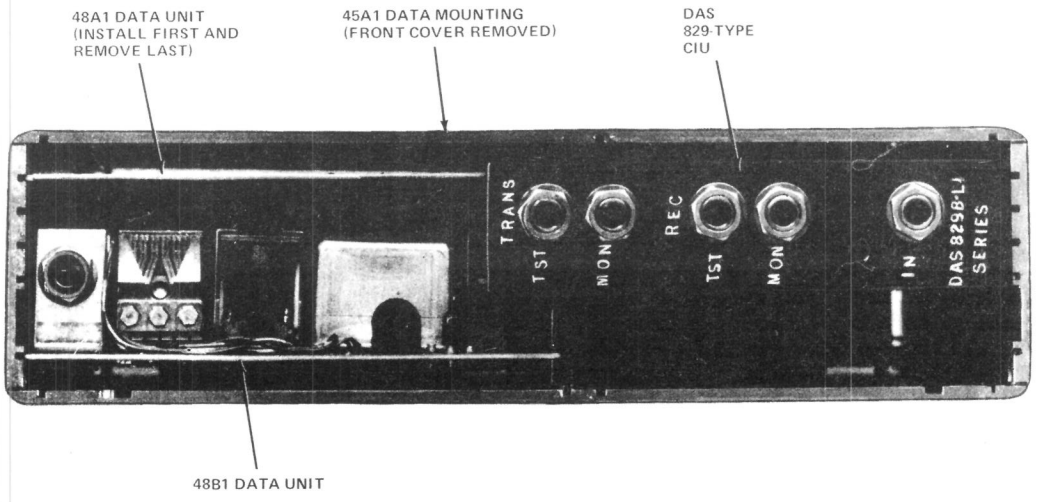


Fig. 14—45A1 Data Mounting Equipped With a DAS 829-Type CIU, a 48A1 Data Unit, and a 48B1 Data Unit

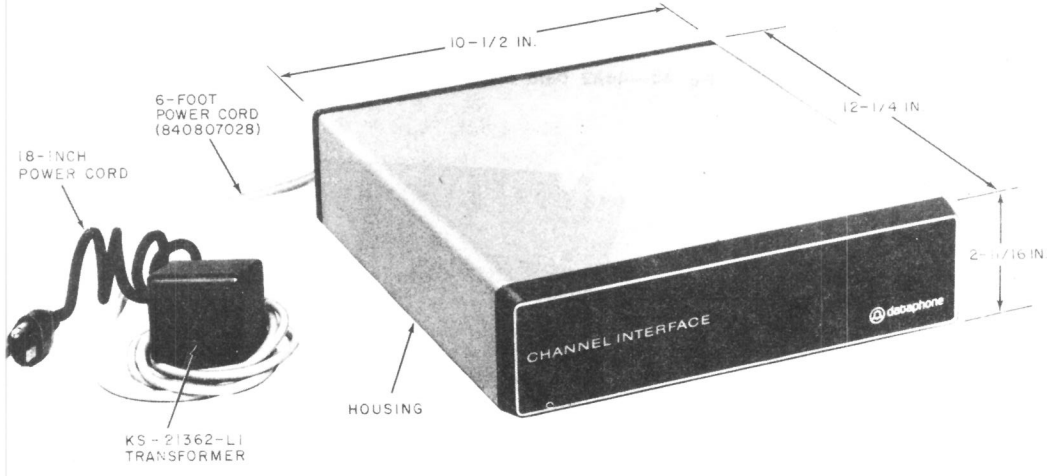


Fig. 15—45A1 Data Mounting—Front View

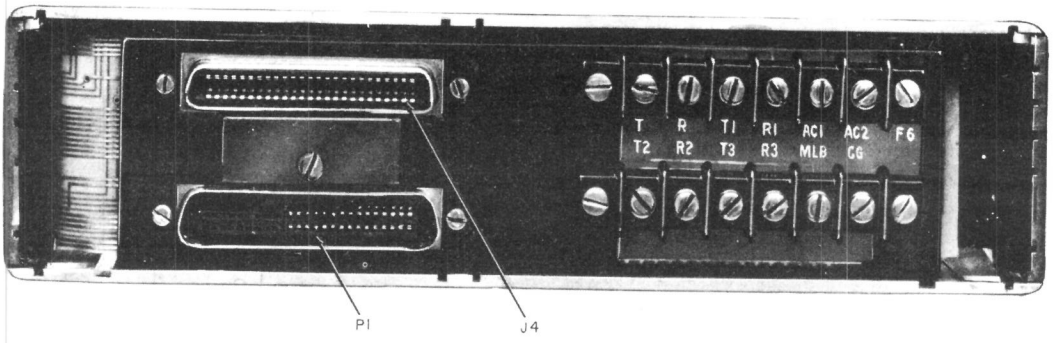


Fig. 16—45A1 Data Mounting—Rear View

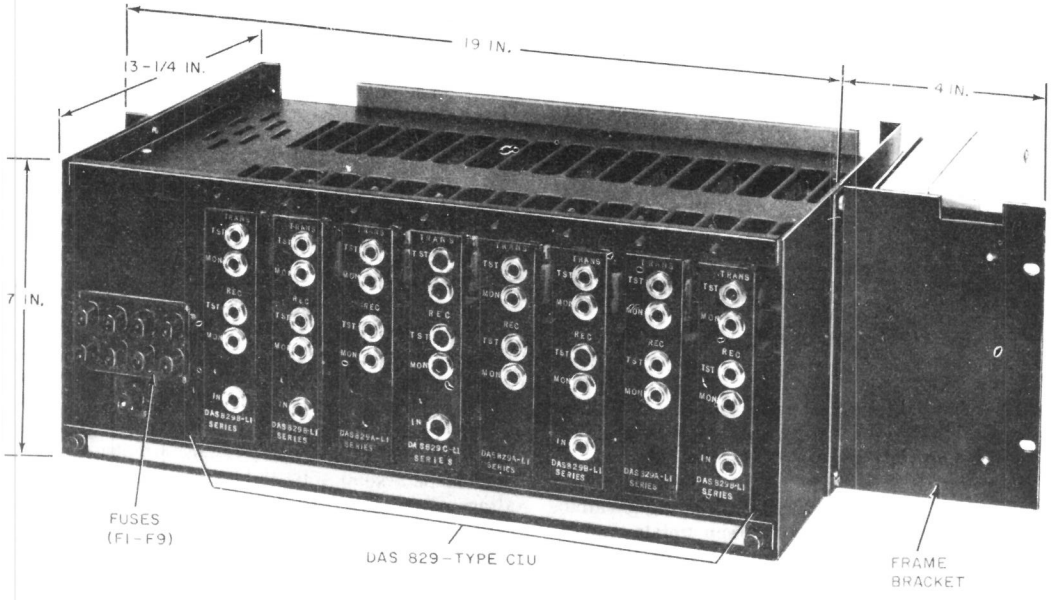


Fig. 17—46A1 or 46A2 Data Mounting—Front View

transformer or from the external dc power source. Power cord connector P2 and terminal strip TS1 are located on the rear of the 46A1 or 46A2 data mounting (Fig. 18 or 19) adjacent to the backplane. Terminal strip TS1 provides access to the operating voltages from the internal transformer to the CIUs.

2.13 Connector P1 permits direct connection to a multiple data mounting, such as the 40B data mounting for data set 202T. For connections from connector P1 to individual modems, a separately ordered KS-21253-L1 adapter can be used. This adapter concentrates up to eight modems into one

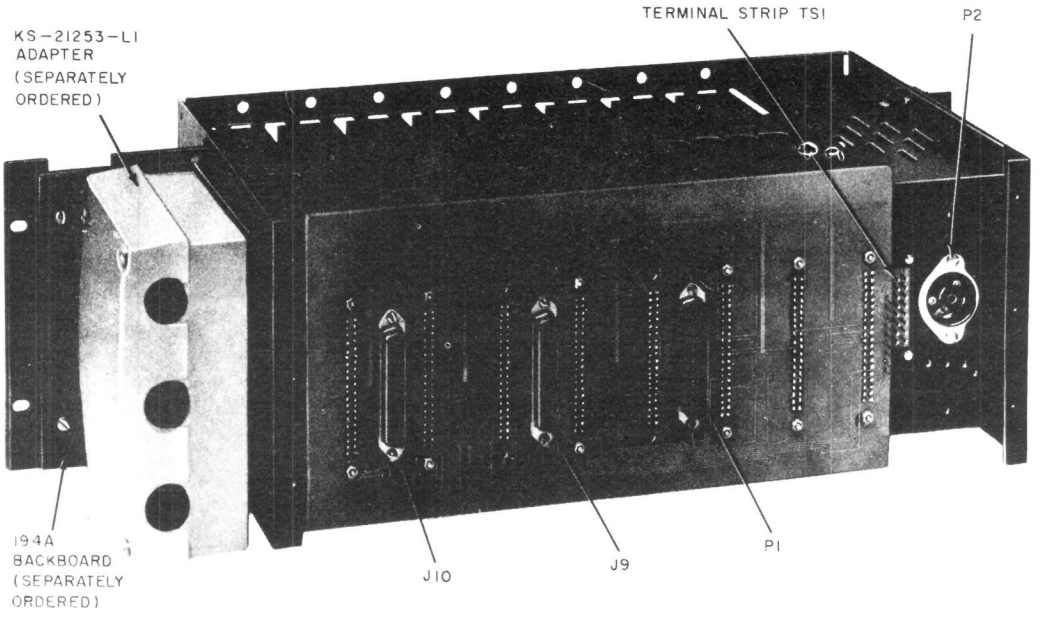


Fig. 18—46A1 Data Mounting—Rear View

50-pin connector. The adapter can be installed on the 46A1 or 46A2 data mounting by using a separately ordered 194A backboard as shown in Fig. 18 or 19.

2.14 The 46A1 or 46A2 data mounting is 7 inches high, 19 inches wide, and 13-1/4 inches deep. The data mounting weighs 20 pounds.

2.15 The 46A1 or 46A2 data mounting can be mounted on 19- or 23-inch relay racks. Mounting in KS-20018-type cabinets is recommended. Descriptive information on KS-20018-type cabinets is provided in Section 590-010-201.

D. 46B1 Data Mounting

2.16 The 46B1 data mounting (Fig. 20) provides a housing for up to eight 48A1 or 48G1 data units. A 24-Vac transformer, a bridge rectifier power supply, and nine fuses are integral parts of the data mounting. A 4-foot power cord (840339907) is supplied with the data mounting.

2.17 The backplane (Fig. 21) of the 46B1 data mounting contains three 50-pin connectors and a plug-in option strap. Connector P1 permits connection to up to eight modems. Direct connection can be made to a multiple data mounting, such as the 40B data mounting for data set 202T or the 46C1 or 46C2 data mounting for 4-wire switched dial backup service. Direct connection can also be made to a second 46B1 data mounting for 2-wire alternate voice service. For connections from connector P1 to individual modems, a separately ordered KS-21253-L1 adapter can be used. Connector J9 permits connection to a 46A1 or 46A2 data mounting. Connector J10 permits connection to a 10-button key telephone set (830- or 2830-type), a 48D1 data unit, or a locally engineered key system. Power cord connector P2 and terminal strip TS1 are located on the rear of the data mounting adjacent to the backplane. Terminal strip TS1 provides access to the operating voltages from the internal transformer to the 48A1 or 48G1 data units.

2.18 The ringing supply option (Fig. 21) uses a plug-in strap to select an internal ringing

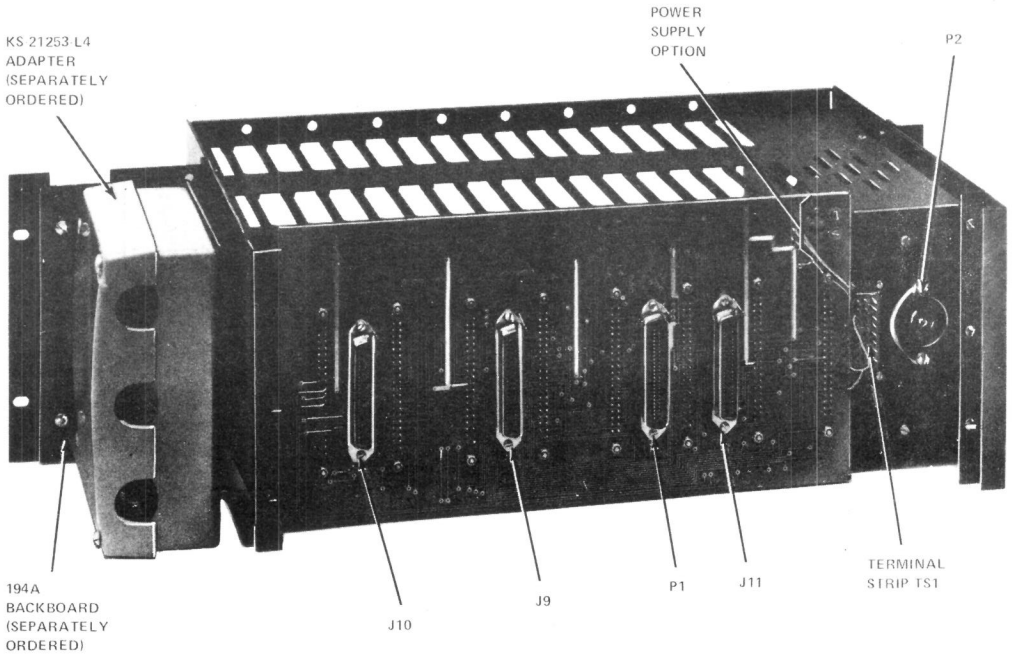


Fig. 19—46A2 Data Mounting—Rear View

supply (plug-in strap in INT position) or an external ringing supply (plug-in strap in EXT position). When the 46B1 data mounting is used with an 830- or 2830-type key telephone set, the plug-in strap must be in the INT position. When the 46B1 data mounting is used with a 48D1 data unit or a locally engineered key system, the plug-in strap must be in the EXT position.

2.19 The 46B1 data mounting is 7 inches high, 19 inches wide, and 13-1/4 inches deep. The data mounting weighs 20 pounds.

2.20 The 46B1 data mounting can be mounted on 19- or 23-inch relay racks. Mounting in KS-20018-type cabinets is recommended. Descriptive information on KS-20018-type cabinets is provided in Section 590-010-201.

E. 46C1 and 46C2 Data Mountings

2.21 The 46C1 (Fig. 22) and 46C2 (Fig. 23) data mountings are the same except a protective cover has been added at the front of the 46C2 data mounting. The 46C1 data mounting provides a housing for one or two 48B1 data units and up to six 48C1 data units. The 46C2 data mounting provides a housing for one or two 48B1 or 48ER1 data units and up to six 48C1 data units. Part of the control logic required for 4-wire switched dial backup service is an integral part of the 46C1 or 46C2 data mounting.

Note: The 46C1 or 46C2 data mounting must be used with the 48D1 data unit.

2.22 The backplane (Fig. 24) of the 46C1 or 46C2 data mounting contains eight 50-pin connectors, eight screw terminals, and two relays. Connector

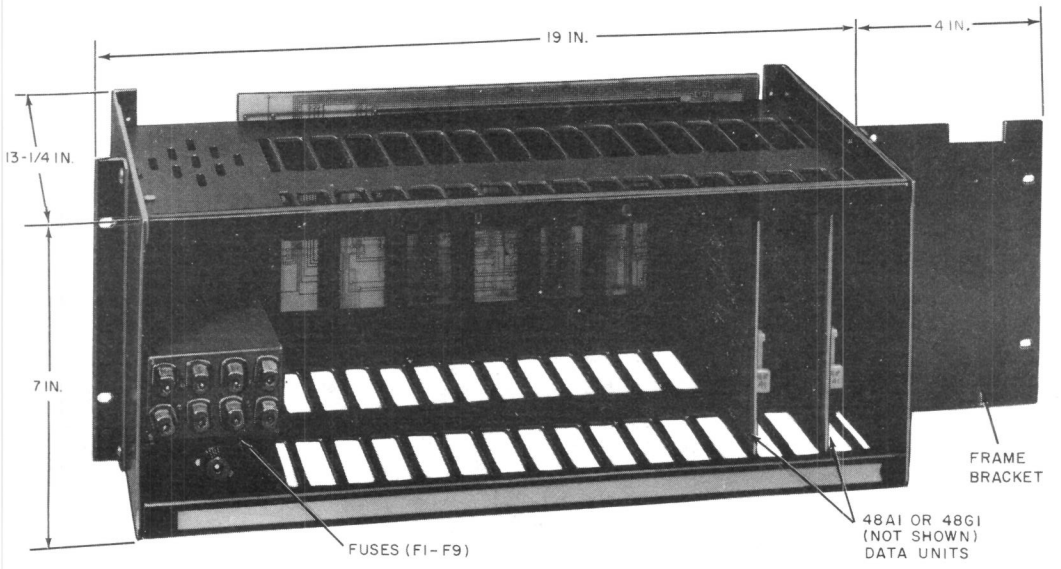


Fig. 20—46B1 Data Mounting—Front View

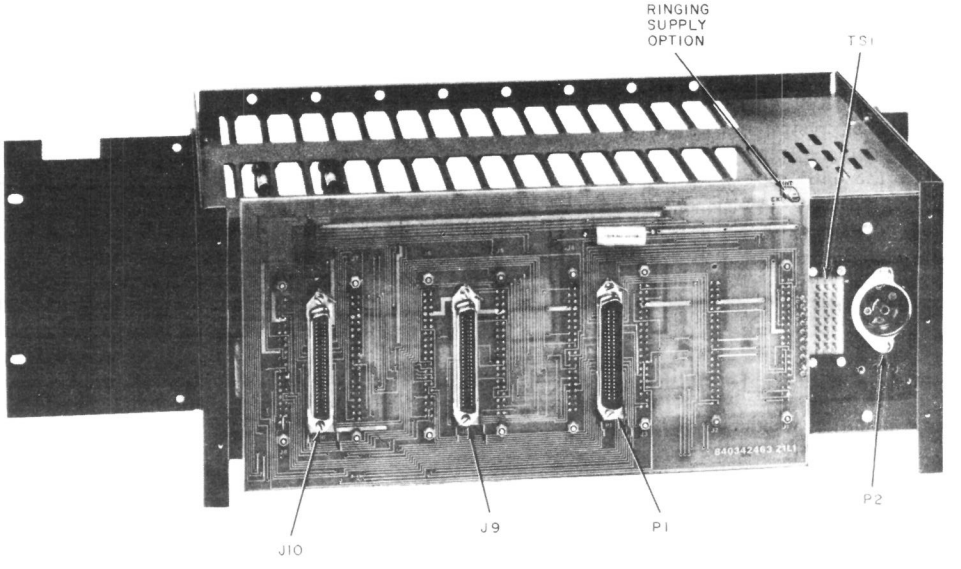


Fig. 21—46B1 Data Mounting—Rear View

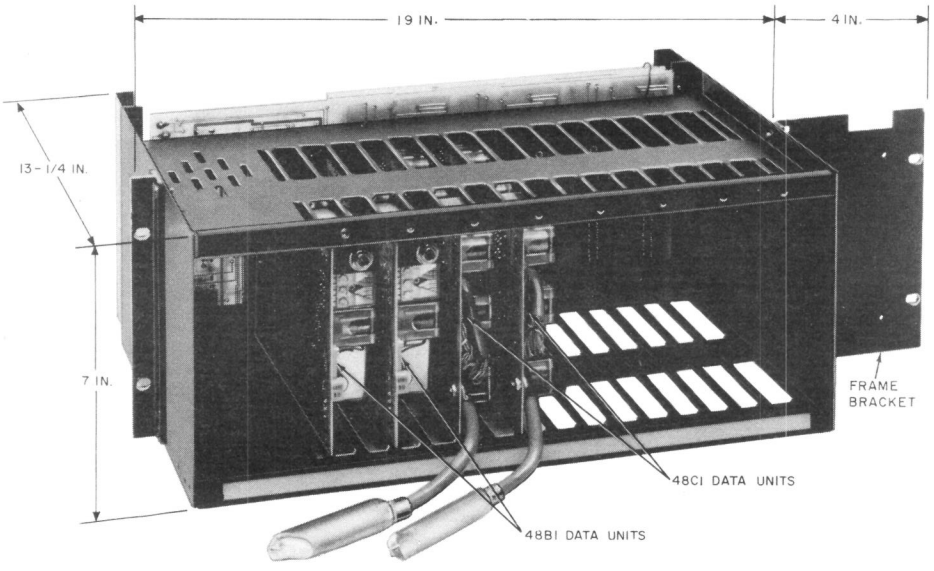


Fig. 22—46C1 Data Mounting—Front View

P1 permits connection to a 48D1 data unit. Connectors P2 through P4 permit connection to a maximum of twenty-three modems. Direct connection can be made from each connector to a multiple data mounting, such as the 40B data mounting for data set 202T. For connections from connectors P2 through P4 to individual modems, separately ordered KS-21253-L1 adapters can be used. To provide data with 4-wire switched dial backup service, connectors J10 through J12 permit connection to up to three 46A1 or 46A2 data mountings containing a maximum of twenty-three DAS 829-type CIUs. To provide data with alternate voice and 4-wire switched dial backup service, connectors J10 through J12 permit connection to up to three 46B1 data mountings containing a maximum of twenty-three 48A1 data units. Connector J1 or the eight screw terminals permit connection to one or two 4-wire dial backup channels consisting of two 2-wire switched network lines per channel. The two relays provide part of the control for the two backup channels.

Note: Use of connector J1 is not permitted in registered arrangements.

2.23 The 46C1 or 46C2 data mounting is 7 inches high, 19 inches wide, and 13-1/4 inches deep. The data mounting weighs 19 pounds.

2.24 The 46C1 or 46C2 data mounting can be mounted on 19- or 23-inch relay racks. Mounting in KS-20018-type cabinets is recommended. Descriptive information on KS-20018-type cabinets is provided in Section 590-010-201.

F. 59A1 Data Mounting

2.25 The 59A1 data mounting provides a housing for a single DAS 829-type CIU or one of the following combinations:

- A CIU and a 48G1 data unit for 2-wire data only service.
- A CIU and a 48A1 data unit for 4-wire data with alternate voice service.
- A CIU plus a 48A1 data unit and a 48G1 data unit for 2-wire data with alternate voice service (Fig. 25).

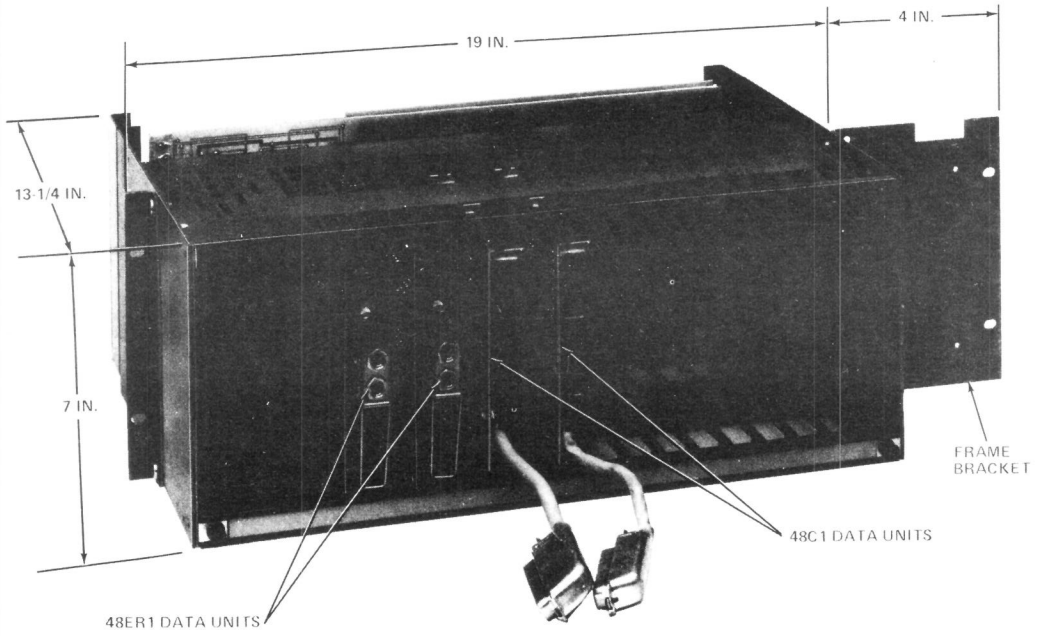


Fig. 23—46C2 Data Mounting—Front View

- A CIU and a 48B1 or 48ER1 data unit for 4-wire data with dial backup service with manual dialing.

- A CIU plus a 48A1 data unit and a 48B1 or 48ER1 data unit for 4-wire data with alternate voice and dial backup service with manual dialing (Fig. 26).

- A CIU and a 48ER1 data unit for 4-wire data with dial backup service with automatic dialing.

- A CIU and a 48FR1 data unit for 4-wire data with dial backup service with automatic answering.

2.26 The 59A1 data mounting (Fig. 27) consists of a housing, a 6-foot power cord (840807028), and a 24-Vac wall-mounted transformer (KS-21362-L1) with an 18-inch power cord. A bridge rectifier power supply is an integral part of the data mounting.

2.27 The backplane (Fig. 28) of the 59A1 data mounting contains two 50-pin connectors and the screw terminals for connecting to 4-wire metallic facilities, a 4-wire dial backup channel consisting of two 2-wire switched network lines, a 24-Vac transformer, a manual loopback key, the simplex pair of the 4-wire metallic facilities, and a customer- or modem-provided contact. Connector P1 connects to a single modem. Connector J4 connects to a 6-button key telephone set (565HKM or 2565HKM), a station dial (43A or 53A), or an automatic calling unit (DAS 801CR-L1/2).

2.28 The 59A1 data mounting is 3-2/3 inches high, 11-1/2 inches wide, and 12-2/3 inches deep. The data mounting weighs 6-7/8 pounds.

2.29 The 59A1 data mounting can be used as a free standing unit on a desk or shelf or can be wall mounted using a separately ordered 193A backboard (Fig. 13).

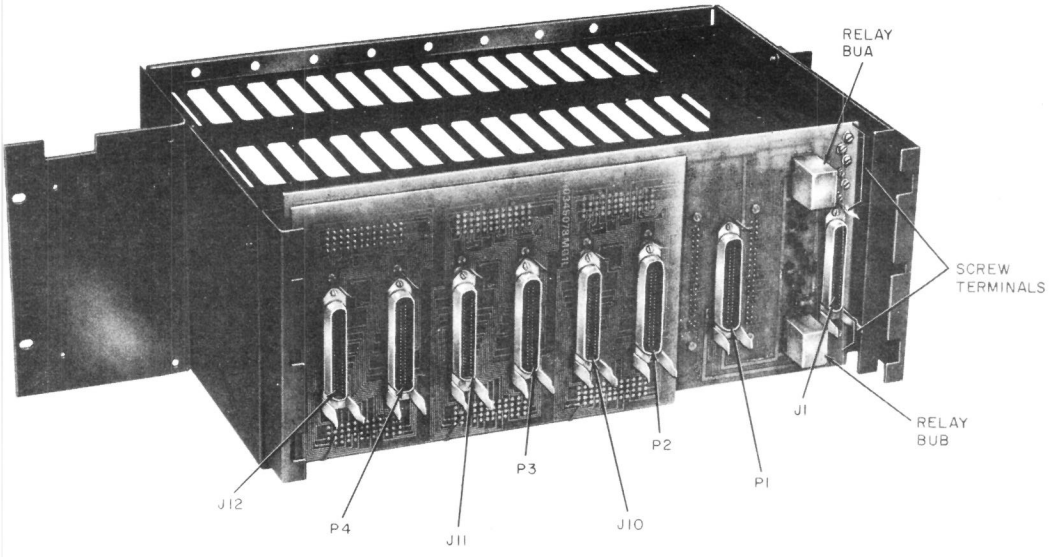


Fig. 24—46C1 or 46C2 Data Mounting—Rear View

G. 62A1 Data Mounting

2.30 The 62A1 data mounting provides a housing for a single DAS 829-type CIU or a CIU and a 48G1 data unit (Fig. 29). The data mounting (Fig. 30) consists of a housing, a 6-foot power cord (840807028), and a 24-Vac wall-mounted transformer (KS-21239-L4). A bridge rectifier power supply is an integral part of the data mounting. The data mounting can also operate from a -24 or -48 Vdc power source.

2.31 The backplane (Fig. 31) of the 62A1 data mounting contains a 50-pin connector and the screw terminals for connecting to 4-wire metallic facilities, the 24-Vac transformer, a manual loopback key, the simplex pair of the 4-wire metallic facilities, and a single modem. Connector P1 provides the preferred method for connecting to a single modem.

2.32 The 62A1 data mounting is 3-13/16 inches high, 5-7/8 inches wide, and 10-7/8 inches deep. The data mounting weighs 3-1/8 pounds.

2.33 The 62A1 data mounting can be used as a free standing unit on a desk or shelf or can be wall mounted using a separately ordered 193A backboard (Fig. 13).

CHANNEL INTERFACE UNITS (CIU)

2.34 The DAS 829-type CIU provides a prewired and tested standard termination for 4-wire private line voiceband data channels. The DAS 829-type CIU is available in six codes for proper termination of channels having various loop facilities. The three L1A codes provide all the functions of the corresponding L1 codes and also provide the following functions: (1) data only service on 8-dB channels, (2) operation from a -48 Vdc power source, (3) visual indication of loopback, and (4) provision for disabling loopback by use of special data mountings. All six codes are plug-in circuit packs that are housed in single or multiple data mountings.

A. DAS 829A-L1 CIU

2.35 The DAS 829A-L1 CIU (Fig. 32) contains the circuitry required to provide a standard termination for short 4-wire metallic facilities. The CIU consists of component apparatus mounted on

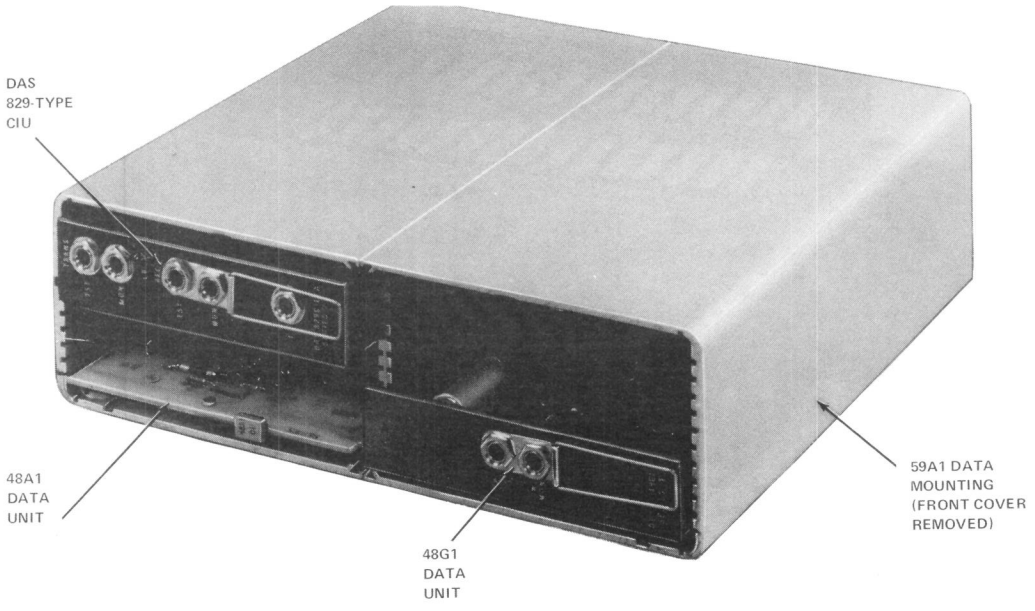


Fig. 25—59A1 Data Mounting Equipped With a DAS 829-Type CIU, a 48A1 Data Unit, and a 48G1 Data Unit

a plug-in printed wiring board. The CIU is housed in a 44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1 data mounting.

2.36 Two monitoring jacks and two test jacks are located on the CIU faceplate. These jacks will accept a standard 310 plug. Two variable attenuators and two installer options (line impedance and sealing current) are located on the printed wiring board.

2.37 The DAS 829A-L1 CIU is 1-1/3 inches high, 5-1/2 inches wide, and 9-2/3 inches long. The CIU weighs 15 ounces.

2.38 The DAS 829A-L1 CIU will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

B. DAS 829B-L1 CIU

2.39 The DAS 829B-L1 CIU (Fig. 33) contains the circuitry required to provide a standard termination for longer nonloaded 4-wire metallic facilities. The CIU consists of component apparatus mounted on a plug-in printed wiring board. The CIU is housed in a 44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1 data mounting.

2.40 Two monitoring jacks, two test jacks, and one input jack are located on the CIU faceplate. These jacks will accept a standard 310 plug. A receive fine gain control located on the printed wiring board is accessible through a hole in the faceplate. A variable attenuator and three installer options (receive coarse gain, line impedance, and sealing current) are also located on the printed wiring board.

2.41 The DAS 829B-L1 CIU is 1-1/3 inches high, 5-1/2 inches wide, and 9-2/3 inches long. The CIU weighs 1-5/8 pounds.

2.42 The DAS 829B-L1 CIU will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

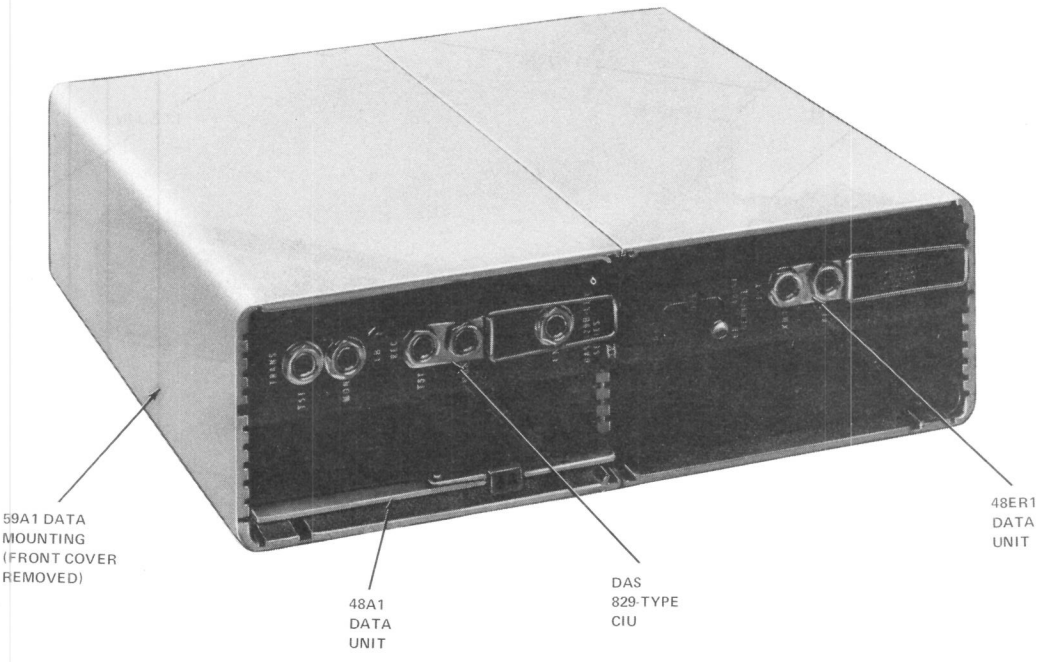


Fig. 26—59A1 Data Mounting Equipped With a DAS 829-Type CIU, a 48A1 Data Unit, and a 48ER1 Data Unit

C. DAS 829C-L1 CIU

2.43 The DAS 829C-L1 CIU (Fig. 34) contains the circuitry required to provide a standard termination for longer loaded 4-wire metallic facilities. The CIU consists of component apparatus mounted on a plug-in printed wiring board. The CIU is housed in a 44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1 data mounting.

2.44 Two monitoring jacks, two test jacks, and one input jack are located on the CIU faceplate. These jacks will accept a standard 310 plug. A receive fine gain control located on the printed wiring board is accessible through a hole in the faceplate. A variable attenuator and three installer options (receive coarse gain, 359A or 359K equalizer equivalent, and sealing current) are also located on the printed wiring board.

2.45 The DAS 829C-L1 CIU is 1-1/3 inches high, 5-1/2 inches wide, and 9-2/3 inches long. The CIU weighs 1-1/4 pounds.

2.46 The DAS 829C-L1 CIU will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

D. DAS 829A-L1A CIU

2.47 The DAS 829A-L1A CIU (Fig. 35) contains the circuitry required to provide a standard termination for short 4-wire metallic facilities. The CIU consists of component apparatus mounted on a plug-in printed wiring board. The CIU is housed in a 44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1 data mounting. A handle is provided on the CIU faceplate to facilitate removal of the CIU from the data mounting.

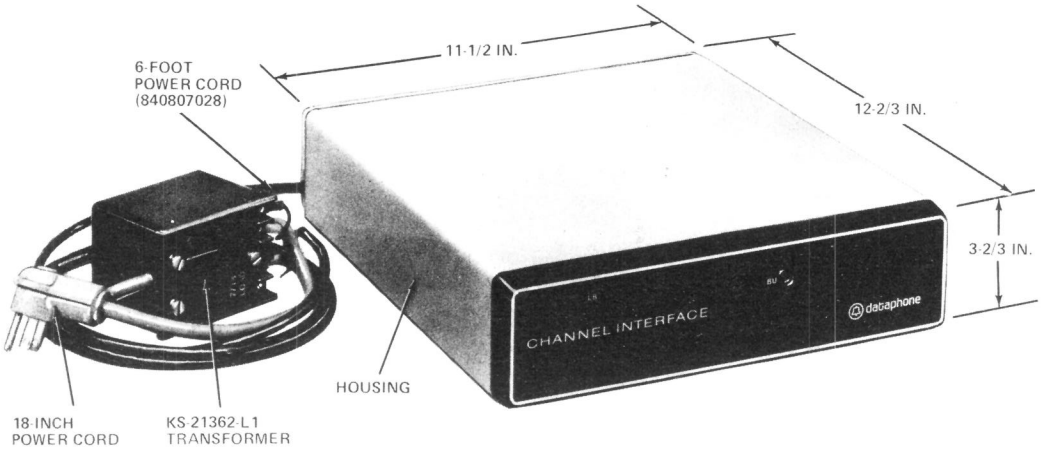


Fig. 27—59A1 Data Mounting—Front View

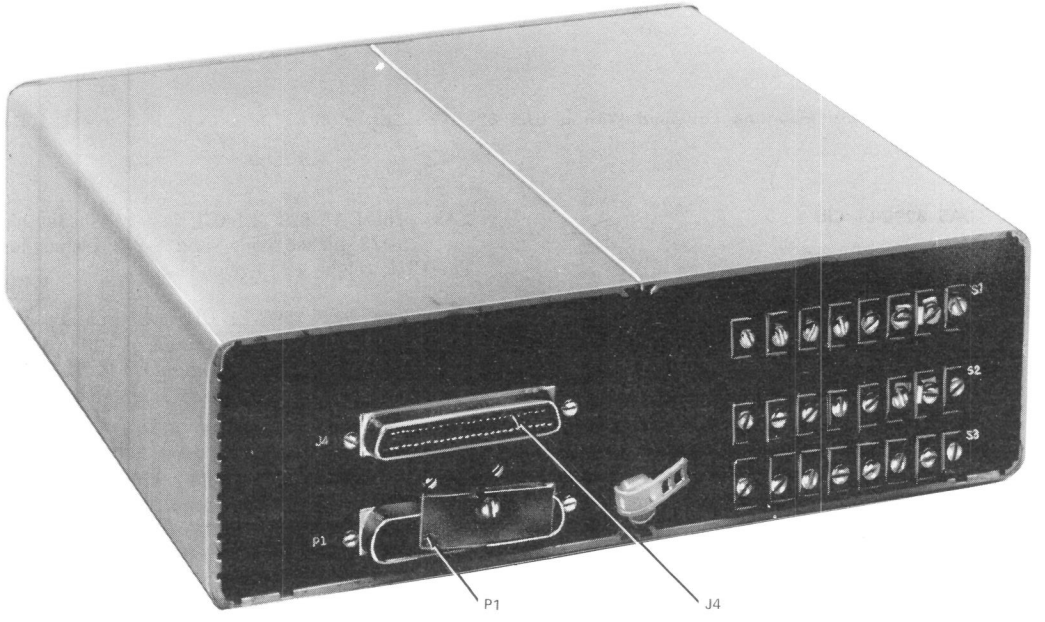


Fig. 28—59A1 Data Mounting—Rear View



Fig. 29—62A1 Data Mounting Equipped With a DAS 829-Type CIU and a 48G1 Data Unit

2.48 Two monitoring jacks and two test jacks are located on the CIU faceplate. These jacks will accept a standard 310 plug. A loopback indicator light is also located on the faceplate. Two variable attenuators and four installer options (line impedance, sealing current, loopback amplifier gain, and power supply) are located on the printed wiring board.

2.49 The DAS 829A-L1A CIU is 1-1/3 inches high, 5-1/2 inches wide, and 9-2/3 inches long. The CIU weighs 15 ounces.

2.50 The DAS 829A-L1A CIU will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

E. DAS 829B-L1A CIU

2.51 The DAS 829B-L1A CIU (Fig. 36) contains the circuitry required to provide a standard termination for longer nonloaded 4-wire metallic facilities. The CIU consists of component apparatus mounted on a plug-in printed wiring board. The CIU is housed in a 44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1 data mounting. A handle is provided on the CIU faceplate to facilitate removal of the CIU from the data mounting.

2.52 Two monitoring jacks, two test jacks, and one input jack are located on the CIU faceplate. These jacks will accept a standard 310 plug. A loopback indicator light is also located on the faceplate. A receive fine gain control located on the printed wiring board is accessible through a hole in the faceplate. A variable attenuator and five installer options (receive coarse gain, line impedance, sealing current, loopback amplifier gain, and power supply) are also located on the printed wiring board.

2.53 The DAS 829B-L1A CIU is 1-1/3 inches high, 5-1/2 inches wide, and 9-2/3 inches long. The CIU weighs 1-5/8 pounds.

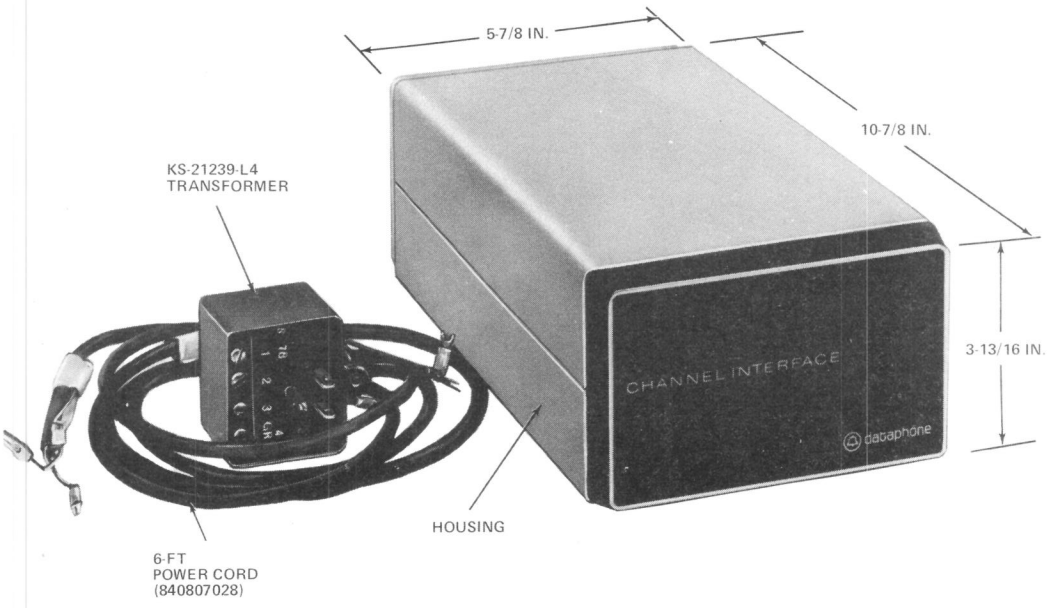


Fig. 30—62A1 Data Mounting—Front View

2.54 The DAS 829B-L1A CIU will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

F. DAS 829C-L1A CIU

2.55 The DAS 829C-L1A CIU (Fig. 37) contains the circuitry required to provide a standard termination for longer loaded 4-wire metallic facilities. The CIU consists of component apparatus mounted on a plug-in printed wiring board. The CIU is housed in a 44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1 data mounting. A handle is provided on the CIU faceplate to facilitate removal of the CIU from the data mounting.

2.56 Two monitoring jacks, two test jacks, and one input jack are located on the CIU faceplate. These jacks will accept a standard 310 plug. A loopback indicator light is also located on the faceplate. A receive fine gain control located on the printed wiring board is accessible through a hole in the faceplate. A variable attenuator and five installer options (receive coarse gain, 359A or 359K equalizer equivalent, sealing current, loopback amplifier gain, and power supply) are also located on the printed wiring board.

2.57 The DAS 829C-L1A CIU is 1-1/3 inches high, 5-1/2 inches wide, and 9-2/3 inches long. The CIU weighs 1-1/4 pounds.

2.58 The DAS 829C-L1A CIU will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

DATA UNITS

2.59 The 48-type data units provide the functions that are required to supplement the CIUs for 4-wire data with alternate voice, dial backup, and switched dial backup service. Two-wire data only and data with alternate voice service are also provided. The 48A1, 48B1, 48C1, 48ER1, 48FR1, and 48G1 data units are plug-in circuit packs that are housed in single or multiple data mountings. The 48D1 data unit is rack mounted and does not require housing.

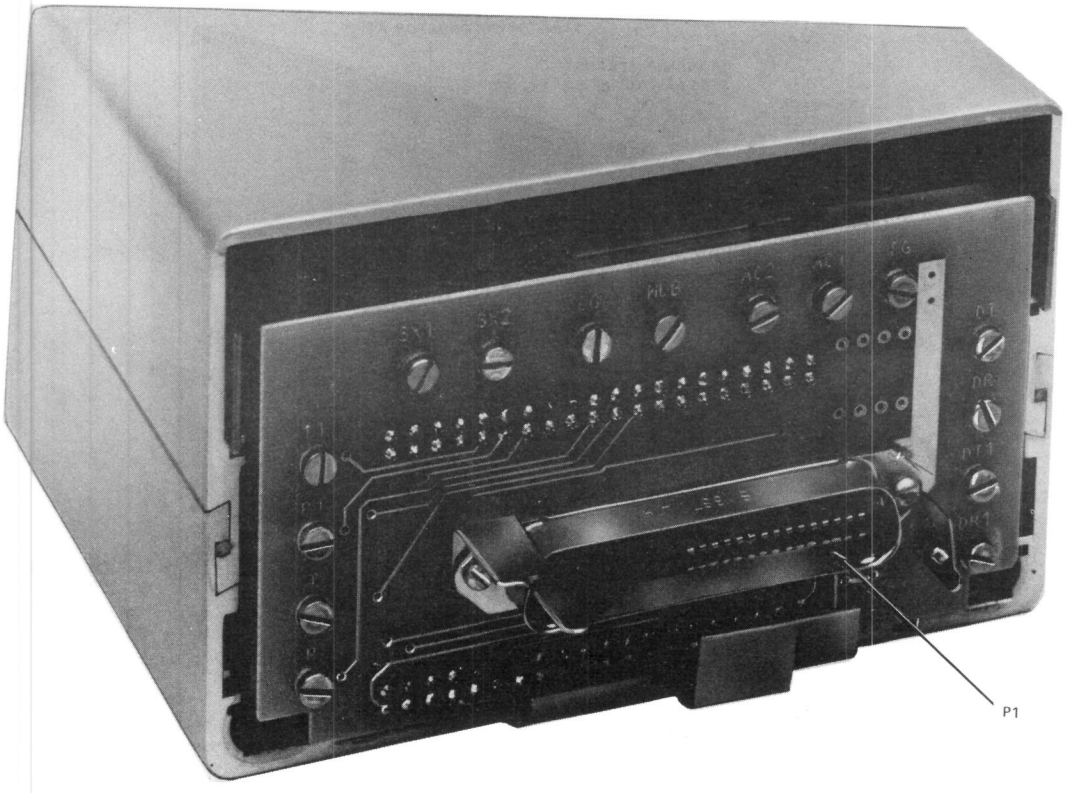


Fig. 31—62A1 Data Mounting—Rear View

A. 48A1 Data Unit

2.60 The 48A1 data unit (Fig. 38) contains the circuitry required to provide alternate voice service. The data unit consists of component apparatus mounted on a plug-in printed wiring board. The data unit is housed in a 45A1, 46B1, or 59A1 data mounting.

2.61 The alternate voice arrangement provided by the 48A1 data unit is not compatible with alternate voice arrangements of either the DAS 828A-type CIU or locally engineered systems requiring 20-Hz ringdown signaling unless signal conversion equipment is provided. When signal conversion equipment is required, the F-type SF unit is recommended. The E-type SF unit is not recommended. The 48A1 data unit uses an inband signal of 2600 Hz for ringdown signaling.

2.62 The 48A1 data unit is 1-1/4 inches high, 5-1/2 inches wide, and 9-11/16 inches deep. The data unit weighs 1-1/4 pounds.

2.63 The 48A1 data unit will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

B. 48B1 Data Unit

2.64 The 48B1 data unit (Fig. 39) contains the circuitry required to provide 4-wire dial backup service with manual dialing. The data unit consists of component apparatus mounted on a plug-in printed wiring board. The data unit is

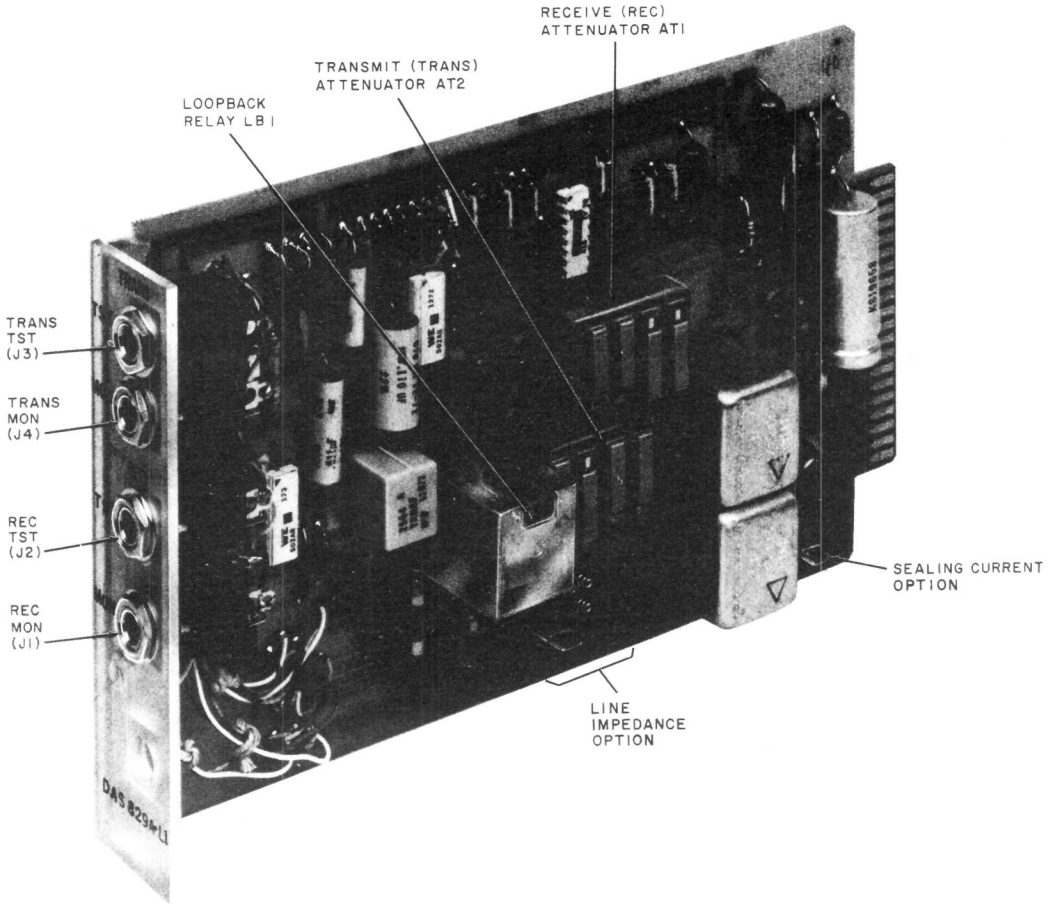


Fig. 32—DAS 829A-L1 CIU

housed in a 45A1, 46C1, 46C2, or 59A1 data mounting.

2.65 A test jack is located at the front of the data unit. This jack will accept a standard 310 plug. A variable attenuator, a variable gain control, and an installer option (slope equalizer) are located on the printed wiring board.

2.66 The dial backup arrangement provided by the 48B1 data unit is compatible with dial backup arrangements provided by either the DAS 828C-type CIU or by locally engineered systems that are equivalent to the DAS 828C-type CIU.

2.67 The 48B1 data unit is 1-1/4 inches high, 5-1/2 inches wide, and 9-11/16 inches deep. The data unit weighs 2 pounds.

2.68 The 48B1 data unit will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

C. 48C1 Data Unit

2.69 The 48C1 data unit (Fig. 40) contains the circuitry required to provide a 2-by-4 switching matrix that can connect any one of four 4-wire modems to either one of two 4-wire dial backup

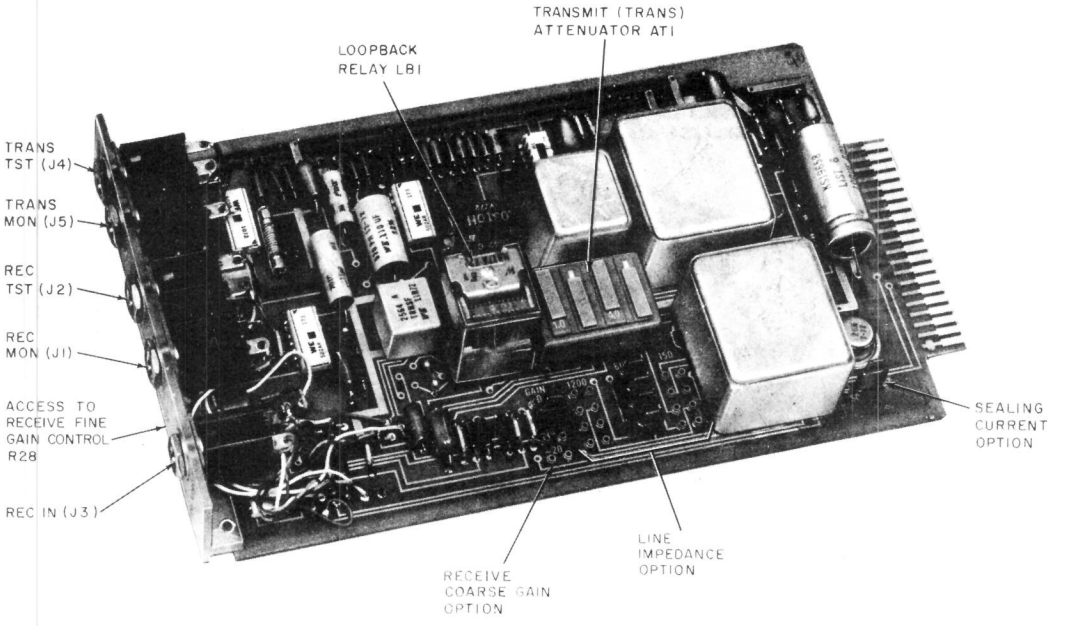


Fig. 33—DAS 829B-L1 CIU

channels. The data unit consists of component apparatus mounted on a plug-in printed wiring board. An attached cable and connector J1 permit direct connection to a 48D1 data unit. The 48C1 data unit is housed in a 46C1 or 46C2 data mounting.

2.70 The 48C1 data unit is 1-1/4 inches high, 5-1/2 inches wide, and 9-11/16 inches deep. The data unit weighs 1-3/4 pounds.

2.71 The 48C1 data unit will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

D. 48D1 Data Unit

2.72 The 48D1 data unit provides an interface adapter for use with a 46B1 and/or a 46C1 or 46C2 data mounting to concentrate control of 48A1, 48B1 or 48ER1, and 48C1 data units in an 18- or 30-button CALL DIRECTOR key telephone set.

2.73 The 48D1 data unit (Fig. 41) provides six 50-pin connectors, P4 through P9, for direct connection of up to six 48C1 data units mounted in a 46C1 or 46C2 data mounting. A 24-Vac transformer, a bridge rectifier power supply, a regulated power supply, and four fuses are integral parts of the 48D1 data unit. A 4-foot power cord (840339907) is supplied with the 48D1 data unit.

2.74 The backplane (Fig. 42) of the 48D1 data unit contains twelve 50-pin connectors. Connectors J1 through J5 permit connection to an 18- or 30-button CALL DIRECTOR key telephone set. Connector J6 permits connection to a 46C1 or 46C2 data mounting. Connectors P1 through P3 permit connection to up to three 46B1 data mountings containing a maximum of twenty-three 48A1 data units. Connectors P11 and P12 permit concentrated connection to a maximum of twenty-three modems to provide dial backup status to modems requiring this information. Connector P10 is provided for future use. Power cord connector P13 is located on the rear of the data unit adjacent to the backplane.

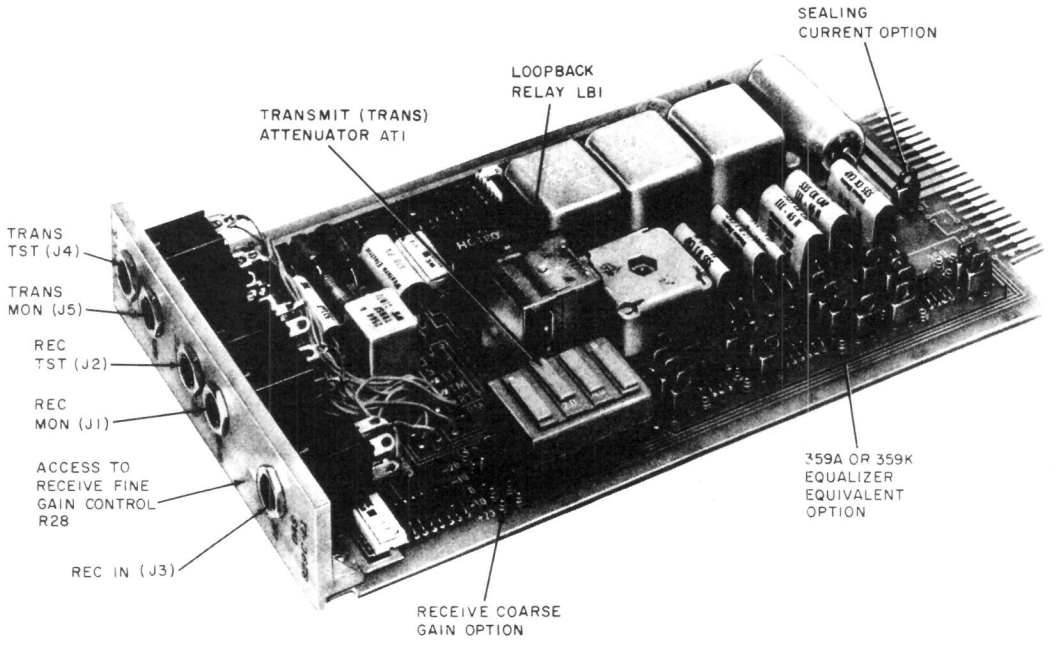


Fig. 34—DAS 829C-L1 CIU

2.75 The 48D1 data unit is 7 inches high, 19 inches wide, and 13-1/4 inches deep. The data unit weighs 24 pounds.

2.76 The 48D1 data unit can be mounted on 19- or 23-inch relay racks. Mounting in KS-20018-type cabinets is recommended. Descriptive information on KS-20018-type cabinets is provided in Section 590-010-201.

2.77 The 48D1 data unit will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

E. 48ER1 Data Unit

2.78 The 48ER1 data unit (Fig. 43) contains the circuitry required to provide 4-wire dial backup service with manual or automatic dialing. The data unit consists of component apparatus mounted on a plug-in printed wiring board. The data unit is housed in a 46C2 or 59A1 data mounting. A handle is provided on the data unit faceplate to facilitate removal of the data unit from the data mounting.

2.79 Two test jacks are located on the data unit faceplate. These jacks will accept a standard 310 plug. A locking switch and a dial backup indicator light are also located on the faceplate. Two gain control switches and three installer options (call control, unit control, and power supply) are located on the printed wiring board.

2.80 The dial backup arrangement provided by the 48ER1 data unit is compatible with dial backup arrangements provided by the 48B1 data unit, the DAS 828C-type CIU, or by locally engineered arrangements that are equivalent to the 48B1 data unit or the DAS 828C-type CIU.

2.81 The 48ER1 data unit is 1-1/4 inches high, 5-1/2 inches wide, and 10-1/16 inches deep. The data unit weighs 1-7/8 pounds.

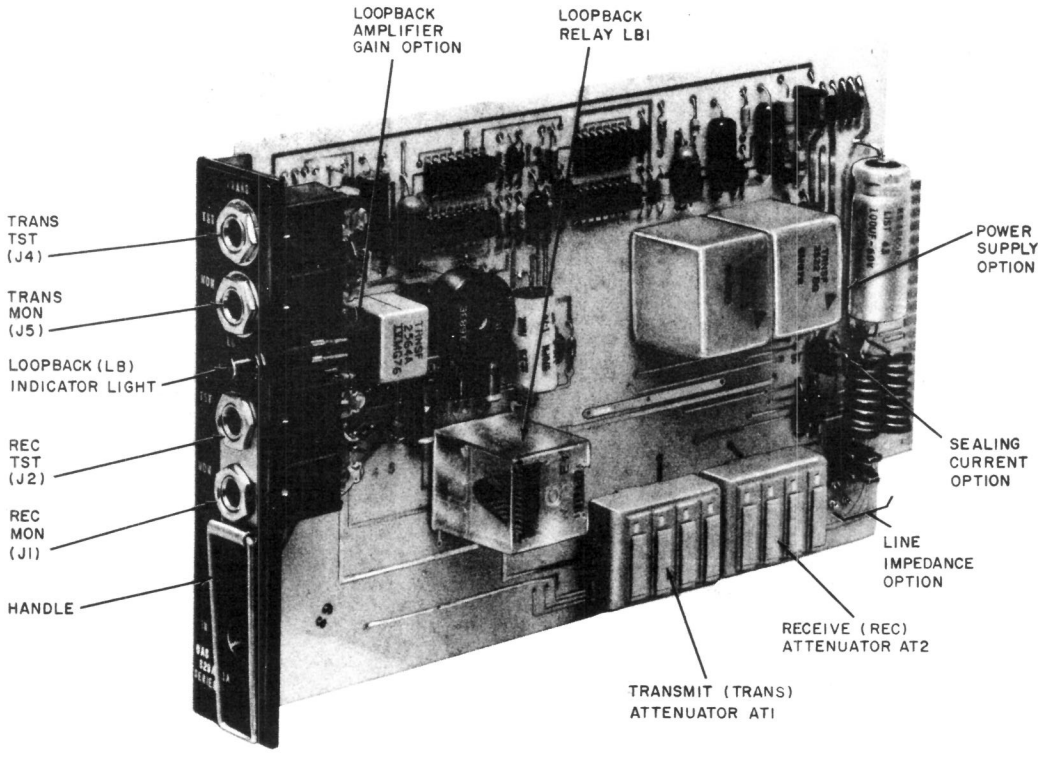


Fig. 35—DAS 829A-L1A CIU

2.82 The 48ER1 data unit will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

F. 48FR1 Data Unit

2.83 The 48FR1 data unit (Fig. 44) contains the circuitry required to provide 4-wire dial backup service with automatic answering. The data unit consists of component apparatus mounted on a plug-in printed wiring board. The data unit is housed in a 59A1 data mounting. A handle is provided on the data unit faceplate to facilitate removal of the data unit from the data mounting.

2.84 Two test jacks are located on the data unit faceplate. These jacks will accept a standard 310 plug. A nonlocking switch and a dial backup indicator light are also located on the faceplate. Two gain control switches and three installer options (call control, unit control, and power supply) are located on the printed wiring board.

2.85 The 48FR1 data unit is 1-1/4 inches high, 5-1/2 inches wide, and 10-1/16 inches deep. The data unit weighs 2 pounds.

2.86 The 48FR1 data unit will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

G. 48G1 Data Unit

2.87 The 48G1 data unit (Fig. 45) contains the circuitry required to provide conversion from a 2-wire to a 4-wire channel. The data unit consists of component apparatus mounted on a plug-in printed wiring board. The data unit is housed in

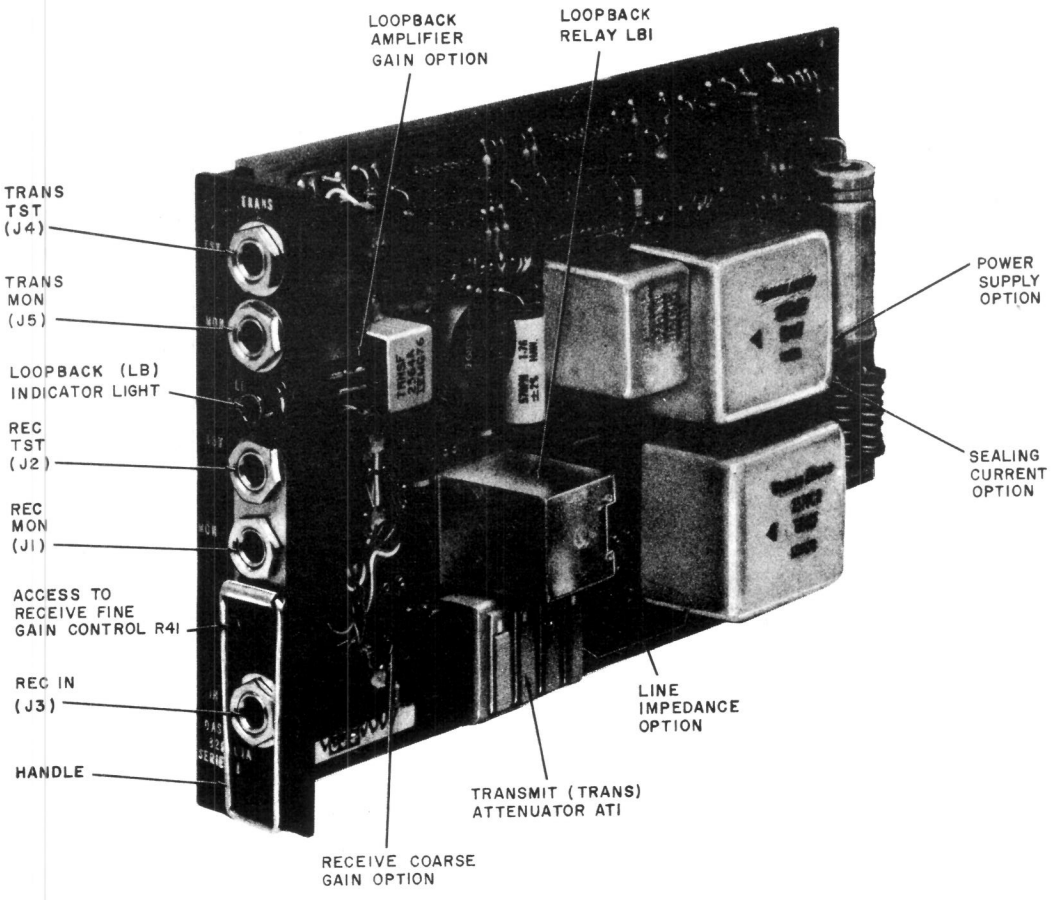


Fig. 36—DAS 829B-L1A CIU

a 46B1, 59A1, or 62A1 data mounting. A handle is provided on the data unit faceplate to facilitate removal of the data unit from the data mounting.

2.88 A monitoring jack and a test jack are located on the data unit faceplate. These jacks will accept a standard 310 plug. An installer option (power supply) is located on the printed wiring board.

2.89 The 48G1 data unit is 1-1/4 inches high, 5-1/2 inches wide, and 10-1/16 inches deep. The data unit weighs 2/3 pound.

2.90 The 48G1 data unit will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

3. FUNCTIONAL DESCRIPTION

CHANNEL INTERFACE UNITS (CIU)

3.01 The DAS 829-type CIU provides the transmission circuitry required for proper termination of 4-wire private line voiceband data channels. The DAS 829-type CIU is available in six codes for use with channels having various loop

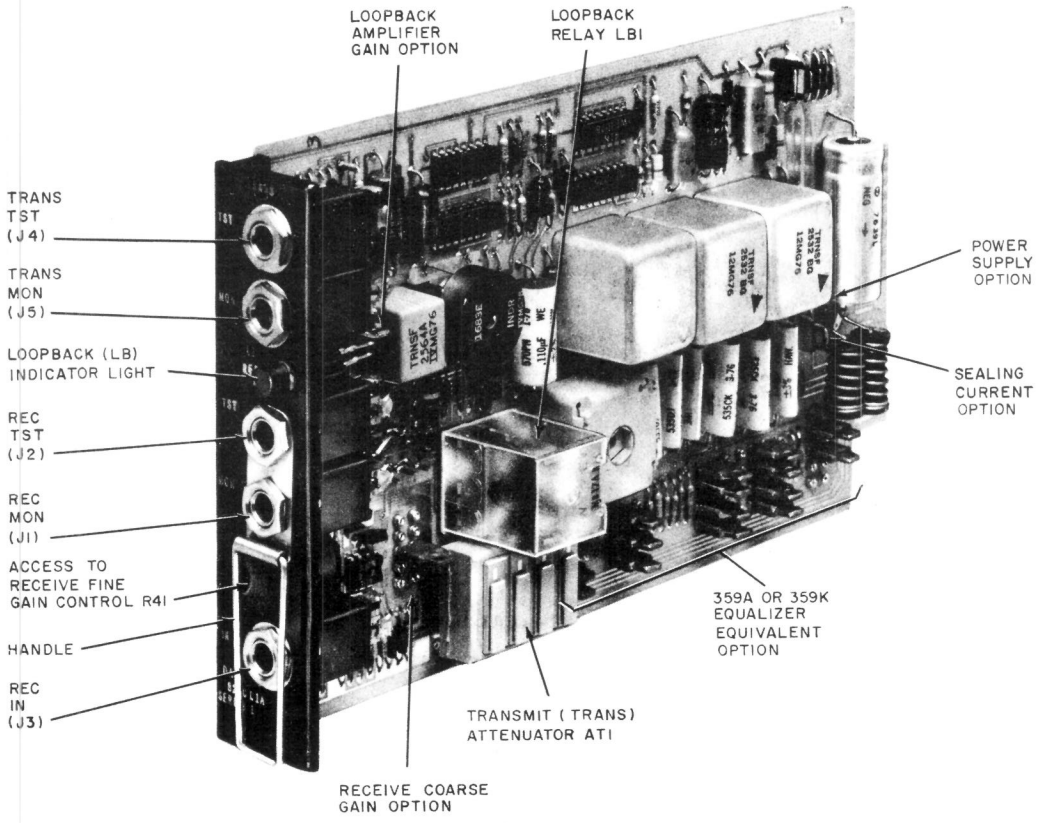


Fig. 37—DAS 829C-L1A CIU

facilities. The three L1A codes provide all the functions of the corresponding L1 codes and also provide the following functions: (1) data only service on 8-dB channels, (2) operation from a -48 Vdc power source, (3) visual indication of loopback, and (4) provision for disabling loopback by use of special data mountings.

3.02 For 4-wire data only service on a single 4-wire private line, the DAS 829-type CIU is housed in a 44A1 or 44A2 data mounting. For 4-wire data service on a single 4-wire private line, with alternate voice and/or dial backup service using manual dialing, the CIU and the required 48A1 and/or 48B1 data units are housed in a 45A1 or 59A1 data mounting. For 4-wire data service on a single 4-wire private line, with alternate voice and/or registered dial backup service using manual dialing, the CIU and the required 48A1 and/or 48ER1 data units are housed in a 59A1 data mounting. For 4-wire data service on a single 4-wire private line with registered dial backup service using automatic dialing or automatic answering, the CIU and the required 48ER1 or 48FR1 data unit are housed in a 59A1 data mounting. For 2-wire data only service on a single 4-wire line, the CIU and the required 48G1 data unit are housed in a 59A1 or 62A1 data mounting. For 2-wire data service on a single 4-wire line with alternate voice service, the CIU and the required 48A1 and 48G1 data units are housed in a 59A1 data mounting. Although the 45A1, 59A1, and 62A1 data mountings

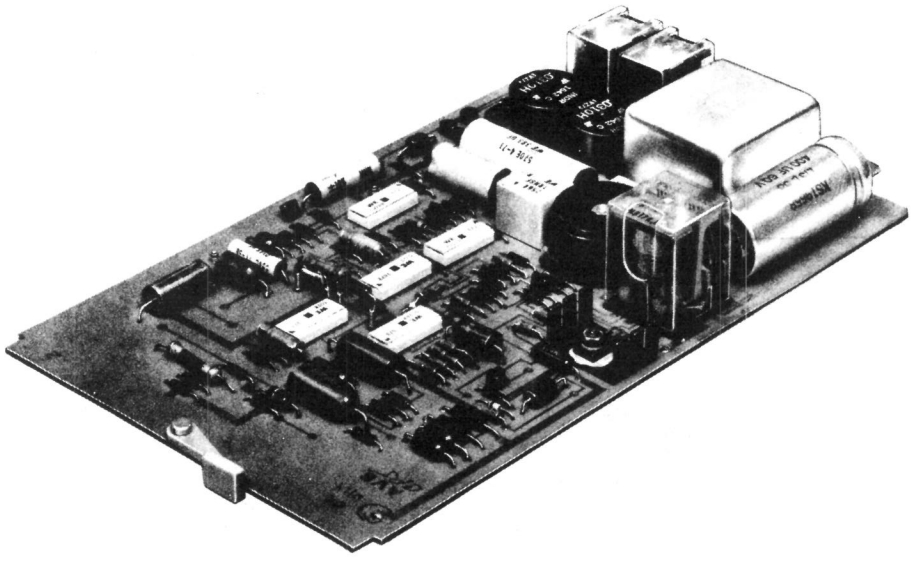


Fig. 38—48A1 Data Unit

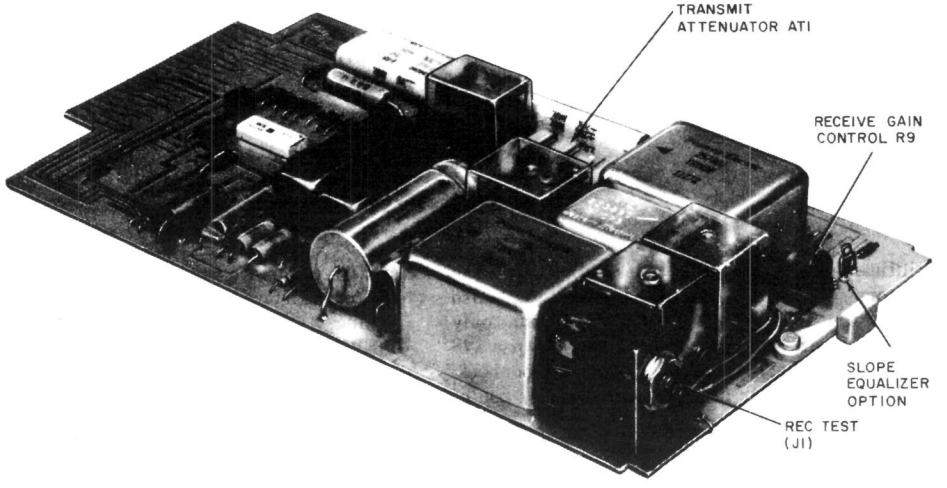


Fig. 39—48B1 Data Unit

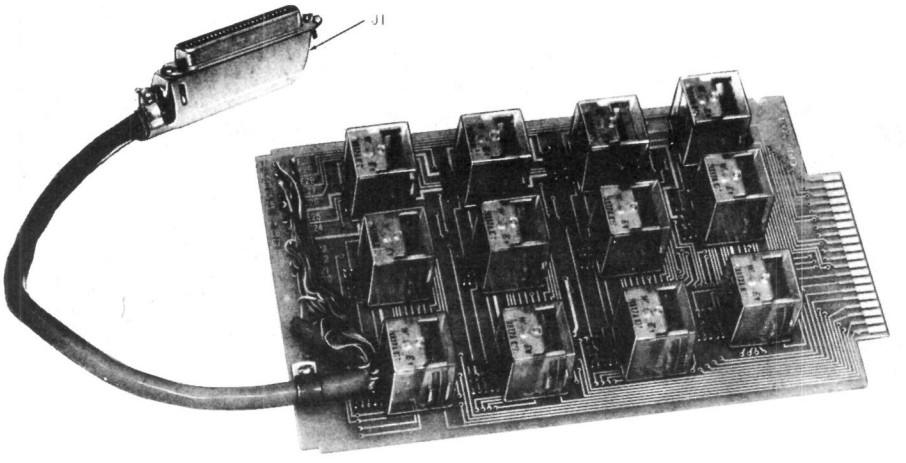


Fig. 40—48C1 Data Unit

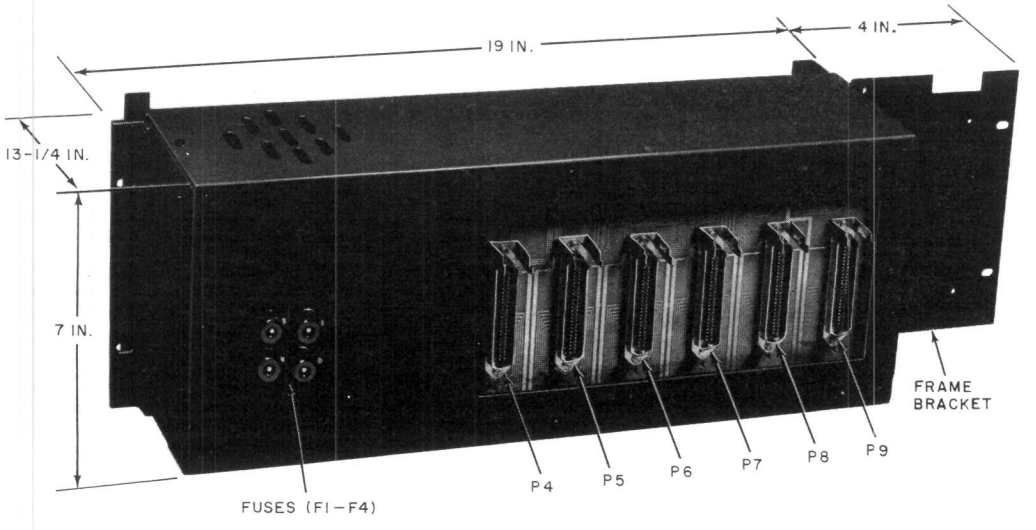


Fig. 41—48D1 Data Unit—Front View

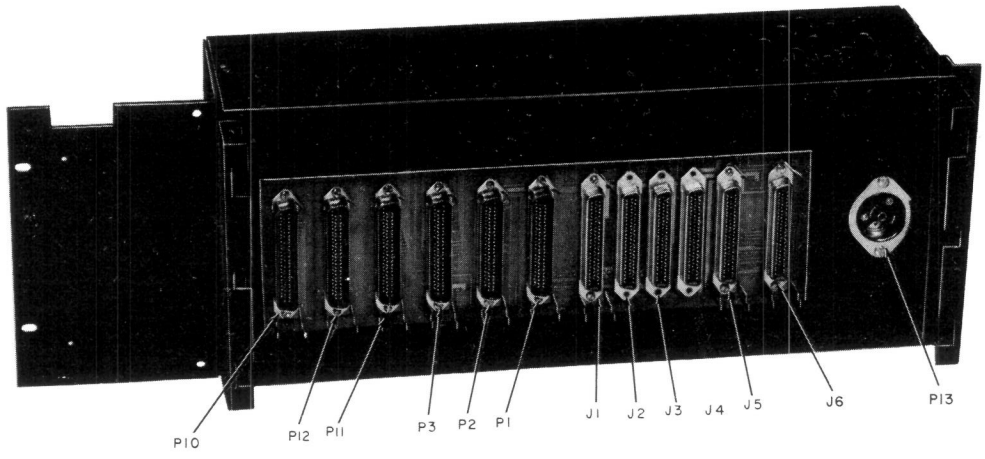


Fig. 42—48D1 Data Unit—Rear View

can house a CIU only, they are not normally used for this purpose. At present, 2-wire dial backup service is not available.

3.03 For 4-wire data only or data with additional services (alternate voice and/or switched dial backup) on multiple (up to eight) 4-wire private lines, the DAS 829-type CIU is housed in a 46A1 or 46A2 data mounting. For 2-wire data only or data with alternate voice service on multiple (up to eight) 4-wire lines, the CIU is also housed in a 46A1 or 46A2 data mounting. At present, 2-wire switched dial backup service is not available.

3.04 In the normal (data) mode (Fig. 1), the 4-wire modem can transmit and receive data over the 4-wire metallic facilities since the DAS 829-type CIU provides a through connection for the transmission leads of the standard 6-lead interface (DT, DR, DT1, DR1, TEK5, and TEK6) that connects the 4-wire modem to the CIU. The four transmission leads (DT, DR, DT1, and DR1) are complete through the normally-closed contacts of the LB1 relay in the CIU as long as the CIU remains in the data mode. This condition is indicated by an in-data line status signal to the modem.

3.05 In the normal (data) mode (Fig. 2), the 2-wire modem can transmit and receive data over the 4-wire metallic facilities since the DAS 829-type CIU provides a through connection for the 4-wire port of the 2-wire to 4-wire hybrid circuit in the 48G1 data unit that connects the 2-wire modem to the CIU. The four transmission leads (DT, DR, DT1, and DR1) are complete through the normally-closed contacts of the LB1 relay in the CIU as long as the CIU remains in the data mode. This condition is indicated by an in-data line status signal to the modem.

3.06 In the loopback mode (Fig. 1 or 2), operation of the LB1 relay in the DAS 829-type CIU disconnects the modem from the 4-wire metallic facilities and loops back the receive pair to the transmit pair through a loopback amplifier in the CIU. The 4-wire metallic facilities are now reserved for test purposes and are not available for data transmission. This condition is indicated by a not-in-data line status signal to the modem.

A. DAS 829A-L1 CIU

3.07 The DAS 829A-L1 CIU provides the transmission circuitry required for proper termination of short nonloaded or loaded 4-wire metallic facilities when no gain is required in the transmit or receive paths. A facility loopback circuit, a not-in-data indication, and a sealing current option are also provided. A dc power supply in the CIU obtains its required 24-Vac input from a transformer associated with the data mounting

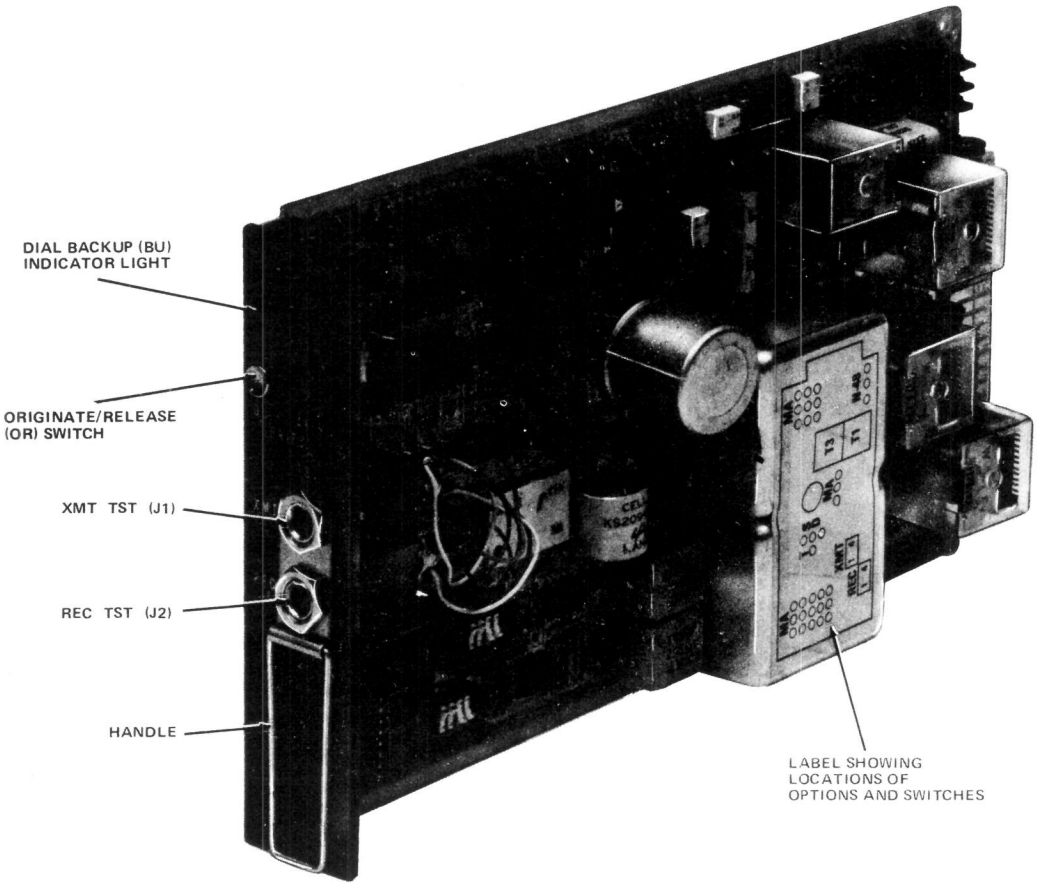


Fig. 43—48ER1 Data Unit

(44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1) that houses the CIU. All connections to the CIU are made through the data mounting.

Transmit Circuit

3.08 In the data mode (Fig. 46), transmitted signals on the modem transmit pair (DT1, DR1) are passed through the normally-closed contacts of test jack J3 (TRANS TST), the normally-closed contacts of relay LB1, the 0 to 15 dB attenuator AT2 (TRANS), and transformer T3 to the station transmit pair (T1, R1).

3.09 Resistor R38 functions as a fuse for the modem transmit pair (DT1, DR1). If excessive power is dissipated in resistor R38, the resistor opens to disconnect the hazardous voltage. Diode CR6 limits voltage surges in the circuit. The line impedance option provides a 600- or 1200-ohm line termination. Monitor jack J4 (TRANS MON) provides a monitoring point on the modem side of the CIU.

Receive Circuit

3.10 In the data mode (Fig. 46), received signals on the station receive pair (T, R) are passed

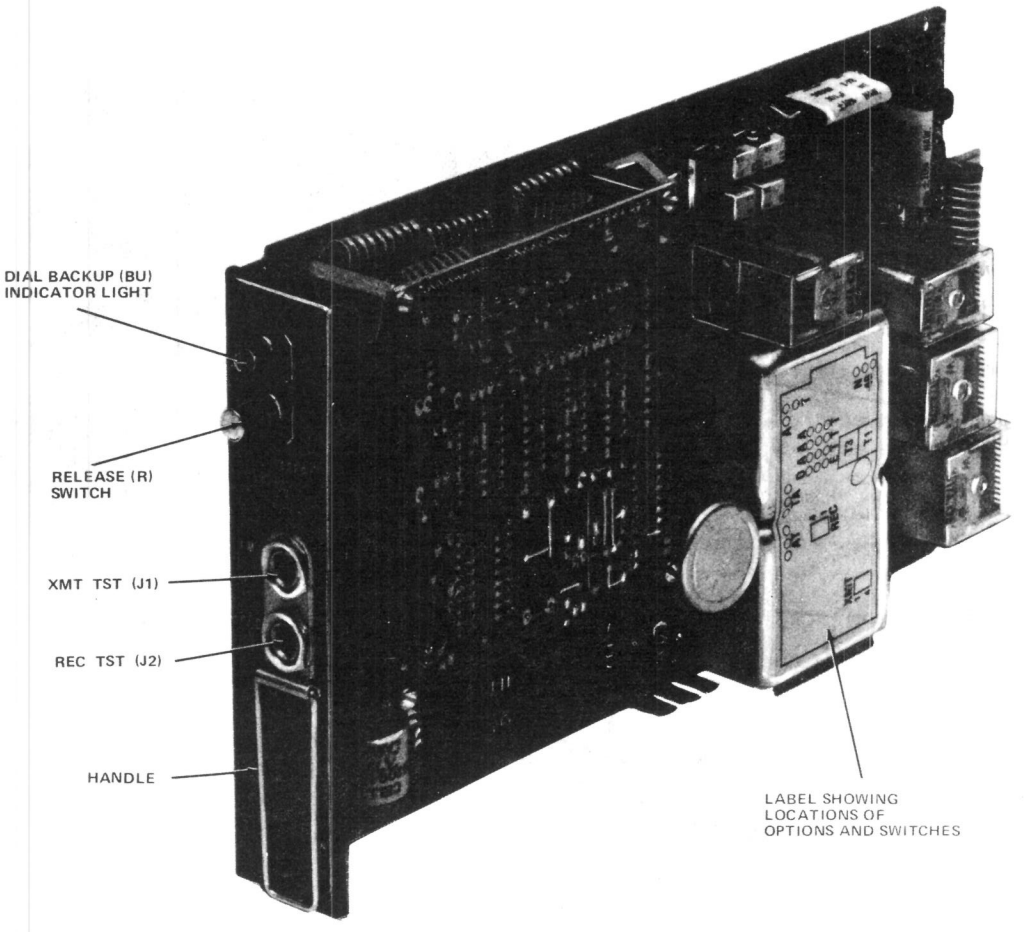


Fig. 44—48FR1 Data Unit

through transformer T2, the 0 to 15 dB attenuator AT1 (REC), the normally-closed contacts of test jack J2 (REC TST), and the normally-closed contacts of relay LB1 to the modem receive pair (DT, DR).

3.11 Resistor R37 functions as a fuse for the modem receive pair (DT, DR). If excessive power is dissipated in resistor R37, the resistor opens to disconnect the hazardous voltage. Diode CR5 limits voltage surges in the circuit. The line impedance option provides a 600- or 1200-ohm line termination. Monitor jack J1 (REC MON) provides a monitoring point on the modem side of the CIU.

Loopback Circuit

3.12 The loopback circuit (Fig. 46) provides a loopback mode of operation to permit testing of the transmitting and receiving facilities from a remote test center. The modem is disconnected and the station receive pair is looped back to the station transmit pair through a 16-dB loopback amplifier. The loopback amplifier provides a

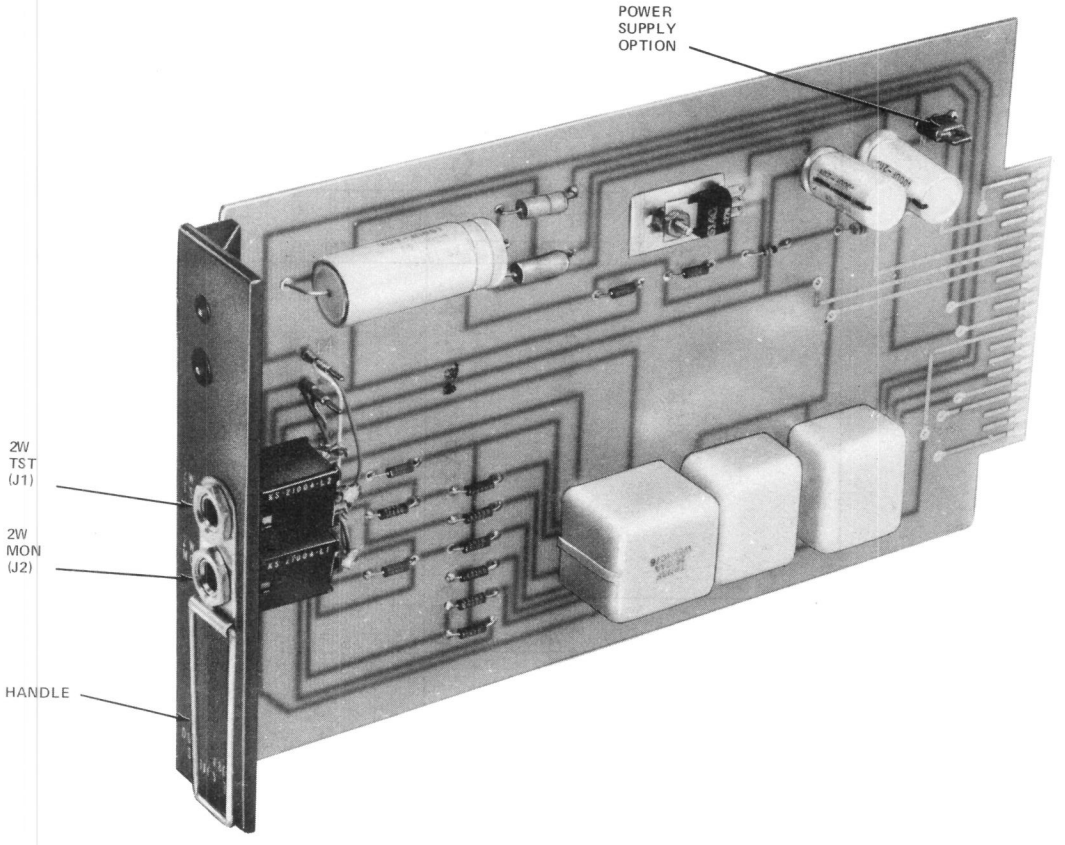


Fig. 45—48G1 Data Unit

loopback transmission path at equal (normal) levels. The loopback relay contacts, the TRANS TST jack contacts, and the interconnection between the modem and the CIU are not included in the loopback path.

3.13 Loopback is accomplished by operation of loopback relay LB1. Release of this relay restores the CIU to the normal (data) mode. Operation and release of the relay is usually initiated by a 2713-Hz tone from a remote test center. Operation and release of the relay may be initiated locally, if a manual loopback key is connected to the CIU.

3.14 The 2713-Hz tone from the test center is sent over the station receive pair (T, R) and activates the tone detector circuit in the CIU. To ensure activation, the transmitted tone should be 2713±5 Hz. Depending on the signal-to-noise ratio, the tone detector circuit may have a bandwidth as wide as 2685 Hz to 2741 Hz. When the 2713-Hz tone is sent for a minimum of 5 seconds and then removed, the tone detector circuit operates loopback relay LB1. The test center then sends a 1004-Hz test tone over the station receive pair (T, R). If the test tone is returned to the test center over the station transmit pair (T1, R1), loopback has been accomplished.

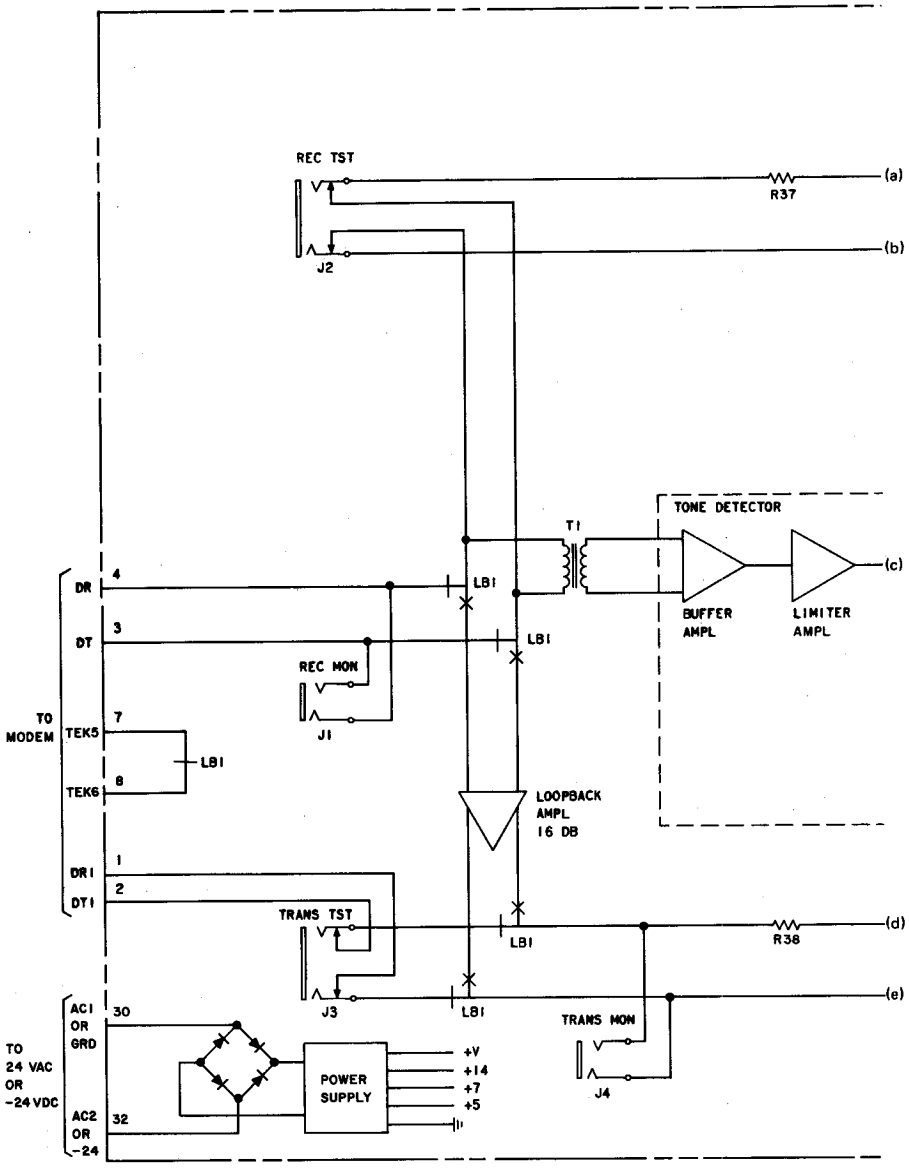


Fig. 46—DAS 829A-L1 CIU—Functional Diagram (Sheet 1 of 2)

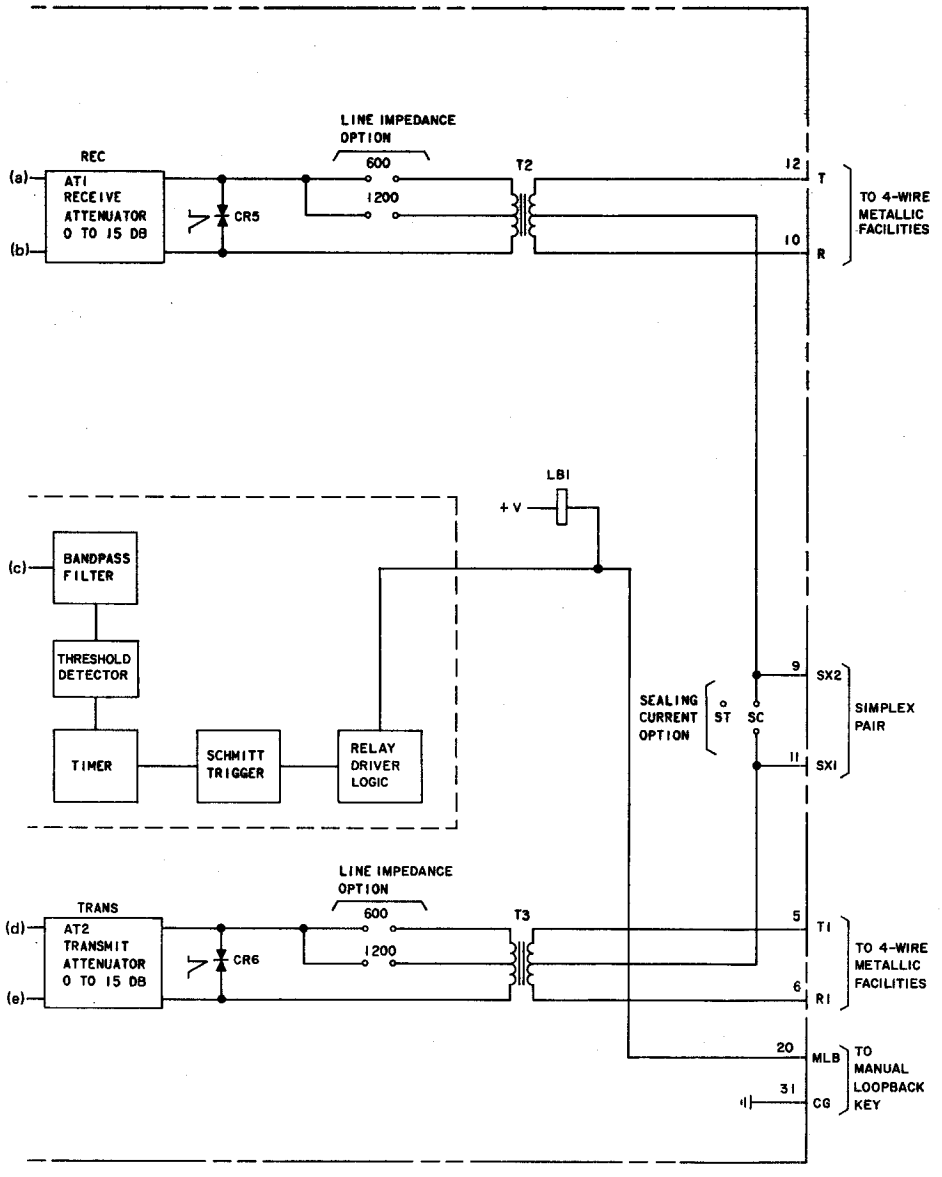


Fig. 46—DAS 829A-L1 CIU—Functional Diagram (Sheet 2 of 2)

Note: When a 2-wire private line is tested, the test center should open circuit the station transmit pair. This ensures that when the 2-wire port of the 2-wire to 4-wire hybrid circuit in a 48G1 data unit is improperly terminated, open or short circuit, the 2713-Hz tone will not be looped back via the hybrid circuit.

3.15 After the desired tests are completed, the 2713-Hz tone from the test center is again sent over the station receive pair (T, R) and activates the tone detector circuit in the CIU. About 1 second after activation, the tone detector circuit releases loopback relay LB1. The 2713-Hz tone is sent for a minimum of 5 seconds and then removed. The test center then sends the 1004-Hz test tone over the station receive pair (T, R). If the test tone is not returned to the test center over the station transmit pair (T1, R1), the CIU has been returned to the normal (data) mode.

Note: When a 2-wire private line is tested, an improperly terminated 2-wire port of a 48G1 data unit could cause the 1004-Hz tone to be returned to the test center. If the 2-wire port is open- or short-circuited, the improper loopback signal will be 16 dB below the valid loopback signal.

Not-in-Data Indication

3.16 When the CIU (Fig. 46) is in the loopback mode (relay LB1 operated), a normally-closed contact of the relay is opened to provide a not-in-data (line status) indication to the modem through the TEK5 and TEK6 leads.

3.17 The following two restrictions apply to the not-in-data indication if it is used with a customer-provided modem:

(1) The circuit in the modem must be noninductive or equipped with contact protection.

(2) Current to the CIU must not exceed 500 mA.

Sealing Current Option

3.18 Sealing current is a small dc current that is applied to the simplex pair of the 4-wire metallic facilities to eliminate impaired transmission. If sealing current is used, the sealing current option (Fig. 46) in the CIU provides dc continuity for the simplex pair. A typical sealing current arrangement is shown in Fig. 47.

B. DAS 829B-L1 CIU

3.19 The DAS 829B-L1 CIU provides the transmission circuitry required for proper termination of medium or long nonloaded 4-wire metallic facilities that require gain in the receive path. A facility loopback circuit, a not-in-data indication, and a sealing current option are also provided. A dc power supply in the CIU obtains its required 24-Vac input from a transformer associated with the data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1) that houses the CIU. All connections to the CIU are made through the data mounting.

Transmit Circuit

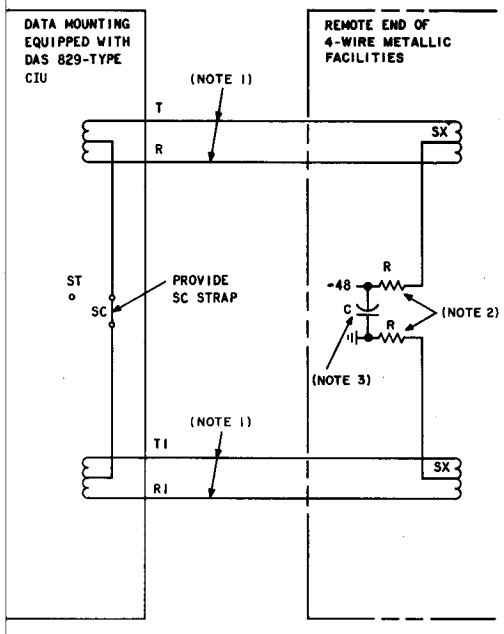
3.20 In the data mode (Fig. 48), transmitted signals on the modem transmit pair (DT1, DR1) are passed through the normally-closed contacts of test jack J4 (TRANS TST), the normally-closed contacts of relay LB1, the 0 to 15 dB attenuator AT1 (TRANS), and transformer T4 to the station transmit pair (T1, R1).

3.21 Resistor R42 functions as a fuse for the modem transmit pair (DT1, DR1). If excessive power is dissipated in resistor R42, the resistor opens to disconnect the hazardous voltage. Diode CR6 limits voltage surges in the circuit. The line impedance option provides a 150-, 600-, or 1200-ohm line termination. Monitor jack J5 (TRANS MON) provides a monitoring point on the modem side of the CIU.

Receive Circuit

3.22 In the data mode (Fig. 48), received signals on the station receive pair (T, R) are passed through transformer T3, the normally-closed contacts of input jack J3 (REC IN), the receive level circuit (coarse gain option), the 0 to 10 dB amplifier, transformer T2, the normally-closed contacts of test jack J2 (REC TST), and the normally-closed contacts of relay LB1 to the modem receive pair (DT, DR).

3.23 The coarse gain option provides coarse adjustment of the signal gain. The available coarse adjustments (GAIN) are +10, 0, -10, and



NOTES:

1. METALLIC CIRCUIT CURRENT (UNBALANCE) MUST BE LIMITED TO 0.5 MA TO ENSURE DATA WILL NOT BE AFFECTED BY SATURATION CHARACTERISTICS OF TRANSFORMERS IN DAS 829-TYPE CIU.
2. POWER SUPPLY FILTER AND CURRENT LIMITING RESISTORS (R) SHOULD BE PROVIDED AS REQUIRED.
3. POWER SUPPLY FILTER CAPACITOR (C) SHOULD BE 20 MFD.

Fig. 47—Typical Sealing Current Arrangement

-20 dB. Variable resistor R28 and the 0 to 10 dB amplifier provide fine adjustment of the signal gain. Diode CR5 limits voltage surges in the circuit. The line impedance option provides a 150-, 600-, or 1200-ohm line termination. Monitor jack J1 (REC MON) provides a monitoring point on the modem side of the CIU.

Loopback Circuit

3.24 The loopback circuit (Fig. 48) is the same as the loopback circuit described in paragraphs 3.12 through 3.15 for the DAS 829A-L1 CIU.

Not-in-Data Indication

3.25 The not-in-data indication (Fig. 48) is the same as the not-in-data indication described in paragraphs 3.16 and 3.17 for the DAS 829A-L1 CIU.

Sealing Current Option

3.26 The sealing current option (Fig. 48) is the same as the sealing current option described in paragraph 3.18 for the DAS 829A-L1 CIU.

C. DAS 829C-L1 CIU

3.27 The DAS 829C-L1 CIU provides the transmission circuitry required for proper termination of medium or long loaded 4-wire metallic facilities that require gain in the receive path and extensive amplitude equalization. A facility loopback circuit, a not-in-data indication, and a sealing current option are also provided. A dc power supply in the CIU obtains its required 24-Vac input from a transformer associated with the data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1) that houses the CIU. All connections to the CIU are made through the data mounting.

Transmit Circuit

3.28 In the data mode (Fig. 49), transmitted signals on the modem transmit pair (DT1, DR1) are passed through the normally-closed contacts of test jack J4 (TRANS TST), the normally-closed contacts of relay LB1, the 0 to 15 dB attenuator AT1 (TRANS), and transformer T4 to the station transmit pair (T1, R1).

3.29 Resistor R42 functions as a fuse for the modem transmit pair (DT1, DR1). If excessive power is dissipated in resistor R42, the resistor opens to disconnect the hazardous voltage. Diode CR6 limits voltage surges in the circuit. The 359A or 359K equalizer equivalent option provides a 1200- or a 600-ohm line termination, respectively. Monitor jack J5 (TRANS MON) provides a monitoring point on the modem side of the CIU.

Receive Circuit

3.30 In the data mode (Fig. 49), received signals on the station receive pair (T, R) are passed through transformer T3, the slope equalizer circuit, the normally-closed contacts of input jack J3 (REC IN), the receive level circuit (coarse gain option), the 0 to 10 dB amplifier, transformer T2, the normally-closed contacts of test jack J2 (REC TST),

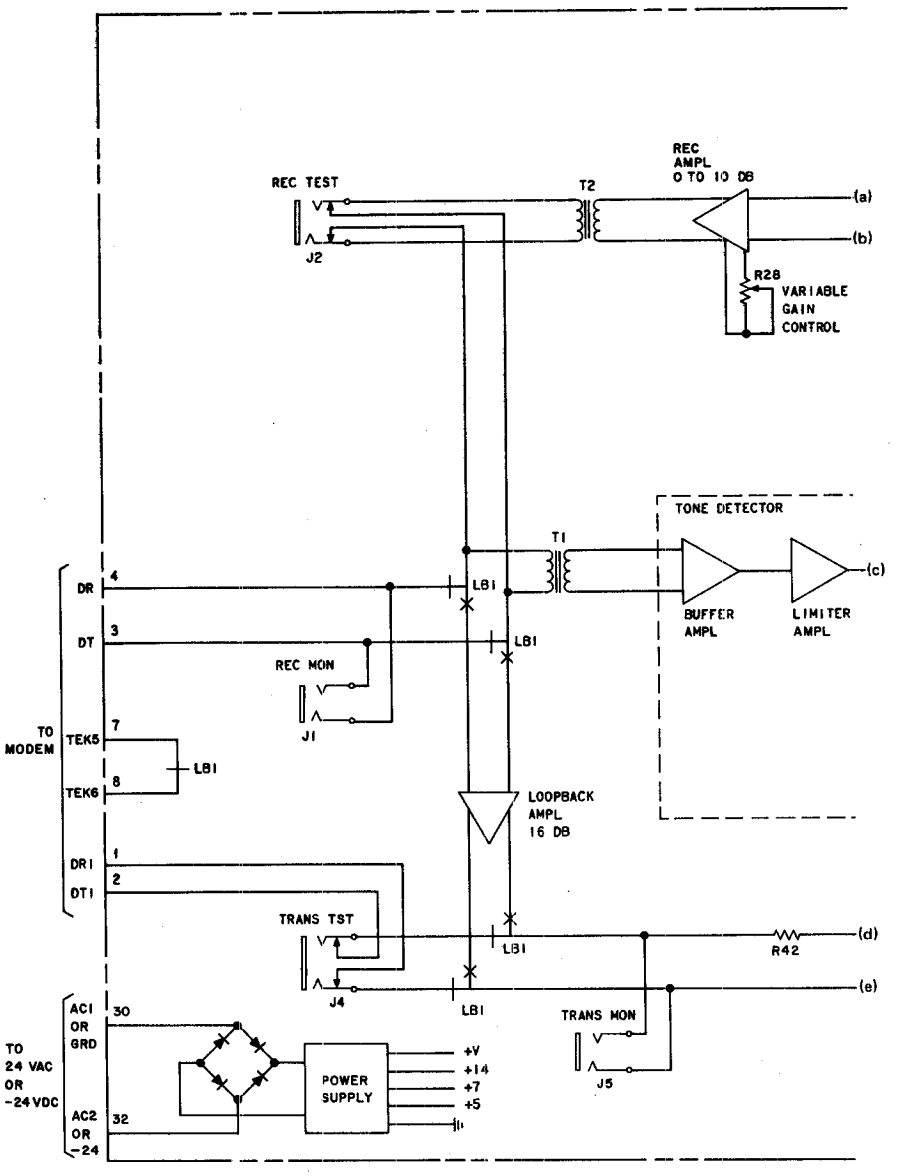


Fig. 48—DAS 829B-L1 CIU—Functional Diagram (Sheet 1 of 2)

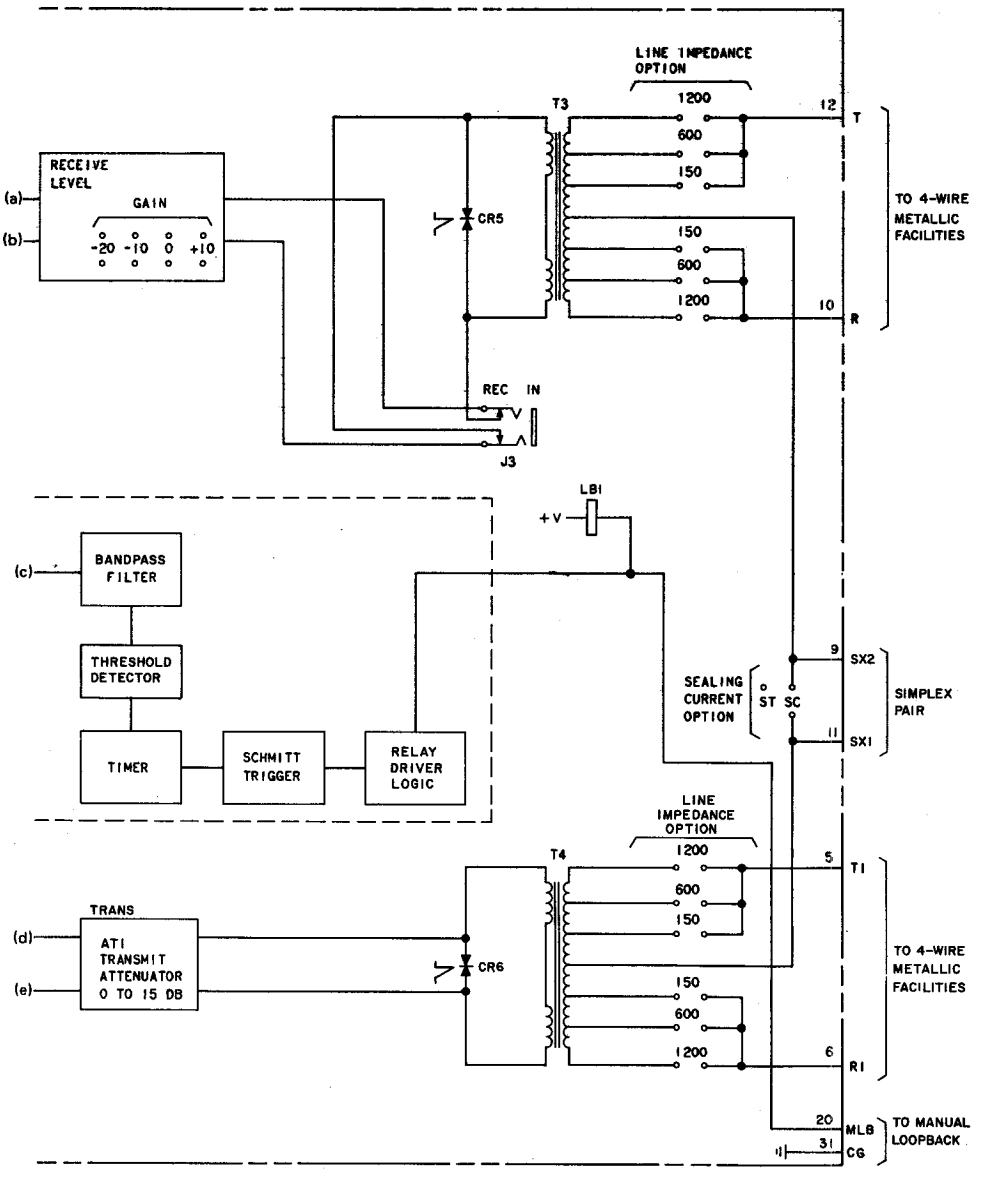


Fig. 48—DAS 829B-L1 CIU—Functional Diagram (Sheet 2 of 2)

and the normally-closed contacts of relay LB1 to the modem receive pair (DT, DR).

3.31 The coarse gain option provides coarse adjustment of the signal gain. The available coarse adjustments (GAIN) are +20, +10, 0, -10, and -20 dB. Variable resistor R28 and the 0 to 10 dB amplifier provide fine adjustment of the signal gain. Diode CR5 limits voltage surges in the circuit. The 359A or 359K equalizer equivalent option provides a 1200- or a 600-ohm line termination, respectively. Monitor jack J1 (REC MON) provides a monitoring point on the modem side of the CIU.

3.32 The slope equalizer circuit and the 1200- or 600-ohm line terminations (transmit and receive) form the equivalent of a 359A or 359K equalizer. The slope equalizer circuit and the line terminations for the receive circuit are shown in Fig. 50.

3.33 The slope equalizer circuit contains jacks arranged in a matrix. The matrix consists of four columns and four rows with a storage position to the left of each column. The required equalization is obtained by inserting plug-in straps into the appropriate matrix jacks.

3.34 All four columns (A, B, C, and D) are required to provide the equivalent of a 359A equalizer while only columns C and D are required for the equivalent of a 359K equalizer. Columns A and B comprise the high frequency section and are designed for equalization of H88-loaded high-capacitance cable. Columns C and D provide equalization for 4-wire or 2-wire private lines at frequencies up to 1000 Hz.

Loopback Circuit

3.35 The loopback circuit (Fig. 49) is the same as the loopback circuit described in paragraphs 3.12 through 3.15 for the DAS 829A-L1 CIU.

Not-in-Data Indication

3.36 The not-in-data indication (Fig. 49) is the same as the not-in-data indication described in paragraphs 3.16 and 3.17 for the DAS 829A-L1 CIU.

Sealing Current Option

3.37 The sealing current option (Fig. 49) is the same as the sealing current option described in paragraph 3.18 for the DAS 829A-L1 CIU.

D. DAS 829A-L1A CIU

3.38 The DAS 829A-L1A CIU provides the transmission circuitry required for proper termination of short nonloaded or loaded 4-wire metallic facilities when no gain is required in the transmit or receive paths. A facility loopback circuit, a not-in-data indication, a sealing current option, a loopback amplifier gain option, and a power supply option are also provided. The 2-position power supply option enables the associated dc power supply to operate on 24 Vac (N position), -24 Vdc (N position), or -48 Vdc (-48 position). The 24 Vac input is obtained from a transformer associated with the data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1) that houses the CIU. The -24 and -48 Vdc inputs are obtained from an external power source. All connections to the CIU are made through the data mounting.

Transmit Circuit

3.39 In the data mode (Fig. 51), transmitted signals on the modem transmit pair (DT1, DR1) are passed through the normally-closed contacts of test jack J4 (TRANS TST), the normally-closed contacts of relay LB1, the 0 to 15 dB attenuator AT1 (TRANS), and transformer T1 to the station transmit pair (T1, R1).

3.40 Resistors R7 and F1 function as fuses for the modem transmit pair (DT1, DR1) and the station transmit pair (T1, R1), respectively. If excessive power is dissipated in resistor R7 or F1, the resistor opens to disconnect the hazardous voltage. Diodes CR1 and CR2 limit voltage surges in the circuit. The line impedance option provides a 600- or 1200-ohm line termination. Monitor jack J5 (TRANS MON) provides a monitoring point on the modem side of the CIU.

Receive Circuit

3.41 In the data mode (Fig. 51), received signals on the station receive pair (T, R) are passed through transformer T3, the 0 to 15 dB attenuator AT2 (REC), the normally-closed contacts of test

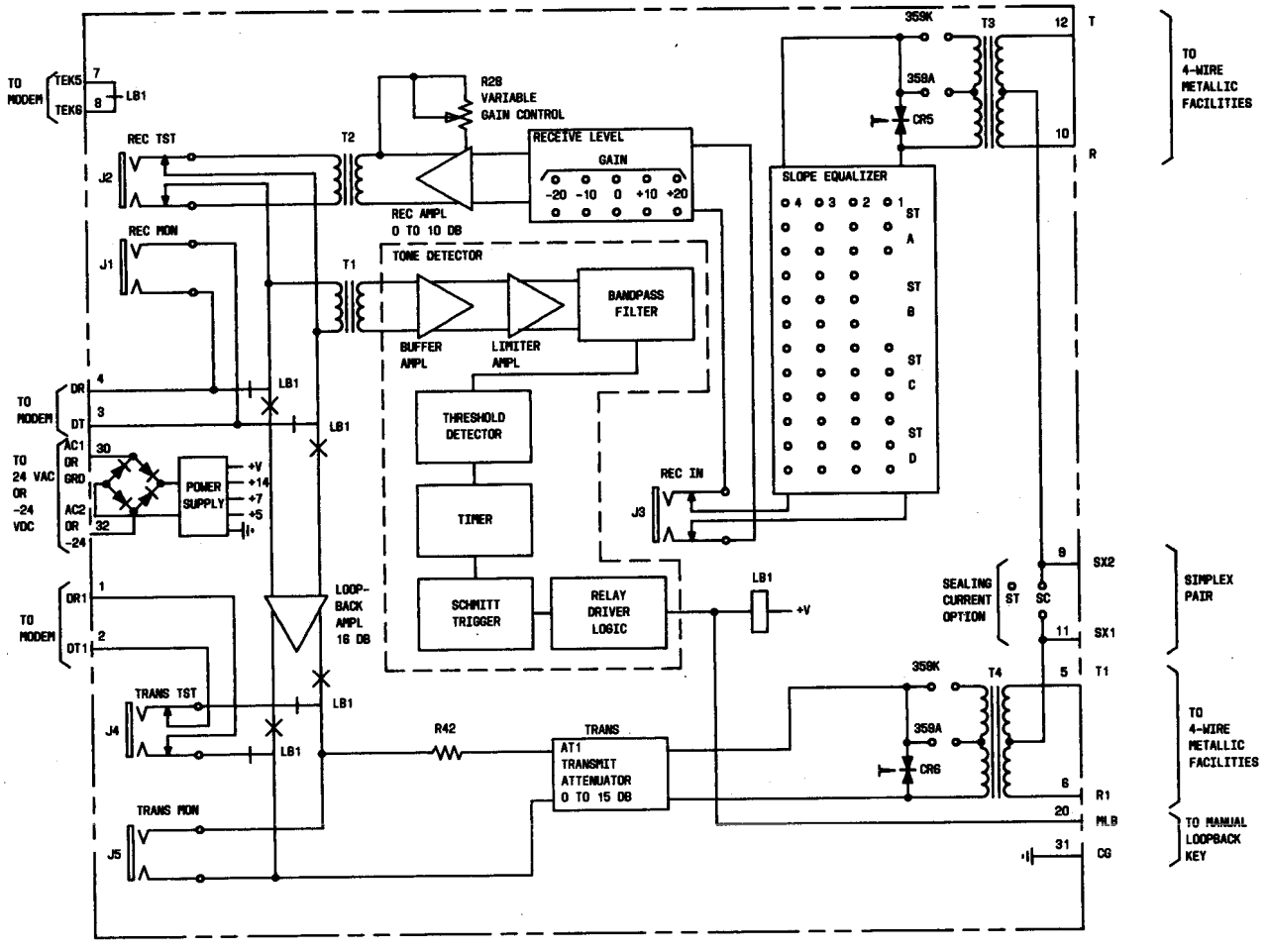


Fig. 49—DAS 829C-L1 CIU—Functional Diagram

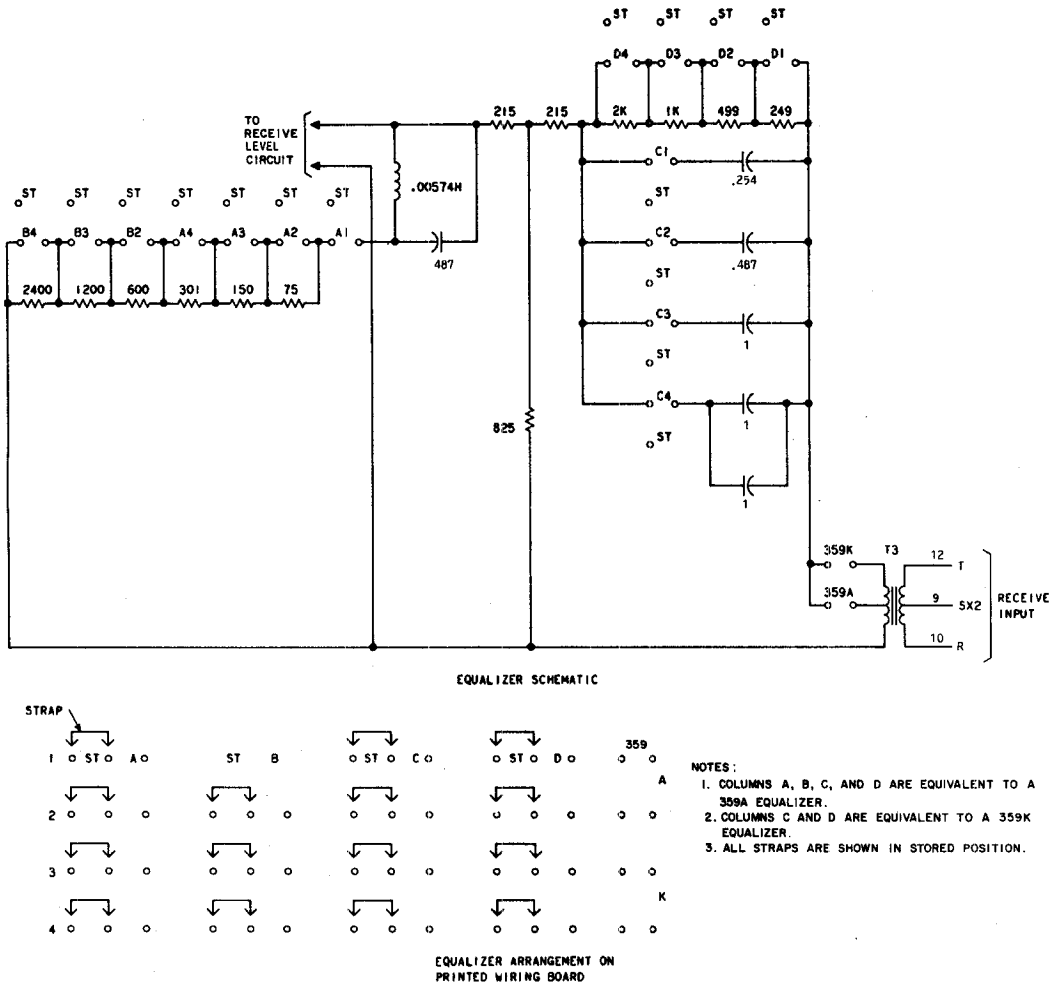


Fig. 50—Schematic and Physical Layout of Equalizer Circuit

jack J2 (REC TST), and the normally-closed contacts of relay LB1 to the modem receive pair (DT, DR).

3.42 Resistors R56 and F2 function as fuses for the modem receive pair (DT, DR) and the station receive pair (T, R), respectively. If excessive power is dissipated in resistor R56 or F2, the resistor opens to disconnect the hazardous voltage. Diodes CR15 and CR16 limit voltage surges in the circuit. The line impedance option provides a 600- or 1200-ohm line termination. Monitor jack J1 (REC MON) provides a monitoring point on the modem side of the CIU.

Loopback Circuit

3.43 The loopback circuit (Fig. 51) is the same as the loopback circuit described in paragraphs

3.12 through 3.15 for the DAS 829A-L1 CIU, with the following exceptions:

(a) A loopback amplifier gain option has been added to permit operation on either 8- or 16-dB channels.

(b) A light-emitting diode, DS1 (LB), has been added on the faceplate of the CIU to provide visual indication of the loopback mode. The diode is lighted when the CIU is in the loopback mode.

(c) The loopback control logic has been improved to ensure that the loopback logic will not respond to a 2713-Hz tone while the manual loopback key is operated, and to ensure that release of the manual loopback key will always return the CIU to the data mode.

(d) The loopback circuit can be disabled by means of an isolated (floating) low-impedance interface connection (such as a relay contact or an optically coupled transistor) between the DTD lead (pin 40) and the CG lead (pin 31). This feature is not available when the CIU is housed in a standard data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1), since these data mountings do not provide access to the DTD lead.

Not-in-Data Indication

3.44 The not-in data indication (Fig. 51) is the same as the not-in-data indication described in paragraphs 3.16 and 3.17 for the DAS 829A-L1 CIU.

Sealing Current Option

3.45 The sealing current option (Fig. 51) is the same as the sealing current option described in paragraph 3.18 for the DAS 829A-L1 CIU.

E. DAS 829B-L1A CIU

3.46 The DAS 829B-L1A CIU provides the transmission circuitry required for proper termination of medium or long nonloaded 4-wire metallic facilities that require gain in the receive path. A facility loopback circuit, a not-in-data indication, a sealing current option, a loopback amplifier gain option, and a power supply option are also provided. The 2-position power supply option enables the associated dc power supply to operate on 24 Vac (N position), -24 Vdc (N position), or -48 Vdc (-48 position). The 24 Vac input is obtained from a transformer associated with the data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1) that houses the CIU. The -24 and -48 Vdc inputs are obtained from an external power source. All connections to the CIU are made through the data mounting.

Transmit Circuit

3.47 In the data mode (Fig. 52), transmitted signals on the modem transmit pair (DT1, DR1) are passed through the normally-closed contacts of test jack J4 (TRANS TST), the normally-closed contacts of relay LB1, the 0 to 15 dB attenuator AT1 (TRANS), and transformer T1 to the station transmit pair (T1, R1).

3.48 Resistors R7 and F1 function as fuses for the modem transmit pair (DT1, DR1) and the station transmit pair (T1, R1), respectively. If excessive power is dissipated in resistor R7 or F1, the resistor opens to disconnect the hazardous voltage. Diodes CR1 and CR2 limit voltage surges in the circuit. The line impedance option provides a 150-, 600-, or 1200-ohm line termination. Monitor jack J5 (TRANS MON) provides a monitoring point on the modem side of the CIU.

Receive Circuit

3.49 In the data mode (Fig. 52), received signals on the station receive pair (T, R) are passed through transformer T3, the normally-closed contacts of input jack J3 (REC IN), the receive level circuit (coarse gain option), the 0 to 10 dB amplifier, transformer T4, the normally-closed contacts of test jack J2 (REC TST), and the normally-closed contacts of relay LB1 to the modem receive pair (DT, DR).

3.50 The coarse gain option provides coarse adjustment of the signal gain. The available coarse adjustments (GAIN) are +10, 0, -10, and -20 dB. Variable resistor R41 and the 0 to 10 dB amplifier provide fine adjustment of the signal gain. Resistors R56 and F2 function as fuses for the modem receive pair (DT, DR) and the station receive pair (T, R), respectively. If excessive power is dissipated in resistor R56 or F2, the resistor opens to disconnect the hazardous voltage. Diodes CR15 through CR17 limit voltage surges in

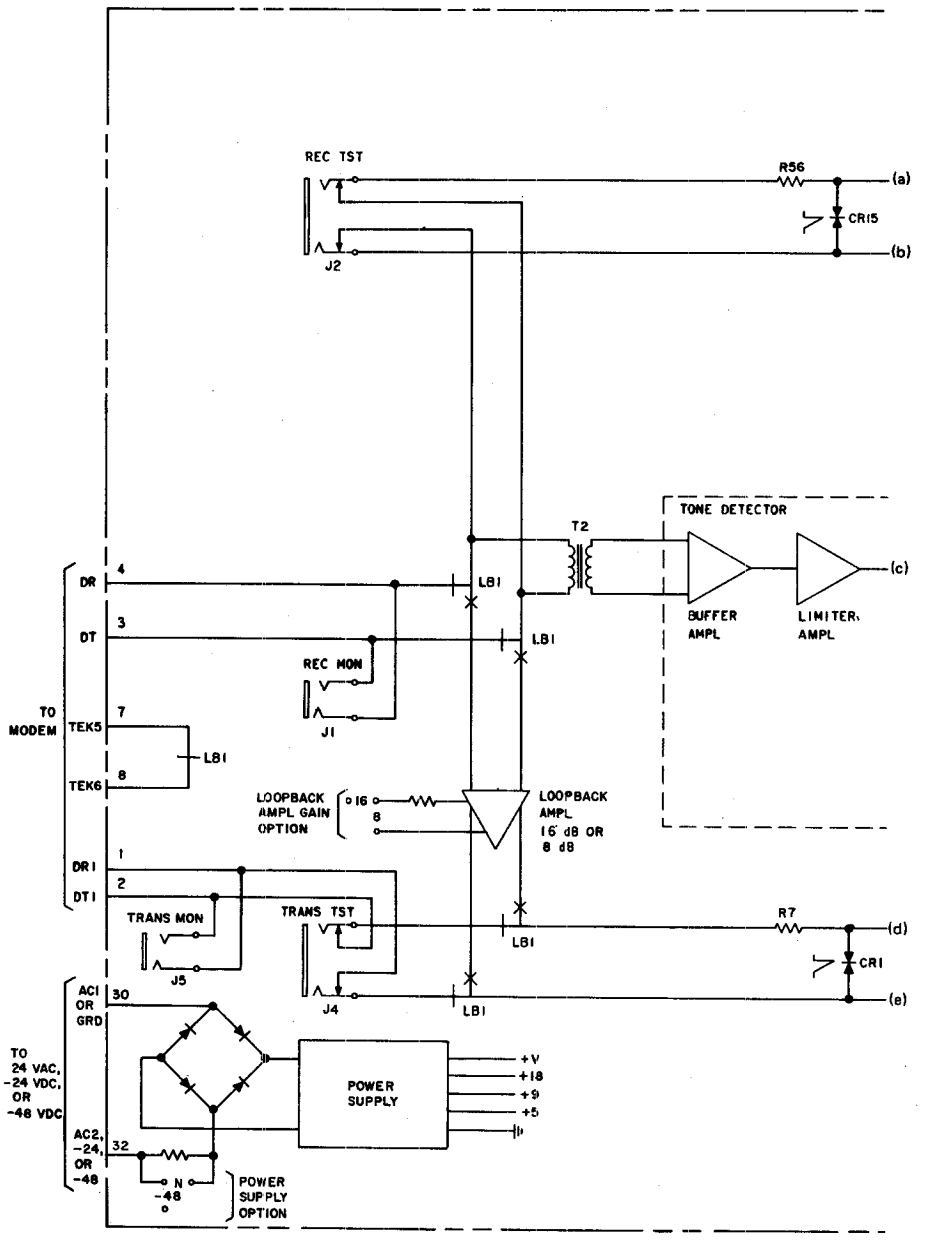


Fig. 51—DAS 829A-L1A CIU—Functional Diagram (Sheet 1 of 2)

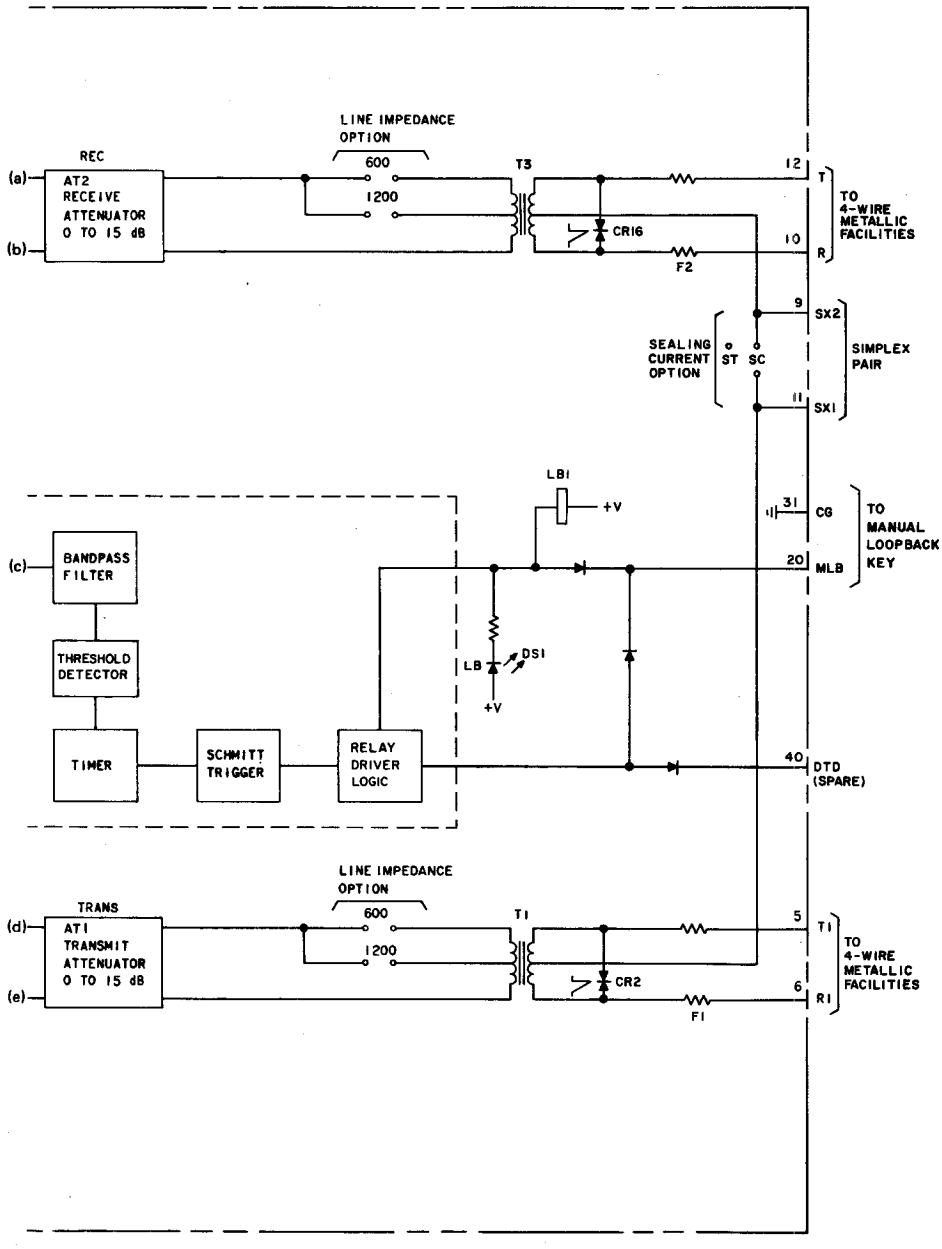


Fig. 51— DAS 829A-L1A CIU—Functional Diagram (Sheet 2 of 2)

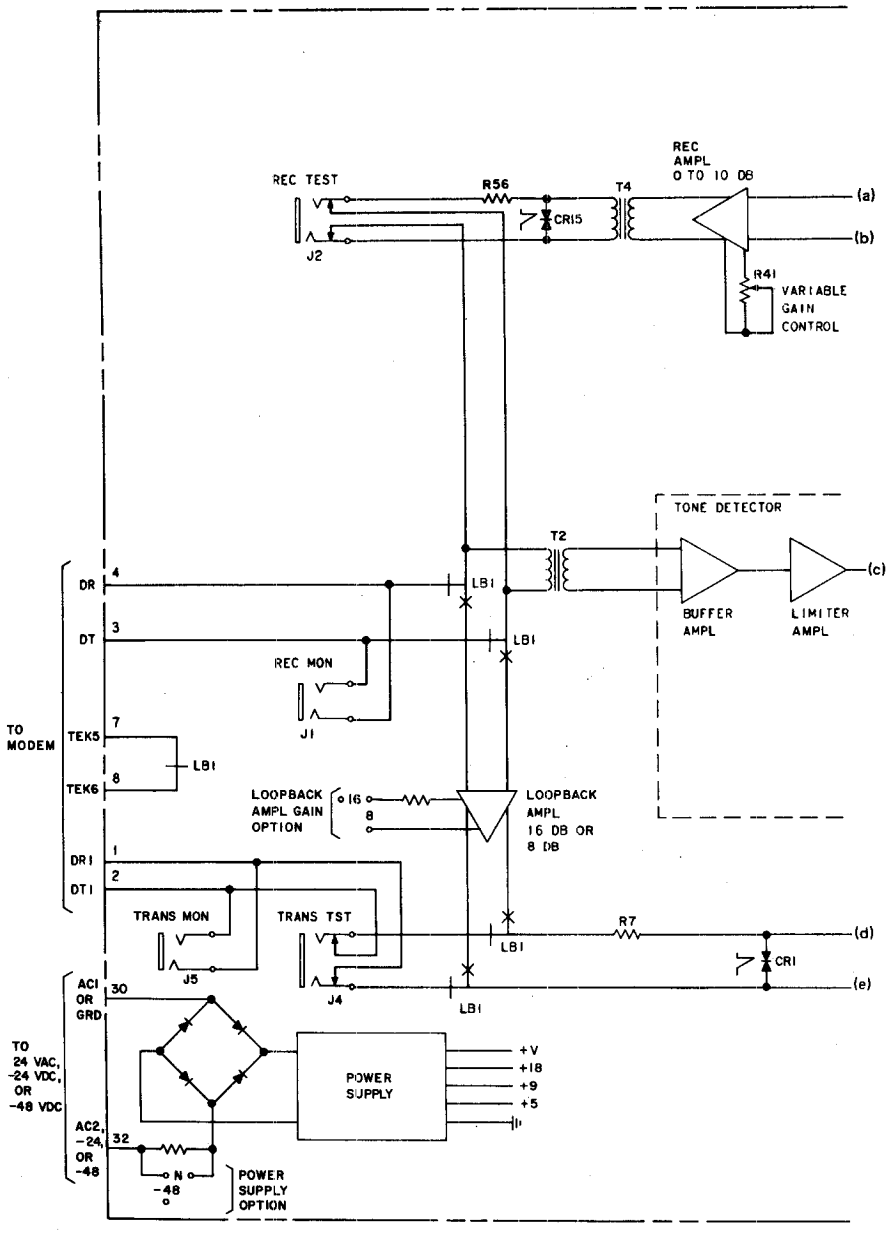


Fig. 52—DAS 829B-L1A CIU—Functional Diagram (Sheet 1 of 2)

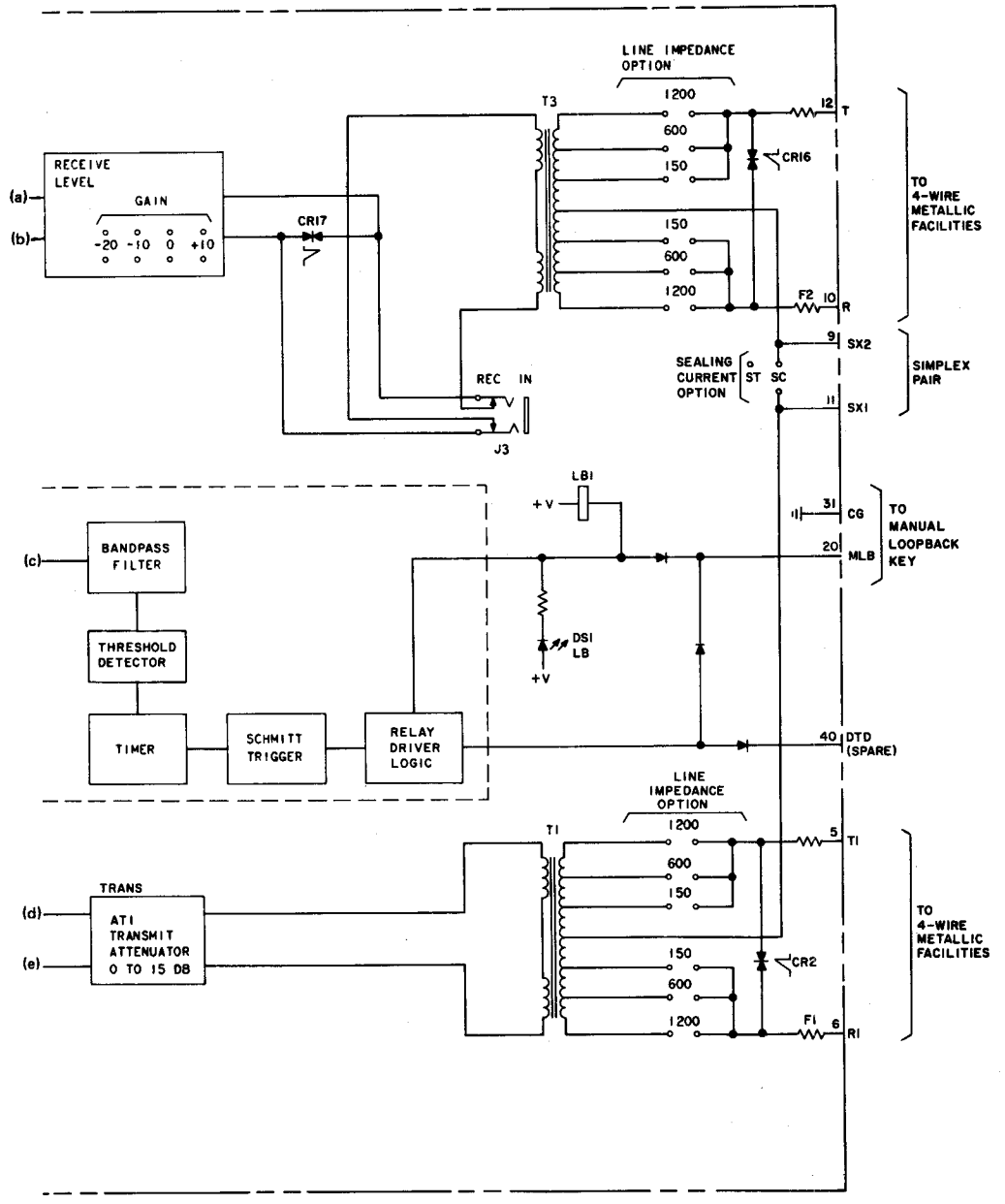


Fig. 52—DAS 829B-L1A CIU—Functional Diagram (Sheet 2 of 2)

the circuit. The line impedance option provides a 150-, 600-, or 1200-ohm line termination. Monitor jack J1 (REC MON) provides a monitoring point on the modem side of the CIU.

Loopback Circuit

3.51 The loopback circuit (Fig. 52) is the same as the loopback circuit described in paragraphs 3.12 through 3.15 for the DAS 829A-L1 CIU, with the following exceptions:

(a) A loopback amplifier gain option has been added to permit operation on either 8- or 16-dB channels.

(b) A light-emitting diode, DS1 (LB), has been added on the faceplate of the CIU to provide visual indication of the loopback mode. The diode is lighted when the CIU is in the loopback mode.

(c) The loopback control logic has been improved to ensure that the loopback logic will not respond to a 2713-Hz tone while the manual loopback key is operated, and to ensure that release of the manual loopback key will always return the CIU to the data mode.

(d) The loopback circuit can be disabled by means of an isolated (floating) low-impedance interface connection (such as a relay contact or an optically coupled transistor) between the DTD lead (pin 40) and the CG lead (pin 31). This feature is not available when the CIU is housed in a standard data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1), since these data mountings do not provide access to the DTD lead.

Not-in-Data Indication

3.52 The not-in-data indication (Fig. 52) is the same as the not-in-data indication described in paragraphs 3.16 and 3.17 for the DAS 829A-L1 CIU.

Sealing Current Option

3.53 The sealing current option (Fig. 52) is the same as the sealing current option described in paragraph 3.18 for the DAS 829A-L1 CIU.

F. DAS 829C-L1A CIU

3.54 The DAS 829C-L1A CIU provides the transmission circuitry required for proper termination of medium or long loaded 4-wire metallic facilities that require gain in the receive path and extensive amplitude equalization. A facility loopback circuit, a not-in-data indication, a sealing current option, a loopback amplifier gain option, and a power supply option are also provided. The 2-position power supply option enables the associated dc power supply to operate on 24 Vac (N position), -24 Vdc (N position), or -48 Vdc (-48 position). The 24 Vac input is obtained from a transformer associated with the data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1) that houses the CIU. The -24 and -48 Vdc inputs are obtained from an external power source. All connections to the CIU are made through the data mounting.

Transmit Circuit

3.55 In the data mode (Fig. 53), transmitted signals on the modem transmit pair (DT1, DR1) are passed through the normally-closed contacts of test jack J4 (TRANS TST), the normally-closed contacts of relay LB1, the 0 to 15 dB attenuator AT1 (TRANS), and transformer T1 to the station transmit pair (T1, R1).

3.56 Resistors R7 and F1 function as fuses for the modem transmit pair (DT1, DR1) and the station transmit pair (T1, R1), respectively. If excessive power is dissipated in resistor R7 or F1, the resistor opens to disconnect the hazardous voltage. Diodes CR1 and CR2 limit voltage surges in the circuit. The 359A or 359K equalizer equivalent option provides a 1200- or a 600-ohm line termination, respectively. Monitor jack J5 (TRANS MON) provides a monitoring point on the modem side of the CIU.

Receive Circuit

3.57 In the data mode (Fig. 53), received signals on the station receive pair (T, R) are passed through transformer T3, the slope equalizer circuit, the normally-closed contacts of input jack J3 (REC IN), the receive level circuit (coarse gain option), the 0 to 10 dB amplifier, transformer T4, the normally-closed contacts of test jack J2 (REC TST), and the normally-closed contacts of relay LB1 to the modem receive pair (DT, DR).

3.58 The coarse gain option provides coarse adjustment of the signal gain. The available coarse adjustments (GAIN) are +20, +10, 0, -10, and -20 dB. Variable resistor R41 and the 0 to 10 dB amplifier provide fine adjustment of the signal gain. Resistors R56 and F2 function as fuses for the modem receive pair (DT, DR) and the station receive pair (T, R), respectively. If excessive power is dissipated in resistor R56 or F2, the resistor opens to disconnect the hazardous voltage. Diodes CR15 and CR16 limit voltage surges in the circuit. The 359A or 359K equalizer equivalent option provides a 1200- or a 600-ohm line termination, respectively. Monitor jack J1 (REC MON) provides a monitoring point on the modem side of the CIU. The slope equalizer circuit is the same as the slope equalizer circuit described in paragraphs 3.32 through 3.34 for the DAS 829C-L1 CIU.

Loopback Circuit

3.59 The loopback circuit (Fig. 53) is the same as the loopback circuit described in paragraphs 3.12 through 3.15 for the DAS 829A-L1 CIU, with the following exceptions:

(a) A loopback amplifier gain option has been added to permit operation on either 8- or 16-dB channels.

(b) A light-emitting diode, DS1 (LB), has been added on the faceplate of the CIU to provide visual indication of the loopback mode. The diode is lighted when the CIU is in the loopback mode.

(c) The loopback control logic has been improved to ensure that the loopback logic will not respond to a 2713-Hz tone while the manual loopback key is operated, and to ensure that release of the manual loopback key will always return the CIU to the data mode.

(d) The loopback circuit can be disabled by means of an isolated (floating) low-impedance interface connection (such as a relay contact or an optically coupled transistor) between the DTD lead (pin 40) and the CG lead (pin 31). This feature is not available when the CIU is housed in a standard data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1), since these data mountings do not provide access to the DTD lead.

Not-in-Data Indication

3.60 The not-in-data indication (Fig. 53) is the same as the not-in-data indication described in paragraphs 3.16 and 3.17 for the DAS 829A-L1 CIU.

Sealing Current Option

3.61 The sealing current option (Fig. 53) is the same as the sealing current option described in paragraph 3.18 for the DAS 829A-L1 CIU.

48A1 DATA UNIT

3.62 The 48A1 data unit provides the switching, signaling, and transmission circuitry required to add alternate voice service to 4-wire or 2-wire private line data service. A dc power supply in the data unit obtains its unregulated input from a bridge rectifier power supply in the data mounting (45A1, 46B1, or 59A1) that houses the data unit. All connections to the data unit are made through the data mounting.

3.63 For alternate voice service on a single 4-wire private line, the 48A1 data unit is housed in a 45A1 or 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU. If dial backup service is provided, a 48B1 data unit is also housed in the 45A1 or 59A1 data mounting or a 48ER1 data unit is also housed in the 59A1 data mounting. For alternate voice service on a single 2-wire private line, the 48A1 data unit is housed in a 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU and 48G1 data unit. A 6-button key telephone set (565HK, 565HKM, 2565HK, or 2565HKM) is used with the 48A1 data unit. The fourth pickup key (RING) on the telephone set must be converted to nonlocking operation and the six pushbuttons labeled as follows:

HOLD	—	—	PL TALK	RING	—

3.64 For alternate voice service on multiple (up to eight) 4-wire or 2-wire private lines, the 48A1 data units are housed in a 46B1 data mounting and the required DAS 829-type CIUs are housed

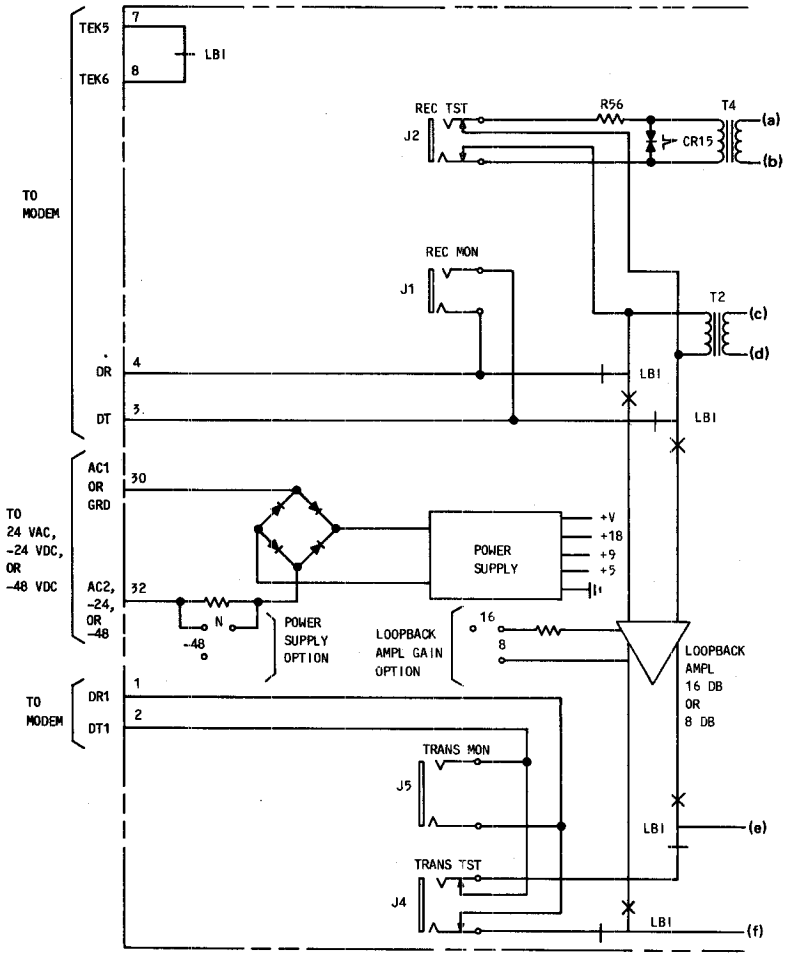


Fig. 53—DAS 829C-L1A CIU—Functional Diagram (Sheet 1 of 2)

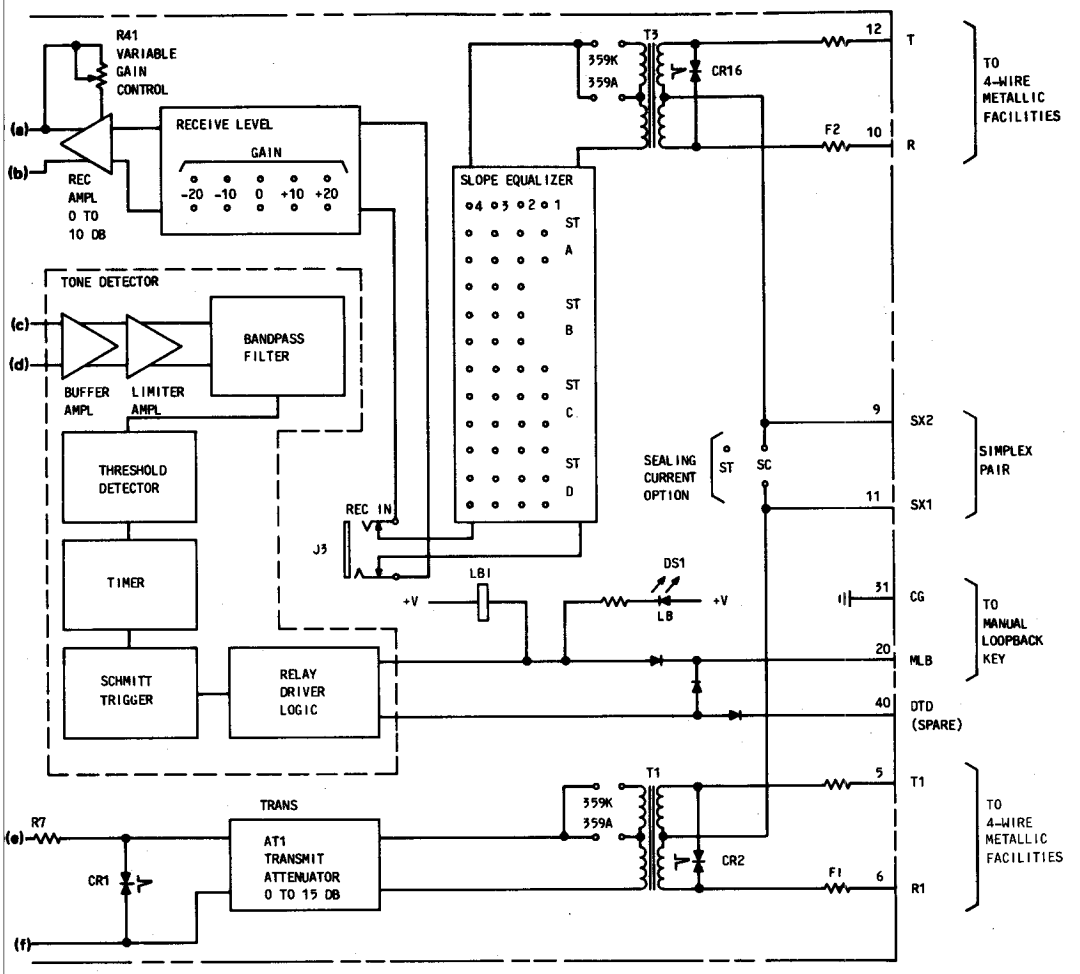


Fig. 53—DAS 829C-L1A CIU—Functional Diagram (Sheet 2 of 2)

in a 46A1 or 46A2 data mounting. The additional 48G1 data units required on 2-wire private lines are housed in a separate 46B1 data mounting. A 10-button key telephone set (830-type or 2830-type) is used with the 48A1 data units. The ninth pickup key (RING) on the telephone set must be converted to nonlocking operation and the ten pushbuttons labeled as follows:

HOLD	PL TALK1	PL TALK2	PL TALK3	PL TALK4

PL TALK5	PL TALK6	PL TALK7	PL TALK8	RING

A. Data Service

3.65 In the data mode (Fig. 3), the 4-wire modem can transmit and receive data over the 4-wire private line since the 48A1 data unit provides a through connection for the standard 6-lead interface (DT, DR, DT1, DR1, TEK5, TEK6) that connects the 4-wire modem to the DAS 829-type CIU. This 6-lead interface is complete through the normally-closed contacts of the TK relay in the 48A1 data unit as long as the 48A1 data unit remains in the data mode. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6, if the DAS 829-type CIU is also in the data mode.

3.66 In the data mode (Fig. 8), the 2-wire modem can transmit and receive data over the 2-wire private line since the 48A1 data unit provides a through connection for the 4-wire port of the 2-wire to 4-wire hybrid network in the 48G1 data unit that connects the 2-wire modem to the DAS 829-type CIU. The 4-wire transmission path and the 2-wire line status path are complete through the normally-closed contacts of the TK relay in the 48A1 data unit as long as the 48A1 data unit remains in the data mode. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6, if the DAS 829-type CIU is also in the data mode.

3.67 When data units are not installed in all positions of the 45A1, 46B1, or 59A1 data mounting, the data unit connectors at the vacant positions of the data mounting provide a through connection for the 6-lead interface.

B. Alternate Voice Service

3.68 In the alternate voice mode (Fig. 3 or 8), operation of the TK relay in the 48A1 data unit disconnects the modem and connects the key telephone set to the private line. A not-in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6.

3.69 The description in the following paragraphs assumes that the 48A1 data unit (Fig. 54) is installed in the 45A1 or 59A1 data mounting (Fig. 55 or 58), the required DAS 829-type CIU is installed in the data mounting, the required key telephone set is provided, and all necessary connections are made. The following description also applies to the 48A1 data unit when it is installed in the 46B1 data mounting. Operation of the 48A1 data unit is the same for 4-wire or 2-wire private lines.

Alternate Voice Mode

3.70 To put the 48A1 data unit in the alternate voice mode, the TK relay must be operated by taking the telephone handset off-hook and depressing the PL TALK key. This initiates the following actions:

(a) The PL TALK lamp on the telephone set lights.

(b) The modem is disconnected from the transmit and receive pairs and a not-in-data indication is supplied to the modem on interface leads TEK5 and TEK6.

(c) The transmit pair (DT1, DR1) is connected to the telephone set through an amplifier and a balanced hybrid circuit.

(d) The receive pair (DT, DR) is connected to the telephone set through a fixed attenuator and the balanced hybrid circuit.

(e) The 2600-Hz tone (inband ring) detector is disabled.

(f) The relay driver logic for ringdown signaling is partially enabled.

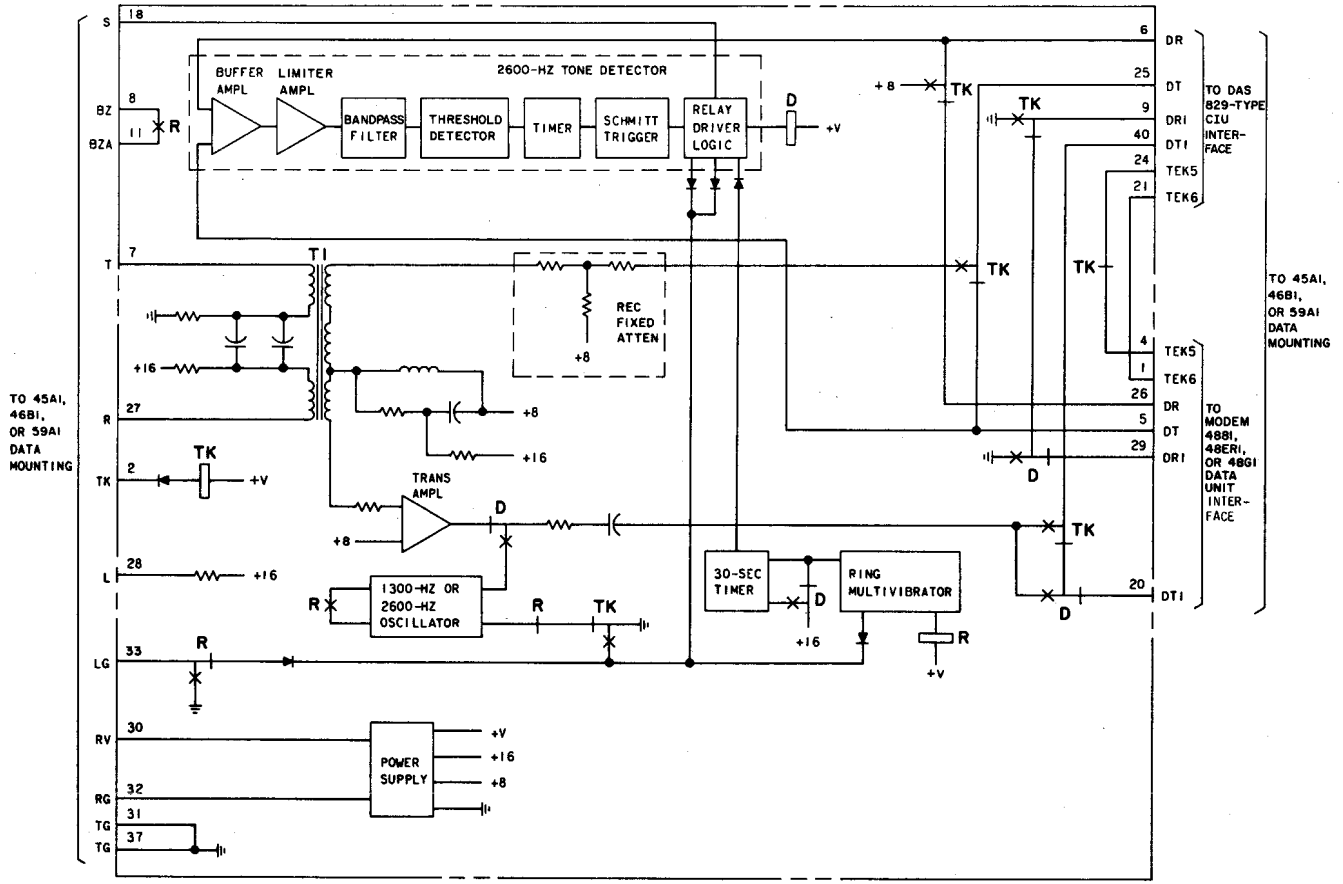
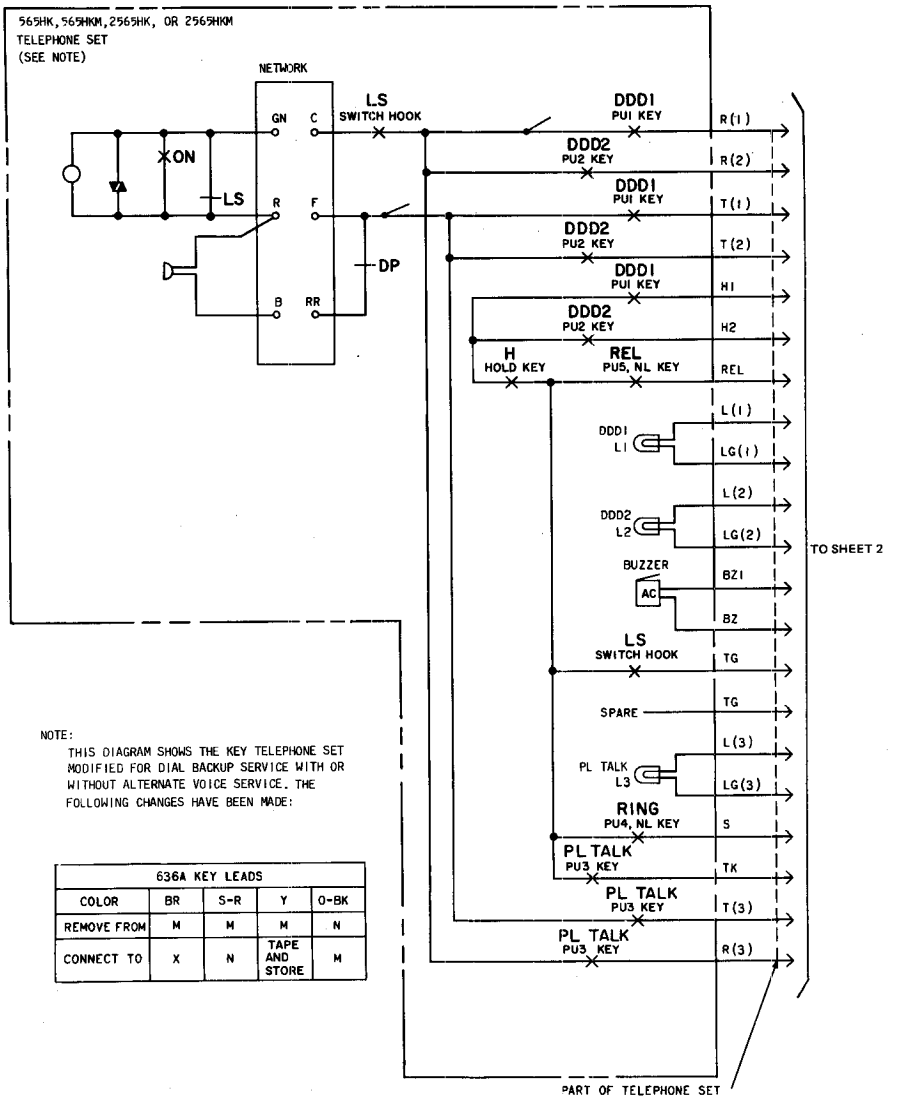


Fig. 54—48A1 Data Unit—Functional Diagram



NOTE:
THIS DIAGRAM SHOWS THE KEY TELEPHONE SET MODIFIED FOR DIAL BACKUP SERVICE WITH OR WITHOUT ALTERNATE VOICE SERVICE. THE FOLLOWING CHANGES HAVE BEEN MADE:

636A KEY LEADS				
COLOR	BR	S-R	Y	O-BK
REMOVE FROM	M	M	M	N
CONNECT TO	X	N	TAPE AND STORE	M

Fig. 55—45A1 Data Mounting—Interface Diagram (Sheet 1 of 4)

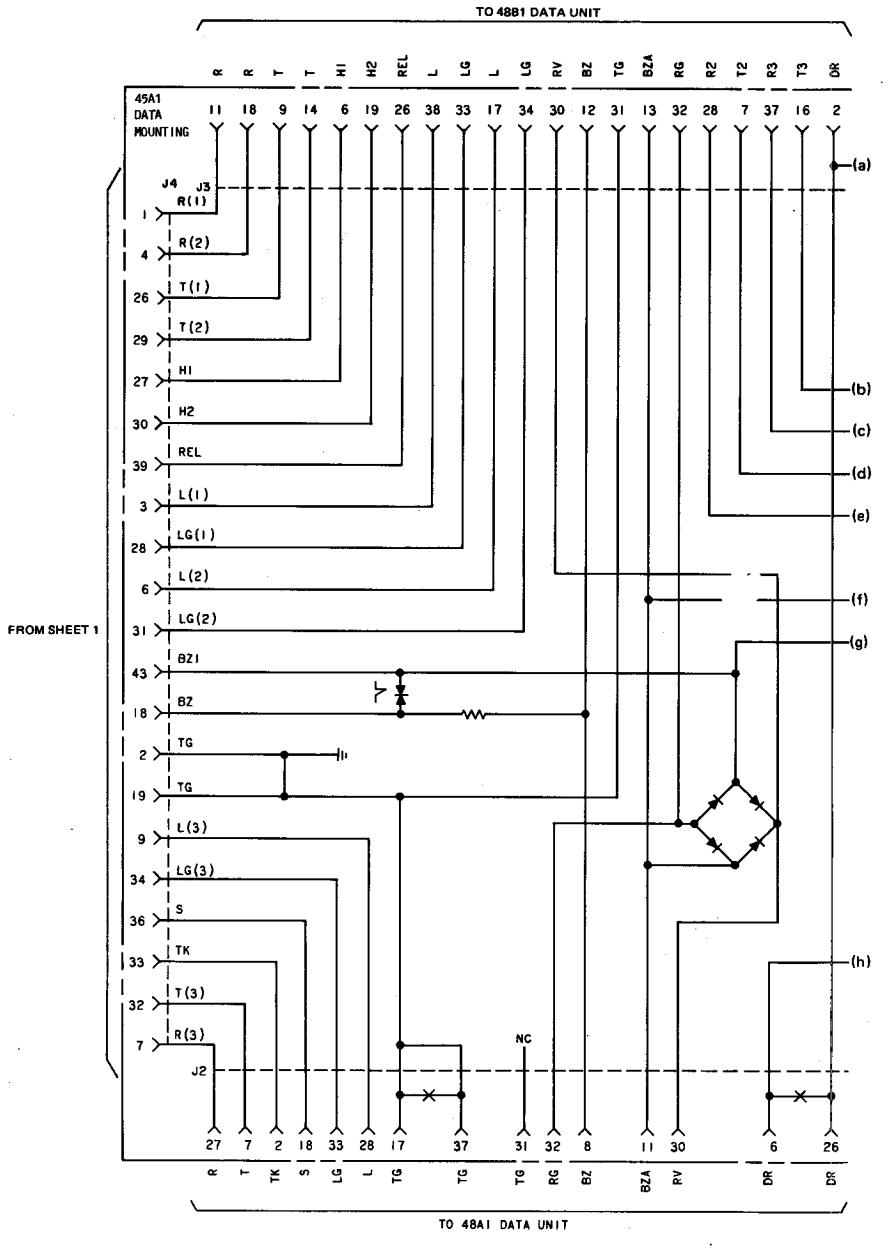


Fig. 55— 45A1 Data Mounting—Interface Diagram (Sheet 2 of 4)

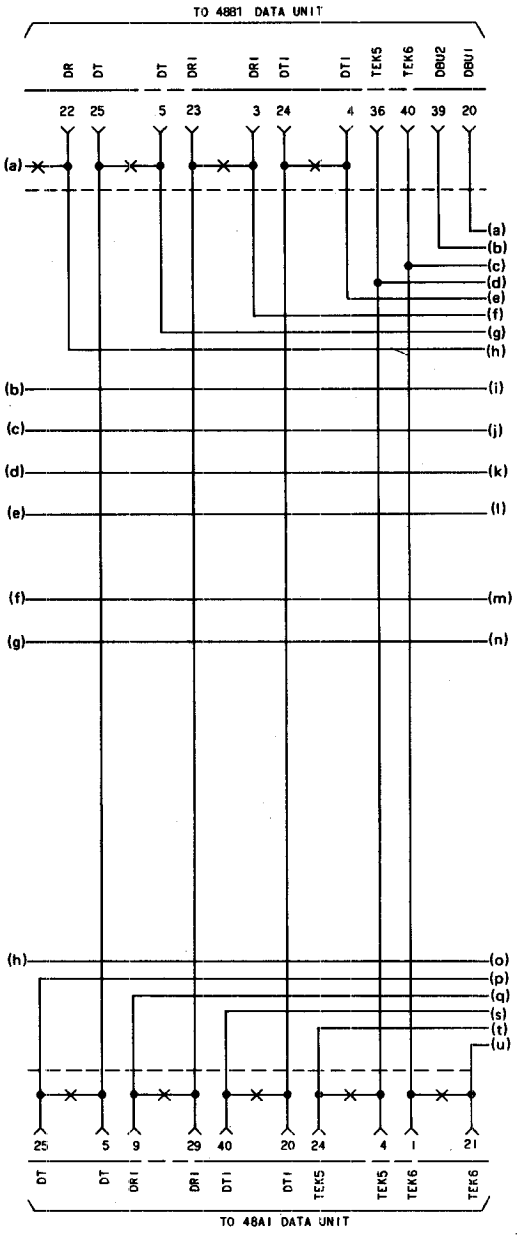


Fig. 55—45A1 Data Mounting—Interface Diagram (Sheet 3 of 4)

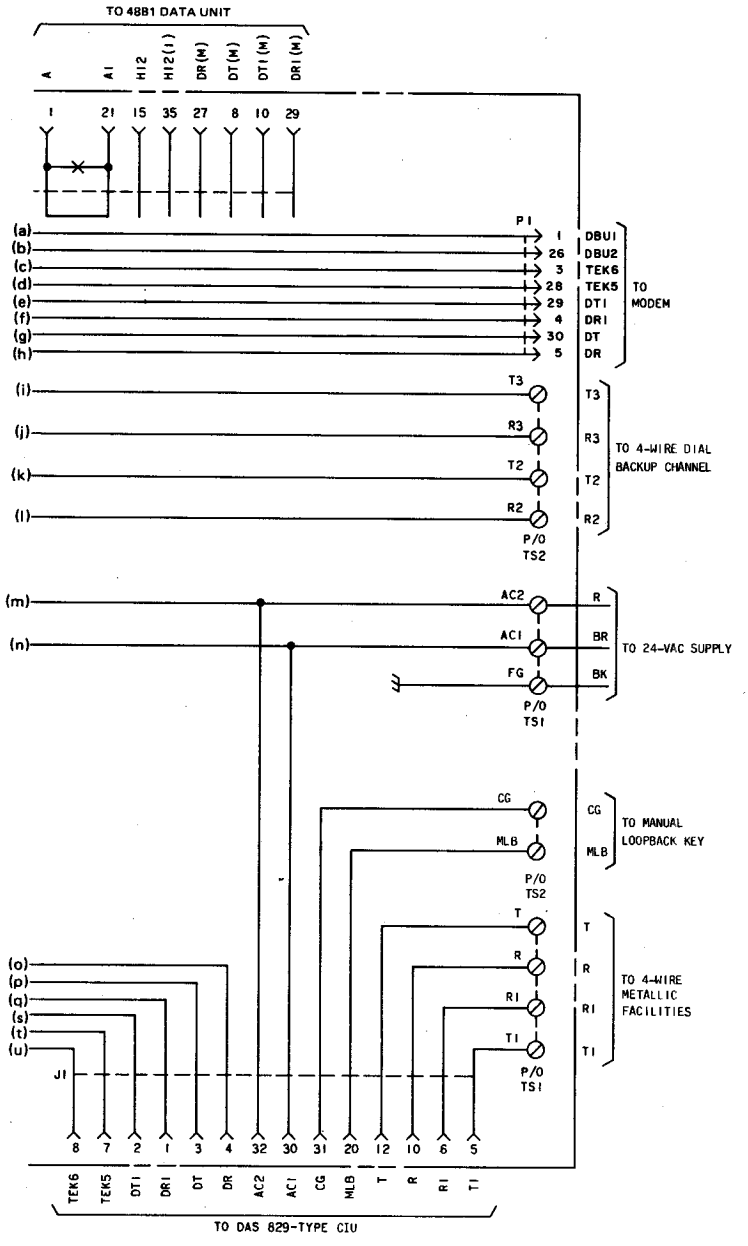


Fig. 55— 45A1 Data Mounting—Interface Diagram (Sheet 4 of 4)

3.71 The 48A1 data unit is now in the alternate voice mode (TK relay operated) and conversation can take place over the private line if the far end is also in the alternate voice mode.

3.72 The amplifier in the transmit pair and the fixed attenuator in the receive pair of the 48A1 data unit provide the required transmission level at the interface with the DAS 829-type CIU. The required level at this interface is +13 TLP (0 dBm) transmit and -3 TLP (-16 dBm) receive. The level at the 2-wire telephone set interface is 0 TLP transmit and -10 TLP receive.

Ringdown Signaling in Alternate Voice Mode

3.73 When the 48A1 data unit is in the alternate voice mode (TK relay operated), ringdown signaling is initiated by depressing the nonlocking RING key on the telephone set. This causes the relay driver logic in the data unit to operate the D relay. Since both TK and D relays are now operated, the transmit amplifier is disconnected from the transmit pair, a 2600-Hz oscillator is connected to the transmit pair, and a 2600-Hz ringdown signal is sent to the far end. At that end, the DAS 829-type CIU and the 48A1 data unit must be in the data mode to receive the 2600-Hz signal. If the CIU is in the loopback mode or the data unit is in the alternate voice mode, the 2600-Hz tone detector in the data unit cannot be activated.

3.74 The RING key should remain depressed until an audible ringback signal (bursts of 1300 Hz) is heard in the handset. This signal should be heard within 10 seconds after the RING key is depressed. When the signal is heard, the RING key should be released. The far end, if unanswered, will ring for about 30 seconds. If the RING key remains depressed for more than 30 seconds, the far end will ring until the RING key is released.

Ringdown Signaling in Data Mode

3.75 When the 48A1 data unit is in the data mode (TK relay released) and a 2600-Hz ringdown signal is detected by the 2600-Hz tone detector in the data unit, the relay driver logic causes the D relay to operate and put the data unit in the ring mode. Operation of the D relay initiates the following actions:

(a) A 30-second timer is activated. The timer ensures that the data unit will remain in the ring mode for about 30 seconds. If the 2600-Hz signal is still being detected when the timed interval elapses, the data unit will remain in the ring mode until the 2600-Hz signal is removed.

(b) The modem and the transmit amplifier are disconnected from the transmit pair and a 1300-Hz oscillator is connected to the transmit pair.

(c) A ring multivibrator is activated that periodically operates and releases the R relay. This cycling of the R relay causes the PL TALK lamp in the telephone set to flash and the buzzer to sound. The cycling also causes the 1300-Hz oscillator in the data unit to send an audible ringback signal (bursts of 1300 Hz) to the far end.

3.76 The ring mode is ended when the 48A1 data unit is placed in the alternate voice mode (TK relay operated).

C. Alternate Voice Call Sequence

3.77 To originate a voice call using the 48A1 data unit, perform the following steps:

(a) Depress the desired PL TALK key.

(b) Take the telephone handset off-hook.

(c) The PL TALK lamp is lighted while the 48A1 data unit is in the voice mode.

(d) Depress the RING key until the audible ringback signal is heard in the handset. When the audible ringback signal ceases, the RING key can be depressed again to initiate a new ring cycle.

Note: When the far end is equipped with a DAS 828A-type CIU there is no audible ringback signal. In this case, depress the RING key until the far end responds.

3.78 To answer a voice call, perform the following steps:

(a) Depress the PL TALK key associated with a flashing lamp.

(b) Take the telephone handset off-hook and talk.

3.79 To end a voice call and return to the data mode, perform the following steps:

(a) Depress and release the HOLD key to return the PL TALK key to its normal (released) position.

(b) The PL TALK lamp goes off.

(c) Place the telephone handset on-hook.

48B1 DATA UNIT

3.80 The 48B1 data unit provides the switching, ring detection, and transmission circuitry required to add 4-wire dial backup service with manual dialing to 4-wire private line data or data with alternate voice service. A dc power supply in the data unit obtains its unregulated input from a bridge rectifier power supply associated with the data mounting (45A1, 46C1, 46C2, or 59A1) that houses the data unit. All connections to the data unit are made through the data mounting.

A. Arrangements

3.81 The 48B1 data unit can be used to provide 4-wire dial backup service in the following equipment arrangements: single installation (manual dialing), and multiple installation (manual dialing).

Single Installation (Manual Dialing)

3.82 For 4-wire dial backup service with manual dialing on a single 4-wire private line, the 48B1 data unit is housed in a 45A1 or 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU and a 48A1 data unit (if alternate voice service is provided). A 6-button key telephone set (565HK, 565HKM, 2565HK, or 2565HKM) provides control of the 48B1 data unit.

(a) When used for dial backup service only, the key telephone set must be modified as shown in Fig. 55 or 58, the fifth pickup key (REL) converted to nonlocking operation, and the six pushbuttons labeled as follows:

HOLD	DDD1	DDD2	—	—	REL

(b) When used for dial backup and alternate voice service, the key telephone set must be modified as shown in Fig. 55 or 58, the fourth pickup key (RING) and the fifth pickup key (REL) converted to nonlocking operation, and the six pushbuttons labeled as follows:

HOLD	DDD1	DDD2	PL TALK	RING	REL

3.83 For a detailed description of the single installation (manual dialing) arrangement, refer to paragraphs 3.86 through 3.111.

Multiple Installation (Manual Dialing)

3.84 For 4-wire dial backup service with manual dialing on multiple 4-wire private lines, the 48B1 data unit is housed in a 46C1 or 46C2 data mounting and switched dial backup is used. An 18- or 30-button CALL DIRECTOR key telephone set provides control of the 48B1 data unit.

3.85 For a detailed description of the multiple installation (manual dialing) arrangement, refer to paragraphs 3.112 through 3.133.

B. Data Service

3.86 In the data mode (Fig. 3), the 4-wire modem can transmit and receive data over the 4-wire private line since the 48B1 data unit provides a through connection for the transmission leads of the standard 6-lead interface (DT, DR, DT1, DR1, TEK5, TEK6) that connects the modem to the DAS 829-type CIU. The four transmission leads (DT, DR, DT1, DR1) are complete through the normally-closed contacts of the A relay in the 48B1 data unit as long as the 48B1 data unit remains in the data mode. An in-data line status signal is

supplied to the modem on interface leads TEK5 and TEK6, if the 48A1 data unit and the DAS 829-type CIU are also in the data mode. Two additional interface leads, DBU1 and DBU2, supply a dial backup status signal to the modem.

3.87 When data units are not installed in all positions of the 45A1 or 59A1 data mounting, the data unit connectors at the vacant positions of the data mounting provide a through connection for the 6-lead interface.

3.88 The following are the transmission leads from the DAS 829-type CIU (or a 48A1 data unit, if alternate voice service is provided) and the corresponding 48B1 terminal numbers (Fig. 56):

Designation	48B1 Terminal Number
DT	25
DR	2
DT1	24
DR1	23

3.89 For 4-wire dial backup service on a single 4-wire private line, the following are the transmission leads from the modem and the corresponding 48B1 terminal numbers (Fig. 56):

Designation	48B1 Terminal Number
DT	5
DR	22
DT1	4
DR1	3

C. Dial Backup Service

3.90 In the dial backup mode (Fig. 3), operation of the A relay in the 48B1 data unit transfers the 4-wire modem from the 4-wire private line to the 4-wire dial backup channel. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

Transmit Circuit

3.91 In the dial backup mode (A relay operated, Fig. 56), the modem transmit pair (DT1, DR1) is connected through the normally-open contacts of relay A, the 0 to 15 dB attenuator AT1, line-holding transformer T1, and the normally-open contacts of relay H1 to the 2-wire dial-up line terminating on T2 and R2.

3.92 The 48B1 data unit provides a 900-ohm termination for the dial-up line and a 600-ohm termination for the modem. Diode CR1 limits voltage surges in the circuit.

Receive Circuit

3.93 In the dial backup mode (A relay operated, Fig. 56), the modem receiver pair (DT, DR) is connected through the normally-open contacts of relay A, the normally-closed contacts of test jack J1 (REC), isolation transformer T3, the slope equalizer option, the -6 to +14 dB amplifier, line-holding transformer T2, and the normally-open contacts of relay H2 to the 2-wire dial-up line terminating on T3 and R3.

3.94 The 48B1 data unit provides a 900-ohm termination for the dial-up line and a 600-ohm termination for the modem. Diode CR2 limits voltage surges in the circuit. Variable resistor R9 and the -6 to +14 dB amplifier provide adjustment of the signal gain. The slope equalizer option provides either 0 or 4 dB of slope equalization.

Dial Backup Mode

3.95 The description in the following paragraphs assumes that the 48B1 data unit (Fig. 56) is installed in the 45A1 or 59A1 data mounting (Fig. 55 or 58), the required DAS 829-type CIU is installed in the data mounting, the required key telephone set is provided, and all necessary connections are made.

3.96 To put the 48B1 data unit in the dial backup mode, the H2, H1, and A relays are operated.

(a) The H2 relay is operated by taking the telephone handset off-hook and depressing the DDD2 and HOLD keys. The H2 relay latches under control of a release circuit in the data unit and the DDD2 lamp on the telephone set lights. The 2-wire dial-up line (DDD2) terminating

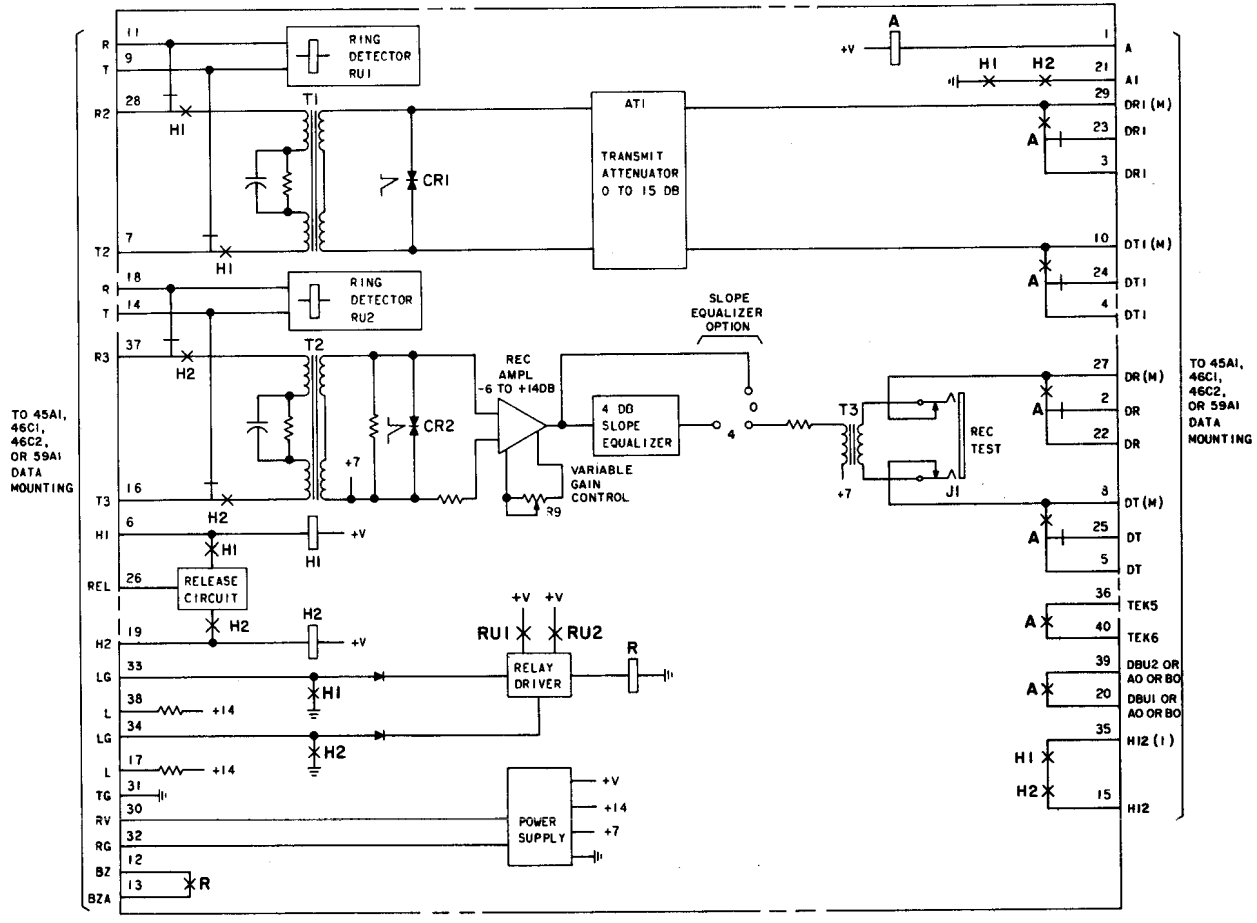


Fig. 56—48B1 Data Unit—Functional Diagram

on T3 and R3 is transferred from the telephone set to the receive circuit of the data unit and is now in the hold mode.

(b) The H1 relay is operated by taking the telephone handset off-hook and depressing the DDD1 and HOLD keys. The H1 relay latches under control of a release circuit in the data unit and the DDD1 lamp on the telephone set lights. The 2-wire dial-up line (DDD1) terminating on T2 and R2 is transferred from the telephone set to the transmit circuit of the data unit and is now in the hold mode.

(c) With the DDD2 and DDD1 dial-up lines in the hold mode (H2 and H1 relays operated), the A relay operates. The modem is transferred from the 4-wire private line to the transmit and receive circuits of the data unit. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

(d) The data unit is now in the dial backup mode (A relay operated) and data transmission can take place over the 4-wire dial backup channel.

Release From Hold Mode

3.97 When either the DDD2 or DDD1 lamp is lighted (H2 or H1 relay operated), the associated 2-wire dial-up line (DDD2 or DDD1) is in the hold mode. Release of a dial-up line from the hold mode is accomplished as follows:

(a) Take the telephone handset off-hook.

(b) Depress the REL key.

(c) The DDD2 or DDD1 lamp goes off (H2 or H1 relay released) indicating that the DDD2 or DDD1 dial-up line is released from the hold mode and returned to telephone set control.

(d) Place the telephone handset on-hook.

Note: The dial-up lines cannot be released from the hold mode except as described above.

Release From Dial Backup Mode

3.98 When both the DDD2 and DDD1 lamps are lighted (H2 and H1 relays operated), the 48B1 data unit is in the dial backup mode (A relay operated). Release of the data unit from the dial backup mode is accomplished as follows:

(a) Take the telephone handset off-hook.

(b) Depress the REL key.

(c) The DDD2 and DDD1 lamps go off (H2 and H1 relays released) indicating the data unit is released from the dial backup mode (A relay released) and the DDD2 and DDD1 dial-up lines are returned to telephone set control.

(d) Place the telephone handset on-hook.

Note: The data unit cannot be released from the dial backup mode except as described above.

3.99 The line holding arrangement described above provides the following features that were not available with the DAS 828C-type CIU.

(a) The telephone handset can be placed on-hook without ending the dial backup mode.

(b) Multiple installations requiring more than one 4-wire dial backup channel can be provided.

Ring Detection

3.100 A ring detector circuit and a 2-wire telephone set line are connected to each 2-wire dial-up line (DDD1 and DDD2). A ringing signal on either idle dial-up line (DDD1 or DDD2) operates the relay (RU1 or RU2) in the ring detector circuit associated with the dial-up line and causes the corresponding lamp (DDD1 or DDD2) to flash. When either the RU1 or RU2 relay is operated, the R relay operates and causes the telephone set buzzer to sound.

3.101 The ring detector circuits and telephone set lines are only connected to the dial-up lines when the data unit is not in the hold or dial backup modes. If the data unit is in the dial backup mode, both ring detector circuits and associated telephone set lines are disconnected. If either

dial-up line is in the hold mode, the associated ring detector circuit and telephone set line are disconnected.

D. Dial Backup Call Sequence

3.102 A preferred dial backup call sequence for two stations, A and B, is described in the following paragraphs. This description assumes that the following conditions exist:

(a) The 4-wire modem is used to transmit and receive data over a 4-wire private line terminated with a DAS 829-type CIU that is conditioned for data transmission and the 48B1 data unit is used for 4-wire dial backup at both stations.

(b) Station A initiates the first call on line 2 and Station B answers the call on line 1.

(c) Station A initiates the second call on line 1 and Station B answers the call on line 2.

3.103 As long as line 1 of one station is connected to line 2 of the other station, either station can initiate both calls, or either station can initiate the first call and the other station can initiate the second call.

Idle State

3.104 At both Station A and Station B, all dial-up line lamps (DDD1 and DDD2) are off and the telephone handsets are on-hook. The modem is connected through the 48B1 data unit to the 4-wire private line terminated by the DAS 829-type CIU. Both 2-wire dial-up lines (DDD1 and DDD2) are released and connected to their ring detector circuits. The 48B1 data unit passes an in-data or not-in-data indication to the modem, as determined by the DAS 829-type CIU. Since the DAS 829-type CIU is conditioned for data transmission, an in-data indication is passed.

First Call

3.105 The sequence begins with Station A deciding for some reason, such as the inability of the modem to send data over the 4-wire private line, that a backup connection should be made. Station A goes off-hook, selects line 2 by depressing the DDD2 key, and dials line 1 of Station B.

3.106 At Station B, a ringing signal causes the line 1 (DDD1) lamp to flash and the telephone set buzzer to sound. Station B then goes off-hook and depresses the DDD1 key. Ringing stops and conversation can now take place. If the connection is not satisfactory, the call can be dropped by placing the handset on-hook, and then reinitiated. At this point both line lamps (DDD1 and DDD2) are off at each station.

3.107 Once the nature of the call is established (backup) and the procedure for the next call determined, both stations hold their respective lines. At Station A, the HOLD key is depressed until the line 2 (DDD2) lamp lights, indicating line 2 is being held. At Station B, a similar procedure puts line 1 on hold. At this point, one line lamp is lighted at each station. The stations need not remain off-hook to hold the call.

Second Call

3.108 Station A selects line 1 by depressing the DDD1 key and dials line 2 of Station B. At Station B, a ringing signal causes the line 2 (DDD2) lamp to flash and the telephone set buzzer to sound. Station B then depresses the DDD2 key and answers the call. If the connection is not satisfactory, the second call can be dropped by placing the telephone handset on-hook, and then reinitiated. Both stations now hold their respective lines by depressing the HOLD key. The stations need not remain off-hook to hold the call.

Data Transmission

3.109 Once the second call is held, the 48B1 data unit at each station enters the dial backup mode, as indicated by the DDD1 and DDD2 lamps at each station being lighted. The modem at each station is transferred from the 4-wire private line to the 4-wire dial backup channel composed of dial-up lines 1 and 2 and an in-data indication is passed to the modems. At this point, each station should go on-hook.

3.110 The modems now have a complete 4-wire data transmission path over the dial backup channel. While the modems are connected to the dial backup channel, the 4-wire private line can be tested from a remote location without interfering with data transmission over the dial backup channel. If alternate voice service is provided, the 4-wire private line can also be used for conversation.

Return to Idle State

3.111 Once the 4-wire private line is cleared for data transmission, the modems can be returned to the 4-wire private line. Each station goes off-hook and the REL key is depressed until the line lamps (DDD1 and DDD2) go off. Each station now goes on-hook and is again in the idle state.

48C1 DATA UNIT AND 46C1 OR 46C2 DATA MOUNTING

3.112 The 48C1 data unit and 46C1 or 46C2 data mounting, when used with the 48D1 and 48B1 data units, provide the switching and transmission circuitry required to add 4-wire switched dial backup service to multiple 4-wire private line data or data with alternate voice service. If the 46C2 data mounting is used, the 48ER1 data unit can be used instead of the 48B1 data unit. The unregulated dc input required by the 48C1 and 48B1 or 48ER1 data units and the 46C1 or 46C2 data mounting is obtained from a bridge rectifier power supply in the 48D1 data unit. The 48D1 data unit also contains the interface circuitry required to concentrate control of 48A1, 48B1 or 48ER1, and 48C1 data units in an 18- or 30-button CALL DIRECTOR key telephone set. The 48B1 and 48ER1 data units contain the circuitry required for proper termination of a 4-wire dial backup channel and are described in paragraphs 3.80 through 3.111 and 3.134 through 3.183, respectively. Differences in operation of the 48B1 or 48ER1 data unit when used with multiple modems instead of a single modem are described in paragraph 3.129. The 48A1 data unit contains the circuitry required to provide alternate voice service and is described in paragraphs 3.62 through 3.79.

3.113 For 4-wire switched dial backup service, up to six 48C1 data units are housed in a 46C1 or 46C2 data mounting. One or two 48B1 data units are also housed in the 46C1 or 46C2 data mounting, or one or two 48ER1 data units are also housed in the 46C2 data mounting. Each 48C1 data unit can connect any one of four 4-wire modems to a 4-wire dial backup channel or to either one of two 4-wire dial backup channels. Since each dial backup channel must be terminated by a 48B1 or 48ER1 data unit, the number of available dial backup channels is determined by the number of 48B1 and/or 48ER1 data units housed in the data mounting. When the maximum number of six 48C1 data units are housed in the data mounting, it appears that twenty-four modems and associated 4-wire private lines can be controlled. However, the maximum number that can actually be controlled is twenty-three, since the 30-button CALL DIRECTOR key telephone set has only twenty-three pickup keys available for control. The DAS 829-type CIUs required for proper termination of the 4-wire private lines are housed in up to three 46A1 or 46A2 data mountings. If alternate voice service is provided, the required 48A1 data units are housed in up to three 46B1 data mountings.

3.114 When used for 4-wire switched dial backup service, the 18- or 30-button CALL DIRECTOR key telephone set must be modified and the pushbuttons labeled as described in Section 598-082-200. For example, the pushbuttons for an 18-button CALL DIRECTOR key telephone set providing control for two 4-wire dial backup channels, control of the switching circuitry for eleven modems, and control of eleven data with alternate voice circuits are labeled as follows:

	REL	RING	TALK — DBU6
*	DDD1A	TALK — DBU1	TALK — DBU7
	DDD2A	TALK — DBU2	TALK — DBU8
†	DDD1B	TALK — DBU3	TALK — DBU9
	DDD2B	TALK — DBU4	TALK — DBU10
	HOLD	TALK — DBU5	TALK — DBU11

* Backup Channel A

† Backup Channel B

A. Data Service

3.115 In the data mode (Fig. 9), 4-wire modem No. 1 can transmit and receive data over 4-wire private line No. 1 since the 48C1 data unit

provides a through connection for the transmission leads of the standard 6-lead interface (DT, DR, DT1, DR1, TEK5, TEK6) that connects the modem to the DAS 829-type CIU. The four transmission leads (DT, DR, DT1, DR1) are complete through the normally-closed contacts of the 1A and 1B relays (for modem No. 1) in the 48C1 data unit as long as the 48C1 data unit remains in the data mode. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6, if the 48A1 data unit and the DAS 829-type CIU are also in the data mode. Two additional interface leads, DBU1 and DBU2, supply a dial backup status signal to the modem. The line status and dial backup status signals normally supplied by the 48B1 or 48ER1 data unit are not used with switched dial backup service.

3.116 The data unit connectors at any vacant positions of the 46B1 multiple data mounting provide a through connection for the 6-lead interface. The data unit connectors at any vacant positions of the 46C1 or 46C2 multiple data mounting ***do not*** provide a through connection for the 6-lead interface.

3.117 For switched dial backup service, the following are the transmission leads from the modem and the corresponding 48B1 or 48ER1 terminal numbers (Fig. 56 or 59):

Designation	48B1 or 48ER1 Terminal Number
DT(M)	8
DR(M)	27
DT1(M)	10
DR1(M)	29

B. Switched Dial Backup Service

3.118 In the dial backup mode (Fig. 9), operation of the 1A or 1B relay in the 48C1 data unit transfers 4-wire modem No. 1 from 4-wire private line No. 1 to 4-wire dial backup channel A or B, respectively. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

3.119 A simplified functional diagram of the switched dial backup control circuitry is shown in Fig. 57. This figure shows the switching logic required to control 4-wire dial backup channel A, to connect 4-wire modem 1 to channel A, and to provide alternate voice service over the 4-wire private line for modem 1. The operation of the control circuitry shown in this figure is described in the following paragraphs.

Dial Backup Mode

3.120 To put the 48B1 or 48ER1 data unit for dial backup channel A in the dial backup mode, the H2, H1, and A relays in the 48B1 or 48ER1 data unit must be operated as follows:

(a) The H2 relay is operated by taking the telephone handset off-hook and depressing the DDD2A and HOLD keys. The H2 relay latches under the control of a release circuit in the 48B1 or 48ER1 data unit and the DDD2A lamp on the telephone set lights. The DDD2A 2-wire dial-up line is now in the hold mode.

(b) The H1 relay is operated by taking the telephone handset off-hook and depressing the DDD1A and HOLD keys. The H1 relay latches under the control of a release circuit in the 48B1 or 48ER1 data unit and the DDD1A lamp on the telephone set lights. The DDD1A 2-wire dial-up line is now in the hold mode.

(c) With the DDD2A and DDD1A dial-up lines in the hold mode (H2 and H1 relays operated), the A relay operates, immediately if the 48B1 data unit is used or after a delay of 10 seconds if the 48ER1 data unit is used, and the 48B1 or 48ER1 data unit is now available for use on dial backup channel A. Dial backup channel A can now be connected to any one of the modems.

3.121 To connect modem 1 to the available dial backup channel A, the 1A relay in the 48C1 data unit must be operated by taking the telephone handset off-hook and depressing the TALK-DBU1 key. Operation of the 1A relay transfers modem 1 from the 4-wire private line to 4-wire dial backup channel A and operates the M1 relay in the 48C1 data unit.

3.122 Operation of the M1 relay initiates the following actions:

(a) The TALK-DBU1 lamp on the telephone set lights at one of two levels as follows: (1)

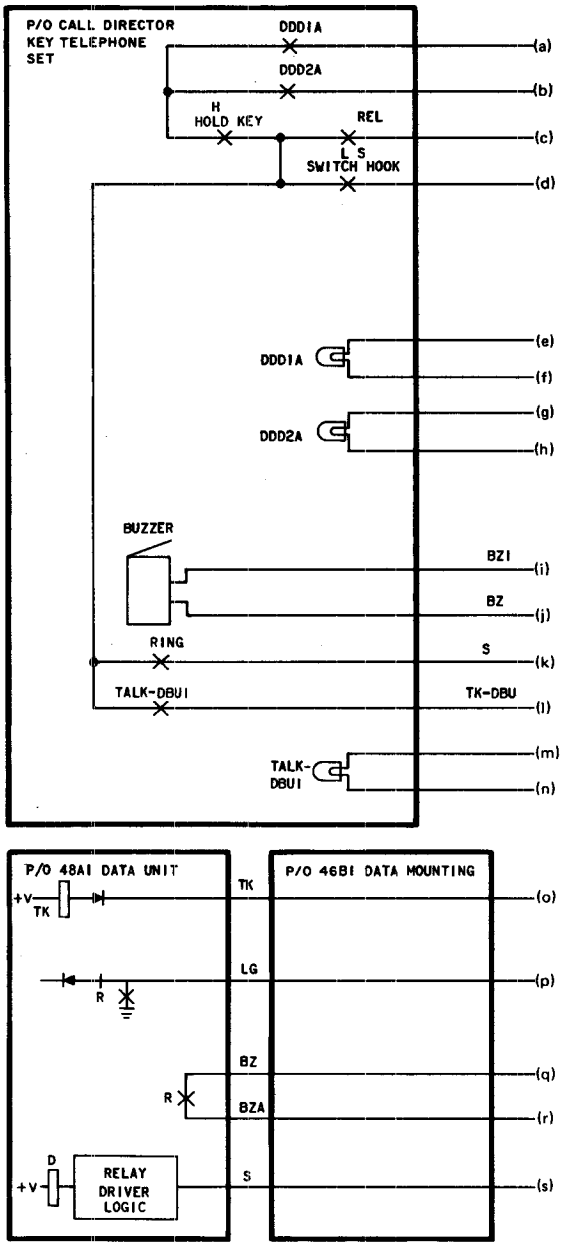


Fig. 57—4-Wire Switched Dial Backup Control Circuitry—Simplified Functional Diagram (Sheet 1 of 3)

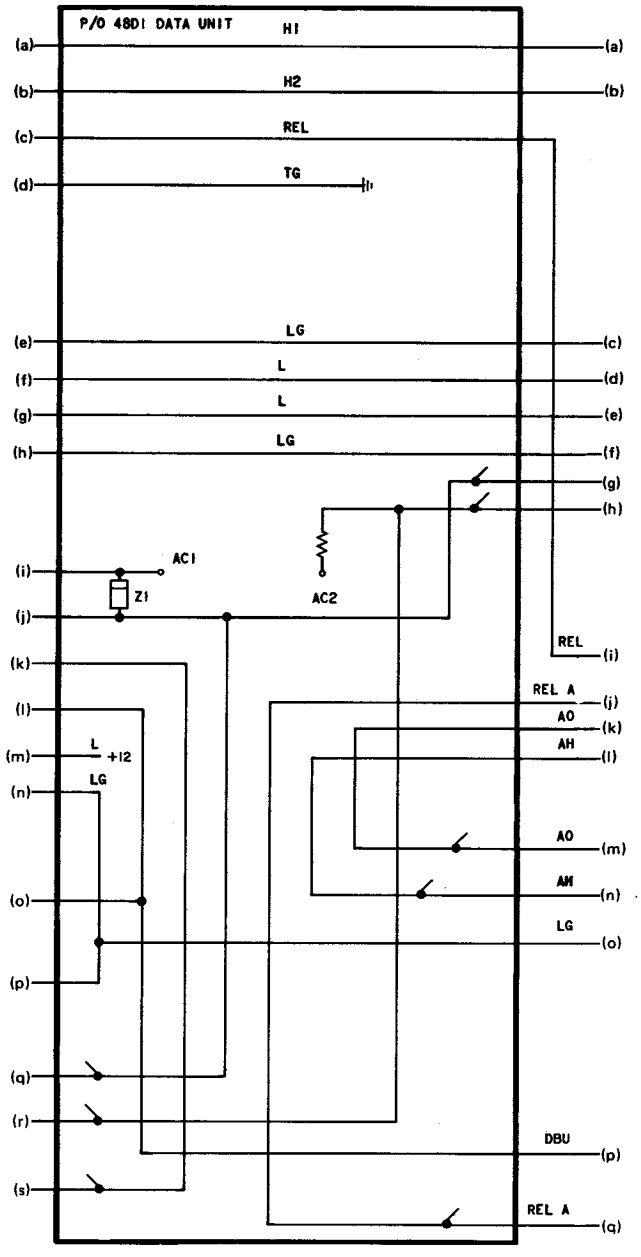


Fig. 57—4-Wire Switched Dial Backup Control Circuitry—Simplified Functional Diagram (Sheet 2 of 3)

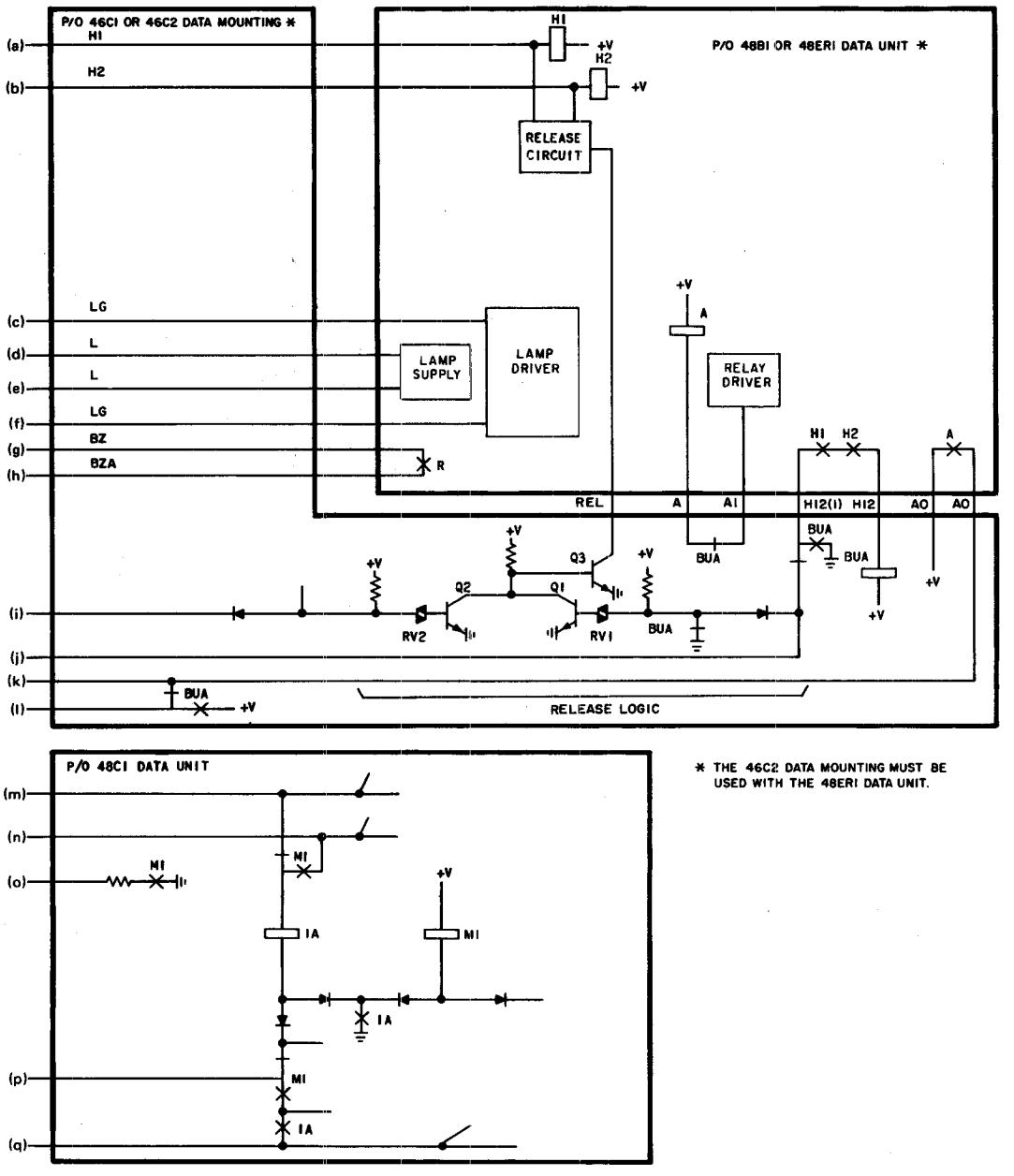


Fig. 57— 4-Wire Switched Dial Backup Control Circuitry—Simplified Functional Diagram (Sheet 3 of 3)

at reduced brightness, if the 48A1 data unit for modem 1 is in the data mode, or (2) at full brightness, if the 48A1 data unit for modem 1 is in the alternate voice mode.

(b) An in-data line status signal is supplied to modem 1 on interface leads TEK5 and TEK6.

(c) A dial backup status signal is supplied to modem 1 on interface leads DBU1 and DBU2.

(d) The BUA (backup A) relay in the 46C1 or 46C2 data mounting operates.

Operation of the BUA relay releases the A relay in the 48B1 or 48ER1 data unit, to prevent connection of any further modems to dial backup channel A.

3.123 To complete the procedure, the TALK-DBU1 key is released by depressing and releasing the HOLD key, and the telephone handset is placed on-hook. The DDD2A, DDD1A, and TALK-DBU1 lamps are lighted.

Release From Dial Backup Mode

3.124 When the DDD2A, DDD1A, and TALK-DBU1 lamps are lighted (H2, H1, 1A, M1, and BUA relays operated), the 48B1 or 48ER1 data unit for dial backup channel A is in the dial backup mode and modem 1 is connected to channel A. Release of modem 1 from channel A is accomplished as follows:

(a) Take the telephone handset off-hook.

(b) Depress the TALK-DBU1 key.

(c) Depress the REL key. The H2 and H1 relays release and the DDD2A and DDD1A lamps go off, immediately if the 48B1 data unit is used or after a delay of 3 seconds if the 48ER1 data unit is used. The DDD2A and DDD1A dial-up lines are released from the hold mode when the H2 and H1 relays release.

(d) The release of the H2 or H1 relay releases the BUA relay thereby releasing the 1A and M1 relays. Modem 1 is released from dial backup channel A when the 1A relay releases.

Note: Taking the telephone handset off-hook and depressing the REL key releases all dial-up lines and backup channels that are not connected to a modem.

(e) The TALK-DBU1 lamp remains lighted indicating the 48A1 data unit is in the alternate voice mode.

(f) Release the TALK-DBU1 key by depressing and releasing the HOLD key.

(g) The TALK-DBU1 lamp goes off indicating modem 1 has been transferred to the 4-wire private line.

(h) Place the telephone handset on-hook.

Note: The 48B1 or 48ER1 data unit cannot be released from the dial backup mode except as described above. Placing the telephone handset on-hook while the 48B1 or 48ER1 data unit is in the dial backup mode will not release the 48B1 or 48ER1 data unit from the dial backup mode.

C. Alternate Voice Call Sequence

3.125 Alternate voice circuits (using 48A1 data units housed in 46B1 data mountings) are concentrated through a 48D1 data unit in an 18- or 30-button CALL DIRECTOR key telephone set. To originate a voice call using the 48A1 data unit, perform the following steps:

(a) Depress the desired TALK or TALK-DBU key and take the telephone handset off-hook. The TALK or TALK-DBU lamp lights.

Note: When the Nth circuit is in either the alternate voice or dial backup mode, the TALK-DBU-N lamp is lighted. However, in the dial backup mode the lamp is not as bright as in the alternate voice mode. Therefore, when the Nth circuit is in the dial backup mode and the handset is off-hook, depressing the TALK-DBU-N key causes the TALK-DBU-N lamp to become brighter.

(b) Depress the RING key until the audible ringback signal (burst of 1300 Hz) is heard in the handset. When the audible ringback signal ceases, the RING key can be depressed again to initiate a new ring cycle.

Note: When the far end is equipped with a DAS 828A-type CIU there is no audible ringback signal. In this case, depress the RING key until the far end responds.

3.126 To answer a voice call, perform the following steps:

(a) Depress the TALK or TALK-DBU key associated with a flashing lamp.

Note: When the Nth circuit is in the dial backup mode, the TALK-DBU-N lamp is lighted. During the interval in the ring cycle that the telephone set buzzer is sounding the TALK-DBU-N lamp flashes brighter.

(b) Take the telephone handset off-hook and talk.

3.127 To end a voice call, perform the following steps:

(a) Depress and release the HOLD key to return the TALK or TALK-DBU key to its normal (released) position.

(b) If a TALK key was released, the TALK lamp goes off indicating the modem is in the data mode (connected to the 4-wire private line). If a TALK-DBU key was released, one of two lamp indications occurs as follows:

(1) The TALK-DBU lamp goes off indicating the modem is in the data mode (connected to the 4-wire private line), or

(2) The TALK-DBU lamp remains lighted but not as brightly indicating the modem is in the dial backup mode (connected to a dial backup channel).

(c) Place the telephone handset on-hook.

D. Switched Dial Backup Call Sequence

3.128 With switched dial backup for multiple modems, a dial backup channel is established; then, a modem is manually selected and connected to the dial backup channel. To release a modem from a dial backup channel, the modem to be released is manually selected; then, when the telephone handset is off-hook and the REL key is depressed, the modem is automatically released.

The 46C1 or 46C2 data mounting provides for up to two 4-wire dial backup channels, designated A and B. The two 2-wire dial-up lines required for dial backup channel A are controlled by the DDD1A and the DDD2A keys. The two 2-wire dial-up lines required for dial backup channel B are controlled by the DDD1B and DDD2B keys.

Note: Only the indicated channels can be used for dial backup. For example, a dial backup channel ***cannot*** be established using the DDD1A and DDD2B keys.

3.129 The switched dial backup call sequence for multiple modems varies in only two respects from the dial backup call sequence for a single modem using a DAS 828C-type CIU, a 48B1 data unit housed in a 45A1 or 59A1 data mounting, or a 48E1 data unit housed in a 59A1 data mounting.

(a) With dial backup for a single modem, the dial backup channel is established; then, the modem is automatically connected to the dial backup channel.

(b) When the telephone handset is off-hook and the REL key is depressed, the modem is automatically released from the dial backup channel.

The dial backup call sequence for a single modem using a 48B1 data unit is described in paragraphs 3.102 through 3.111. The dial backup call sequence for a single modem using a 48ER1 data unit is described in paragraphs 3.169 through 3.176.

3.130 A typical switched dial backup call sequence for two stations, A and B, is described in the following paragraphs. This description assumes that the following conditions exist:

(a) Station A uses a 30-button CALL DIRECTOR key telephone set to control up to twenty-three modems.

(b) Dial backup channel A is to provide switched dial backup for modem 19.

(c) Station B consists of a single modem using a DAS 828C-type CIU, a 48B1 data unit installed in a 45A1 or 59A1 data mounting, or a 48ER1 data unit installed in a 59A1 data mounting.

Originating Call

3.131 The sequence begins with Station A deciding for some reason, such as the inability of modem 19 to send data over the 4-wire private line, that a backup connection should be made. To establish 4-wire dial backup channel A and connect modem 19 to channel A, perform the following steps:

(a) Complete a call between DDD2A at Station A and DDD1 at Station B.

(b) When the call is satisfactorily completed, place DDD2A and DDD1 on hold. The DDD2A and DDD1 lamps are lighted, providing a visual indication of the hold mode.

(c) Complete a call between DDD1A at Station A and DDD2 at Station B.

(d) When the call is satisfactorily completed, place DDD1A and DDD2 on hold. The DDD1A and DDD2 lamps are lighted, providing a visual indication of the hold mode

(e) Station B is now in the dial backup mode, as indicated by the DDD1 and DDD2 lamps being lighted.

(f) Station A has now established dial backup channel A, as indicated by the DDD1A and DDD2A lamps being lighted. A modem can now be selected and connected to channel A.

(g) At Station A, take the telephone handset off-hook and depress the DBU19 or TALK-DBU19 key. When Station A uses a 48B1 data unit, the DBU19 or TALK-DBU19 lamp lights immediately. When Station A uses a 48ER1 data unit, the DBU19 lamp lights after a delay of 10 seconds. The TALK-DBU19 lamp lights immediately but goes off if the TALK-DBU19 key is released before the 10 seconds have elapsed. If this occurs, again depress the TALK-DBU19 key until the TALK-DBU19 lamp remains lighted.

Note: If the 19th circuit is in the alternate voice mode, the TALK-DBU19 lamp will already be lighted.

(h) Depress and release the HOLD key to return the DBU19 or TALK-DBU19 key to its normal (released) position. The DBU19 or TALK-DBU19 lamp remains lighted.

(i) Place the telephone handset on-hook. The DDD1A, DDD2A, and DBU19 or TALK-DBU19 lamps remain lighted, indicating modem 19 is connected to dial backup channel A.

3.132 The above sequence established 4-wire dial backup channel A and connected modem 19 to channel A. The sequence can now be repeated to establish 4-wire dial backup channel B and connect another modem, such as modem 8, to channel B. With both modems 8 and 19 connected to a dial backup channel, the DDD1A, DDD2A, DDD1B, DDD2B, DBU8 or TALK-DBU8, and DBU19 or TALK-DBU19 lamps are lighted. The actual indication of a modem being in the dial backup mode is given by the DBU-N or TALK-DBU-N lamp being lighted with the DBU-N or TALK-DBU-N key in the normal (released) position.

Releasing Call

3.133 Once the 4-wire private line is cleared for data transmission, the modem can be returned to the 4-wire private line. To return modem 19 of the above example to the 4-wire private line, perform the following steps:

(a) Take the telephone handset off-hook.

(b) Depress the DBU19 or TALK-DBU19 key.

(c) Depress the REL key. The DDD1A and DDD2A lamps go off, immediately when Station A uses a 48B1 data unit or after a delay of 3 seconds when Station A uses a 48ER1 data unit, indicating dial backup channel A has released.

(d) Depress and release the HOLD key to return the DBU19 or TALK-DBU19 key to its normal (released) position. The DBU19 or TALK-DBU19 lamp goes off, indicating modem 19 has been returned to the 4-wire private line.

(e) Place the telephone handset on-hook. In this example, the DDD1B, DDD2B, and DBU8 or TALK-DBU8 lamps remain lighted, indicating dial backup channel B is still established and modem 8 is still connected to channel B.

48ER1 DATA UNIT

3.134 The 48ER1 data unit provides the switching, ring detection, and transmission circuitry required to add 4-wire dial backup service with manual or automatic dialing to 4-wire private line data service. If manual dialing is used, alternate voice service can also be added. A dc power supply in the data unit obtains its unregulated input from a bridge rectifier power supply associated with the data mounting (46C2 or 59A1) that houses the data unit. All connections to the data unit are made through the data mounting.

A. Options

3.135 The 48ER1 data unit is provided with several options that may be requested by the customer. The desired options must be specified when the data unit is ordered. Refer to Table B for a summary of the options.

3.136 ***Call Control:*** The calls required to enable the 48ER1 data unit to establish a 4-wire dial backup channel are initiated by either manual or automatic dialing.

(a) With manual dialing (option M), a key telephone set is used.

(b) With automatic dialing (option A), the following items are used: a station dial and a customer- or modem-provided contact; a station dial and the O/R (originate/release) switch on the faceplate of the 48ER1 data unit; or an automatic calling unit (ACU) and a customer- or modem-provided contact.

3.137 ***Unit Control:*** Operating control of the 48ER1 data unit is provided by a key telephone set, a customer- or modem-provided contact, or the O/R (originate/release) switch on the faceplate of the 48ER1 data unit.

(a) With a key telephone set (option T), the 48ER1 data unit will establish a 4-wire dial backup channel and connect the modem to the dial backup channel when directed by control signals from the key telephone set. To release the dial backup channel and return the modem to the 4-wire private line, the required control signals are again provided by the key telephone set. The key telephone set can be used to control single or multiple installations.

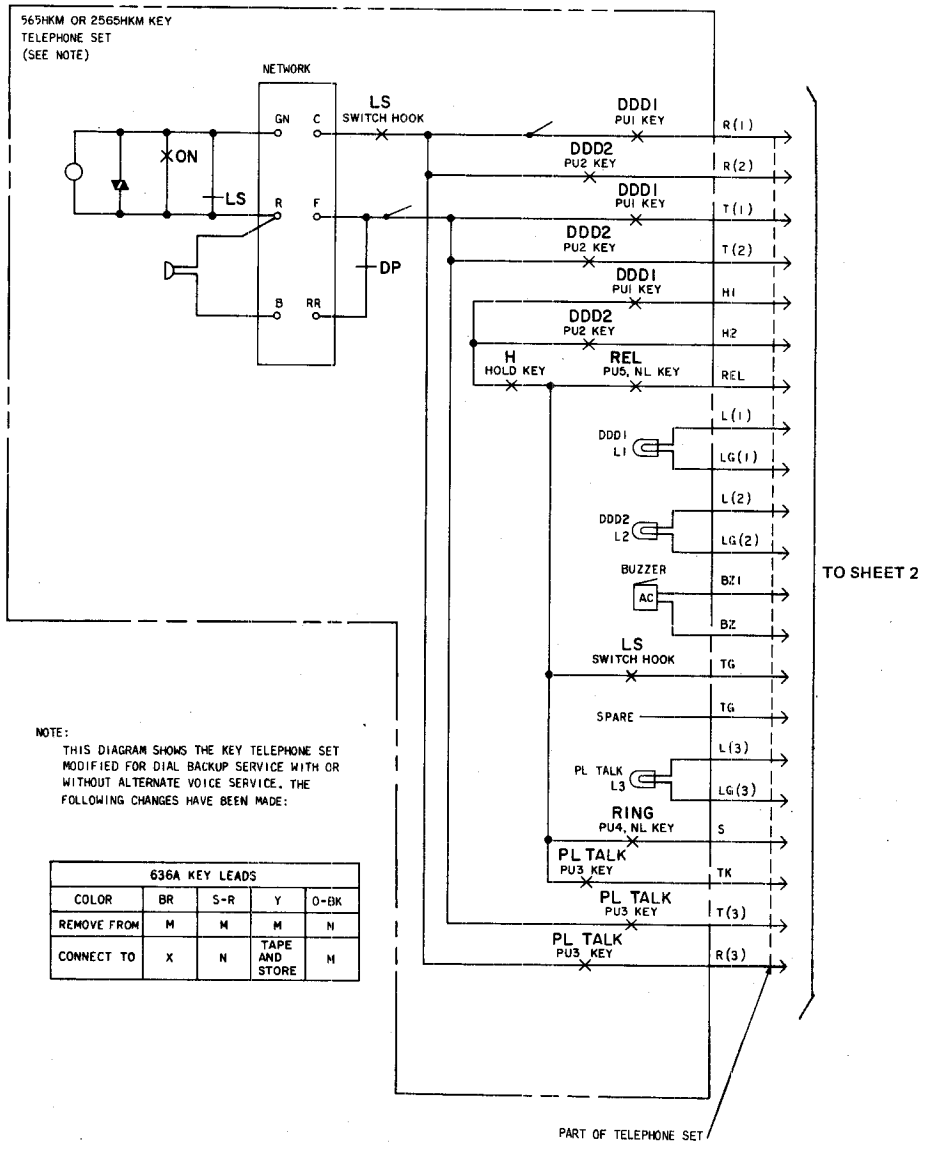
(b) With a customer- or modem-provided contact (option D), the 48ER1 data unit and an associated station dial or ACU will attempt to establish a 4-wire dial backup channel when the customer or modem provides and maintains a

TABLE B

48ER1 DATA UNIT OPTIONS

FEATURE	OPTION	PLUG-IN STRAP(S)		PROVIDE
		QUANTITY	POSITION	
Call Control	Manual Dialing (M)	9	M1-M9	One Per Unit
	Automatic Dialing (A)	9	A1-A9	
Unit Control	Key Telephone Set (T)	1	T	One Per Unit
	Customer- or Modem-Provided Contact (D)	1	D	
	O/R (Originate/Release) Switch (S)	1	S	
Power Supply	24 Vac (N)	1	N	One Per Unit
	-48 Vdc (-48)*	1	-48	

* Use not permitted.



NOTE:
THIS DIAGRAM SHOWS THE KEY TELEPHONE SET MODIFIED FOR DIAL BACKUP SERVICE WITH OR WITHOUT ALTERNATE VOICE SERVICE. THE FOLLOWING CHANGES HAVE BEEN MADE:

636A KEY LEADS				
COLOR	BR	S-R	Y	O-BK
REMOVE FROM	M	M	M	N
CONNECT TO	X	N	TAPE AND STORE	M

Fig. 58—59A1 Data Mounting—Interface Diagram (Sheet 1 of 5)

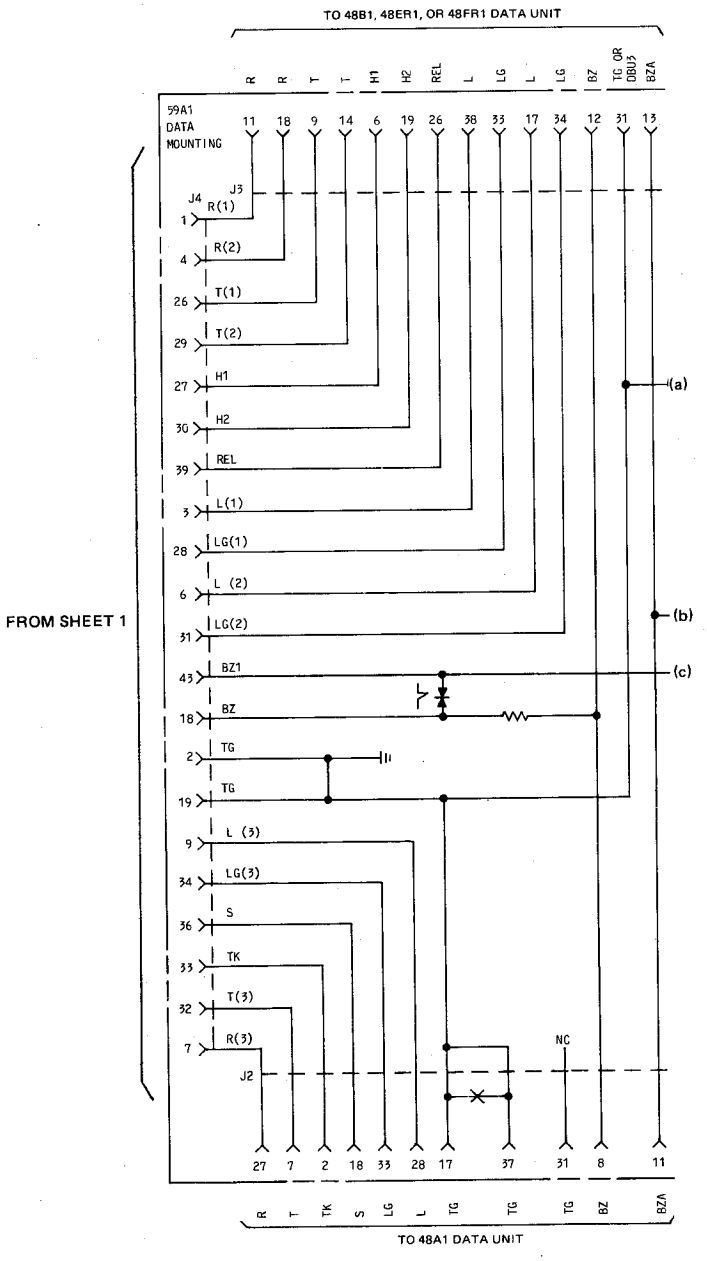


Fig. 58—59A1 Data Mounting—Interface Diagram (Sheet 2 of 5)

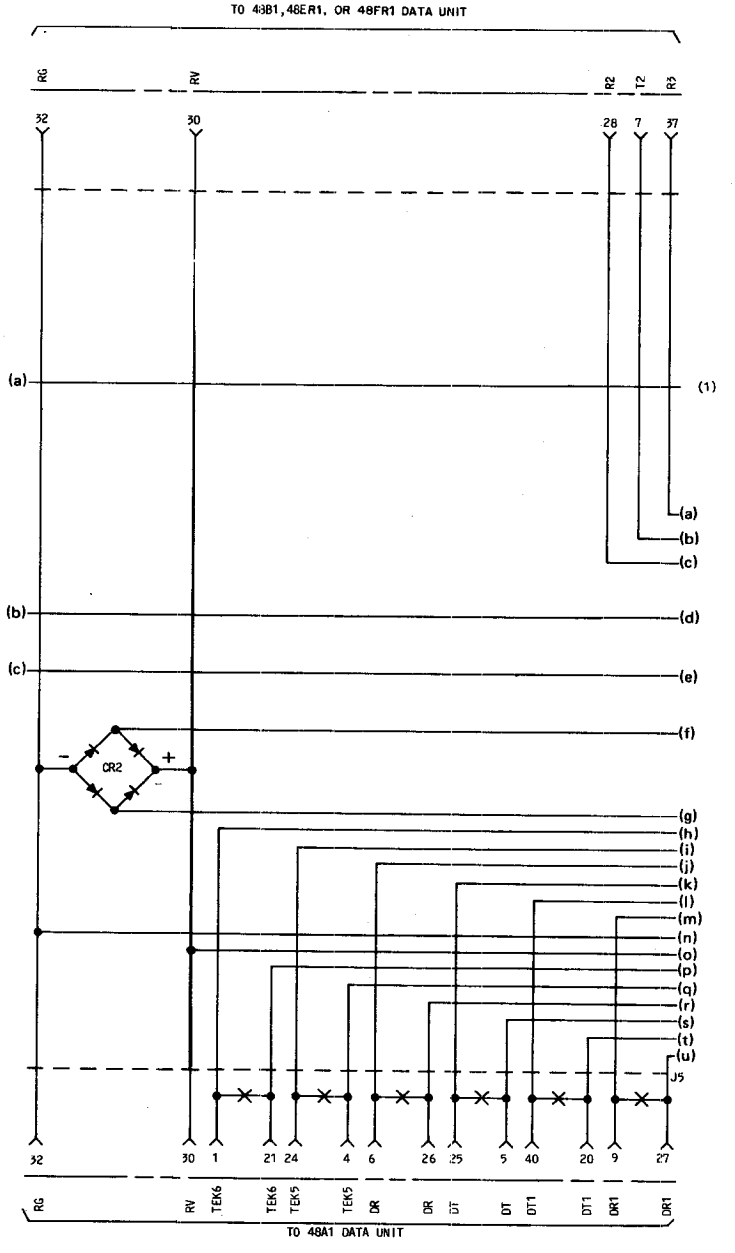


Fig. 58—59A1 Data Mounting—Interface Diagram (Sheet 3 of 5)

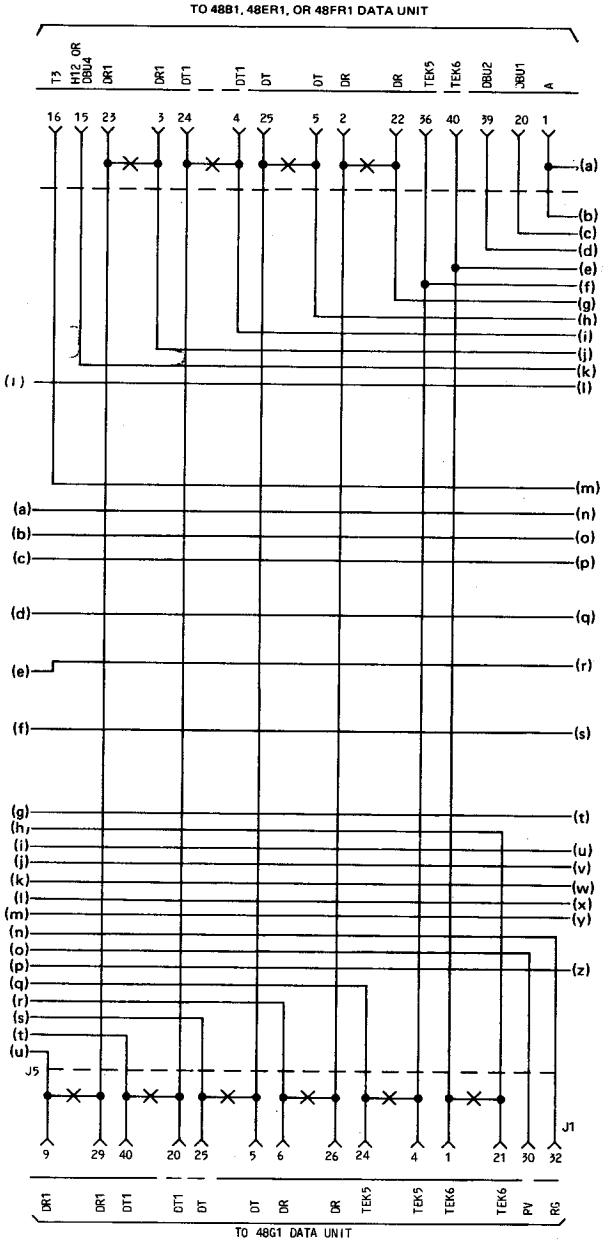


Fig. 58—59A1 Data Mounting—Interface Diagram (Sheet 4 of 5)

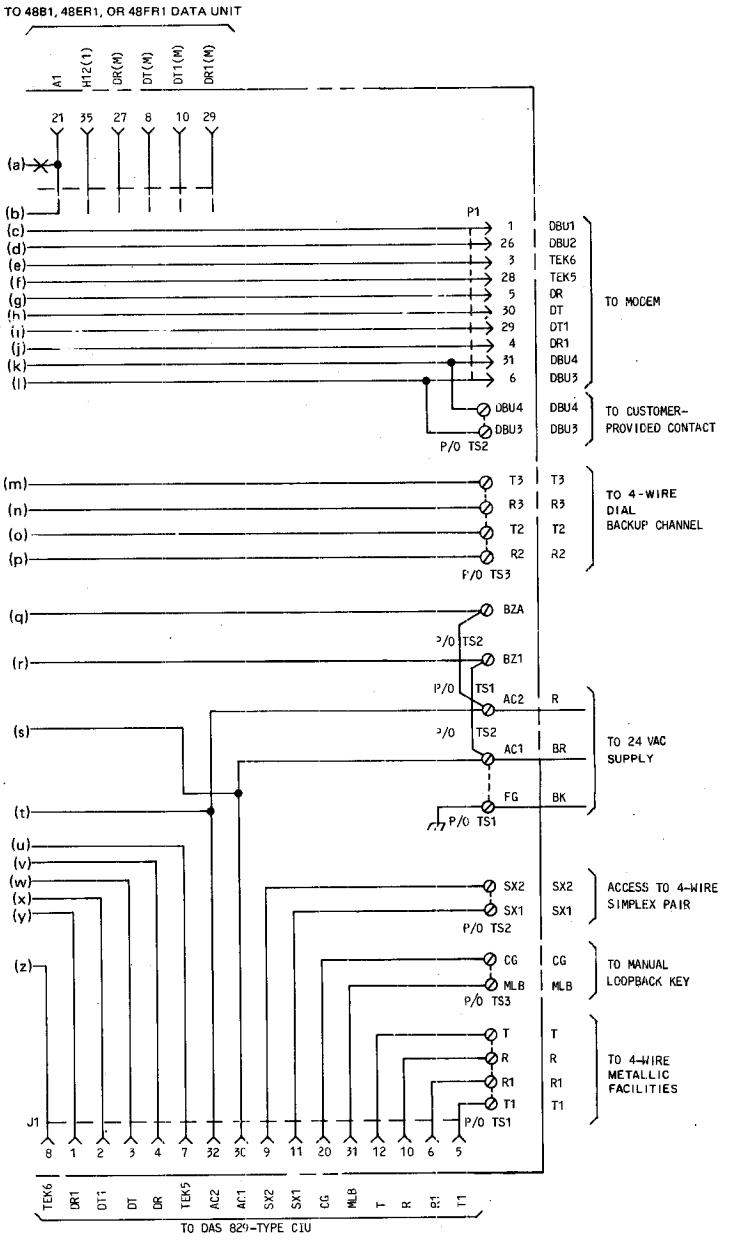


Fig. 58—59A1 Data Mounting—Interface Diagram (Sheet 5 of 5)

contact closure. When the dial backup channel is established, the 48ER1 data unit will connect the modem to the dial backup channel. If the dial backup channel is not established within 3 minutes, the customer or modem must generate a retry request by interrupting the contact closure for a minimum of 25 ms. To release the dial backup channel and return the modem to the 4-wire private line, the customer or modem removes the contact closure. At present, the customer- or modem-provided, contact cannot be used to control multiple installations.

(c) With the O/R switch (option S), the 48ER1 data unit and an associated station dial will attempt to establish a 4-wire dial backup channel when the O/R switch is operated. When the dial backup channel is established, the 48ER1 data unit will connect the modem to the dial backup channel. If the dial backup channel is not established within 3 minutes, a retry request must be generated by releasing and then operating the O/R switch. To release the dial backup channel and return the modem to the 4-wire private line, the O/R switch is released. At present, the O/R switch cannot be used to control multiple installations.

3.138 ***Power Supply:*** Operating power for the 48ER1 data unit can be provided by either a 24 Vac (option N) or a -48 Vdc (option -48) supply.

Note: Use of a -48 Vdc supply is not permitted.

B. Arrangements

3.139 The 48ER1 data unit can be used to provide 4-wire dial backup service in the following equipment arrangements: single installation (manual dialing), single installation (automatic dialing), and multiple installation (manual dialing).

Single Installation (Manual Dialing)

3.140 For 4-wire dial backup service with manual dialing on a single 4-wire private line, the 48ER1 data unit is equipped with options M, N, and T and housed in a 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU and a 48A1 data unit (if alternate voice service is provided). A 6-button key telephone set (565HKM or 2565HKM) provides control of the 48ER1 data unit.

(a) When used for dial backup service only, the key telephone set must be modified as shown in Fig. 58, the fifth pickup key (REL) converted to nonlocking operation, and the six pushbuttons labeled as follows:

HOLD	DDD1	DDD2	—	—	REL

(b) When used for dial backup and alternate voice service, the key telephone set must be modified as shown in Fig. 58, the fourth pickup key (RING) and the fifth pickup key (REL) converted to nonlocking operation, and the six pushbuttons labeled as follows:

HOLD	DDD1	DDD2	PL TALK	RING	REL

3.141 For a detailed description of the single installation (manual dialing) arrangement, refer to paragraphs 3.147 through 3.162 and 3.169 through 3.176.

Single Installation (Automatic Dialing)

3.142 For 4-wire dial backup service with automatic dialing on a single 4-wire private line, the 48ER1 data unit is equipped with options A, N, and D or S and housed in a 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU. A 43A or 53A station dial or an 801CR-L1/2 ACU is required for automatic dialing. When a 43A or 53A station dial is used, a customer- or modem-provided contact (option D) or the O/R switch (option S) provides control of the 48ER1 data unit. When an 801CR-L1/2 ACU is used, a customer- or modem-provided contact (option D) provides control of the 48ER1 data unit.

3.143 When a 43A or 53A station dial is used, the station dial must be optioned for the restricted mode of operation. For those installations that have precise dial tone available, a 1A350 tone detector can be used with either the 43A or 53A station dial. The minimum time required to establish a dial backup channel is obtained when a 53A station dial equipped with a 1A350 tone detector is used. If the 1A350 tone detector is not used, an internal timer starts the station dial.

3.144 For a detailed description of the single installation (automatic dialing) arrangement, refer to paragraphs 3.147 through 3.155, 3.163 through 3.168, and 3.177 through 3.183.

Multiple Installation (Manual Dialing)

3.145 For 4-wire dial backup service with manual dialing on multiple 4-wire private lines, the 48ER1 data unit is equipped with options M, N, and T and housed in a 46C2 data mounting and switched dial backup is used. An 18- or 30-button CALL DIRECTOR key telephone set provides control of the 48ER1 data unit.

3.146 For a detailed description of the multiple installation (manual dialing) arrangement, refer to paragraphs 3.112 through 3.133.

C. Data Service

3.147 In the data mode (Fig. 3), the 4-wire modem can transmit and receive data over the 4-wire private line since the 48ER1 data unit provides a through connection for the transmission leads of the standard 6-lead interface (DT, DR, DT1, DR1, TEK5, TEK6) that connects the modem to the DAS 829-type CIU. The four transmission leads (DT, DR, DT1, DR1) are complete through the normally-closed contacts of the A relay in the 48ER1 data unit as long as the 48ER1 data unit remains in the data mode. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6, if the 48A1 data unit and the DAS 829-type CIU are also in the data mode. Two additional interface leads, DBU1 and DBU2, supply a dial backup status signal to the modem.

3.148 When data units are not installed in all positions of the 59A1 data mounting, the data unit connectors at the vacant positions of the data mounting provide a through connection for the 6-lead interface.

3.149 The following are the transmission leads from the DAS 829-type CIU (or a 48A1 data unit, if alternate voice service is provided) and the corresponding 48ER1 terminal numbers (Fig. 59):

Designation	48ER1 Terminal Number
DT	25
DR	2
DT1	24
DR1	23

3.150 For 4-wire dial backup service on a single 4-wire private line, the following are the transmission leads from the modem and the corresponding 48ER1 terminal numbers (Fig. 59):

Designation	48ER1 Terminal Number
DT	5
DR	22
DT1	4
DR1	3

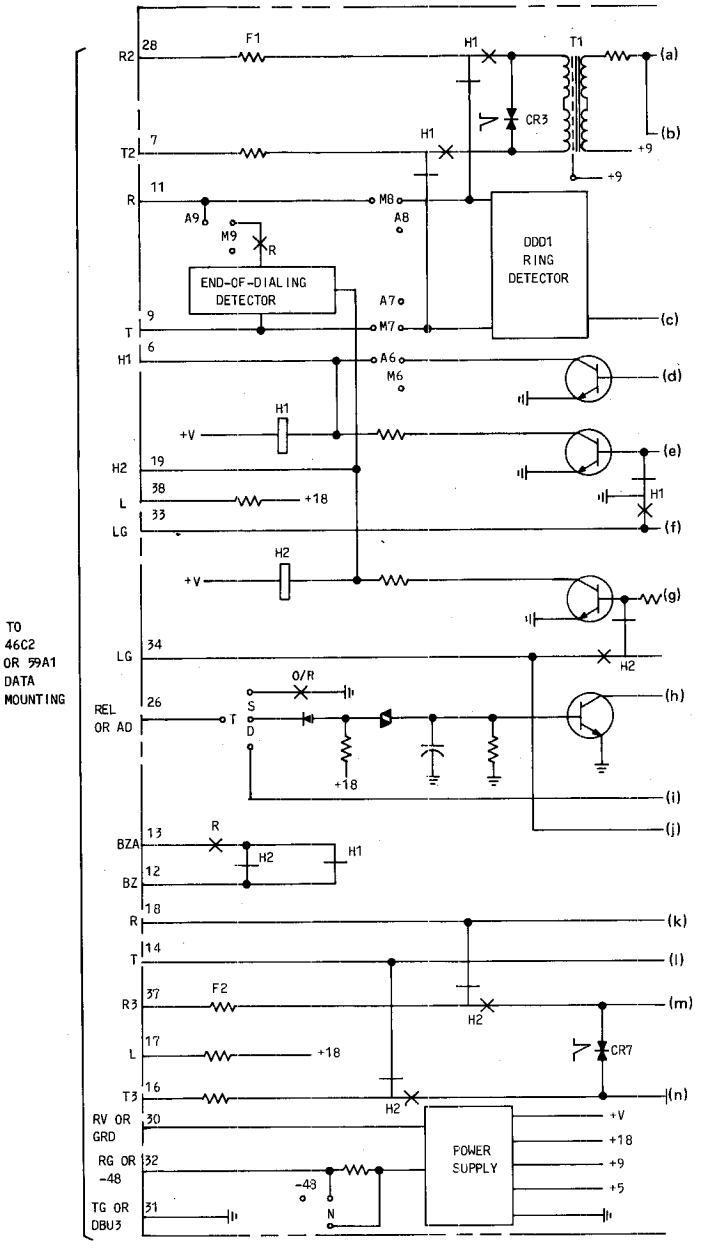


Fig. 59—48ER1 Data Unit—Functional Diagram (Sheet 1 of 3)

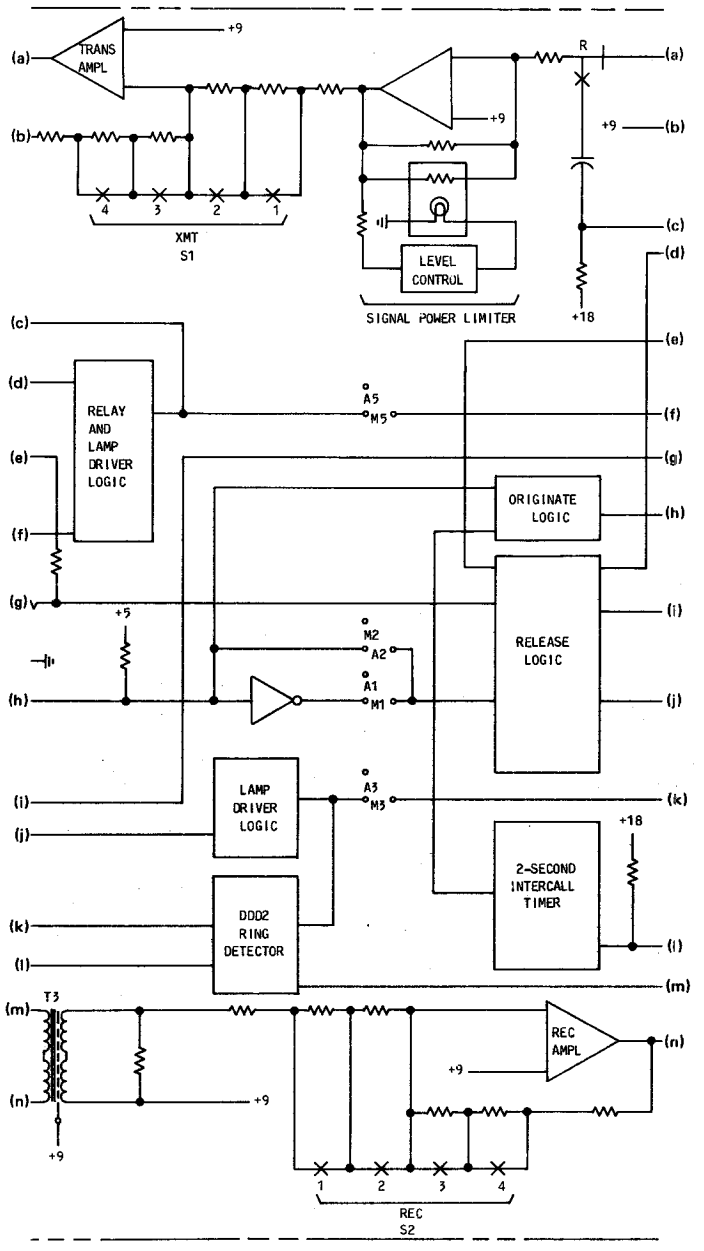


Fig. 59—48ER1 Data Unit—Functional Diagram (Sheet 2 of 3)

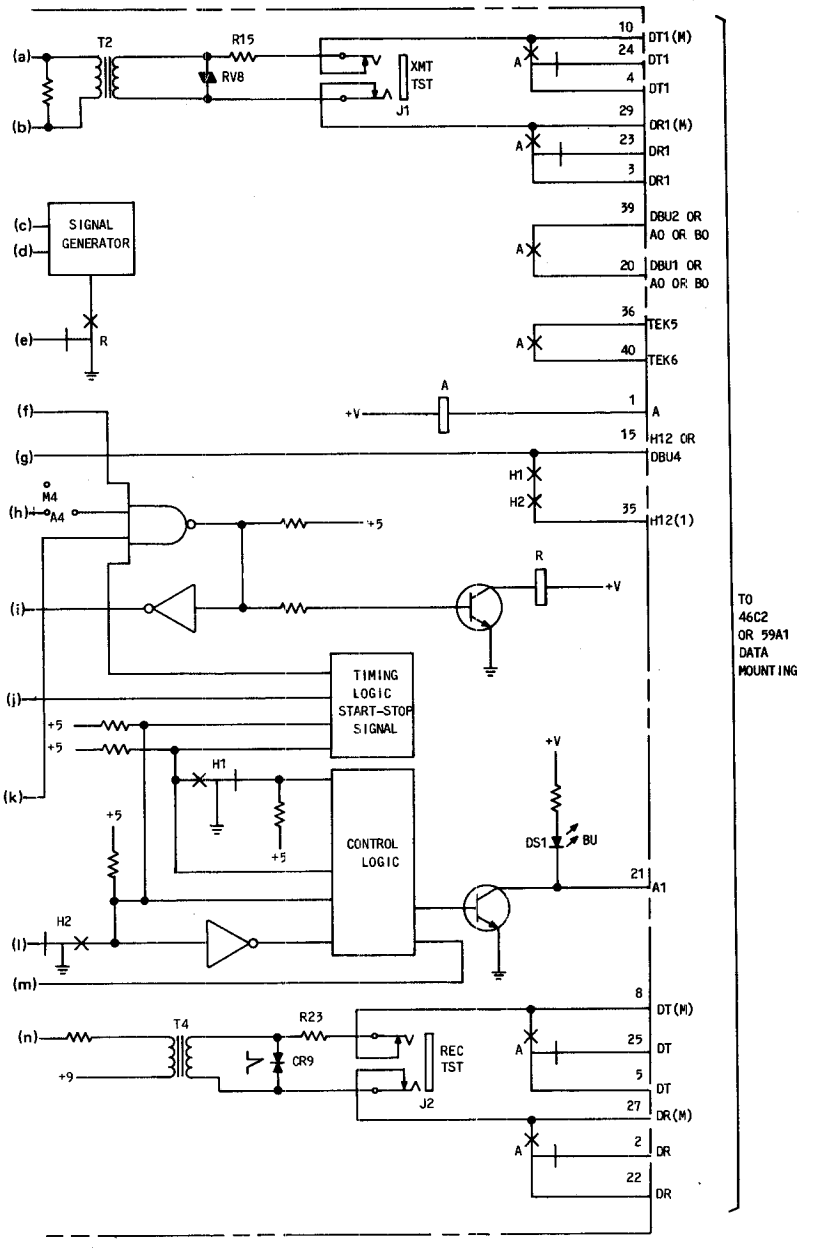


Fig. 59—48ER1 Data Unit—Functional Diagram (Sheet 3 of 3)

D. Dial Backup Service

3.151 In the dial backup mode (Fig. 3), operation of the A relay in the 48ER1 data unit transfers the 4-wire modem from the 4-wire private line to the 4-wire dial backup channel. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

Transmit Circuit

3.152 In the dial backup mode (A relay operated, Fig. 59), the modem transmit pair (DT1, DR1) is connected through the normally-open contacts of relay A, the normally-closed contacts of test jack J1 (XMT), isolation transformer T2, the normally-closed contact of relay R, the signal power limiter circuit, the transmit amplifier, line-holding transformer T1, and the normally-open contacts of relay H1 to the 2-wire dial-up line terminating on T2 and R2.

3.153 The 48ER1 data unit provides a 600-ohm termination for the dial-up line and a 600-ohm termination for the modem. Resistors R15 and F1 function as fuses for the modem transmit pair (DT1, DR1) and the dial-up transmit pair (T2, R2), respectively. If excessive power is dissipated in resistor R15 or F1, the resistor opens to disconnect the hazardous voltage. Diode CR3 and varistor RV8 limit voltage surges in the circuit. Switch S1 (XMT) provides adjustment of the signal gain. The signal power limiter circuit assures that the signal level does not exceed -4 dBm when averaged over any 3-second period.

Note: The setting of XMT switch S1 is fixed in registered arrangements.

Receive Circuit

3.154 In the dial backup mode (A relay operated, Fig. 59), the modem receive pair (DT, DR) is connected through the normally-open contacts of relay A, the normally-closed contacts of test jack J2 (REC), isolation transformer T4, the receive amplifier, line-holding transformer T3, and the normally-open contacts of relay H2 to the 2-wire dial-up line terminating on T3 and R3.

3.155 The 48ER1 data unit provides a 600-ohm termination for the dial-up line and a 600-ohm termination for the modem. Resistors R23 and F2 function as fuses for the modem receive pair (DT, DR) and the dial-up receive pair (T3, R3), respectively. If excessive power is dissipated in resistor R23 or F2, the resistor opens to disconnect the hazardous voltage. Diodes CR7 and CR9 limit voltage surges in the circuit. Switch S2 (REC) provides adjustment of the signal gain.

Note: The setting of REC switch S2 is fixed in registered arrangements.

Dial Backup Mode (Manual Dialing)

3.156 The description in the following paragraps assumes that the 48ER1 data unit (with options M, N, and T installed, Fig. 59) is installed in the 59A1 data mounting (Fig. 58), the required DAS 829-type CIU is installed in the data mounting, the required key telephone set is provided, and all necessary connections are made.

3.157 To put the 48ER1 data unit in the dial backup mode, the H2 and H1 relays are operated, a start signal is transmitted, and the A relay is operated.

(a) The H2 relay is operated by taking the telephone handset off-hook and depressing the DDD2 and HOLD keys. The H2 relay latches under control of the release logic in the data unit and the DDD2 lamp on the telephone set lights. The 2-wire dial-up line (DDD2) terminating on T3 and R3 is transferred from the telephone set to the receive circuit of the data unit and is now in the hold mode.

(b) The H1 relay is operated by taking the telephone handset off-hook and depressing the DDD1 and HOLD keys. The H1 relay latches under control of the release logic in the data unit and the DDD1 lamp on the telephone set lights. The 2-wire dial-up line (DDD1) terminating on T2 and R2 is transferred from the telephone set to the transmit circuit of the data unit and is now in the hold mode.

(c) With the DDD2 and DDD1 dial-up lines in the hold mode (H2 and H1 relays operated), the timing logic in the data unit operates the R relay for 10 seconds causing the signal generator in the data unit to transmit a 941-Hz start signal

during the 10-second period. If a 48FR1 data unit is used at the far end of the dial backup channel, the detection and removal of the start signal places the 48FR1 data unit in the dial backup mode.

(d) At the end of the start signal, the control logic in the data unit operates the A relay. The modem is transferred from the 4-wire private line to the transmit and receive circuits of the data unit. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

(e) The data unit is now in the dial backup mode (A relay operated) and data transmission can take place over the 4-wire dial backup channel. A light-emitting diode, DS1 (BU), on the faceplate of the data unit is lighted to provide visual indication of the dial backup mode.

Release From Hold Mode (Manual Dialing)

3.158 When either the DDD2 or DDD1 lamp is lighted (H2 or H1 relay operated), the associated 2-wire dial-up line (DDD2 or DDD1) is in the hold mode. Release of a dial-up line from the hold mode is accomplished as follows:

(a) Take the telephone handset off-hook.

(b) Depress the REL key.

(c) The DDD2 or DDD1 lamp goes off (H2 or H1 relay released) indicating that the DDD2 or DDD1 dial-up line is released from the hold mode and returned to telephone set control.

(d) Place the telephone handset on-hook.

Note: The dial-up lines cannot be released from the hold mode except as described above.

Release From Dial Backup Mode (Manual Dialing)

3.159 When both the DDD2 and DDD1 lamps are lighted (H2 and H1 relays operated) and transmission of the start signal has been completed, the BU lamp is lighted and the 48ER1 data unit is in the dial backup mode (A relay operated). Release of the data unit from the dial backup mode is accomplished as follows:

(a) Take the telephone handset off-hook.

(b) Depress the REL key.

(c) The timing logic in the data unit operates the R relay for 3 seconds causing the signal generator in the data unit to transmit a 941-Hz and 1633-Hz stop signal during the 3-second period. If a 48FR1 data unit is used at the far end of the dial backup channel, the stop signal releases the 48FR1 data unit from the dial backup mode.

(d) At the end of the stop signal, the DDD2 and DDD1 lamps go off (H2 and H1 relays released) indicating that the DDD2 and DDD1 dial-up lines are released from the hold mode and returned to telephone set control. The BU lamp also goes off (A relay released) indicating that the 48ER1 data unit is released from the dial backup mode.

(e) Place the telephone handset on-hook.

Note: The data unit cannot be released from the dial backup mode except as described above.

3.160 The line holding arrangement described above provides the following features that were not available with the DAS 828C-type CIU.

(a) The telephone handset can be placed on-hook without ending the dial backup mode.

(b) Multiple installations requiring more than one dial backup channel can be provided.

Ring Detection (Manual Dialing)

3.161 A ring detector circuit and a 2-wire telephone set line are connected to each 2-wire dial-up line (DDD1 and DDD2). A ringing signal on either idle dial-up line (DDD1 or DDD2) causes the associated lamp (DDD1 or DDD2) to flash and the R relay to operate. Operation of the R relay causes the telephone set buzzer to sound.

3.162 The ring detector circuits and telephone set lines are only connected to the dial-up lines when the data unit is not in the hold or dial backup

modes. If the data unit is in the dial backup mode, both ring detector circuits and associated telephone set lines are disconnected. If either dial-up line is in the hold mode, the associated ring detector circuit and telephone set line are disconnected.

Dial Backup Mode (Automatic Dialing)

3.163 The description in the following paragraphs assumes that the 48ER1 data unit (with options A, N, and S or D installed, Fig. 59) is installed in the 59A1 data mounting (Fig. 58), the required DAS 829-type CIU is installed in the data mounting, the required station dial or ACU is provided (instead of the key telephone set shown in Fig. 58), and all necessary connections are made.

3.164 To put the 48ER1 data unit in the dial backup mode, the H2 and H1 relays are operated, a start signal is transmitted, and the A relay is operated.

(a) When a station dial is used with the 48ER1 data unit, the H2 relay (Fig. 59) is operated as follows: The O/R (originate/release) switch on the faceplate of the data unit is operated (if option S is installed) or a customer- or modem-provided contact is operated (if option D is installed) causing the originate logic in the data unit to operate the R relay. With the R relay operated, loop current is detected by the station dial causing the station dial to place a call, on the 2-wire dial-up line terminating on T3 and R3 (DDD2) of the 48ER1 data unit, to the number of the DDD1 dial-up line for the 48FR1 data unit at the far end of the dial backup channel. When dialing is completed, loop current is detected by the end-of-dialing detector in the 48ER1 data unit causing the H2 relay to operate and then latch under control of the release logic in the data unit. The DDD2 dial-up line of the 48ER1 data unit is transferred from the station dial to the receive circuit of the data unit and is now in the hold mode.

(b) When an ACU is used with the 48ER1 data unit, the H2 relay (Fig. 59) is operated as follows: A customer- or modem-provided contact is operated (option D) installed) and then the customer requests the ACU to place a call, on the 2-wire dial-up line terminating on T3 and R3 (DDD2) of the 48ER1 data unit, to the number of the DDD1 dial-up line for the 48FR1 data unit at the far end of the dial backup channel. When the customer has presented all the digits of the number to be dialed to the ACU, the customer presents an end-of-number (EOM) signal to the ACU. The ACU then signals the 48ER1 data unit to operate the H2 relay. The H2 relay remains operated under control of the release logic in the data unit. The DDD2 dial-up line of the 48ER1 data unit is transferred from the ACU to the receive circuit of the data unit and is now in the hold mode.

Note: The EOM signal must be presented to the ACU before the 48ER1 data unit can proceed to establish the dial backup channel.

(c) The H1 relay (Fig. 59) is operated as follows: When the 48FR1 data unit at the far end of the dial backup channel detects a ringing signal on the DDD1 dial-up line, the associated station dial places a call on the DDD2 dial-up line to the number of the 2-wire dial-up line terminating on T2 and R2 (DDD1) of the 48ER1 data unit. When the DDD1 ring detector in the 48ER1 data unit detects a ringing signal on the DDD1 dial-up line, the DDD1 ring detector causes the H1 relay to operate and then latch under control of the release logic in the data unit. The DDD1 dial-up line is transferred from the DDD1 ring detector to the transmit circuit of the data unit and is now in the hold mode.

(d) With the DDD2 and DDD1 dial-up lines in the hold mode (H2 and H1 relays operated), the timing logic in the data unit operates the R relay for 10 seconds causing the signal generator in the data unit to transmit a 941-Hz start signal during the 10-second period. At the end of the start signal, the control logic in the data unit operates the A relay. The modem is transferred from the 4-wire private line to the transmit and receive circuits of the data unit. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

(e) The data unit is now in the dial backup mode (A relay operated) and data transmission can take place over the 4-wire dial backup channel. A light-emitting diode, DS1 (BU), on the faceplate of the data unit is lighted to provide visual indication of the dial backup mode.

Release From Hold Mode (Automatic Dialing)

3.165 When the H2 relay is operated or both the H2 and H1 relays are operated but transmission of the start signal has not been completed, the associated 2-wire dial-up line (DDD2 or DDD1) is in the hold mode. Release of a dial-up line from the hold mode is accomplished as follows:

(a) Release the O/R switch on the faceplate of the data unit (if option S is installed) or release the customer- or modem-provided contact (if option D is installed)

(b) If only the H2 relay is operated, the H2 relay and the DDD2 dial-up line are released immediately.

(c) If both the H2 and H1 relays are operated but transmission of the start signal has not been completed, the H2 and H1 relays and the DDD2 and DDD1 dial-up lines are released after a minimum delay of 3 seconds.

Release From Dial Backup Mode (Automatic Dialing)

3.166 When both the H2 and H1 relays are operated and transmission of the start signal has been completed, the BU lamp is lighted and the 48ER1 data unit is in the dial backup mode (A relay operated). Release of the data unit from the dial backup mode is accomplished as follows:

(a) Release the O/R switch on the faceplate of the data unit (if option S is installed) or release the customer- or modem-provided contact (if option D is installed).

(b) The timing logic in the data unit operates the R relay for 3 seconds causing the signal generator in the data unit to transmit a 941-Hz and 1633-Hz stop signal during the 3-second period. The stop signal releases the 48FR1 data unit at the far end of the dial backup channel from the dial backup mode.

(c) At the end of the stop signal the H2 and H1 relays release and the BU lamp goes off (A relay released), indicating that the 48ER1 data unit is released from the dial backup mode.

Ring Detection (Automatic Dialing)

3.167 A ring detector circuit is connected to each 2-wire dial-up line (DDD1 and DDD2). If the H2 relay is operated, a ringing signal on dial-up line DDD1 causes the H1 relay to operate and place DDD1 on hold. If the H2 relay is released, the DDD1 line will not respond to a ringing signal. The DDD2 line will not respond to a ringing signal at any time.

3.168 The ring detector circuits are only connected to the dial-up lines when the data unit is not in the hold or dial backup modes. If the data unit is in the dial backup mode, both ring detector circuits are disconnected. If either dial-up line is in the hold mode, the associated ring detector circuit is disconnected.

E. Dial Backup Call Sequence (Manual Dialing)

3.169 A typical manual dialing call sequence for two stations, A and B, is described in the following paragraphs. This description assumes that the following conditions exist:

(a) The 4-wire modem is used to transmit and receive data over a 4-wire private line terminated with a DAS 829-type CIU that is conditioned for data transmission, a 48ER1 data unit is used for dial backup at Station A, and a 48ER1 or 48FR1 data unit is used for dial backup at Station B.

(b) The 48FR1 data unit at Station B is optioned for automatic answering enabled by the unit internal logic.

(c) Station A initiates the first call on line 2.

(d) Station A initiates the second call on line 1 when Station B is equipped with a 48ER1 data unit or with a 48FR1 data unit that is optioned for two calls answered.

(e) Station A answers the second call on line 1 when Station B is equipped with a 48FR1 data unit that is optioned for automatic call back.

Idle State

3.170 At Station A, all dial-up line lamps (DDD1 and DDD2) are off, the telephone handset is on-hook, and the BU lamp is off. The modem

is connected through the 48ER1 data unit to the 4-wire private line terminated by the DAS 829-type CIU. Both 2-wire dial-up lines (DDD1 and DDD2) are released and connected to their ring detector circuits. The 48ER1 data unit passes an in-data or not-in-data indication to the modem, as determined by the DAS 829-type CIU. Since the DAS 829-type CIU is conditioned for data transmission, an in-data indication is passed.

First Call

3.171 The sequence begins with Station A deciding for some reason, such as the inability of the modem to send data over the 4-wire private line, that a backup connection should be made. An attendant at Station A places the telephone handset off-hook, selects line 2 by depressing the DDD2 key, and dials line 1 of Station B. Station B responds to the call in one of two ways.

(a) When Station B is equipped with a 48ER1 data unit, a ringing signal causes the line 1 (DDD1) lamp to flash and the telephone set buzzer to sound. An attendant at Station B places the telephone handset off-hook and depresses the DDD1 key. Ringing stops and conversation can now take place. If the connection is not satisfactory, the call can be dropped by placing the handset on-hook, and then reinitiated. At this point both line lamps (DDD1 and DDD2) are off at each station. Once the nature of the call is established (backup), both stations hold their respective lines. At station A, the HOLD key is depressed until the line 2 (DDD2) lamp lights, indicating line 2 is being held. At Station B, a similar procedure puts line 1 on hold. At this point, one line lamp is lighted at each station. The stations need not remain off-hook to hold the call.

(b) When Station B is equipped with a 48FR1 data unit, the data unit is unattended and automatically answers the call on line 1 by placing line 1 on hold. When Station B answers the call, the ringback signal is removed from the line. At Station A, the HOLD key is then depressed until the line 2 (DDD2) lamp lights, indicating line 2 is being held. Station A need not remain off-hook to hold the call.

Second Call

3.172 When Station B is equipped with a 48ER1 data unit or with a 48FR1 data unit that is optioned for two calls answered, the attendant at Station A selects line 1 by depressing the DDD1 key and dials line 2 of Station B. Station B responds to the call in one of two ways.

(a) When Station B is equipped with a 48ER1 data unit, a ringing signal causes the line 2 (DDD2) lamp to flash and the telephone set buzzer to sound. An attendant at Station B depresses the DDD2 key and answers the call. If the connection is not satisfactory, the second call can be dropped by placing the telephone handset on-hook, and then reinitiated. Both stations now hold their respective lines by depressing the HOLD key. The stations need not remain off-hook to hold the call.

(b) When Station B is equipped with a 48FR1 data unit that is optioned for two calls answered, the data unit automatically answers the call on line 2 by placing line 2 on hold. When Station B answers the call, the ringback signal is removed from the line. The attendant at Station A then places line 1 on hold by depressing the HOLD key. Station A need not remain off-hook to hold the call. If the second call is not completed within 2 minutes after line 1 of Station B is placed on hold, line 1 is placed on-hook and the ring detector for line 2 of Station B is disabled. In this case, the entire call sequence must be repeated.

3.173 When Station B is equipped with a 48FR1 data unit that is optioned for automatic call back, the data unit places a station dial connected to line 2 off-hook after a call is answered on line 1. The station dial then automatically dials line 1 of Station A. When dialing is completed, the 48FR1 data unit at Station B places line 2 on hold and disconnects the station dial. At Station A, a ringing signal causes the line 1 (DDD1) lamp to flash and the telephone set buzzer to sound. The attendant at Station A depresses the DDD1 key, answers the call, and then depresses the HOLD key. Station A need not remain off-hook to hold the call.

Data Transmission

3.174 Once the second call is held, the 48ER1 data unit at Station A sends a start signal to the 48ER1 or 48FR1 data unit at Station B and the data unit at each station then enters the dial backup mode, as indicated by the BU lamp at each station being lighted. The DDD1 and DDD2 lamps are lighted at Station A, and also at Station B when a 48ER1 data unit is used at Station B. The modem at each station is transferred from the 4-wire private line to the 4-wire dial backup channel composed of dial-up lines 1 and 2, and in-data and dial backup indications are passed to the modems. At this point, Station A should go on-hook, and also Station B when a 48ER1 data unit is used at Station B.

3.175 The modems now have a complete 4-wire data transmission path over the dial backup channel. While the modems are connected to the dial backup channel, the 4-wire private line can be tested from a remote location without interfering with data transmission over the dial backup channel. If alternate voice service is provided, the 4-wire private line can also be used for conversation.

Return to Idle State

3.176 Once the 4-wire private line is cleared for data transmission, the modems can be returned to the 4-wire private line. Station A goes off-hook and the REL key is depressed. When Station B is equipped with a 48ER1 data unit, Station B also goes off-hook and the REL key is depressed. When Station B is equipped with a 48FR1 data unit, a stop signal from the 48ER1 data unit at Station A causes the 48FR1 data unit at Station B to release from the dial backup mode. The line lamps (DDD1 and DDD2) and the BU lamps go off. Station A and Station B (when equipped with a 48ER1 data unit) now go on-hook and the stations are again in the idle state.

F. Dial Backup Call Sequence (Automatic Dialing)

3.177 A typical automatic dialing call sequence for two stations, A and B, is described in the following paragraphs. This description assumes that the following conditions exist:

(a) The 4-wire modem is used to transmit and receive data over a 4-wire private line terminated with a DAS 829-type CIU that is conditioned for data transmission, a 48ER1 data unit is used for dial backup at Station A, and a 48FR1 data unit is used for dial backup at Station B.

(b) The customer commands the 48ER1 data unit at Station A to originate a dial backup channel through use of a customer- or modem-provided contact and a station dial or an ACU.

(c) The 48FR1 data unit at Station B is optioned for automatic answering enabled by the unit internal logic.

Idle State

3.178 At Station A, the customer- or modem-provided contact is open and the BU lamp is off. The modem is connected through the 48ER1 data unit to the 4-wire private line terminated by the DAS 829-type CIU. Both 2-wire dial-up lines (DDD1 and DDD2) are released and connected to their ring detector circuits. The 48ER1 data unit passes an in-data or not-in-data indication to the modem, as determined by the DAS 829-type CIU. Since the DAS 829-type CIU is conditioned for data transmission, an in-data indication is passed.

First Call

3.179 The sequence begins with Station A deciding for some reason, such as the inability of the modem to send data over the 4-wire private line, that a backup connection should be made. The customer- or modem-provided contact at Station A is closed by the customer causing the station dial or ACU connected to line 2 of Station A to automatically dial line 1 of Station B. When dialing is completed, the 48ER1 data unit at Station A places line 2 on hold and disconnects the station dial or ACU. The 48FR1 data unit at Station B automatically answers the call on line 1 by placing line 1 on hold. The customer- or modem-provided contact at Station A must remain closed until a release or retry command is to be initiated.

Second Call

3.180 The 48FR1 data unit at Station B places a station dial connected to line 2 off-hook after a call is answered on line 1. The station dial then automatically dials line 1 of Station A. When dialing is completed, the 48FR1 data unit at Station

B places line 2 on hold and disconnects the station dial. The 48ER1 data unit at Station A automatically answers the call on line 1 by placing line 1 on hold.

Data Transmission

3.181 Once the second call is held, the 48ER1 data unit at Station A sends a start signal to the 48FR1 data unit at Station B and the data unit at each station then enters the dial backup mode, as indicated by the BU lamp at each station being lighted. The modem at each station is transferred from the 4-wire private line to the 4-wire dial backup channel composed of dial-up lines 1 and 2, and in-data and dial backup indications are passed to the modems.

3.182 The modems now have a complete 4-wire data transmission path over the dial backup channel. While the modems are connected to the dial backup channel, the 4-wire private line can be tested from a remote location without interfering with data transmission over the dial backup channel.

Return to Idle State

3.183 Once the 4-wire private line is cleared for data transmission, the modems can be returned to the 4-wire private line. The customer- or modem-provided contact at Station A is opened causing the 48ER1 data unit at Station A to release from the dial backup mode, as indicated by the BU lamp going off, and to send a stop signal to the 48FR1 data unit at Station B. The stop signal causes the 48FR1 data unit to release from the dial backup mode, as indicated by the BU lamp going off. The stations are again in the idle state.

48FR1 DATA UNIT

3.184 The 48FR1 data unit provides the switching, ring detection, and transmission circuitry required to add 4-wire dial backup service with automatic answering to 4-wire private line data service. A dc power supply in the data unit obtains its unregulated input from a bridge rectifier power supply associated with the 59A1 data mounting that houses the data unit. All connections to the data unit are made through the data mounting.

A. Options

3.185 The 48FR1 data unit is provided with several options that may be requested by the customer. The desired options must be specified when the data unit is ordered. Refer to Table C for a summary of the options.

3.186 ***Call Control:*** Two methods of automatic answering are provided.

(a) With two calls answered (option T), the 48FR1 data unit automatically answers a

TABLE C

48FR1 DATA UNIT OPTIONS

FEATURE	OPTION	PLUG-IN STRAP(S)		PROVIDE
		QUANTITY	POSITION	
Call Control	Two Calls Answered (T)	6	T	One Per Unit
	Automatic Call Back (A)	6	A	
Unit Control	Unit Internal Logic (E)	1	E	One Per Unit
	Customer- or Modem-Provided Contact (D)	1	D	
Power Supply	24 Vac (N)	1	N	One Per Unit
	-48 Vdc (-48)*	1	-48	

* Use not permitted.

call on line 1 and then automatically answers a call on line 2, if the second call is received within 2 minutes of the time line 1 went on hold.

(b) With automatic call back (option A), the 48FR1 data unit automatically answers a call on line 1 and then automatically initiates a call on line 2.

3.187 ***Unit Control:*** Two methods of enabling automatic answering are provided.

(a) With unit internal logic (option E), automatic answering is enabled by the internal logic in the 48FR1 data unit. The data unit can automatically answer a call on line 1 and then automatically answer or initiate a call on line 2.

(b) With a customer- or modem-provided contact (option D), automatic answering is enabled only when the customer or modem provides and maintains a contact closure. The data unit can automatically answer a call on line 1 and then automatically answer or initiate a call on line 2.

3.188 ***Power Supply:*** Operating power for the 48FR1 data unit can be provided by either a 24 Vac (option N) or a -48 Vdc (option -48) supply.

Note: Use of a -48 Vdc supply is not permitted.

B. Arrangements

3.189 The 48FR1 data unit can be used to provide 4-wire dial backup service with automatic answering on a single 4-wire private line in the following equipment arrangements: single installation (two calls answered), and single installation (automatic call back).

Single Installation (Two Calls Answered)

3.190 For this arrangement, the 48FR1 data unit is equipped with options N, T, and E or D and housed in a 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU. Automatic answering is enabled by internal logic in the 48FR1 data unit (option E) or by a customer- or modem-provided contact (option D). This arrangement provides that the far end of a 4-wire dial backup channel is established when the following sequence is completed within 2 minutes: a call is automatically answered on line 1, a call is then automatically answered on line 2, and a start signal is received on line 2.

3.191 For a detailed description of the single installation (two calls answered) arrangement, refer to paragraphs 3.199 through 3.216 and 3.223 through 3.230.

Single Installation (Automatic Call Back)

3.192 For this arrangement, the 48FR1 data unit is equipped with options A, N, and E or D and housed in a 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU. Automatic answering is enabled by internal logic in the 48FR1 data unit (option E) or by a customer- or modem-provided contact (option D). This arrangement provides that the far end of a 4-wire dial backup channel is established when the following sequence is completed within 2 minutes: a call is automatically answered on line 1, a call is then automatically initiated on line 2, and a start signal is received on line 2.

3.193 A 43A or 53A station dial is required for automatic call back. The station dial must be optioned for the restricted mode of operation. For those installations that have precise dial tone available, a 1A350 tone detector can be used with either the 43A or 53A station dial. The minimum time required to establish a dial backup channel is obtained when a 53A station dial equipped with a 1A350 tone detector is used. If the 1A350 tone detector is not used, an internal timer starts the station dial.

3.194 For a detailed description of the single installation (automatic call back) arrangement, refer to paragraphs 3.199 through 3.208 and 3.217 through 3.230.

C. Security

3.195 Arrangements that include a 48ER1 data unit at the near end station of a 4-wire private line and a 48FR1 data unit at an unattended far end station enable the customer to establish a 4-wire dial backup channel, through use of the switched network, to a data set at the unattended station. These arrangements also enable an unauthorized party to access the unattended station unless security measures are taken. The security

measures should ensure that an unauthorized party cannot access the unattended station or deny access to the customer. To accomplish these objectives, the security measures should ensure that an unauthorized party cannot use the switched network to establish a 4-wire dial backup channel to the unattended station.

3.196 When the 48FR1 data unit is equipped with option D, the data unit is controlled by a customer- or modem-provided contact. This is the most secure arrangement as a 4-wire dial backup channel cannot be established until the customer or modem enables the unattended station by providing a contact closure. However, the equipment at the unattended station must be capable of controlling the contact closure.

3.197 When the 48FR1 data unit is equipped with option E, the data unit is controlled by internal logic. With this arrangement the unattended station is enabled whenever a call is received on line 1. This arrangement provides various degrees of security as follows:

(a) When the 48FR1 data unit is equipped with option T, a 4-wire dial backup channel is established whenever the unattended station answers calls on both lines 1 and 2. This arrangement provides minimum security since any party knowing the two telephone numbers to be called and also knowing the required call sequence can establish a 4-wire dial backup channel to the unattended station.

(b) When the 48FR1 data unit is equipped with option A, a 4-wire dial backup channel is established whenever the unattended station answers a call on line 1 and then originates a call on line 2. However, it is still possible to make the unattended station answer calls on both lines 1 and 2. Therefore, any improvement in security with this arrangement is due solely to the fact that the telephone number of the call-back line (line 2) at the unattended station would not normally be known to an unauthorized user.

(c) If the customer requires maximum security, the 48FR1 data unit at the unattended station must be equipped with option A and the call-back line (line 2) must be an originate-only line. With this arrangement, an unauthorized party cannot use the switched network to establish a 4-wire dial backup channel to the unattended station.

3.198 It is expected that the 48ER1 data unit at the near end station will normally be equipped for manual dialing (option M installed) and the near end station will be attended. With this arrangement, there are no security problems. However, if the 48ER1 data unit is equipped for automatic dialing (option A installed) and maximum security is required, line 2 at the near end station must be an originate-only line.

D. Data Service

3.199 In the data mode (Fig. 3), the 4-wire modem can transmit and receive data over the 4-wire private line since the 48FR1 data unit provides a through connection for the transmission leads of the standard 6-lead interface (DT, DR, DT1, DR1, TEK5, TEK6) that connects the modem to the DAS 829-type CIU. The four transmission leads (DT, DR, DT1, DR1) are complete through the normally-closed contacts of the A relay in the 48FR1 data unit as long as the 48FR1 data unit remains in the data mode. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6, if the DAS 829-type CIU is also in the data mode. Two additional interface leads, DBU1 and DBU2, supply a dial backup status signal to the modem.

3.200 When data units are not installed in all positions of the 59A1 data mounting, the data unit connectors at the vacant positions of the data mounting provide a through connection for the 6-lead interface.

3.201 The following are the transmission leads from the DAS 829-type CIU and the corresponding 48FR1 terminal numbers (Fig. 60):

Designation	48FR1 Terminal Number
DT	25
DR	2
DT1	24
DR1	23

3.202 The following are the transmission leads from the modem and the corresponding 48FR1 terminal numbers (Fig. 60):

Designation	48FR1 Terminal Number
DT	5
DR	22
DT1	4
DR1	3

3.203 The 48FR1 terminals (Fig. 60) designated DT(M), DR(M), DT1(M), and DR1(M) are not used.

E. Dial Backup Service

3.204 In the dial backup mode (Fig. 3), operation of the A relay in the 48FR1 data unit transfers the 4-wire modem from the 4-wire private line to the 4-wire dial backup channel. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

Transmit Circuit

3.205 In the dial backup mode (A relay operated, Fig. 60), the modem transmit pair (DT1, DR1) is connected through the normally-open contacts of relay A, the normally-closed contacts of test jack J1 (XMT), isolation transformer T2, the signal power limiter circuit, the transmit amplifier, line-holding transformer T1, and the normally-open contacts of relay H1 to the 2-wire dial-up line terminating on T2 and R2.

3.206 The 48FR1 data unit provides a 600-ohm termination for the dial-up line and a 600-ohm termination for the modem. Resistors R15 and F1 function as fuses for the modem transmit pair (DT1, DR1) and the dial-up transmit pair (T2, R2), respectively. If excessive power is dissipated in resistor R15 or F1, the resistor opens to disconnect the hazardous voltage. Diode CR3 and varistor RV10 limit voltage surges in the circuit. Switch S1 (XMT) provides adjustment of the signal gain. The signal power limiter circuit assures that the signal level does not exceed -4 dBm when averaged over any 3-second period.

Note: The setting of XMT switch S1 is fixed in registered arrangements.

Receive Circuit

3.207 In the dial backup mode (A relay operated, Fig. 60), the modem receive pair (DT, DR) is connected through the normally-open contacts of relay A, the normally-closed contacts of test jack J2 (REC), isolation transformer T4, the receive amplifier, line-holding transformer T3, and the normally-open contacts of relay H2 to the 2-wire dial-up line terminating on T3 and R3.

3.208 The 48FR1 data unit provides a 600-ohm termination for the dial-up line and a 600-ohm termination for the modem. Resistors R23 and F2 function as fuses for the modem receive pair (DT, DR) and the dial-up receive pair (T3, R3), respectively. If excessive power is dissipated in resistor R23 or F2, the resistor opens to disconnect the hazardous voltage. Diodes CR7 and CR9 limit voltage surges in the circuit. Switch S2 (REC) provides adjustment of the signal gain.

Note: The setting of REC switch S2 is fixed in registered arrangements.

Dial Backup Mode (Two Calls Answered)

3.209 The description in the following paragraphs assumes that the 48FR1 data unit (with options N, T, and E or D installed, Fig. 60) is installed in the 59A1 data mounting (Fig. 58), the required DAS 829-type CIU is installed in the data mounting, and all necessary connections are made. If option D is installed, the customer- or modem-provided contact is closed. The key telephone set shown in Fig. 58 is not required for this arrangement.

3.210 To put the 48FR1 data unit in the dial backup mode, the H1 and H2 relays are operated, a start signal is received, and the A relay is operated.

(a) The H1 relay (Fig. 60) is operated as follows: When the DDD1 ring detector in the 48FR1 data unit detects a ringing signal on the DDD1 dial-up line, the DDD1 ring detector causes the H1 relay to operate and then latch under control of the release logic in the data unit. The DDD1 dial-up line is transferred from the DDD1 ring detector to the transmit circuit of the data unit and is now in the hold mode.

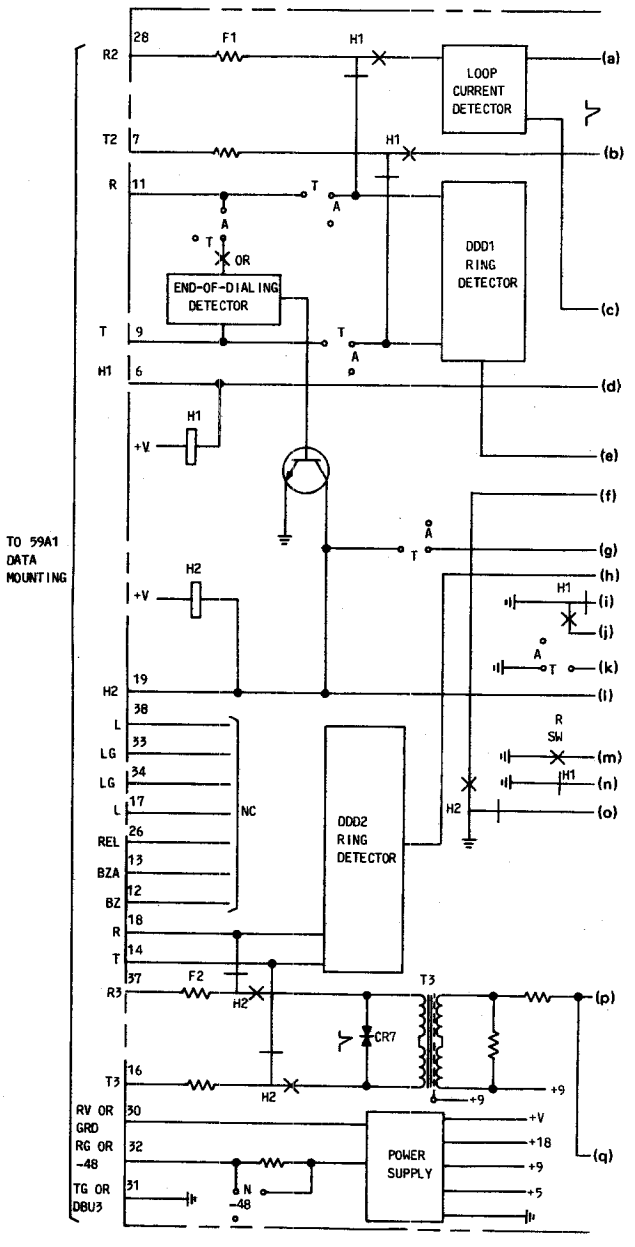


Fig. 60—48FR1 Data Unit—Functional Diagram (Sheet 1 of 3)

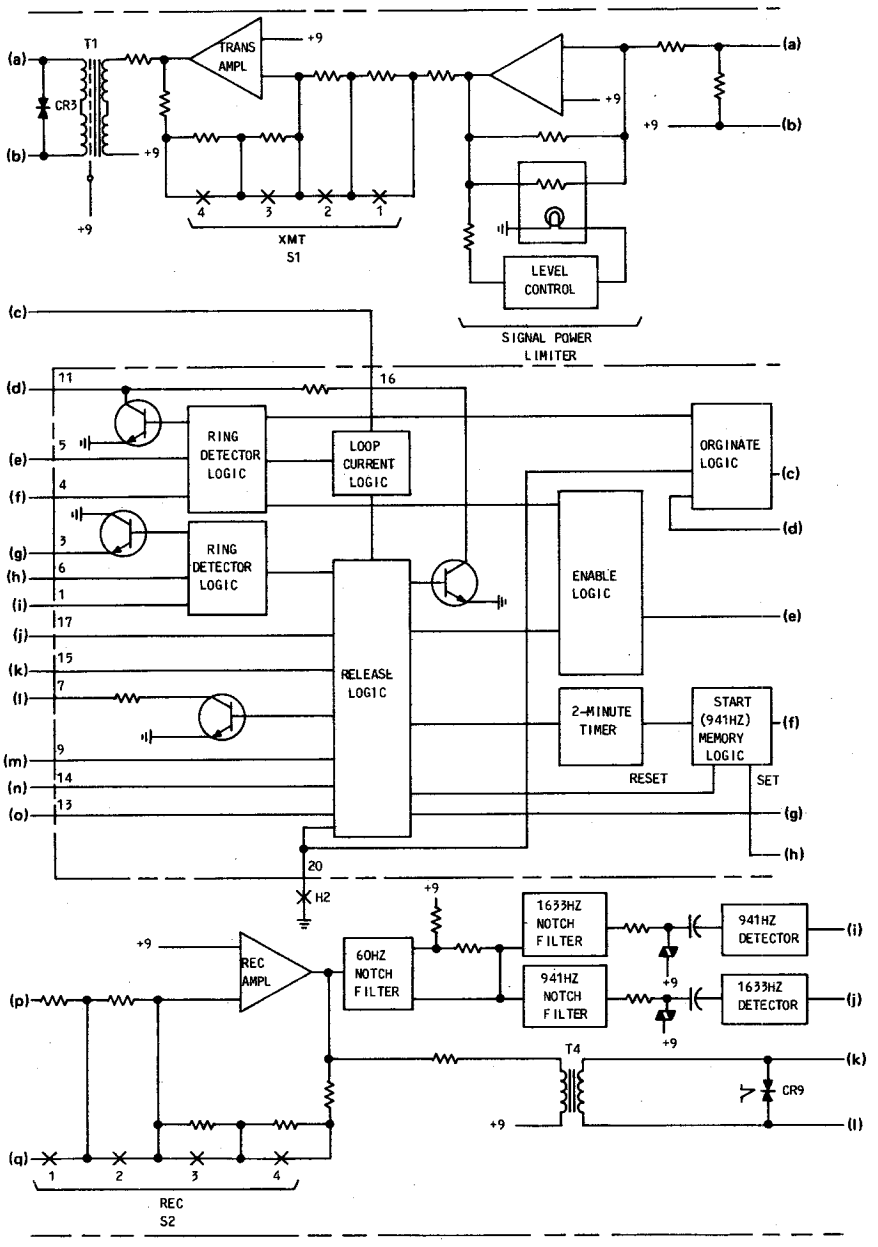


Fig. 60 — 48FR1 Data Unit—Functional Diagram (Sheet 2 of 3)

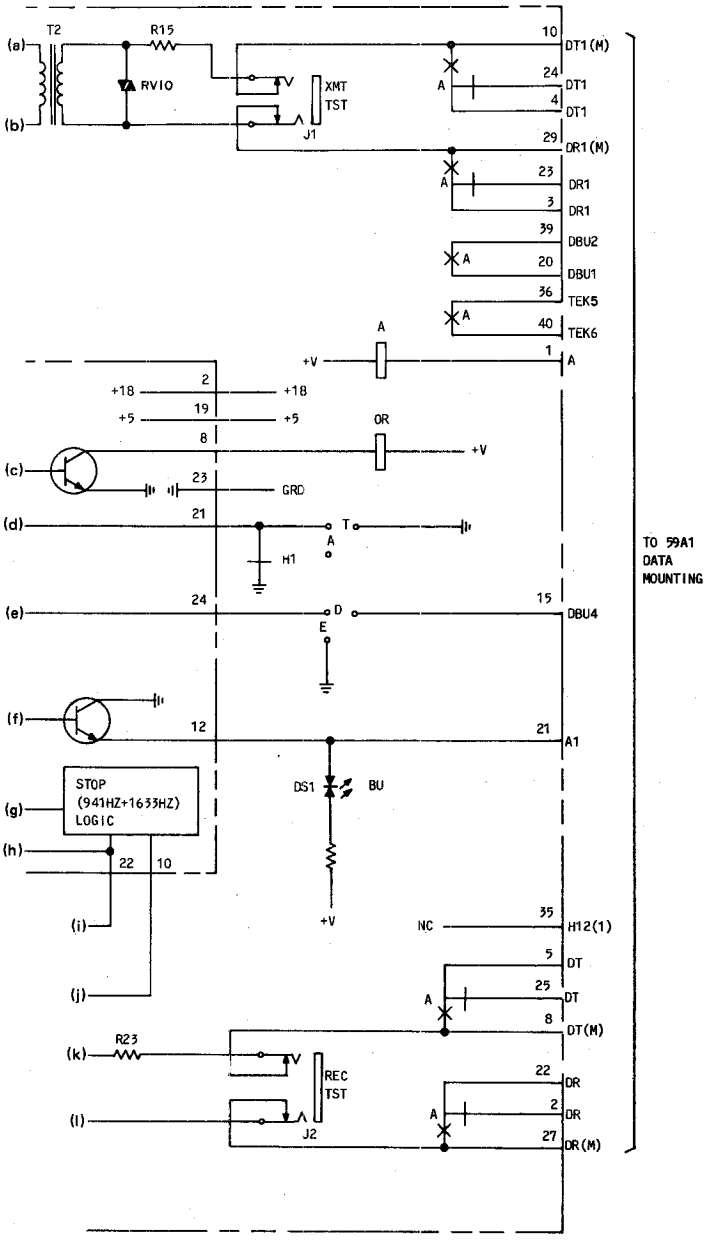


Fig. 60—48FR1 Data Unit—Functional Diagram (Sheet 3 of 3)

(b) The H2 relay (Fig. 60) is operated as follows: When the DDD2 ring detector in the 48FR1 data unit detects a ringing signal on the DDD2 dial-up line within the 2-minute interval provided by a 2-minute timer in the data unit that is started by operation of the H1 relay, the DDD2 ring detector causes the H2 relay to operate and then latch under control of the release logic in the data unit. The DDD2 dial-up line is transferred from the DDD2 ring detector to the receive circuit of the data unit and is now in the hold mode.

(c) With the DDD1 and DDD2 dial-up lines in the hold mode (H1 and H2 relays operated), the A relay operates when a start signal, supplied by the 48ER1 data unit at the near end of the dial backup channel, is detected and removed within the 2-minute interval provided by the 2-minute timer. The modem is transferred from the 4-wire private line to the transmit and receive circuits of the 48FR1 data unit. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

(d) The data unit is now in the dial backup mode (A relay operated) and data transmission can take place over the 4-wire dial backup channel. A light-emitting diode, DS1 (BU), on the faceplate of the data unit is lighted to provide visual indication of the dial backup mode.

Release From Hold and Dial Backup Modes (Two Calls Answered)

3.211 When either the H1 or H2 relay is operated, the associated 2-wire dial-up line (DDD1 or DDD2) is in the hold mode. When both the H1 and H2 relays are operated and a start signal has been detected and removed, the 48FR1 data unit is in the dial backup mode (A relay operated). Release of a dial-up line from the hold mode and release of the data unit from the dial backup mode is accomplished in the following ways:

(a) When the 2-minute interval provided by a 2-minute timer in the 48FR1 data unit has elapsed.

(b) When loop current for the DDD1 dial-up line is interrupted for more than 5 ms.

(c) When a stop signal is received.

(d) When the R (release) switch on the faceplate of the 48FR1 data unit is operated.

3.212 When the data unit is improperly accessed, the H1 and/or H2 relays are released by the 2-minute timer. When the data unit is properly accessed and a dial backup channel is established, the data unit is normally released by receipt of the stop signal. If the stop signal cannot be received and the line control circuitry provides an interruption in the loop current when the calling party disconnects, the data unit is released by this interruption. The R switch provides a way to release the data unit when the normal ways cannot be used.

3.213 When the 48FR1 data unit is released from the dial backup mode by one of the previous ways, the BU lamp goes off (A relay released), indicating that the 48FR1 data unit is released from the dial backup mode.

Ring Detection (Two Calls Answered)

3.214 A ring detector circuit is connected to each 2-wire dial-up line (DDD1 and DDD2). A ringing signal on dial-up line DDD1 causes the H1 relay to operate and place DDD1 on hold. Operation of the H1 relay also starts a 2-minute timer.

3.215 If the H1 relay is operated and the 2-minute interval provided by the 2-minute timer has not elapsed, a ringing signal on dial-up line DDD2 causes the H2 relay to operate and place DDD2 on hold. If the H1 relay is released, the DDD2 line will not respond to a ringing signal.

3.216 The ring detector circuits are only connected to the dial-up lines when the data unit is not in the hold or dial backup modes. If the data unit is in the dial backup mode, both ring detector circuits are disconnected. If either dial backup line is in the hold mode, the associated ring detector circuit is disconnected.

Dial Backup Mode (Automatic Call Back)

3.217 The description in the following paragraphs assumes that the 48FR1 data unit (with options A, N, and E or D installed, Fig. 60) is installed in the 59A1 data mounting (Fig. 58), the required DAS 829-type CIU is installed in the data

mounting, the required station dial is provided (instead of the key telephone set shown in Fig. 58), and all necessary connections are made. If option D is installed, the customer- or modem-provided contact is closed.

3.218 To put the 48FR1 data unit in the dial backup mode, the H1 and H2 relays are operated, a start signal is received, and the A relay is operated.

(a) The H1 relay (Fig. 60) is operated as follows: When the DDD1 ring detector in the 48FR1 data unit detects a ringing signal on the DDD1 dial-up line, the DDD1 ring detector causes the H1 relay to operate and then latch under control of the release logic in the data unit. The DDD1 dial-up line is transferred from the DDD1 ring detector to the transmit circuit of the data unit and is now in the hold mode.

(b) The H2 relay (Fig. 60) is operated as follows: Operation of the H1 relay in the 48FR1 data unit starts a 2-minute timer and causes the originate logic to operate the OR relay. With the OR relay operated, loop current is detected by the station dial causing the station dial to place a call, on the 2-wire dial-up line terminating on T3 and R3 (DDD2) of the 48FR1 data unit, to the number of the DDD1 dial-up line for the 48ER1 data unit at the near end of the dial backup channel. When dialing is completed, loop current is detected by the end-of-dialing detector in the 48FR1 data unit causing the H2 relay to operate and then latch under control of the release logic in the data unit. The DDD2 dial-up line of the 48FR1 data unit is transferred from the station dial to the receive circuit of the data unit and is now in the hold mode.

(c) With the DDD1 and DDD2 dial-up lines in the hold mode (H1 and H2 relays operated), the A relay operates when a start signal, supplied by the 48ER1 data unit at the near end of the dial backup channel, is detected and removed within the 2-minute interval provided by the 2-minute timer. The modem is transferred from the 4-wire private line to the transmit and receive circuits of the 48FR1 data unit. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

(d) The data unit is now in the dial backup mode (A relay operated) and data transmission can take place over the 4-wire dial backup channel. A light-emitting diode, DS1 (BU), on the faceplate of the data unit is lighted to provide visual indication of the dial backup mode.

Release From Hold and Dial Backup Modes (Automatic Call Back)

3.219 Release of a dial-up line from the hold mode and release of the data unit from the dial backup mode is accomplished in the same ways as described in paragraphs 3.211 through 3.213 for the two calls answered arrangement.

Ring Detection (Automatic Call Back)

3.220 A ring detector circuit is connected to each 2-wire dial-up line (DDD1 and DDD2). A ringing signal on dial-up line DDD1 causes the H1 relay to operate and place DDD1 on hold. Operation of the H1 relay also starts a 2-minute timer and after a 5-second delay causes the data unit to initiate a call on dial-up line DDD2.

3.221 If the H1 relay is operated and the 5-second delay has not elapsed, a ringing signal on dial-up line DDD2 causes the H1 relay to release. If the H1 relay is released, the DDD2 line will not respond to a ringing signal.

3.222 The ring detector circuits are only connected to the dial-up lines when the data unit is not in the hold or dial backup modes. If the data unit is in the dial backup mode, both ring detector circuits are disconnected. If either dial-up line is in the hold mode, the associated ring detector circuit is disconnected.

F. Dial Backup Call Sequence (Two Calls Answered or Automatic Call Back)

3.223 A typical automatic answering call sequence for two stations, A and B, is described in the following paragraphs. This description assumes that the following conditions exist:

(a) The 4-wire modem is used to transmit and receive data over a 4-wire private line terminated with a DAS 829-type CIU that is conditioned for data transmission, a 48ER1 data unit is used for dial backup at Station A, and a

48FR1 data unit is used for dial backup at Station B.

(b) The 48FR1 data unit at Station B is optioned for automatic answering enabled by the unit internal logic.

(c) Station B answers the first call on line 1.

(d) Station B answers the second call on line 2 when the 48FR1 data unit at Station B is optioned for two calls answered.

(e) Station B initiates the second call on line 2 when the 48FR1 data unit at Station B is optioned for automatic call back.

Idle State

3.224 At Station B, the H1, H2, and A relays are released and the BU lamp is off. The modem is connected through the 48FR1 data unit to the 4-wire private line terminated by the DAS 829-type CIU. Both 2-wire dial-up lines (DDD1 and DDD2) are released and connected to their ring detector circuits. The 48FR1 data unit passes an in-data or not-in-data indication to the modem, as determined by the DAS 829-type CIU. Since the DAS 829-type CIU is conditioned for data transmission, an in-data indication is passed.

First Call

3.225 The sequence begins with a ringin signal on line 1 of Station B, as a result of a call initiated on line 2 of Station A. The 48FR1 data unit at Station B automatically answers the call on line 1 by operating the H1 relay. Operation of the H1 relay places line 1 on hold and starts the 2-minute timer that restores the data unit to idle when the data unit is improperly accessed. In addition, the H1 relay enables the data unit to answer a call on line 2 when the data unit is optioned for two calls answered, or to initiate a call on line 2 when the data unit is optioned for automatic call back. After the call to line 1 of Station B is completed, line 2 of Station A is placed on-hold.

Second Call

3.226 When the 48FR1 data unit at Station B is optioned for two calls answered, Station A initiates a call on line 1 to line 2 of Station B. The 48FR1 data unit at Station B automatically answers the call on line 2 by operating the H2 relay, if less than 2 minutes has elapsed since the H1 relay operated. Operation of the H2 relay places line 2 on hold. If the second call is not completed within 2 minutes after line 1 of Station B is placed on hold, line 1 is placed on-hook and the ring detector for line 2 of Station B is disabled. In this case, the entire call sequence must be repeated.

3.227 When the 48FR1 data unit at Station B is optioned for automatic call back, the data unit places a station dial connected to line 2 off-hook after a call is answered on line 1. The station dial then automatically dials line 1 of Station A. When dialing is completed, the 48FR1 data unit at Station B operates the H2 relay. Operation of the H2 relay places line 2 on hold and disconnects the station dial. Station A answers the call on line 1 and then places line 1 on hold.

Data Transmission

3.228 Once the second call is held, the 48ER1 data unit at Station A sends a start signal to the 48FR1 data unit at Station B. The start signal disables the 2-minute timer and operates the A relay in the 48FR1 data unit. The data unit at each station then enters the dial backup mode, as indicated by the BU lamp at each station being lighted. The modem at each station is transferred from the 4-wire private line to the 4-wire dial backup channel composed of dial-up lines 1 and 2, and in-data and dial backup indications are passed to the modem.

3.229 The modems now have a complete 4-wire data transmission path over the dial backup channel. While the modems are connected to the dial backup channel, the 4-wire private line can be tested from a remote location without interfering with data transmission over the dial backup channel.

Return to Idle State

3.230 Once the 4-wire private line is cleared for data transmission, the modems can be returned to the 4-wire private line. When Station A is released from the dial backup mode, as indicated by the BU lamp going off, the 48ER1 data unit at Station A sends a stop signal to the 48FR1 data unit at Station B. The stop signal releases the H1, H2, and A relays causing the

48FR1 data unit to release from the dial backup mode, as indicated by the BU lamp going off. The stations are again in the idle state.

48G1 DATA UNIT

3.231 The 48G1 data unit contains the circuitry required to provide conversion from a 2-wire to a 4-wire channel. A dc power supply in the data unit obtains its unregulated input from a bridge rectifier power supply in the 46B1, 59A1, or 62A1 data mounting that houses the data unit. A 2-position power supply option in the data unit enables the associated dc power supply to operate on 24 Vac (N position), -24 Vdc (N position), or -48 Vdc (-48 position). All connections to the data unit are made through the data mounting.

3.232 For data only service on a single 2-wire private line, the 48G1 data unit is housed in a 59A1 or 62A1 data mounting. This data mounting also houses the required DAS 829-type CIU. If alternate voice service is also provided, the 48G1 data unit is housed in a 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU and the required 48A1 data unit.

3.233 For data only service on multiple (up to eight) 2-wire private lines, the 48G1 data units are housed in a 46B1 data mounting. The required DAS 829-type CIUs are housed in a 46A1 or 46A2 data mounting. If alternate voice service is also provided, the required 48A1 data units are housed in a separate 46B1 data mounting.

3.234 Hybrid transformer T3 (Fig. 61) provides the interface between the 2-wire modem and the DAS 829-type CIU that terminates a standard 16-dB channel. The transmit and receive amplifiers in the transmit and receive pairs of the 48G1 data unit have a fixed gain that offsets the circuit losses and provides a 0-dB insertion loss in the transmit and receive paths.

POWER SUPPLIES

3.235 The 44A1, 44A2, 45A1, 46A1, 46A2, 46B1, 59A1, and 62A1 data mountings and the 48D1 data unit have power supplies that require a power source of 105 to 129 volts at 57 to 63 Hz.

A. 44A1 and 44A2 Data Mountings

3.236 The 44A1 or 44A2 data mounting provides input power for the DAS 829-type CIU that is housed in the data mounting. The CIU normally requires a 24-Vac input that is provided by a transformer supplied with the data mounting. Overcurrent protection for the CIU is provided by a thermal breaker in the primary winding of the transformer. If the CIU requires a -24 or -48 Vdc input, locally supplied power connections must be provided.

B. 45A1 Data Mounting

3.237 The 45A1 data mounting provides input power for a DAS 829-type CIU, a 48A1 data unit, and/or a 48B1 data unit that are housed in the data mounting. The CIU normally requires a 24-Vac input. Each data unit requires an unregulated dc input. The input to the data units is provided by a bridge rectifier power supply in the data mounting. A transformer supplied with the data mounting provides the 24-Vac input to the CIU and the bridge rectifier power supply. Overcurrent protection for the CIU and the data units is provided by a thermal breaker in the primary winding of the transformer.

C. 46A1 and 46A2 Data Mountings

3.238 The 46A1 or 46A2 data mounting provides input power for up to eight DAS 829-type CIUs that are housed in the data mounting. The CIUs normally require a 24-Vac input that is provided by a transformer in the 46A1 or 46A2 data mounting. Overcurrent protection for each CIU is provided by fuses F1 through F8 in the transformer output circuit. Overcurrent protection for the transformer is provided by fuse F9 in the transformer input circuit. If the CIUs require a -24 or -48 Vdc input, the 46A2 data mounting must be used. The transformer is disconnected, by use of an installer option, and a -24 or -48 Vdc power source is connected to the data mounting.

D. 46B1 Data Mounting

3.239 The 46B1 data mounting provides input power for up to eight 48A1 or 48G1 data units that are housed in the data mounting. The data units require an unregulated dc input that is provided by a bridge rectifier power supply in the data mounting. A transformer in the data mounting

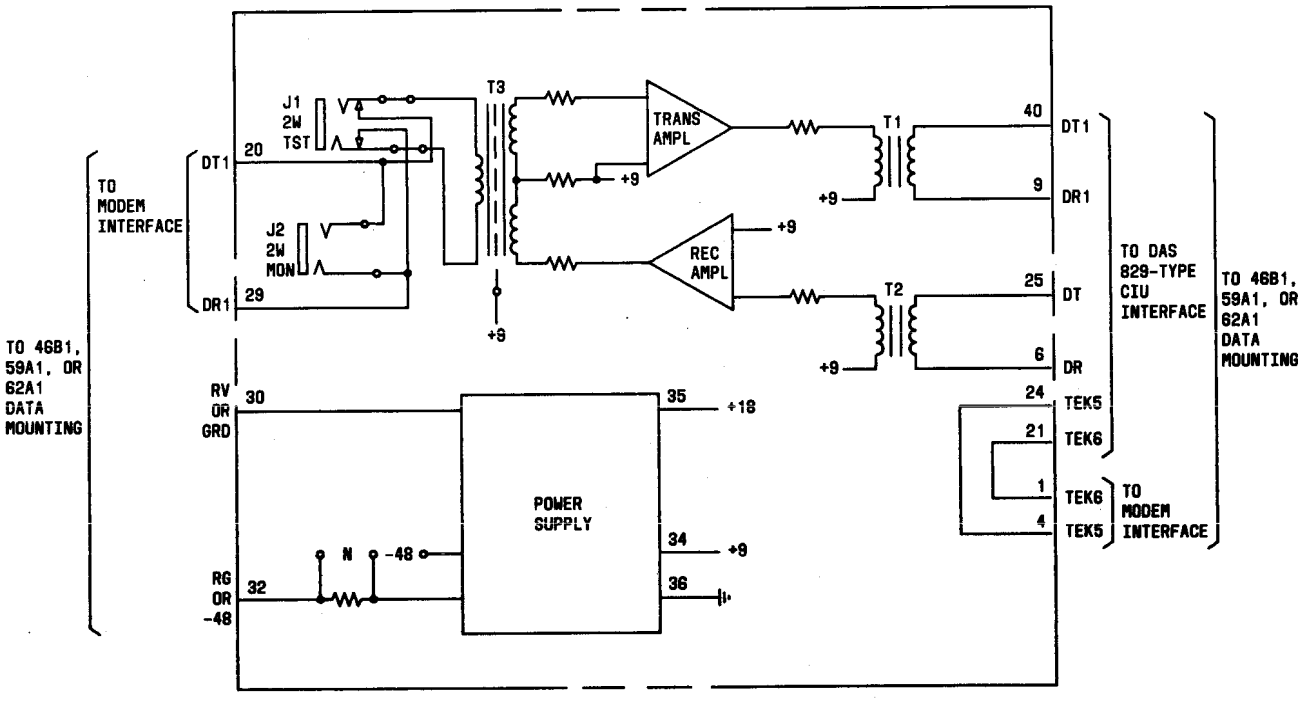


Fig. 61—48G1 Data Unit—Functional Diagram

provides a 24-Vac input to the bridge rectifier power supply. Overcurrent protection for each data unit is provided by fuses F1 through F8 in the bridge rectifier output circuit. Overcurrent protection for the transformer is provided by fuse F9 in the transformer input circuit.

E. 59A1 Data Mounting

3.240 The 59A1 data mounting provides input power for a DAS 829-type CIU, a 48A1 data unit, a 48B1, 48ER1, or 48FR1 data unit, and a 48G1 data unit that are housed in the data mounting. The CIU normally requires a 24-Vac input. Each data unit requires an unregulated dc input. The input to the data units is provided by a bridge rectifier power supply in the data mounting. A transformer supplied with the data mounting provides the 24-Vac input to the CIU and the bridge rectifier power supply. Overcurrent protection for the CIU and the data units is provided by a thermal breaker in the primary winding of the transformer.

F. 62A1 Data Mounting

3.241 The 62A1 data mounting provides input power for a DAS 829-type CIU and a 48G1 data unit that are housed in the data mounting. The CIU normally requires a 24-Vac input. The data unit requires an unregulated dc input. The input to the data unit is provided by a bridge rectifier power supply in the data mounting. A transformer supplied with the data mounting provides the 24-Vac input to the CIU and the bridge rectifier power supply. Overcurrent protection for the CIU and the data unit is provided by a thermal breaker in the primary winding of the transformer. If the CIU and the data unit require a -24 or -48 Vdc input, locally supplied power connections must be provided.

G. 48D1 Data Unit

3.242 The 48D1 data unit provides input power for a 46C1 or 46C2 data mounting and the data units that are housed in the data mounting. The 46C1 data mounting houses one or two 48B1 and up to six 48C1 data units. The 46C2 data mounting houses one or two 48B1 or 48ER1 and up to six 48C1 data units. The 46C1 or 46C2 data mounting, each 48B1, 48C1, and 48ER1 data unit, and a regulated power supply in the 48D1 data unit require an unregulated dc input that is provided by a bridge rectifier power supply in the 48D1 data unit. The regulated power supply provides +12 Vdc lamp power to an 18- or 30-button key telephone set. A transformer in the 48D1 data unit provides a 24-Vac input to the bridge rectifier power supply and to the buzzer in the key telephone set. Overcurrent protection for each 48B1 or 48ER1 data unit is provided by fuses F1 and F2 in the bridge rectifier output circuit. Overcurrent protection for the 46C1 or 46C2 data mounting, the 48C1 data units, and the regulated power supply is provided by fuse F3 in the bridge rectifier output circuit. Overcurrent protection for the transformer is provided by fuse F4 in the transformer input circuit.

4. TRANSMISSION DESIGN

4.01 The following paragraphs describe the basic ground rules for determining transmission design. Typical circuit arrangements are provided.

4.02 Transmission design involves selection of the correct DAS 829-type CIU and the proper options. The basic ground rules for determining transmission design are as follows:

(a) -13 dBm0 design.

(b) The modem interface is +13 TLP (0 dBm) transmit and -3 TLP (-16 dBm) receive.

(c) Equal level loopback is always provided.

4.03 The selection of a particular DAS 829-type code is determined by transmission design with V4 repeaters. Refer to Section 852-307-101 for typical transmission design information on equalizer assignments and adjustments.

4.04 Table D provides information for the selection of DAS 829-type CIUs and options to be used with nonloaded facilities. The nonloaded repeater section to be equalized can be terminated with CIUs at both ends, or by a CIU at one end and a V4 repeater at the other end. When selecting a CIU, either one or both of the V4 repeaters, with its appropriate equalizer, can be replaced by a DAS 829-type CIU equivalent in the following situations:

- V4 in central office
- V4 in DAS 828-type CIU

- V4 in locally engineered data only service.

4.05 The following general rules apply to the selection of a DAS 829-type CIU to be used to terminate both ends of a nonloaded facility.

(a) When a 359N equalizer is specified at both ends of a nonloaded repeater section, the DAS 829A-L1 or L1A CIU (provided with the 600-ohm option) should be used at both ends.

(b) When a 359M equalizer is specified at one end and a 359N equalizer is specified at the other end, the DAS 829B-L1 or L1A CIU (150-ohm option) should be used for the 359M end and the DAS 829A-L1 or L1A CIU (600-ohm option) should be used for the 359N end. If gain is required in the receive pair, the DAS 829B-L1 or L1A CIU (600-ohm option) should be used for the 359N end.

(c) When a 359M equalizer is specified at both ends, the DAS 829B-L1 or L1A CIU (150-ohm option) should be used at both ends.

4.06 The following general rules apply to the selection of a DAS 829-type CIU to be used to terminate a nonloaded facility that is to have a CIU at one end and a V4 repeater at the other end.

(a) When a 359N equalizer is specified at both ends of a nonloaded repeater section, the DAS 829A-L1 or L1A CIU (600-ohm option) should be used at the CIU end, and a V4 repeater equipped with a 359N equalizer should be used at the other end.

(b) When a 359M equalizer is specified at one end and a 359N equalizer is specified at the other end, the DAS 829A-L1 or L1A CIU (600-ohm option) should be used at the CIU end, and a V4 repeater equipped with a 359M equalizer should be used at the other end. If gain is required in the receive pair, the DAS 829B-L1 or L1A CIU (600-ohm option) should be used for the 359N equalizer at the CIU end.

(c) When a 359M equalizer is specified at both ends, the DAS 829B-L1 or L1A CIU (150-ohm option) should be used at the CIU end and a V4 repeater equipped with a 359M equalizer should be used at the other end.

4.07 The following general rules apply to a long loaded facility:

(a) When the facility can be equalized through the use of a 359A equalizer, the DAS 829C-L1 or L1A CIU (359A option) should be used at the CIU end.

(b) When the facility can be equalized through the use of a 359K equalizer, the DAS 829C-L1 or L1A (359K option) should be used at the CIU end.

4.08 The equalization of loaded cable is determined by the following steps:

(a) Refer to Section 852-307-101 to determine the type of equalizer required for the cable end section in question.

TABLE D

SELECTION OF DAS 829-TYPE CIU—NONLOADED LOOPS*

V4 REPEATER EQUIPPED WITH	NO RECEIVE GAIN REQUIRED	RECEIVE GAIN REQUIRED
359N	829A-L1 or L1A (600 Option)	829B-L1 or L1A (600 Option)
359M	829B-L1 or L1A (150 Option)	829B-L1 or L1A (150 Option)
359A	829C-L1 or L1A†	829C-L1 or L1A*

* The 359M and 359N are common equalizers providing 150- and 600-ohm line termination, respectively. Equivalent equalizers providing 150- or 600-ohm line termination should also use the DAS 829-type CIU.

† A, B, C, D option as required.

(b) Refer to Table E for the DAS 829-type CIU providing equalization capabilities equivalent to the equalizer specified by the V4 practices.

4.09 Table F illustrates the procedure in paragraph 4.08. As an example, assume the end section to be equalized is 38 kilofeet of 19H88 HC cable. Table F shows that from zero to 42 kilofeet of 19H88 HC cable can be equalized with a 359A equalizer having the screws designated A1, A2, A3, A4, B3, C1, C2, C3, and C4 in the "screw down" position and the remaining screws in the "screw up" position. This configuration can be provided (see Table E) by a DAS 829C-L1 or L1A CIU having the 359A option and the A1, A2, A3, A4, B3, C1, C2, C3, and C4 options provided. The other equalizer options remain in their storage positions.

4.10 When Table F indicates a screw code as a "screw down" position, the DAS 829C-L1 or L1A CIU should be provided with a strap that corresponds to the screw code. When Table F indicates a screw code as a "screw up" position, the DAS 829C-L1 or L1A CIU strap for that code must remain in its storage position.

TABLE E

SELECTION OF DAS 829-TYPE CIU–LOADED LOOPS*

V4 REPEATER EQUIPPED WITH	NO RECEIVE GAIN REQUIRED	RECEIVE GAIN REQUIRED
359E	829A-L1 or L1A (1200 Option)	829B-L1 or L1A (1200 Option)
359J	829A-L1 or L1A (1200 Option)	829B-L1 or L1A (1200 Option)
359A	829C-L1 or L1A (359A Option)†	829C-L1 or L1A (359A Option)†
359K	829C-L1 or L1A (359K Option)†	829C-L1 or L1A (359K Option)†

* The 359E and 359J are common equalizers providing 1200-ohm line termination. Equivalent equalizers providing 1200-ohm line termination should also use the DAS 829-type CIU.

† A, B, C, D option as required.

TABLE F

PRESCRIPTION ADJUSTMENTS AND COMPONENT VALUES OF
359A AND 359D EQUALIZERS FOR CABLE END SECTIONS 1500 TO 4500 FEET

19H88 HC CABLE									
Cable Length in Kilofeet*				0 to 42	60	78	96	114	132	150
Cable Length in Miles*				0 to 8.0	11.4	14.8	18.2	21.6	25.0	28.4
Screw Designation			Screw Code							
HF	IN	Resistance	A1	•	•	•	•	•	•	•
	75		A2	•	o	•	•	•	o	o
	150		A3	•	o	•	o	o	o	•
	300		A4	•	o	•	o	o	•	•
	600	Resistance	B2	o	•	•	o	o	o	o
	1200		B3	•	o	o	•	•	•	•
	2400		B4	o	•	•	•	•	•	•
LF	0.25	Capacitance	C1	•	o	•	o	•	o	o
	0.50		C2	•	•	o	o	•	•	•
	1.0		C3	•	o	o	o	•	•	•
	2.0		C4	•	•	•	•	o	o	o
	250	Resistance	D1	o	o	o	•	•	•	•
	500		D2	o	o	o	o	•	•	•
	1000		D3	o	o	o	o	o	o	o
	2000		D4	o	o	o	o	o	o	o
1200-Ohm Insertion Loss (dB) of Cable at 1 kHz				0	3.4	4.8	6.8	7.7	9.3	10.6	12.1
Loss of Equalizer (dB) at 1 kHz			359D	0.9	1.4	1.9	2.2	2.2	2.5	3.0
			359A	7.1	7.6	7.1	8.6	8.4	8.7	9.2
HF Total Res			(Ohms)	3000	1725	1200	1050	1050	825	675
LF Total Cap.			(μF)	3.75	2.50	2.25	2.0	1.75	1.50	1.50
LF Total Res			(Ohms)	3750	3750	3750	3500	3000	3000	3000

* For an exact cable length shown at the top of the table, use the adjustment for the shorter lengths.

Example: For 60 kft, use the adjustment for the range 42 to 60 kft.

o Indicates "screw up" (3 full turns)

• Indicates "screw down"

5. REFERENCES

5.01 Additional information concerning the DAS 829-type CIU and the supplemental data units and data mountings is contained in the following publications:

SECTION	TITLE
314-410-100	Voice Bandwidth Private Line Data Circuits—Description
314-410-300	Voice Bandwidth Private Line Data Circuits—Maintenance
314-410-500	Voice Bandwidth Private Line Data Circuits—Tests and Requirements
314-821-100	Data Systems—Central Office—406A Tone Generator—Description
314-821-200	Data Systems—Central Office—406A Tone Generator—Installation and Connections
314-821-500	Data Systems—Central Office—406A Tone Generator—Test Procedures
332-104-500	V4-Type Repeaters—Initial Line-Up
332-116-201	Strapping Charts for 359A and 359D Equalizers or 4182C Network
461-200-102	Adapters—148, 149, 153, and 3-Way Bridging Types—Identification
461-604-100	Connecting Blocks 66-Type—Tools, Terminating, Adapters, and Maintenance
463-140-100	Equipment Cabinets and Apparatus Mountings—Installation
590-010-200	Data Sets and Data Access Arrangements—General Installation and Connection Information
590-010-201	Data Sets—Multiple Installation Information
590-100-131	44A1 Data Unit—Tone Detector—Description
590-100-134	48-Type Data Units—Identification
590-102-134	44A1 Data Mounting—Identification
590-102-135	45A1 Data Mounting—Identification
590-102-136	46-Type Data Mountings—Identification
590-102-144	59A1 Data Mounting—Identification
590-102-164	62A1 Data Mounting—Identification
598-080-100	Data Auxiliary Set 828A—Description and Operation
598-080-101	Data Auxiliary Set 828C—Description and Operation
598-080-200	Data Auxiliary Set 828A—Installation and Connections
598-080-201	Data Auxiliary Set 828C—Installation and Connections
598-080-500	Data Auxiliary Set 828A—Maintenance and Test Procedures
598-080-501	Data Auxiliary Set 828C—Maintenance and Test Procedures
598-082-200	Data Auxiliary Set 829-Type—Channel Interface Units—Voiceband Private Line Channels—Installation and Connections
598-082-500	Data Auxiliary Set 829-Type—Channel Interface Units—Voiceband Private Line Channels—Maintenance and Test Procedures
852-307-101	V4 Telephone Repeaters—Engineering—Message Circuits
856-200-200	Equalizer Selection Programs Deldis and Delman for the GE-235 Time Sharing Computer
880-420-100	Private Line Data Circuits—Voice Bandwidth General Design Information

5.02 Detailed information concerning the DAS 829-type CIU and the supplemental data units and data mountings is contained in CD- and SD-1D247-01.

DATA AUXILIARY SET 829-TYPE
CHANNEL INTERFACE UNITS
VOICEBAND PRIVATE LINE CHANNELS
INSTALLATION AND CONNECTIONS

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1. GENERAL

1.01 This section contains information and instructions for the installation and connection of data auxiliary set (DAS) 829-type and the supplementary data units and data mountings. This section does not cover the installation of modems used in conjunction with the DAS and the supplementary apparatus.

1.02 This section is reissued to add information on the 48ER1, 48FR1, and 48G1 data units and the 44A2, 46A2, 46C2, 59A1, and 62A1 data mountings. Since this reissue is a general revision, arrows normally used to indicate changes have been omitted.

1.03 The DAS 829-type functions as a channel interface unit (CIU) to provide a prewired

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Bell System except under written agreement

and tested standard termination for 4-wire private line voiceband data channels. Basic station arrangements use the DAS 829-type CIU to provide 4-wire data only service. Other station arrangements use the DAS 829-type CIU and the supplementary apparatus to provide 4-wire data with alternate voice, dial backup, and switched dial backup service. Two-wire data only and data with alternate voice service are also provided.

1.04 A choice of six codes for the DAS 829-type CIU provides proper termination of channels having various loop facilities.

- DAS 829A-L1 or L1A for short loops.
- DAS 829B-L1 or L1A for longer nonloaded loops.
- DAS 829C-L1 or L1A for longer loaded loops.

1.05 A choice of seven data units combined with a DAS 829-type CIU provides the following features:

- 48A1 data unit for 4-wire or 2-wire alternate voice service.
- 48B1 data unit for 4-wire dial backup service with manual dialing.
- 48C1 data unit (switching matrix) for switching any one of four 4-wire modems to either one of two 4-wire dial backup channels.
- 48D1 data unit (interface adapter) for use with a 46C-type and/or 46B1 data mounting to concentrate control leads in an 18- or 30-button CALL DIRECTOR® key telephone set.
- 48ER1 data unit for 4-wire dial backup service with manual or automatic dialing. This data unit complies with all requirements of the FCC Registration Program. The registration number for the 48ER1 data unit is AS593M-67751-PC-E. The ringer equivalence number for each line is 0.5A.
- 48FR1 data unit for 4-wire dial backup service with automatic answering. This data unit complies with all requirements of the FCC Registration Program. The registration number for the 48FR1 data unit is AS593M-67757-PC-E. The ringer equivalence number for each line is 0.5A.
- 48G1 data unit for 2-wire to 4-wire conversion.

1.06 A choice of seven data mountings house single or multiple arrangements of DAS 829-type CIUs and/or 48-type data units without any change in wiring.

- 44A1 or 44A2 data mounting houses one DAS 829-type CIU.
- 45A1 data mounting houses one DAS 829-type CIU or one DAS 829-type CIU with the following data units: one 48A1 or 48B1, or one 48A1 and one 48B1.
- 46A1 or 46A2 data mounting houses up to eight DAS 829-type CIUs.
- 46B1 data mounting houses up to eight 48A1 or 48G1 data units.
- 46C1 data mounting houses one or two 48B1 data units and up to six 48C1 data units.
- 46C2 data mounting houses one or two 48B1 or 48ER1 data units and up to six 48C1 data units.
- 59A1 data mounting houses one DAS 829-type CIU or one DAS 829-type CIU with the following data units: one 48A1, 48B1, 48ER1, 48FR1, or 48G1; or one 48A1 and one 48B1, 48ER1, or 48G1.
- 62A1 data mounting houses one DAS 829-type CIU or one DAS 829-type CIU and one 48G1 data unit.

1.07 The 44A-type, 45A1, 59A1, and 62A1 data mountings can be mounted on a desk, shelf, or wall. The 46A-type, 46B1, and 46C-type data mountings and the 48D1 data unit can be mounted on 19- or 23-inch relay racks. Mounting in KS-20018-type cabinets is recommended. Descriptive information on KS-20018-type cabinets is provided in Section 590-010-201. The DAS 829-type CIUs and the 48A1, 48B1, 48C1, 48ER1, 48FR1, and 48G1 data units consist of plug-in circuit packs that are housed in the appropriate data mountings.

2. INSTALLATION

2.01 No special tools are required to install the data mountings and data units.

2.02 The data mountings and data units are to be installed in accordance with the general instructions provided in Section 590-010-200.

A. 44A-Type, 45A1, 59A1, and 62A1 Data Mountings

2.03 The 44A-type, 45A1, 59A1, or 62A1 data mounting can be used as a free standing unit on a desk or shelf or it can be wall-mounted as described in paragraph 2.04. If the 44A-type, 45A1, 59A1, or 62A1 data mounting is used as a free standing unit, omit (1) through (3) of paragraph 2.04.

2.04 The 44A-type, 45A1, 59A1, or 62A1 data mounting is wall-mounted by using a 193A backboard (Fig. 1) as follows:

(1) Install four No. 6 binding-head studs (supplied with the backboard) into the threaded holes in the data mounting.

(2) Install the backboard in the desired location by using four wood screws in the outer flanges.

Note: The backboard should be installed with the elevated tab pointing downward.

(3) Install the data mounting on the backboard by placing the binding-head studs in the slotted holes in the backboard and sliding the data mounting into position.

(4) Install the required plug-in option straps on the required circuit pack or packs, as specified on the service order.

(5) Install the wall-mounted transformer that is supplied with the data mounting. This transformer is a KS-21239-L1 or L4 for the 44A-type or 62A1 data mounting and a KS-21362-L1 for the 45A1 or 59A1 data mounting. The customer must provide a standard 3-wire, grounded 105 to 129V at 57 to 63 Hz, power receptacle that is easily accessible to the data mounting. The receptacle must not be under control of a switch.

Caution: If the receptacle has a metal cover, do not remove the center screw to mount the transformer. When this screw is removed, the metal cover can fall across the prongs of the transformer.

(6) Make all connections to the data mounting as shown on the appropriate connection diagrams, including connection of the 6-foot power cord (840807028, supplied with the data mounting) to the wall-mounted transformer. Dress of the cable connections is shown in Fig. 2 for the 44A1 data mounting, Fig. 3 for the 44A2 data mounting, Fig. 4 for the 45A1 data mounting, Fig. 5 for the 59A1 data mounting, and Fig. 6 for the 62A1 data mounting.

(7) Install the circuit pack or packs in the data mounting. Installation of the circuit packs is shown in Fig. 7 for the 45A1 data mounting, Fig. 8 and 9 for the 59A1 data mounting, and Fig. 10 for the 62A1 data mounting.

(8) Apply 117-Vac power to the data mounting and perform the installation tests, as specified in paragraphs 5.01 through 5.03.

B. 46A-Type and 46B1 Data Mountings

2.05 The 46A-type or 46B1 data mounting is rack-mounted as follows:

(1) Assemble and set up relay rack and mounting bars.

(2) Install the data mounting on the mounting bars.

(3) Make all connections to the data mounting as shown on the appropriate connection diagrams.

(4) Install the required plug-in option straps on the required circuit packs, as specified on the service order.

(5) Install the circuit packs in the data mounting.

(6) Plug the 4-foot power cord (840339907, supplied with the data mounting) into connector P2 on the rear of the data mounting.

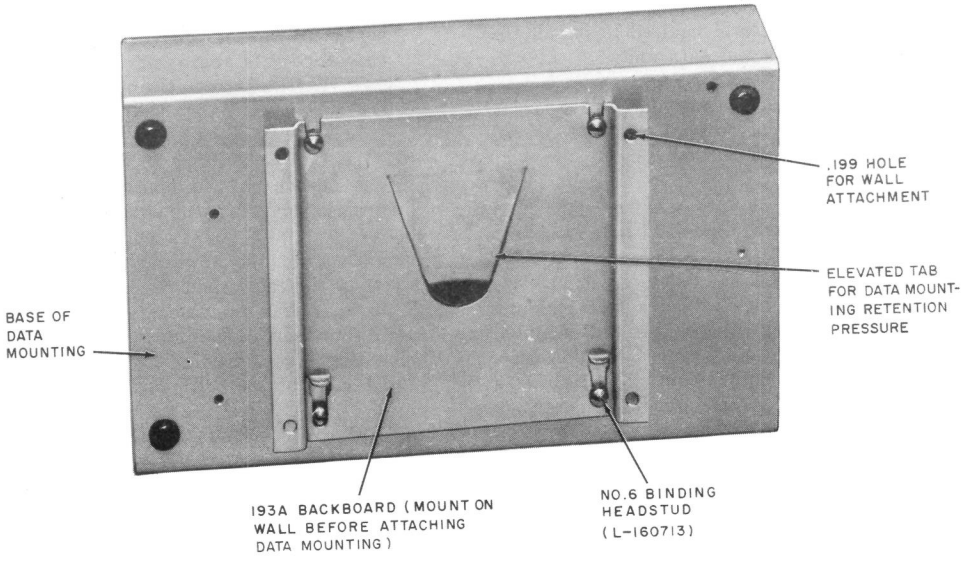


Fig. 1—44A-Type, 45A1, 59A1, or 62A1 Data Mounting Installed on 193A Backboard

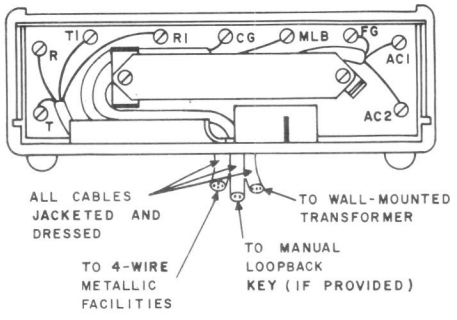


Fig. 2—44A1 Data Mounting Showing Dress of Cable Connections

(7) Apply 117-Vac power to the data mounting and perform the installation tests, as specified in paragraphs 5.01 through 5.03.

C. 46C-Type Data Mounting and 48D1 Data Unit

2.06 The 46C-type data mounting and 48D1 data unit are rack-mounted as follows:

(1) Assemble and set up relay rack and mounting bars.

(2) Install the 46C-type data mounting and 48D1 data unit on the mounting bars.

Note: The 48D1 data unit mounts directly under the 46C-type data mounting.

(3) Make all connections to the data mounting and data unit as shown on the appropriate connection diagrams.

(4) Install the required plug-in option straps on the required circuit packs, as specified on the service order.

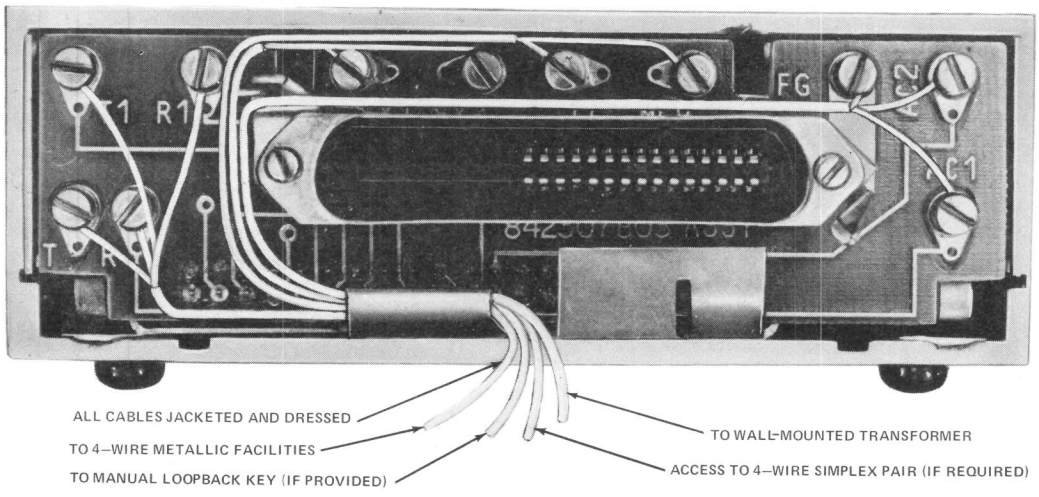


Fig. 3—44A2 Data Mounting Showing Dress of Cable Connections

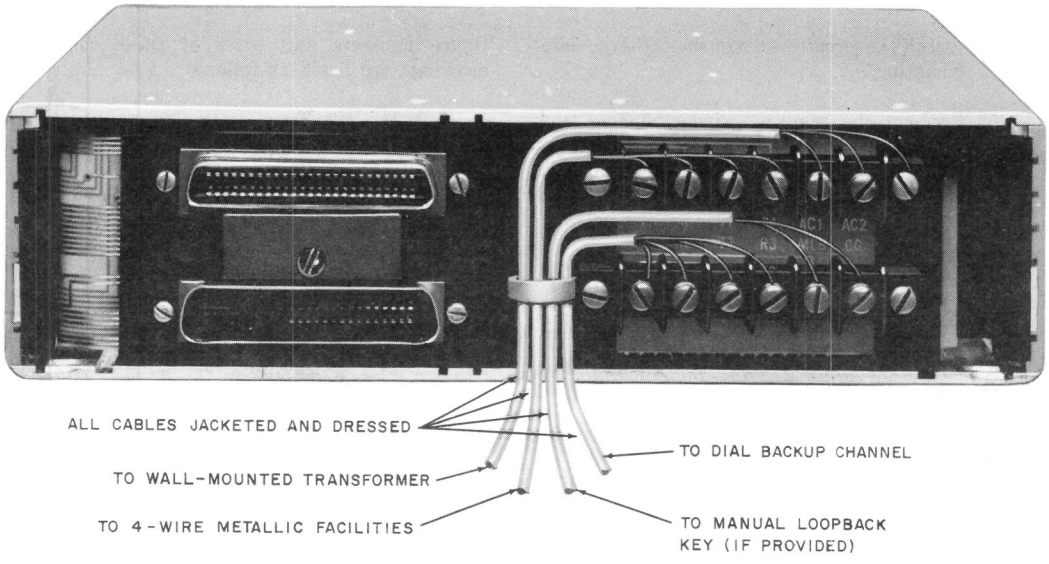


Fig. 4—45A1 Data Mounting Showing Dress of Cable Connections

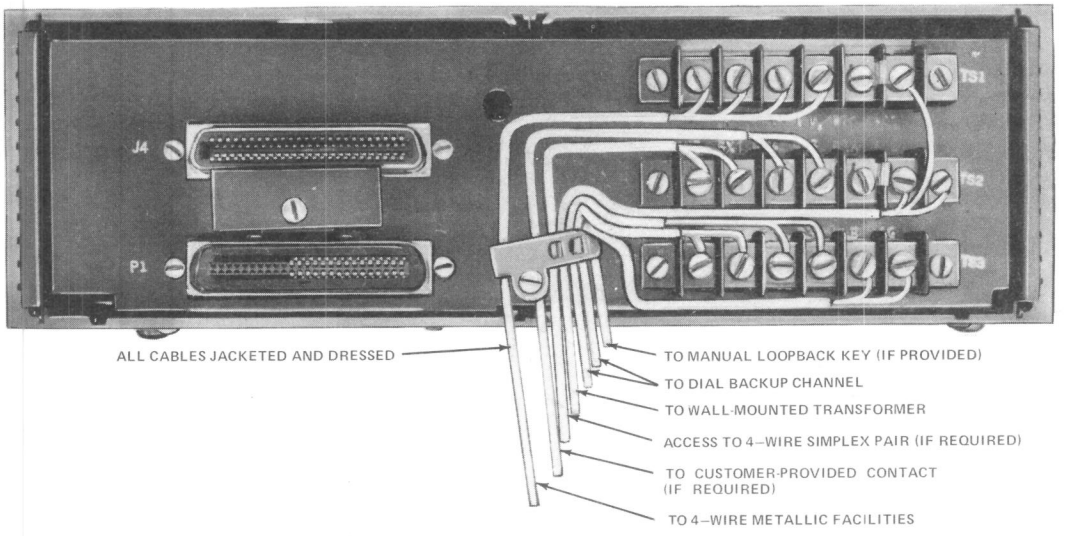


Fig. 5—59A1 Data Mounting Showing Dress of Cable Connections

(5) Install the circuit packs in the 46C-type data mounting.

(6) Perform the required wiring changes and connect the key telephone set to connectors J1 through J3 (for 18-button set) or J1 through J5 (for 30-button set) on the rear of the 48D1 data unit.

(7) Plug the 4-foot power cord (840339907, supplied with the 48D1 data unit) into connector P13 on the rear of the 48D1 data unit.

(8) Apply 117-Vac power to the 48D1 data unit and perform the installation tests, as specified in paragraphs 5.01 through 5.03.

3. CONNECTIONS

A. 44A-Type, 45A1, 59A1, and 62A1 Data Mountings

3.01 Connections for the various types of service using 44A-type, 45A1, 59A1, and 62A1 data mountings are shown in Fig. 11 through 27. The figure numbers and titles of these connection drawings are listed as follows:

Fig. 11—44A-Type Data Mounting—4-Wire Data Only Service

Fig. 12—45A1 Data Mounting—4-Wire Data With Alternate Voice Service

Fig. 13—45A1 Data Mounting—4-Wire Data With 4-Wire Dial Backup Service (Manual Dialing)

Fig. 14—45A1 Data Mounting—4-Wire Data With Alternate Voice and 4-Wire Dial Backup Service (Manual Dialing)

Fig. 15—59A1 Data Mounting—4-Wire Data With Alternate Voice Service

Fig. 16—59A1 Data Mounting—2-Wire Data With Alternate Voice Service

Fig. 17—59A1 Data Mounting—4-Wire Data With 4-Wire Dial Backup Service (Manual Dialing)

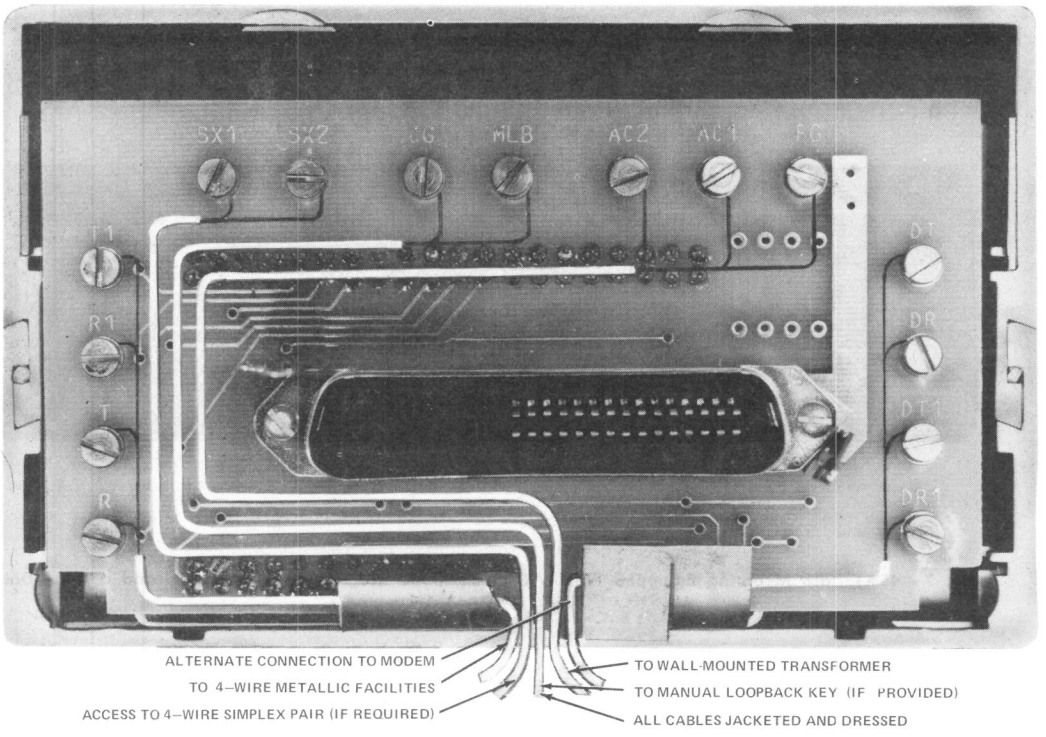


Fig. 6—62A1 Data Mounting Showing Dress of Cable Connections

Fig. 18—59A1 Data Mounting—4-Wire Data With Alternate Voice and 4-Wire Dial Backup Service (Manual Dialing)

Fig. 19—59A1 Data Mounting—4-Wire Data With 4-Wire Dial Backup Service (Automatic Dialing)

Fig. 20—59A1 Data Mounting—4-Wire Data With 4-Wire Dial Backup Service (Automatic Answering)

Fig. 21—59A1 Data Mounting—Connections to 43A or 53A Station Dial

Fig. 22—59A1 Data Mounting—Connections to DAS 801CR-L1/2 ACU

Fig. 23—62A1 Data Mounting—2-Wire Data Only Service

Fig. 24—44A-Type, 45A1, 59A1, or 62A1 Data Mounting—Multiple Arrangement

Fig. 25—Customer-Provided Modem—4-Wire Data Service (With or Without Alternate Voice Service)

Fig. 26—Customer-Provided Modem—2-Wire Data Service (With or Without Alternate Voice Service)

Fig. 27—Customer-Provided Modem—4-Wire Data With 4-Wire Dial Backup Service (With or Without Alternate Voice Service)

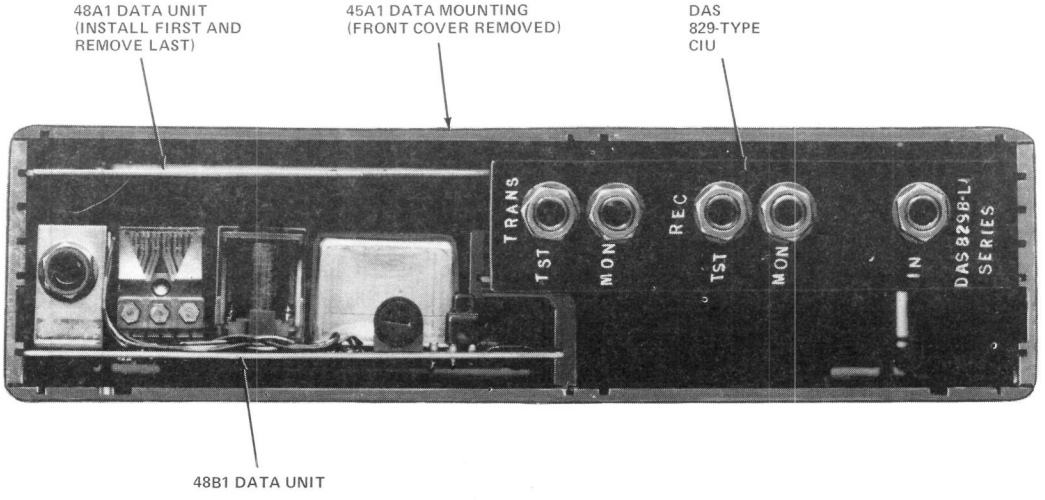


Fig. 7—45A1 Data Mounting Equipped With a DAS 829-Type CIU, a 48A1 Data Unit, and a 48B1 Data Unit

B. 46A-Type and 46B1 Data Mountings

3.02 Connections for the various types of service using 46A-type and 46B1 data mountings are shown in Fig. 28 through 38. The figure numbers and titles of these connection drawings are listed as follows:

Fig. 28—46A-Type Data Mounting—4-Wire Data Only Service

Fig. 29—46A-Type and 46B1 Data Mountings—2-Wire Data Only Service

Fig. 30—46A-Type and 46B1 Data Mountings—4-Wire Data With Alternate Voice Service

Fig. 31—46A-Type and 46B1 Data Mountings—2-Wire Data With Alternate Voice Service

Fig. 32—46A-Type Data Mounting—Connections to 4-Wire Metallic Facilities

Fig. 33—Data Set 202T—4-Wire Multiple Arrangement

Fig. 34—Data Set 202T—2-Wire Multiple Arrangement

Fig. 35—Data Set 201C, 202D, 202T, 208A, or 209A—4-Wire Multiple Arrangement

Fig. 36—Data Set 201C or 202T—2-Wire Multiple Arrangement

Fig. 37—Customer-Provided Modem—Multiple Arrangement Using KS-21253-L1 Adapter

Fig. 38—Customer-Provided Modem—Multiple Arrangement Using 66E-Type Connecting Block

C. 46C-Type Data Mounting and 48D1 Data Unit

3.03 The 46C-type data mounting and the 48D1 data unit provide the interconnection facilities for a variety of multiple arrangements, as described in paragraphs 3.07 through 3.25.

Note: The 48D1 data unit must be used with the 46C-type data mounting.

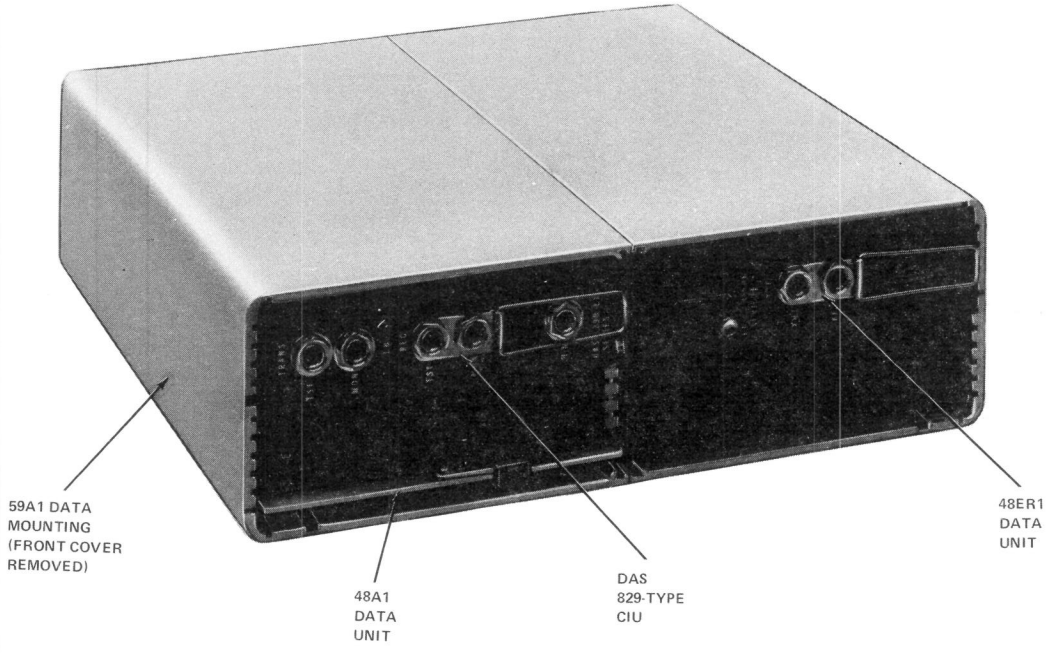


Fig. 8—59A1 Data Mounting Equipped With a DAS 829-Type CIU, a 48A1 Data Unit, and a 48ER1 Data Unit

3.04 The 46C1 data mounting (Fig. 39) houses one or two 48B1 data units and up to six 48C1 data units. The 46C2 data mounting (Fig. 40) houses one or two 48B1 or 48ER1 data units and up to six 48C1 data units. The 46C1 and 46C2 data mountings are the same except a protective cover has been added at the front of the 46C2 data mounting. A cable and connector J1 attached to each 48C1 data unit permits direct connection to connectors P4 through P9 on the 48D1 data unit.

> ***Note:*** The 46C1 data mounting and the 48B1 data unit must not be used in registered arrangements.

3.05 The backplane of the 46C-type data mounting (Fig. 41) contains eight 50-pin connectors and eight screw terminals. Connector P1 permits direct connection to connector J6 on the 48D1 data unit. Connectors P2 through P4 permit connection to a maximum of twenty-three modems. To provide 4-wire data with switched 4-wire dial backup service, connectors J10 through J12 permit connection to up to three 46A-type data mountings containing a maximum of twenty-three DAS 829-type CIUs. To provide 4-wire data with alternate voice and switched 4-wire dial backup service, connectors J10 through J12 permit connection to up to three 46B1 data mountings containing a maximum of twenty-three 48A1 data units. Connector J1 or the eight screw terminals permit connection to one or two dial backup channels consisting of two 2-wire switched network lines per channel.

> ***Note:*** Connector J1 must not be used in registered arrangements.

3.06 The backplane of the 48D1 data unit (Fig. 41) contains twelve 50-pin connectors. Connectors P1 through P3 permit connection to up to three 46B1 data mountings containing a maximum of twenty-three 48A1 data units. Connectors P11 and P12 permit concentrated connection to a

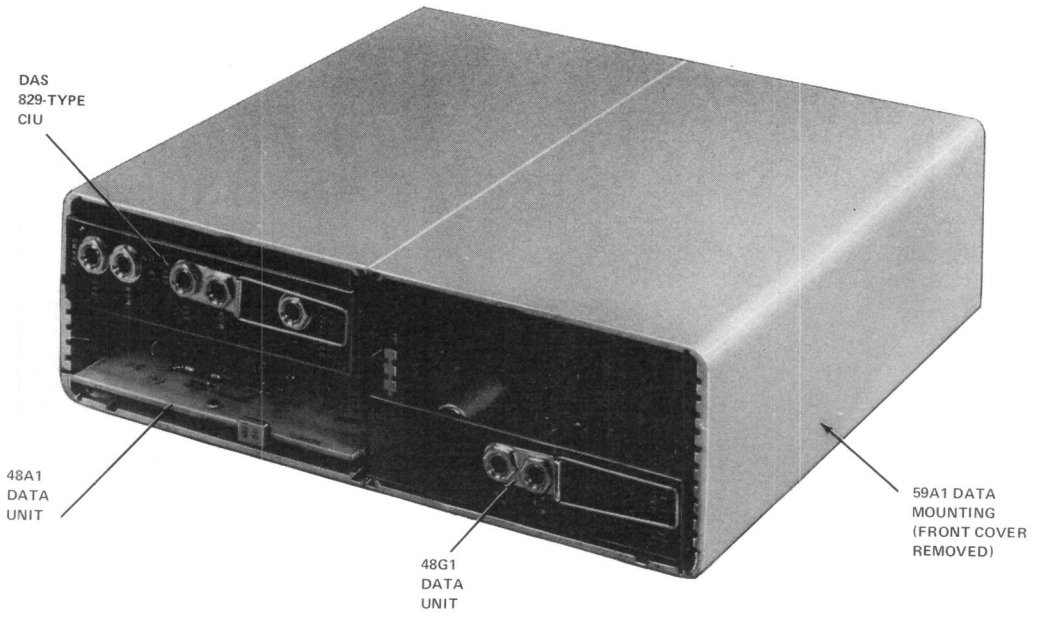


Fig. 9—59A1 Data Mounting Equipped With a DAS 829-Type CIU, a 48A1 Data Unit, and a 48G1 Data Unit

maximum of twenty-three modems to provide dial backup status to modems requiring this information. Connector P10 is provided for future use. Power cord connector P13 is located on the rear of the 48D1 data unit adjacent to the backplane. Connector J6 permits direct connection to connector P1 on the 46C-type data mounting. Connectors J1 through J3 permit connection to an 18-button CALL DIRECTOR key telephone set. Connectors J1 through J5 permit connection to a 30-button CALL DIRECTOR key telephone set. The 18- or 30-button CALL DIRECTOR key strip should be labeled as shown in Table A.

D. Multiple Arrangements

3.07 The DAS 829-type CIU and the 48A1, 48B1, 48C1, and 48ER1 data units are used with the 46C-type data mounting and the 48D1 data unit to provide a variety of multiple 4-wire data only (FD) and/or 4-wire data with alternate voice (FDA) arrangements with or without switched 4-wire dial backup service. Connections for these types of multiple arrangements are shown in Fig. 33, 35, 37, 38, and 42 through 47. The figure numbers and titles of these connection drawings are listed as follows:

Fig. 33—Data Set 202T—4-Wire Multiple Arrangement

Fig. 35—Data Set 201C, 202D, 202T, 208A, or 209A—4-Wire Multiple Arrangement

Fig. 37—Customer-Provided Modem—Multiple Arrangement Using KS-21253-L1 Adapter

Fig. 38—Customer-Provided Modem—Multiple Arrangement Using 66E-Type Connecting Block

Fig. 42—Multiple 4-Wire FD or FDA Arrangement With Switched 4-Wire Dial Backup Service for 11 Modems or Less



Fig. 10—62A1 Data Mounting Equipped With a DAS 829-Type CIU and a 48G1 Data Unit

Fig. 43—Multiple 4-Wire FD or FDA Arrangement With Switched 4-Wire Dial Backup Service for 23 Modems or Less

Fig. 44—Multiple 4-Wire FD and FDA Arrangements With and Without Switched 4-Wire Dial Backup Service

Fig. 45—46C-Type Data Mounting—Connections to DDD Lines

Fig. 46—Multiple Arrangement Showing Cable Length Restrictions

Fig. 47—Multiple Arrangement Using KS-21253-L4 Adapter for Dial Backup Status to Modems

If none of the FD and FDA arrangements require switched dial backup service, the arrangements should be connected as given in paragraph 3.02.

Design Rules

3.08 The following design rules should be used to determine the equipment required to provide a given multiple arrangement.

(1) Determine the number of FD and/or FDA arrangements to be provided with switched dial backup service. When the number of arrangements is 11, or less, an 18-button CALL DIRECTOR key telephone set is used to control the service. When the number of arrangements is 23, or less, a 30-button CALL DIRECTOR key telephone set is used to control the service. When the number of arrangements is greater than 23, more than one CALL DIRECTOR is required; for example, 46 FDA arrangements with switched dial backup service require two separate CALL DIRECTOR arrangements.

(2) Determine the number of FDA arrangements to be provided without switched dial backup

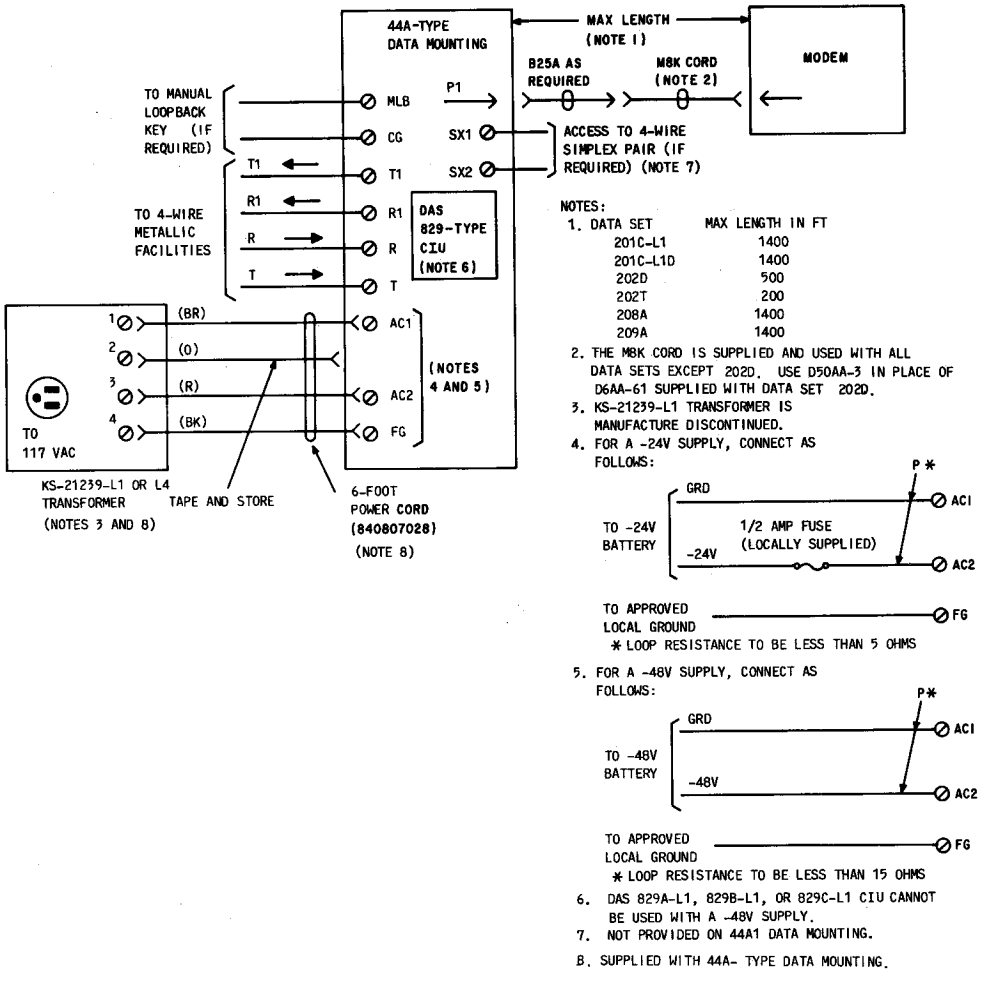
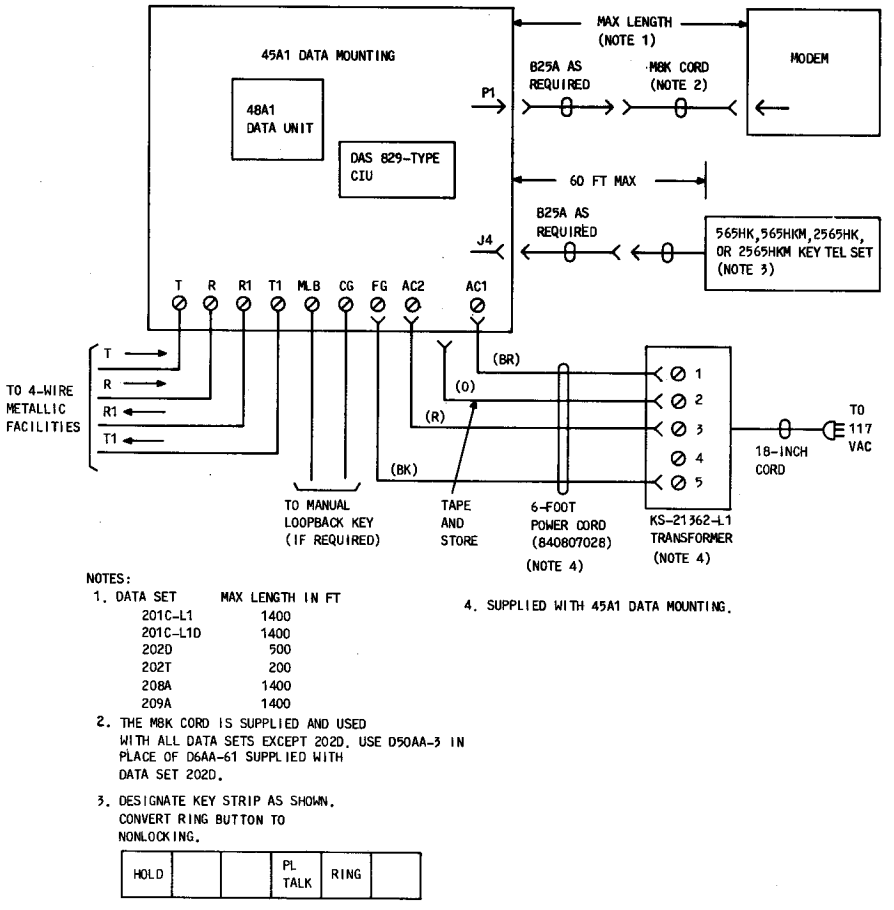


Fig. 11—44A-Type Data Mounting—4-Wire Data Only Service

service. When possible, concentrate the control for the FDA arrangements in the CALL DIRECTOR used to control the switched dial backup service. Table B provides guidelines for using a 30-button CALL DIRECTOR to control FDA arrangements with and without switched dial backup service. When control of the FDA arrangements cannot be concentrated in the CALL DIRECTOR, or when no switched dial backup service is provided, the FDA arrangements should be connected as given in paragraph 3.02.

(3) Determine the number of FD arrangements to be provided without switched dial backup service. These arrangements do not require CALL DIRECTOR control and normally are connected as given in paragraph 3.02. However, when FDA arrangements are provided without switched dial backup service, there may be connections available for FD arrangements. For example, if 12 FDA arrangements are required, the multiple arrangement (two pairs of properly interconnected 46A-type and 46B1 data mountings)



NOTES:

1. DATA SET — MAX LENGTH IN FT

DATA SET	MAX LENGTH IN FT
201C-L1	1400
201C-L1D	1400
202D	500
202T	200
208A	1400
209A	1400

2. THE M8K CORD IS SUPPLIED AND USED WITH ALL DATA SETS EXCEPT 202D. USE D50AA-3 IN PLACE OF D6AA-61 SUPPLIED WITH DATA SET 202D.

3. DESIGNATE KEY STRIP AS SHOWN. CONVERT RING BUTTON TO NONLOCKING.

HOLD			PL TALK	RING	

4. SUPPLIED WITH 45A1 DATA MOUNTING.

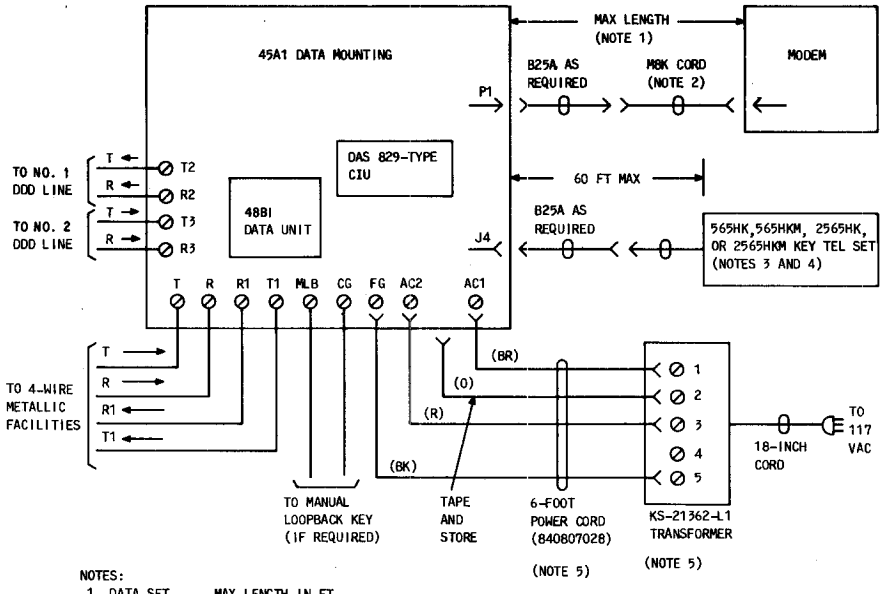
Fig. 12—45A1 Data Mounting—4-Wire Data With Alternate Voice Service

provides for 16 FDA arrangements. The four connections not used for FDA arrangements can be used for FD arrangements.

3.09 Two multiple arrangements are used to explain the above design rules. The examples chosen illustrate the interconnections required between the 48C1 and 48D1 data units and the 46-type data mountings.

First Example—23 FDA Arrangements With Switched Dial Backup Service

3.10 The first example (Fig. 43) is a multiple arrangement consisting of 23 FDA arrangements with switched dial backup service to either one of two dial backup channels. Design rule No. 1 indicates that one 30-button CALL DIRECTOR can be used to control the multiple arrangement. Therefore, for this example, the 631DAM or the



NOTES:

1. DATA SET — MAX LENGTH IN FT

DATA SET	MAX LENGTH IN FT
201C-L1	1400
201C-L1D	1400
202D	500
202T	200
208A	1400
209A	1400

2. THE M8K CORD IS SUPPLIED AND USED WITH ALL DATA SETS EXCEPT 202D. USE D50AA-3 IN PLACE OF D6AA-61 SUPPLIED WITH DATA SET 202D.

3. DESIGNATE KEY STRIP AS SHOWN. CONVERT REL BUTTON TO NONLOCKING.

HOLD	DDD1	DDD2			REL

4. MODIFY TEL SET AS FOLLOWS:

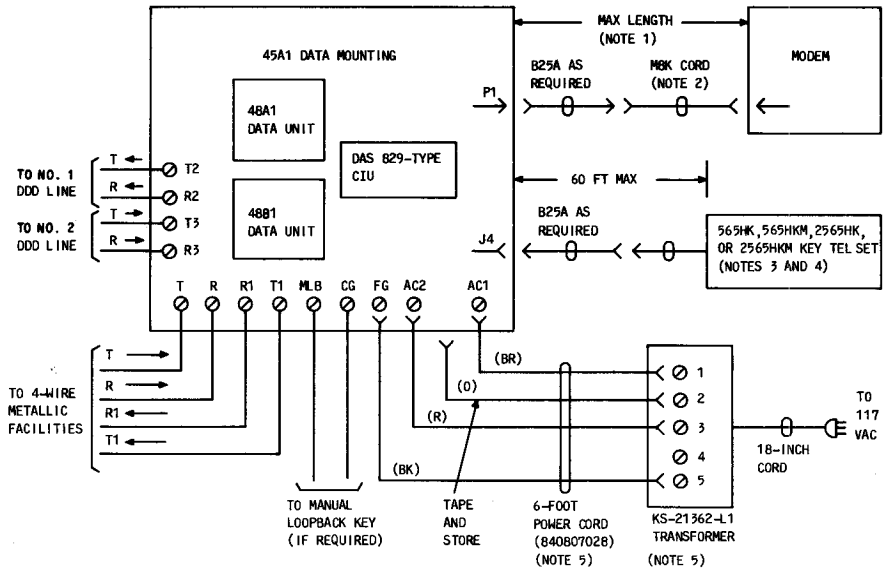
636A KEY LEADS		
COLOR	REMOVE FROM	CONNECT TO
BR	M	X
S-R	M	N
Y	M	TAPE AND STORE
O-BK	N	M

5. SUPPLIED WITH 45A1 DATA MOUNTING.

Fig. 13—45A1 Data Mounting—4-Wire Data With 4-Wire Dial Backup Service (Manual Dialing)

2631DAM 30-button CALL DIRECTOR key telephone set, with the wiring modifications given in Fig. 43, is used to control the multiple arrangement. The CALL DIRECTOR is connected to connectors J1 through J5 of the 48D1 data unit. Design rules No. 2 and 3 do not apply to this example.

3.11 The 23 FDA arrangements are provided by interconnecting 3 pairs of 46A-type and 46B1 data mountings. The three 46A-type data mountings house the twenty-three DAS 829-type CIUs that terminate the 4-wire private lines. The three 46B1 data mountings house the twenty-three 48A1 data



NOTES:

1. DATA SET — MAX LENGTH IN FT

201C-L1	1400
201C-L1D	1400
202D	500
202T	200
208A	1400
209A	1400

2. THE M8K CORD IS SUPPLIED AND USED WITH ALL DATA SETS EXCEPT 202D. USE D50AA-3 IN PLACE OF D6AA-61 SUPPLIED WITH DATA SET 202D.

3. DESIGNATE KEY STRIP AS SHOWN. CONVERT RING AND REL BUTTONS TO NONLOCKING.

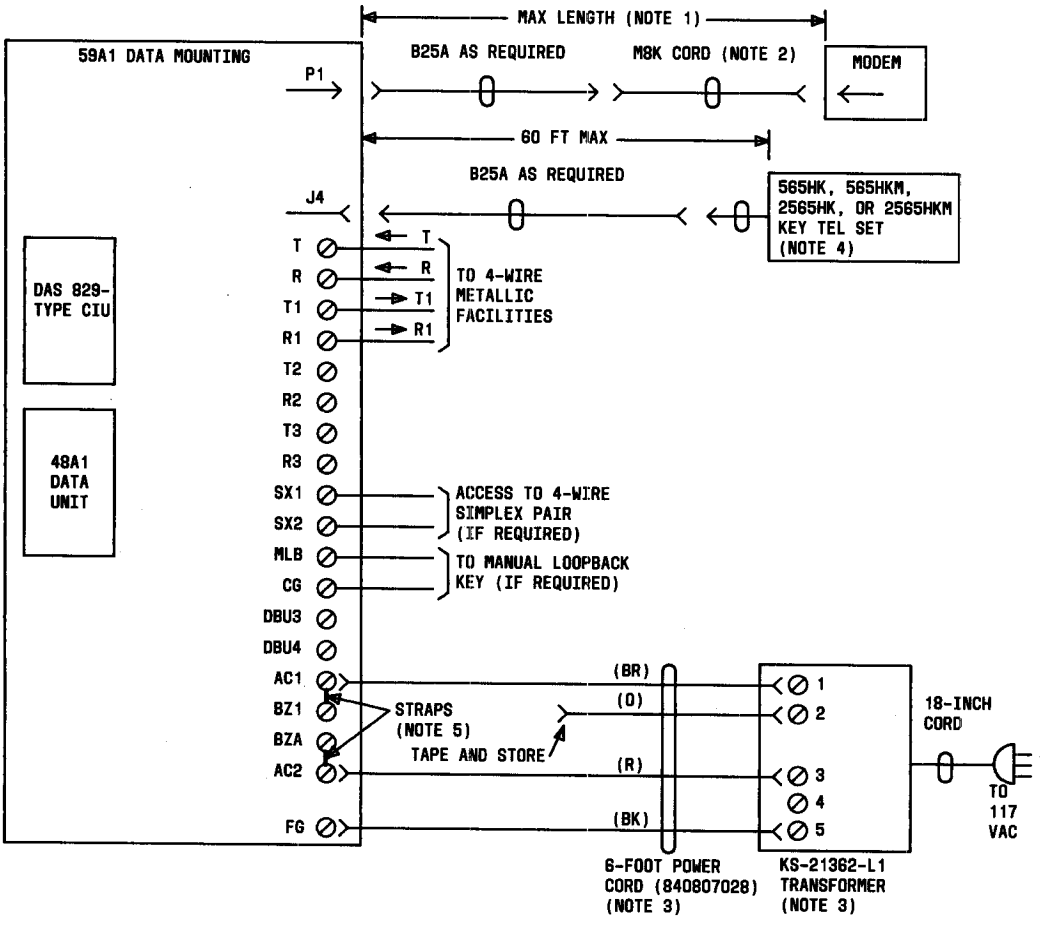
HOLD	DDD1	DDD2	PL TALK	RING	REL

4. MODIFY TEL SET AS FOLLOWS:

636A KEY LEADS		
COLOR	REMOVE FROM	CONNECT TO
BR	M	X
S-R	M	N
Y	M	TAPE AND STORE
O-BK	N	M

5. SUPPLIED WITH 45A1 DATA MOUNTING.

Fig. 14—45A1 Data Mounting—4-Wire Data With Alternate Voice and 4-Wire Dial Backup Service (Manual Dialing)



NOTES:

1. DATA SET MAX LENGTH IN FT

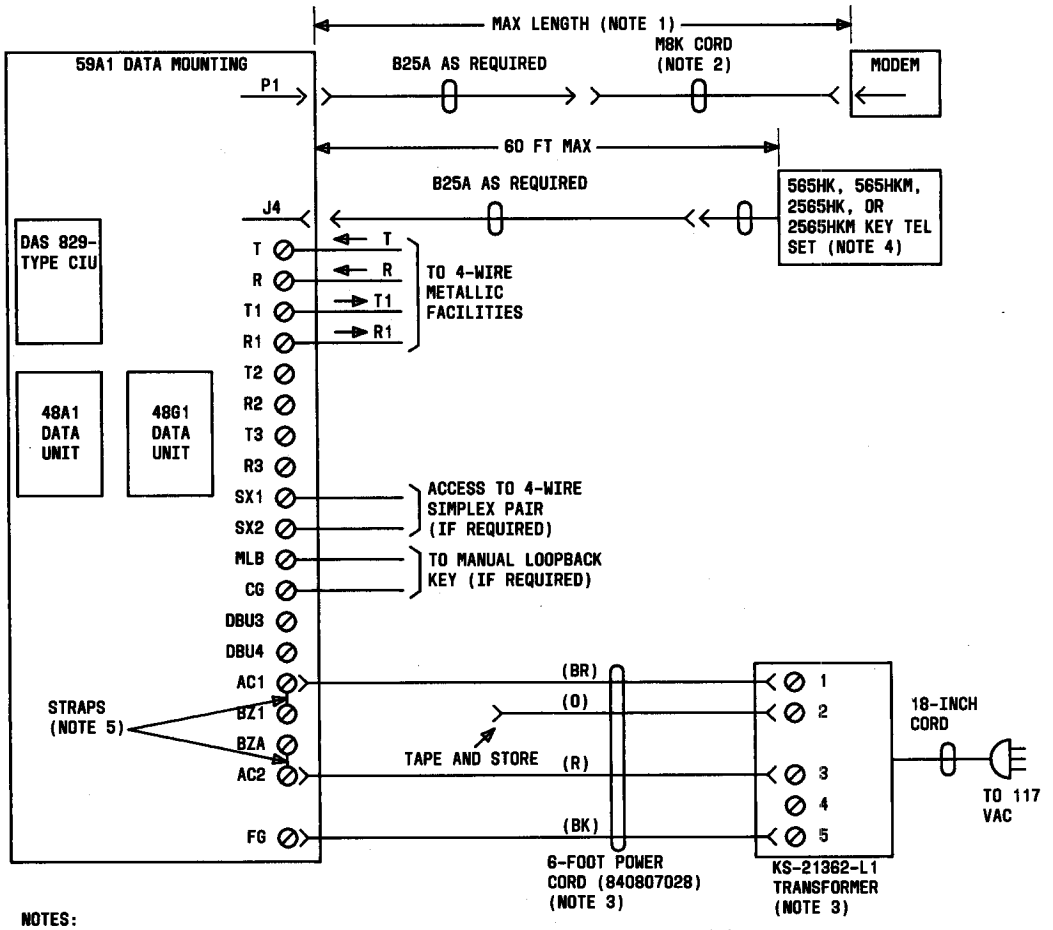
201C-L1	1400
201C-L1D	1400
202D	500
202T	200
208A	1400
209A	1400

2. THE M8K CORD IS SUPPLIED AND USED WITH ALL DATA SETS EXCEPT 202D. USE D50AA-3 IN PLACE OF D6AA-61 SUPPLIED WITH DATA SET 202D
3. SUPPLIED WITH 59A1 DATA MOUNTING
4. DESIGNATE KEY STRIP AS SHOWN. CONVERT RING BUTTON TO NONLOCKING

HOLD			PL TALK	RING		

5. STRAPS PROVIDED AS PART OF 59A1 DATA MOUNTING. DO NOT REMOVE STRAPS

Fig. 15—59A1 Data Mounting—4-Wire Data With Alternate Voice Service



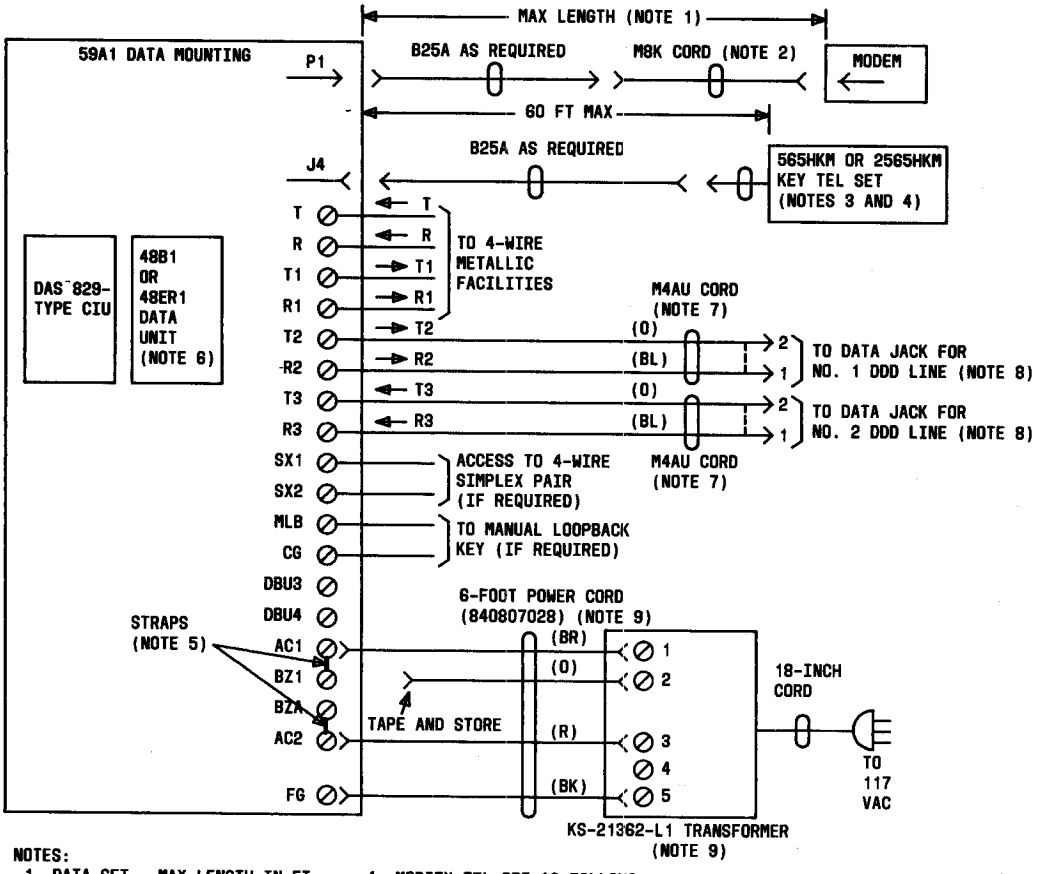
NOTES:

1. DATA SET — MAX LENGTH IN FT
   - 201C-L1 — 1400
   - 201C-L1D — 1400
   - 202T — 200
2. SUPPLIED WITH DATA SET
3. SUPPLIED WITH 59A1 DATA MOUNTING
4. DESIGNATE KEY STRIP AS SHOWN. CONVERT RING BUTTON TO NONLOCKING

HOLD			PL TALK	RING	

5. STRAPS PROVIDED AS PART OF 59A1 DATA MOUNTING. DO NOT REMOVE STRAPS

Fig. 16—59A1 Data Mounting—2-Wire Data With Alternate Voice Service



NOTES:

1. DATA SET — MAX LENGTH IN FT

201C-L1	1400
201C-L1D	1400
202D	500
202T	200
208A	1400
209A	1400

2. THE M8K CORD IS SUPPLIED AND USED WITH ALL DATA SETS EXCEPT 202D. USE D50AA-3 IN PLACE OF D6AA-61 SUPPLIED WITH DATA SET 202D
3. DESIGNATE KEY STRIP AS SHOWN. CONVERT REL BUTTON TO NONLOCKING

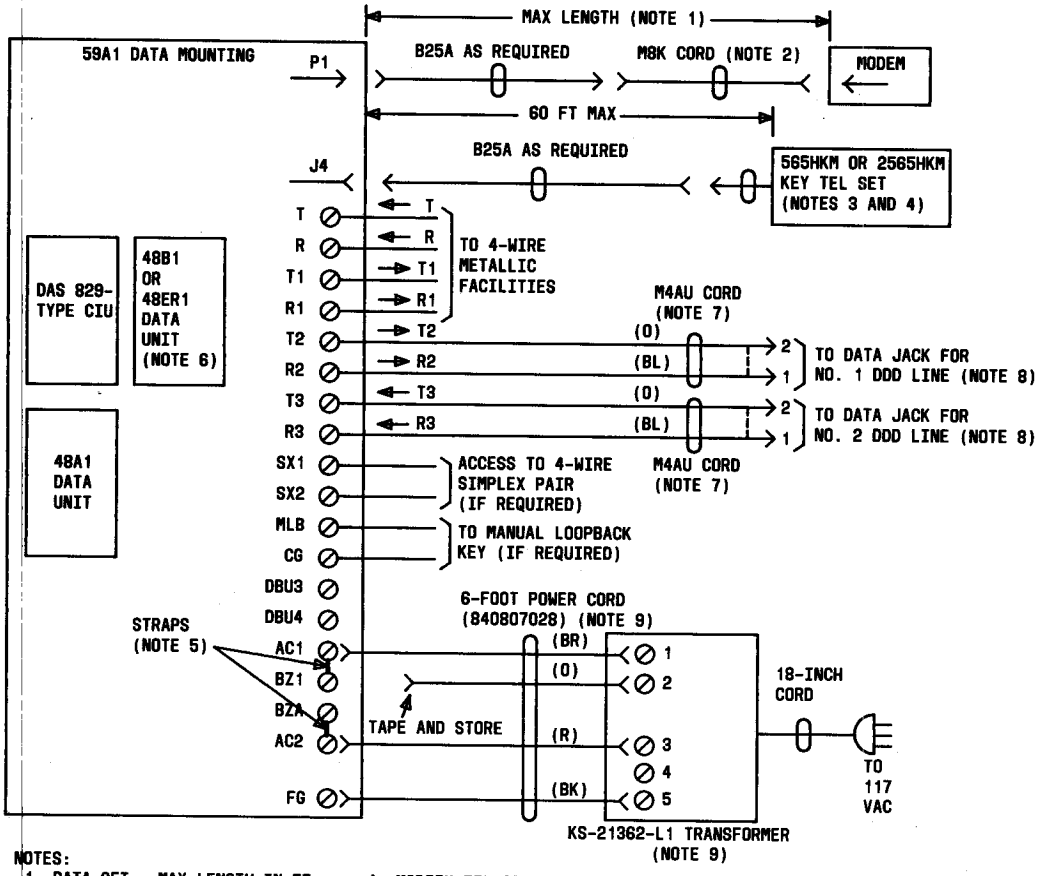
HOLD	DOD1	DOD2			REL

4. MODIFY TEL SET AS FOLLOWS:

636A KEY LEADS		
COLOR	REMOVE FROM	CONNECT TO
BR	M	X
S-R	M	N
Y	M	TAPE AND STORE
O-BK	N	M

5. STRAPS PROVIDED AS PART OF 59A1 DATA MOUNTING. DO NOT REMOVE STRAPS
6. THE 48B1 DATA UNIT CANNOT BE USED IN REGISTERED ARRANGEMENTS OR WHEN THE FAR END OF THE DIAL BACKUP CHANNEL IS EQUIPPED FOR UNATTENDED OPERATION
7. THE TWO M4AU CORDS MUST BE ORDERED SEPARATELY. TAPE AND STORE UNUSED LEADS
8. USE DATA JACK USOC RJ41S WITH SWITCH SET TO FLL. THE TWO DATA JACKS MUST BE ORDERED SEPARATELY
9. SUPPLIED WITH 59A1 DATA MOUNTING

Fig. 17—59A1 Data Mounting—4-Wire Data With 4-Wire Dial Backup Service (Manual Dialing)



NOTES:

1. DATA SET — MAX LENGTH IN FT

201C-L1	1400
201C-L1D	1400
202D	500
202T	200
208A	1400
209A	1400

2. THE M8K CORD IS SUPPLIED AND USED WITH ALL DATA SETS EXCEPT 202D. USE D50AA-3 IN PLACE OF D6AA-61 SUPPLIED WITH DATA SET 202D
3. DESIGNATE KEY STRIP AS SHOWN. CONVERT RING AND REL BUTTONS TO NONLOCKING

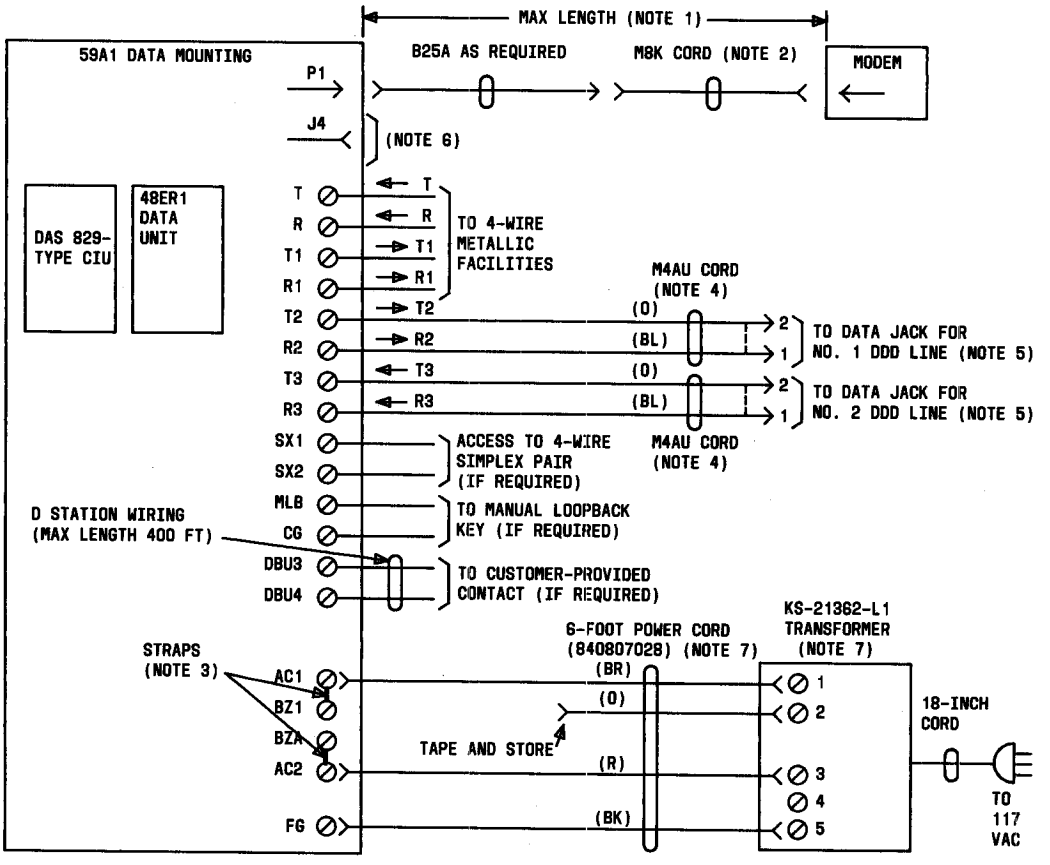
HOLD	DOD1	DOD2	PL TALK	RING	REL	

4. MODIFY TEL SET AS FOLLOWS:

636A KEY LEADS		
COLOR	REMOVE FROM	CONNECT TO
BR	M	X
S-R	M	N
Y	M	TAPE AND STORE
O-BK	N	M

5. STRAPS PROVIDED AS PART OF 59A1 DATA MOUNTING. DO NOT REMOVE STRAPS
6. THE 48B1 DATA UNIT CANNOT BE USED IN REGISTERED ARRANGEMENTS OR WHEN THE FAR END OF THE DIAL BACKUP CHANNEL IS EQUIPPED FOR UNATTENDED OPERATION
7. THE TWO M4AU CORDS MUST BE ORDERED SEPARATELY. TAPE AND STORE UNUSED LEADS
8. USE DATA JACK USOC RJ41S WITH SWITCH SET TO FLL. THE TWO DATA JACKS MUST BE ORDERED SEPARATELY
9. SUPPLIED WITH 59A1 DATA MOUNTING

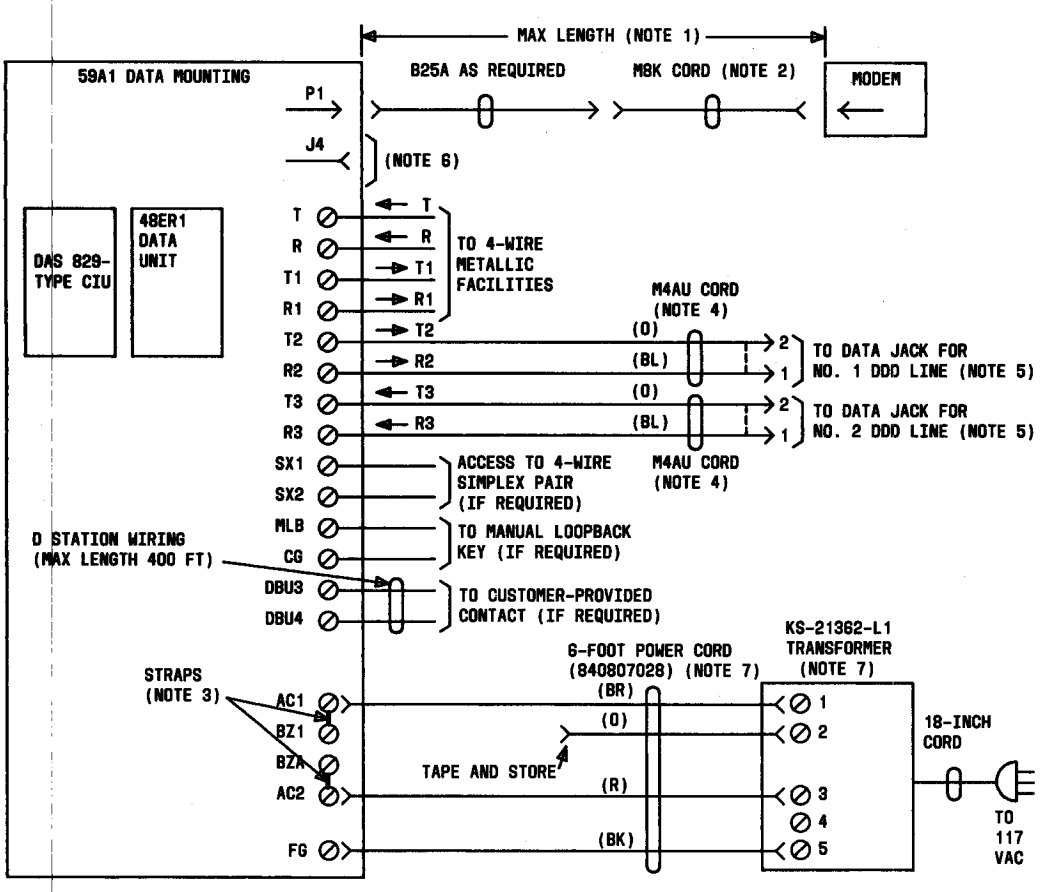
Fig. 18—59A1 Data Mounting—4-Wire Data With Alternate Voice and 4-Wire Dial Backup Service (Manual Dialing)



NOTES:

1. DATA SET MAX LENGTH IN FT
   - 201C-L1 1400
   - 201C-L1D 1400
   - 202D 500
   - 202T 200
   - 208A 1400
   - 209A 1400
2. THE M8K CORD IS SUPPLIED AND USED WITH ALL DATA SETS EXCEPT 202D. USE D50AA-3 IN PLACE OF D6AA-61 SUPPLIED WITH DATA SET 202D
3. STRAPS PROVIDED AS PART OF 59A1 DATA MOUNTING. DO NOT REMOVE STRAPS
4. THE TWO M4AU CORDS MUST BE ORDERED SEPARATELY. TAPE AND STORE UNUSED LEADS
5. USE DATA JACK USOC RJ41S WITH SWITCH SET TO FLL. THE TWO DATA JACKS MUST BE ORDERED SEPARATELY
6. FOR AUTOMATIC DIALING, A SEPARATELY ORDERED 43A OR 53A STATION DIAL OR SEPARATELY ORDERED DAS 801/CR-L1/2 ACU IS CONNECTED TO J4 OF THE 59A1 DATA MOUNTING. IF A 43A OR 53A STATION DIAL IS USED, SEE FIG. 21 FOR CONNECTIONS. IF A DAS 801CR-L1/2 ACU IS USED, SEE FIG. 22 FOR CONNECTIONS
7. SUPPLIED WITH 59A1 DATA MOUNTING

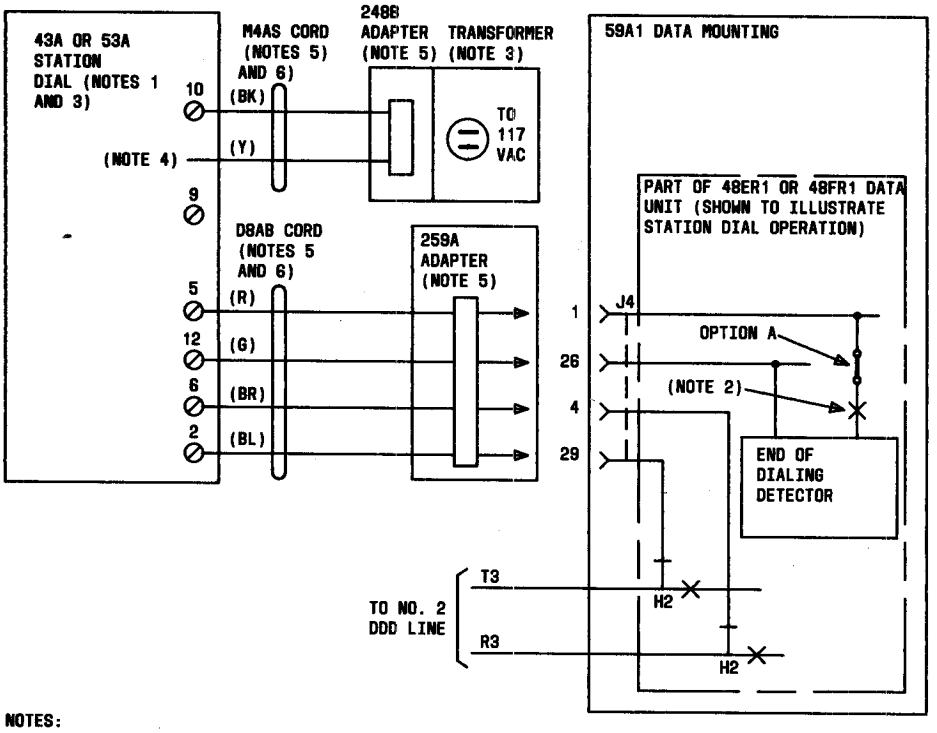
Fig. 19—59A1 Data Mounting—4-Wire Data With 4-Wire Dial Backup Service (Automatic Dialing)



NOTES:

1. DATA SET MAX LENGTH IN FT
   - 201C-L1 1400
   - 201C-L1D 1400
   - 202D 500
   - 202T 200
   - 208A 1400
   - 209A 1400
2. THE M8K CORD IS SUPPLIED AND USED WITH ALL DATA SETS EXCEPT 202D. USE D50AA-3 IN PLACE OF D6AA-61 SUPPLIED WITH DATA SET 202D
3. STRAPS PROVIDED AS PART OF 59A1 DATA MOUNTING. DO NOT REMOVE STRAPS
4. THE TWO M4AU CORDS MUST BE ORDERED SEPARATELY. TAPE AND STORE UNUSED LEADS
5. USE DATA JACK USOC RJ41S WITH SWITCH SET TO FLL. THE TWO DATA JACKS MUST BE ORDERED SEPARATELY
6. FOR AUTOMATIC ANSWERING WITH AUTOMATIC CALLBACK, A SEPARATELY ORDERED 43A OR 53A STATION DIAL IS CONNECTED TO J4 OF THE 59A1 DATA MOUNTING AS SHOWN IN FIG. 21. FOR AUTOMATIC ANSWERING WITH TWO CALLS ANSWERED, THE STATION DIAL IS NOT REQUIRED
7. SUPPLIED WITH 59A1 DATA MOUNTING

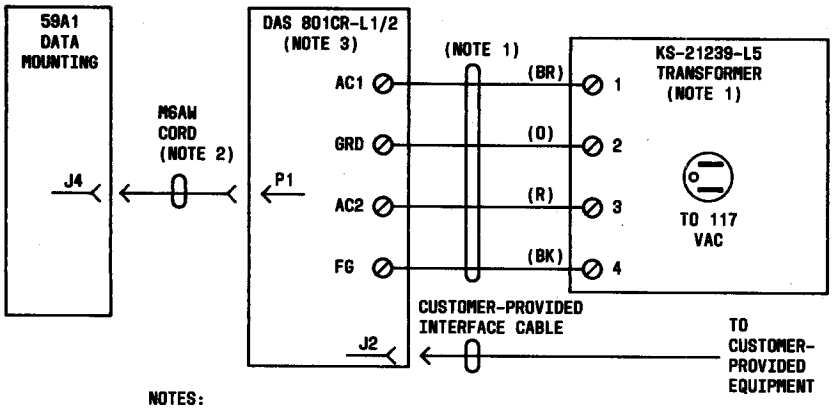
Fig. 20—59A1 Data Mounting—4-Wire Data With 4-Wire Dial Backup Service (Automatic Answering)



NOTES:
1. THE 43A OR 53A STATION DIAL MUST BE OPTIONED FOR RESTRICTED DIALING
2. THE RELAY CONTACT SHOWN IS DESIGNATED R WHEN THE 48ER1 DATA UNIT IS PROVIDED AND IS DESIGNATED OR WHEN THE 48FR1 DATA UNIT IS PROVIDED.
3. A 2012D TRANSFORMER IS REQUIRED WHEN THE 43A OR 53A STATION DIAL IS USED WITHOUT THE 1A350 TONE DETECTOR. A 2075A TRANSFORMER IS REQUIRED WHEN THE 43A OR 53A STATION DIAL IS USED WITH THE 1A350 TONE DETECTOR. THE 2012D TRANSFORMER OR THE 2075A TRANSFORMER AND THE 1A350 TONE DETECTOR MUST BE ORDERED SEPARATELY
4. WHEN A 43A STATION DIAL IS USED, CONNECT YELLOW (Y) LEAD OF M4AS CORD TO TERMINAL 9 OF STATION DIAL. WHEN A 53A STATION DIAL IS USED, CONNECT YELLOW (Y) LEAD OF M4AS CORD TO TERMINAL 6 OF STATION DIAL.
5. THE M4AS CORD, D8AB CORD, 248B ADAPTER, AND 259A ADAPTER MUST BE ORDERED SEPARATELY
6. TAPE AND STORE UNUSED LEADS.

Fig. 21—59A1 Data Mounting—Connections to 43A or 53A Station Dial

units that add alternate voice service to the 4-wire private lines. Each DAS 829-type CIU and 48A1 data unit is identified by a number (N) from 1 to 23. The Nth DAS 829-type CIU terminates the Nth 4-wire private line. The Nth 48A1 data unit adds alternate voice service to the 4-wire private line terminated by the Nth DAS 829-type CIU. The key leads controlling the 23 FDA arrangements are concentrated in connector J10 of each 46B1 data mounting. The key leads controlling FDA arrangements 1 through 8 are connected through connector P1, of the 48D1 data unit, to the keys designated 1 through 8 on the 30-button CALL DIRECTOR. Similarly, the key leads controlling FDA arrangements 9 through 16 and 17 through 23 are connected through connectors P2 and P3, respectively, of the 48D1 data unit, to the keys designated 9 through 16 and 17 through 23,



NOTES:
1. SUPPLIED WITH DAS 801CR-L1/2
2. THE MSAW CORD IS USED INSTEAD OF THE M15H CORD SUPPLIED WITH DAS 801CR-L1/2. THE MSAW CORD MUST BE ORDERED SEPARATELY. THE M15H CORD SHOULD BE RETURNED TO STOCK
3. DAS 801CR-L1/2 OPTIONS REQUIRED ARE SHOWN IN TABLE BELOW.

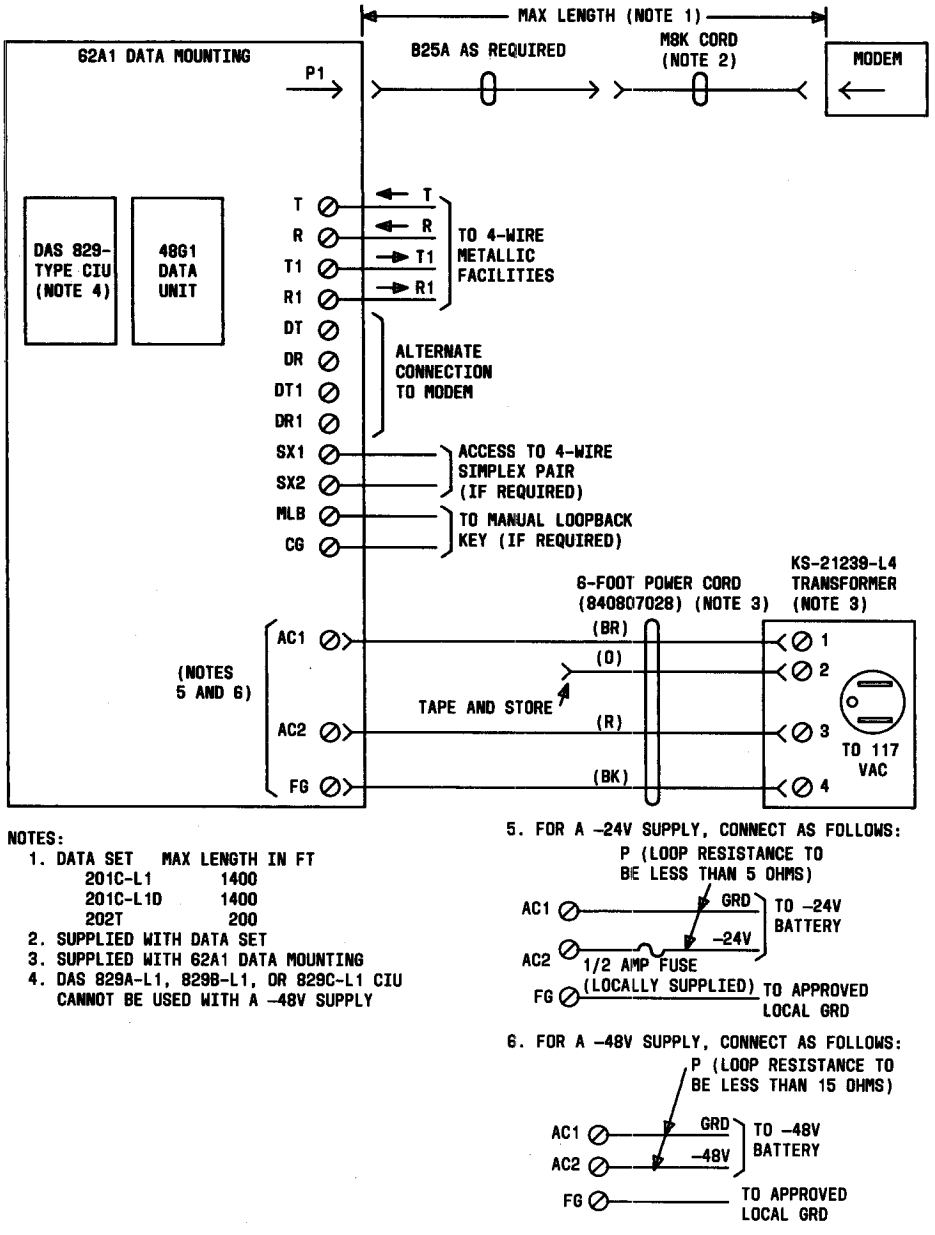
OPTION		SWITCH SETTINGS ON CP1	
DESCRIPTION	DESIG	CLOSED	OPEN
LOOP START	Y	S2-4, S4-1	S1-2, S2-1
DETECT BEGINNING OF ANSWER TONE	X	–	S3-3
DETECT 2225-HZ ANSWER TONE	T	S2-2	S2-3
DATA SET TO DATA MODE BY GROUNDED CONTACT	ZG	S1-1	S1-3
NO CLEAR SIGNAL; NO TK CONTACT	ZN	–	S1-4
TERMINATE CALL VIA DATA SET AFTER DSS ON	G	S4-2	–
STOP ACR TIMER WHEN DSS GOES ON	R	S3-1, S3-2	–
ACR TIMING INTERVAL 56 SEC	ZT	S3-4	S3-5
SIGNAL GRD CONNECTED TO FRAME GRD	ZU	CLOSE SCREW SWITCH ON 52A2 DATA MOUNTING.	

Fig. 22—59A1 Data Mounting—Connections to DAS 801CR-L1/2 ACU

respectively, on the 30-button CALL DIRECTOR. The pickup key controlling the Nth FDA arrangement is designated TALK-DBU N.

3.12 The interface leads for the 23 FDA arrangements and the interface leads for the 23 modems must be connected to the switching matrices controlled by the 30-button CALL DIRECTOR. The interface leads for the 23 FDA arrangements are concentrated in connector P1 of each 46B1 data mounting. The interface leads for FDA arrangements 1 through 8 are connected through connector J10, of the 46C-type data mounting, to the switching matrix provided by the pair of 48C1 data units installed in connectors J4 and J5 of the 46C-type data mounting. The interface leads for modems 1 through 8 are also connected to this matrix through connector P2 of the 46C-type data mounting. The key leads controlling this matrix are connected through connectors P4 and P5, of the 48D1 data unit, to the keys designated 1 through 8 on the 30-button CALL DIRECTOR. The FDA, modem, and key leads for circuits 9 through 16 and 17 through 23 are connected in a similar manner.

3.13 The interface leads for the 23 modems are concentrated in connectors P2, P3, and P4 of the 46C-type data mounting. The modems can



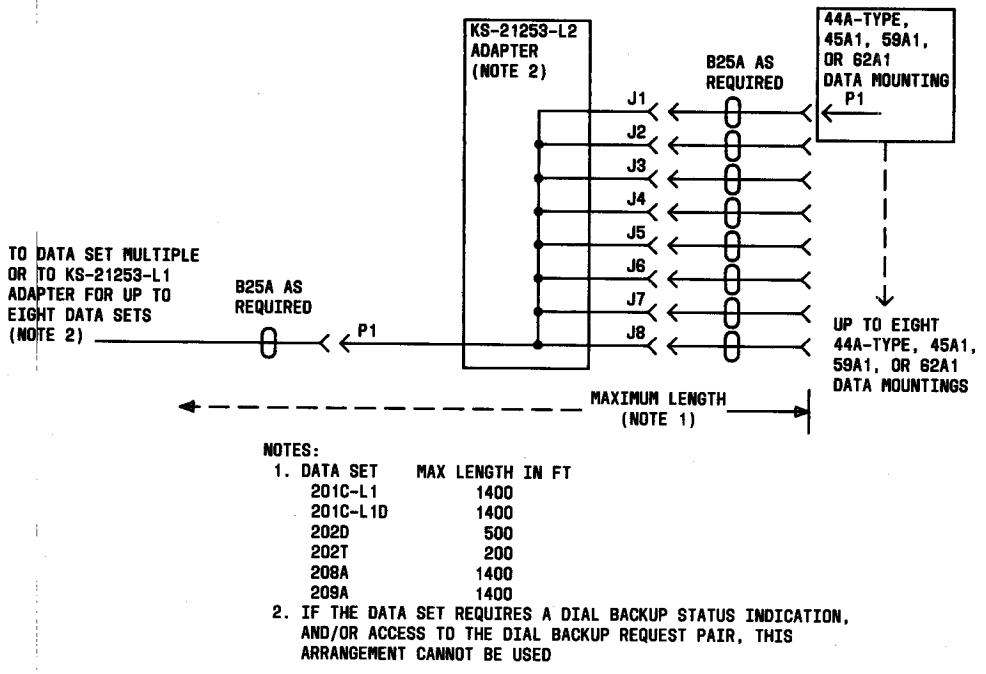
NOTES:

1. DATA SET MAX LENGTH IN FT
   - 201C-L1 1400
   - 201C-L1D 1400
   - 202T 200
2. SUPPLIED WITH DATA SET
3. SUPPLIED WITH 62A1 DATA MOUNTING
4. DAS 829A-L1, 829B-L1, OR 829C-L1 CIU CANNOT BE USED WITH A -48V SUPPLY

5. FOR A -24V SUPPLY, CONNECT AS FOLLOWS:

6. FOR A -48V SUPPLY, CONNECT AS FOLLOWS:

Fig. 23—62A1 Data Mounting—2-Wire Data Only Service



NOTES:

1. DATA SET — MAX LENGTH IN FT

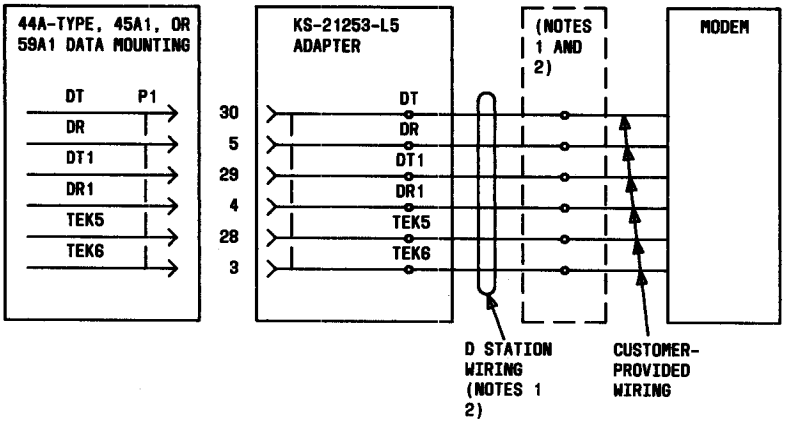
DATA SET	MAX LENGTH IN FT
201C-L1	1400
201C-L1D	1400
202D	500
202T	200
208A	1400
209A	1400

2. IF THE DATA SET REQUIRES A DIAL BACKUP STATUS INDICATION, AND/OR ACCESS TO THE DIAL BACKUP REQUEST PAIR, THIS ARRANGEMENT CANNOT BE USED

Fig. 24—44A-Type, 45A1, 59A1, or 62A1 Data Mounting—Multiple Arrangement

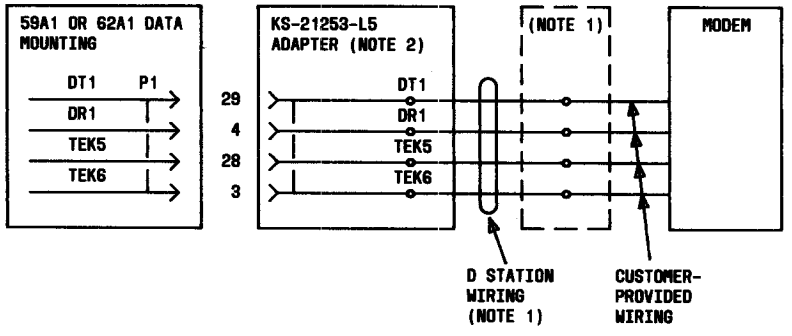
be terminated, as required, using the arrangements given in paragraph 3.02.

3.14 Dial backup channels A and B for the twenty-three FDA arrangements are provided by the two 48B1 or 48ER1 data units installed in connectors J2 and J3 of the 46C-type data mounting. The four direct distance dialing (DDD) lines required for dial backup channels A and B are connected to a terminal strip or connector J1 on the 46C-type data mounting. The key leads controlling the dial backup channels are connected through connector P1, of the 46C-type data mounting, and connector J6, of the 48D1 data unit, to the pickup keys designated DDD1A, DDD2A, DDD1B, DDD2B, and REL.



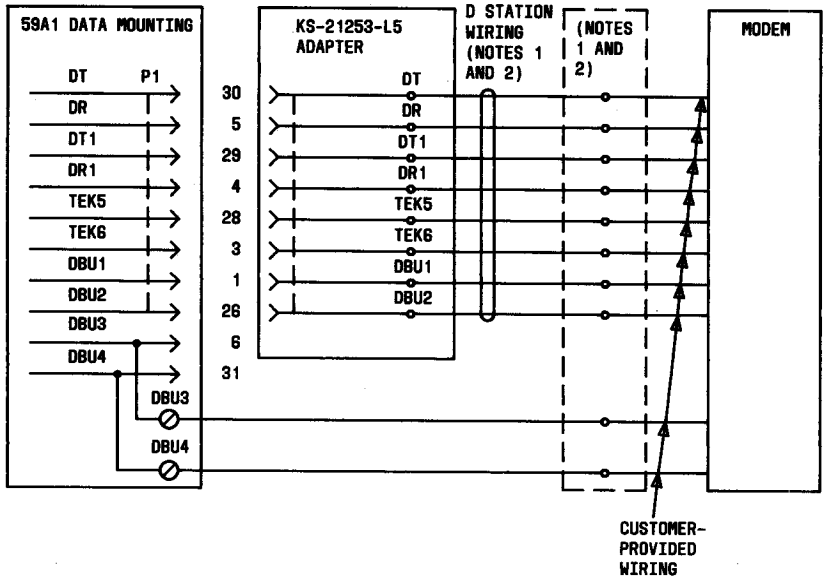
NOTES:
1. IF THE CUSTOMER-PROVIDED WIRING IS TOO SHORT, A 42A CONNECTING BLOCK CAN BE USED WITH D STATION WIRING TO CONNECT THE MODEM TO THE KS-21253-L5 ADAPTER. THE D STATION WIRING SHOULD NOT EXCEED 10 FEET IN LENGTH.
2. IF THE TEK5 AND TEK6 LEADS ARE REQUIRED, A 44A CONNECTING BLOCK MUST BE USED WITH THE D STATION WIRING.

Fig. 25—Customer-Provided Modem—4-Wire Data Service (With or Without Alternate Voice Service)



NOTES:
1. IF THE CUSTOMER-PROVIDED WIRING IS TOO SHORT, A 42A CONNECTING BLOCK CAN BE USED WITH D STATION WIRING TO CONNECT THE MODEM TO THE KS-21253-L5 ADAPTER. THE D STATION WIRING SHOULD NOT EXCEED 10 FEET IN LENGTH.
2. IF THE TEK5 AND TEK6 LEADS ARE NOT REQUIRED FOR 2-WIRE DATA ONLY SERVICE, THE KS-21253-L5 ADAPTER CAN BE OMITTED AND THE DT1 AND DR1 LEADS CONNECTED TO SCREW TERMINALS DT1 AND DR1, RESPECTIVELY, OF THE 62A1 DATA MOUNTING.

Fig. 26—Customer-Provided Modem—2-Wire Data Service (With or Without Alternate Voice Service)



NOTES:
1. IF THE CUSTOMER-PROVIDED WIRING IS TOO SHORT, A 42A CONNECTING BLOCK CAN BE USED WITH D STATION WIRING TO CONNECT THE MODEM TO THE KS-21253-L5 ADAPTER. THE D STATION WIRING SHOULD NOT EXCEED 10 FEET IN LENGTH
2. IF THE TEK5 AND TEK6 LEADS AND/OR DBU1 AND DBU2 LEADS AND/OR DBU3 AND DBU4 LEADS ARE REQUIRED, A 44A CONNECTING BLOCK MUST BE USED WITH THE D STATION WIRING

Fig. 27—Customer-Provided Modem—4-Wire Data With 4-Wire Dial Backup Service (With or Without Alternate Voice Service)

Second Example—Multiple FD and FDA Arrangements With and Without Switched Dial Backup Service

3.15 The second example (Fig. 44) is a multiple arrangement consisting of a variety of services controlled by one CALL DIRECTOR. In this example, 8 FD and 11 FDA arrangements are to be provided. Switched dial backup service using one dial backup channel is to be provided for 5 of the FD and 6 of the FDA arrangements.

3.16 Design rule No. 1 indicates that one 18-button CALL DIRECTOR can be used to control the 11 arrangements (5 FD and 6 FDA) that require switched dial backup service. However, 5 of the FDA arrangements to be provided do not require switched dial backup service. Design rule No. 2 and Table B indicate that when 11 FD and/or FDA arrangements are provided with switched dial backup service, there are up to 8 pickup keys available for control of additional FDA arrangements when a 30-button CALL DIRECTOR is provided. Therefore, for this example, the 631DAM or the 2631DAM 30-button CALL DIRECTOR key telephone set, with the wiring modifications given in Fig. 44, is used to control the entire multiple arrangement. The CALL DIRECTOR is connected to connectors J1 through J5 of the 48D1 data unit. Table B indicates that pickup keys 1 through 8 of the CALL DIRECTOR should be assigned to the FDA arrangements that do not require switched dial backup service. Pickup keys 9 through 23 should be assigned to the FD and/or FDA arrangements that require switched dial backup service.

3.17 The FDA arrangements that do not require switched dial backup service are provided

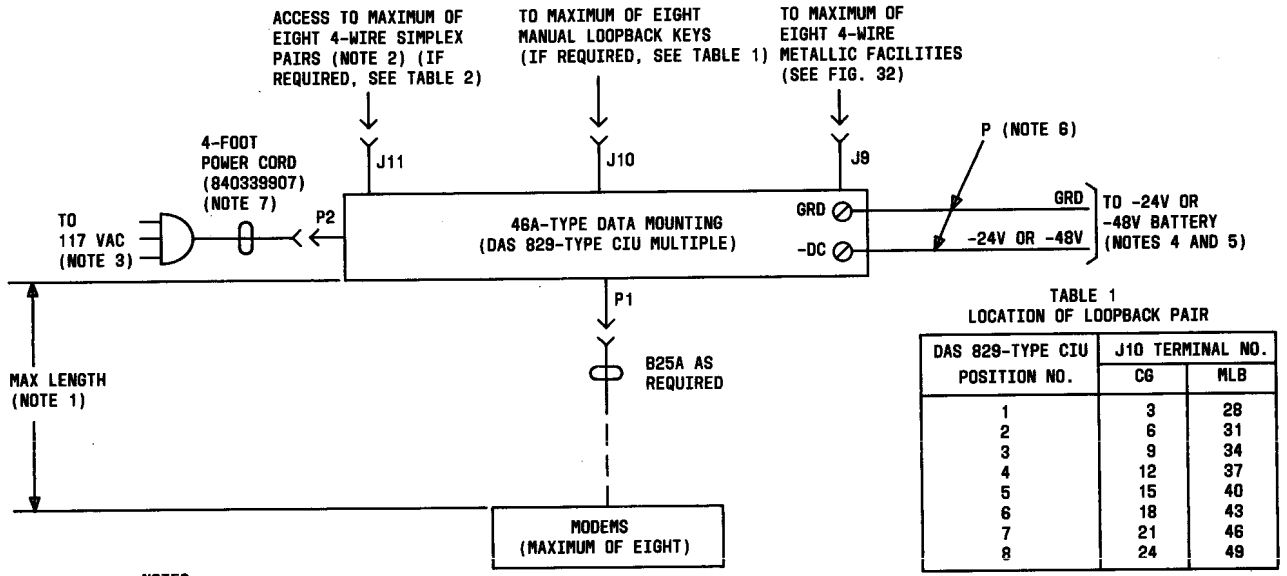


TABLE 1
LOCATION OF LOOPBACK PAIR

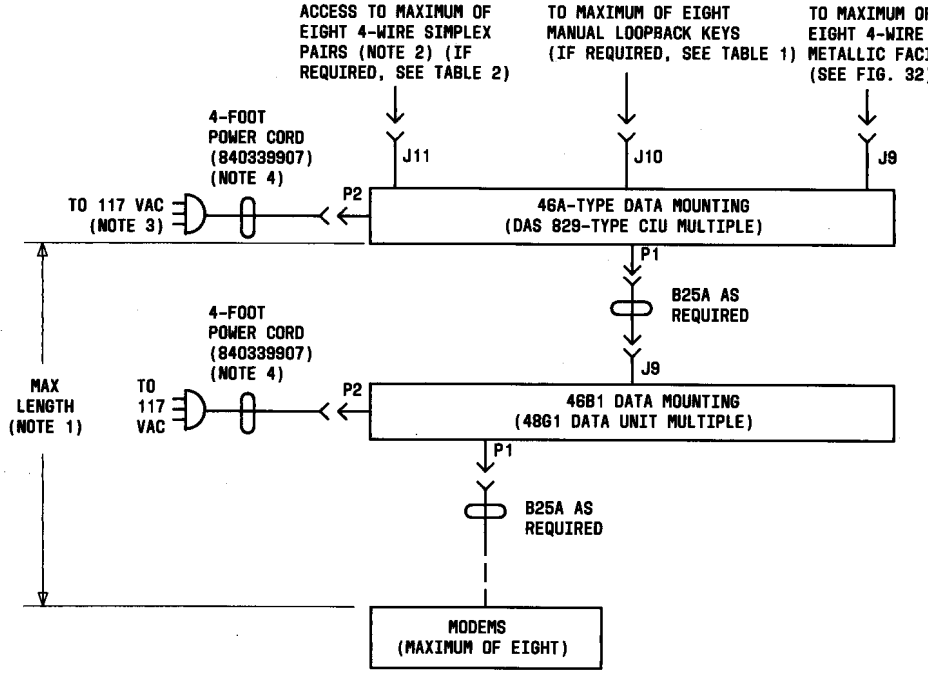
DAS 829-TYPE CIU POSITION NO.	J10 TERMINAL NO.	
	CG	MLB
1	3	28
2	6	31
3	9	34
4	12	37
5	15	40
6	18	43
7	21	46
8	24	49

NOTES:
1. DATA SET — MAX LENGTH IN FT
   - 201C-L1 — 1400
   - 201C-L1D — 1400
   - 202D — 500
   - 202T — 200
   - 208A — 1400
   - 209A — 1400
2. NOT PROVIDED ON 46A1 DATA MOUNTING
3. FOR OPERATION FROM A 117 VAC SUPPLY, THE 46A2 DATA MOUNTING MUST BE EQUIPPED WITH THE AC OPTION
4. FOR OPERATION FROM A DC SUPPLY, THE 46A2 DATA MOUNTING MUST BE EQUIPPED WITH THE DC OPTION. THIS OPTION IS NOT PROVIDED ON THE 46A1 DATA MOUNTING
5. DAS 829A-L1, 829B-L1, OR 829C-L1 CIU CANNOT BE USED WITH A -48V SUPPLY
6. LOOP RESISTANCE TO BE LESS THAN 4 OHMS
7. SUPPLIED WITH DATA MOUNTING. NOT REQUIRED FOR OPERATION FROM A DC SUPPLY

TABLE 2
LOCATION OF SIMPLEX PAIR

DAS 829-TYPE CIU POSITION NO.	J11 TERMINAL NO.	
	SX1	SX2
1	1	26
2	2	27
3	3	28
4	4	29
5	5	30
6	6	31
7	7	32
8	8	33

Fig. 28—46A-Type Data Mounting—4-Wire Data Only Service



NOTES:
1. DATA SET — MAX LENGTH IN FT
   - 201C-L1 — 1400
   - 201C-L1D — 1400
   - 202T — 200
2. NOT PROVIDED ON 46A1 DATA MOUNTING
3. THE 46A2 DATA MOUNTING MUST BE EQUIPPED WITH THE AC OPTION
4. SUPPLIED WITH DATA MOUNTING

Fig. 29—46A-Type and 46B1 Data Mountings—2-Wire Data Only Service

TABLE 1
LOCATION OF LOOPBACK PAIR

DAS 829-TYPE CIU POSITION NO.	J10 TERMINAL NO.	
	CG	MLB
1	3	28
2	6	31
3	9	34
4	12	37
5	15	40
6	18	43
7	21	46
8	24	49

TABLE 2
LOCATION OF SIMPLEX PAIR

DAS 829-TYPE CIU POSITION NO.	J11 TERMINAL NO.	
	SX1	SX2
1	1	26
2	2	27
3	3	28
4	4	29
5	5	30
6	6	31
7	7	32
8	8	33

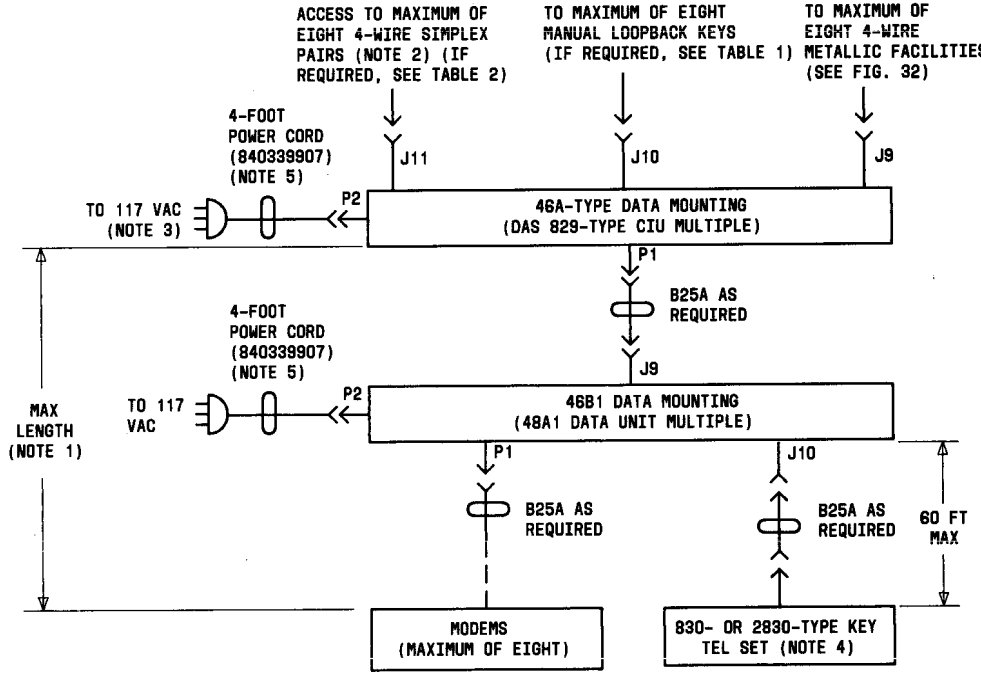


TABLE 1
LOCATION OF LOOPBACK PAIR

DAS 829-TYPE CIU POSITION NO.	J10 TERMINAL NO.	
	CG	MLB
1	3	28
2	6	31
3	9	34
4	12	37
5	15	40
6	18	43
7	21	46
8	24	49

TABLE 2
LOCATION OF SIMPLEX PAIR

DAS 829-TYPE CIU POSITION NO.	J11 TERMINAL NO.	
	SX1	SX2
1	1	26
2	2	27
3	3	28
4	4	29
5	5	30
6	6	31
7	7	32
8	8	33

NOTES:
1. DATA SET — MAX LENGTH IN FT

DATA SET	MAX LENGTH IN FT
201C-L1	1400
201C-L1D	1400
202D	500
202T	200
208A	1400
209A	1400

2. NOT PROVIDED ON 46A1 DATA MOUNTING
3. THE 46A2 DATA MOUNTING MUST BE EQUIPPED WITH THE AC OPTION
4. DESIGNATE KEY STRIP AS SHOWN. CONVERT RING BUTTON TO NONLOCKING

HOLD	PL TALK1	PL TALK2	PL TALK3	PL TALK4	PL TALK5	PL TALK6	PL TALK7	PL TALK8	RING

5. SUPPLIED WITH DATA MOUNTING

Fig. 30—46A-Type and 46B1 Data Mountings—4-Wire Data With Alternate Voice Service

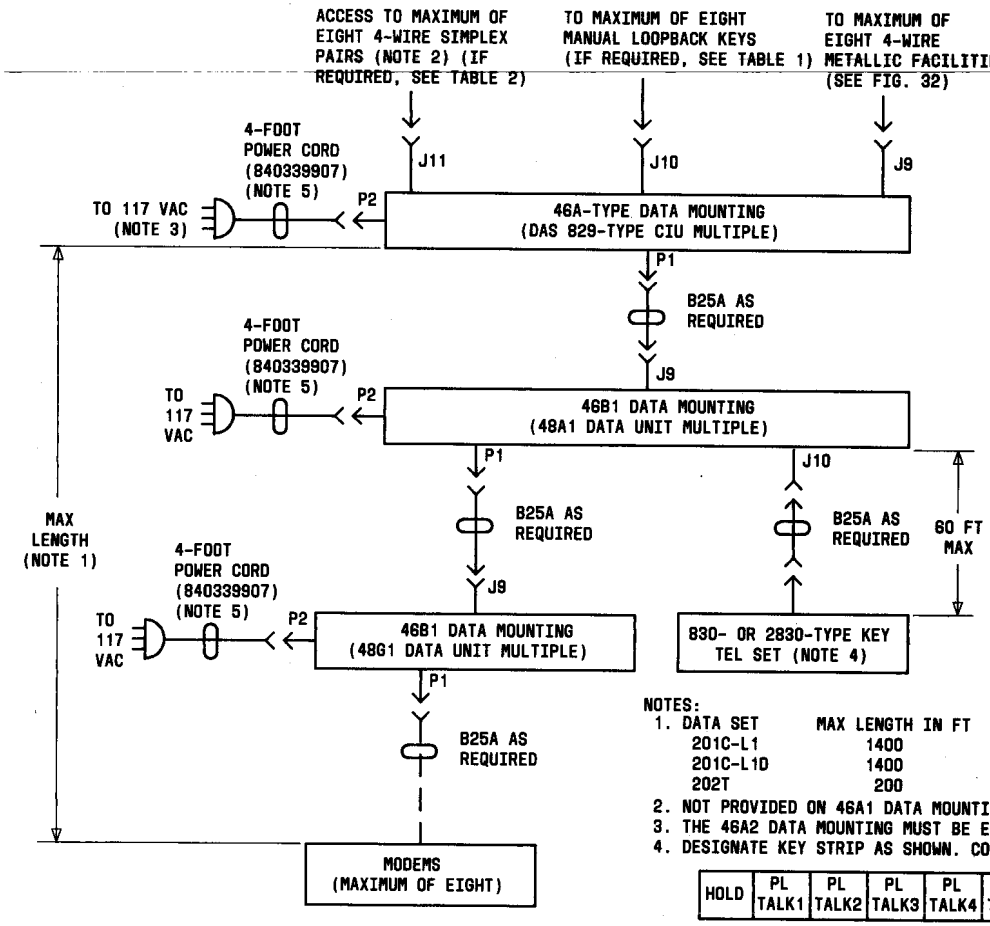


TABLE 1
LOCATION OF LOOPBACK PAIR

DAS 829-TYPE CIU POSITION NO.	J10 TERMINAL NO.	
	CG	MLB
1	3	28
2	6	31
3	9	34
4	12	37
5	15	40
6	18	43
7	21	46
8	24	49

TABLE 2
LOCATION OF SIMPLEX PAIR

DAS 829-TYPE CIU POSITION NO.	J11 TERMINAL NO.	
	SX1	SX2
1	1	26
2	2	27
3	3	28
4	4	29
5	5	30
6	6	31
7	7	32
8	8	33

NOTES:
1. DATA SET — MAX LENGTH IN FT
   - 201C-L1 — 1400
   - 201C-L1D — 1400
   - 202T — 200
2. NOT PROVIDED ON 46A1 DATA MOUNTING.
3. THE 46A2 DATA MOUNTING MUST BE EQUIPPED WITH THE AC OPTION.
4. DESIGNATE KEY STRIP AS SHOWN. CONVERT RING BUTTON TO NONLOCKING.

HOLD	PL TALK1	PL TALK2	PL TALK3	PL TALK4	PL TALK5	PL TALK6	PL TALK7	PL TALK8	RING

5. SUPPLIED WITH DATA MOUNTING

Fig. 31—46A-Type and 46B1 Data Mountings—2-Wire Data With Alternate Voice Service

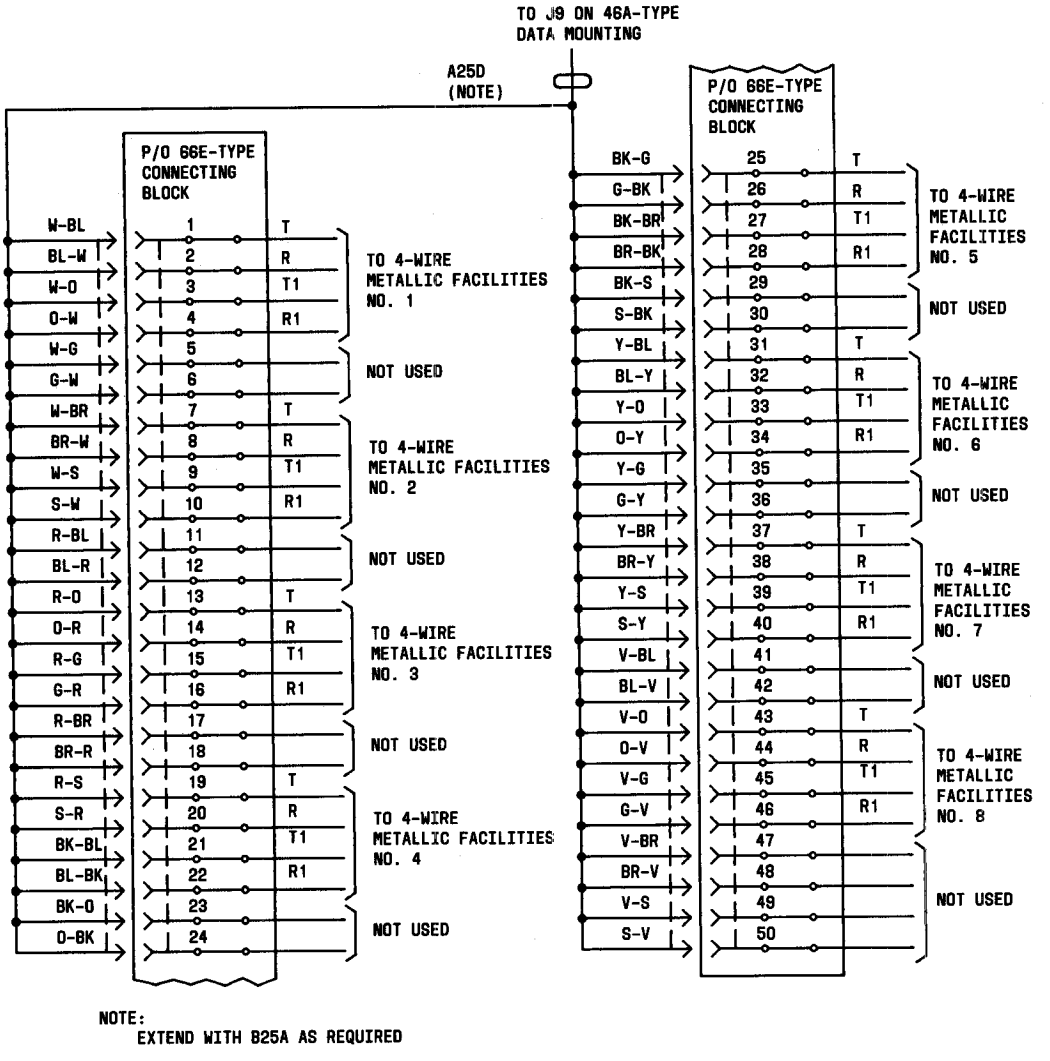
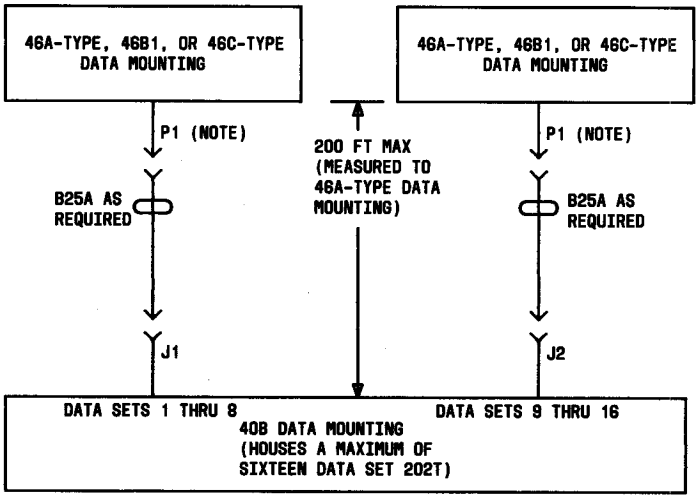


Fig. 32—46A-Type Data Mounting Connections to 4-Wire Metallic Facilities

by the 46A-type and 46B1 data mountings that terminate the 4-wire private lines 1 through 8. Positions 1 through 5 are used for the required 5 FDA arrangements. Positions 6 through 8 are used for the 3 FD arrangements that do not require switched dial backup service (design rule No. 3). The modems for circuits 1 through 8 are connected to connector P1 of the 46B1 data mounting for circuits 1 through 8. The key leads controlling circuits 1 through 8 are connected through connector P1 of the 48D1 data unit.

Note: The 48C1 data units are not installed in connectors J4 and J5 of the 46C-type data



NOTE:
P2, P3, OR P4 ON 46C-TYPE DATA MOUNTING.

Fig. 33—Data Set 202T—4-Wire Multiple Arrangement

mounting. These connectors are left unterminated as switched dial backup service is not required for circuits 1 through 8.

3.18 The pickup keys for positions 1 through 5 control FDA arrangements and are designated TALK 1 through TALK 5, respectively. The pickup keys for positions 6 through 8 are left blank as these positions do not require key lead control.

3.19 The FDA arrangements that require switched dial backup service are provided by the 46A-type and 46B1 data mountings that terminate the 4-wire private lines 9 through 16. Positions 9 through 14 are used for the required 6 FDA arrangements. Positions 15 and 16 are used for 2 of the 5 FD arrangements that require switched dial backup service. The key leads controlling circuits 9 through 16 are connected through connector P2 of the 48D1 data unit.

3.20 The interface leads for FD and/or FDA arrangements 9 through 16 are connected through connector J11, of the 46C-type data mounting, to the switching matrix provided by the pair of 48C1 data units installed in connectors J6 and J7 of the 46C-type data mounting. The interface leads for modems 9 through 16 are also connected to this matrix through connector P3 of the 46C-type data mounting.

3.21 The pickup keys for positions 9 through 14 control FDA arrangements with switched dial backup service and are designated TALK-DBU 9 through TALK-DBU 14, respectively. The pickup keys for positions 15 and 16 control FD arrangements with switched dial backup service and are designated DBU 15 and DBU 16, respectively.

3.22 The remaining FD arrangements that require switched dial backup service are provided by the 46A-type data mounting that terminates 4-wire private lines 17 through 23. Positions 17 through 19 are used for the remaining 3 FD arrangements. Positions 20 through 23 are not used.

3.23 The interface leads for FD arrangements 17 through 23 are connected through connector J12, of the 46C-type data mounting, to switching matrix connectors J8 and J9 of the 46C-type data mounting. The interface leads for modems 17

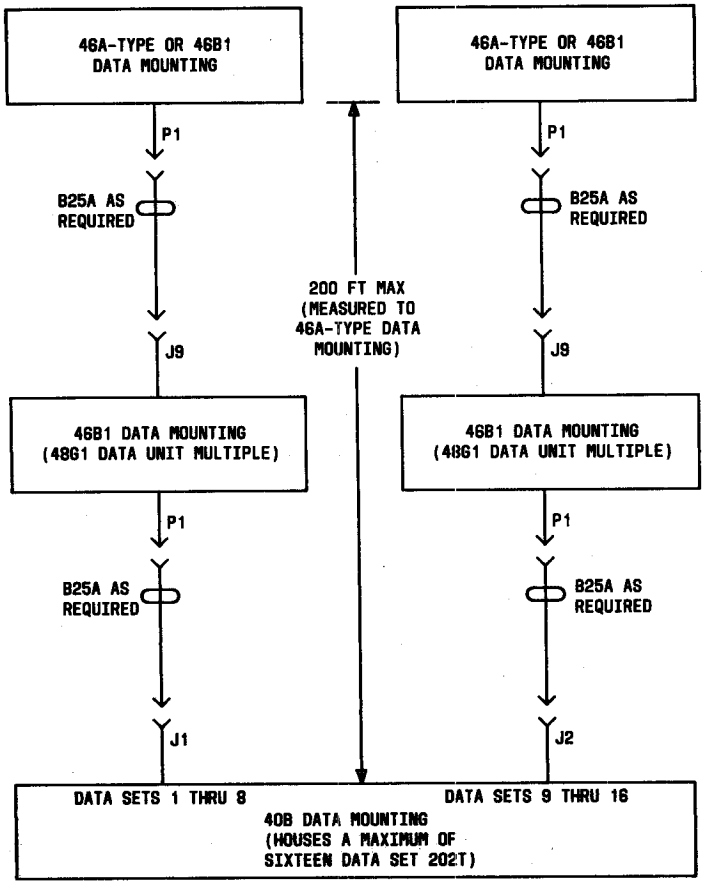


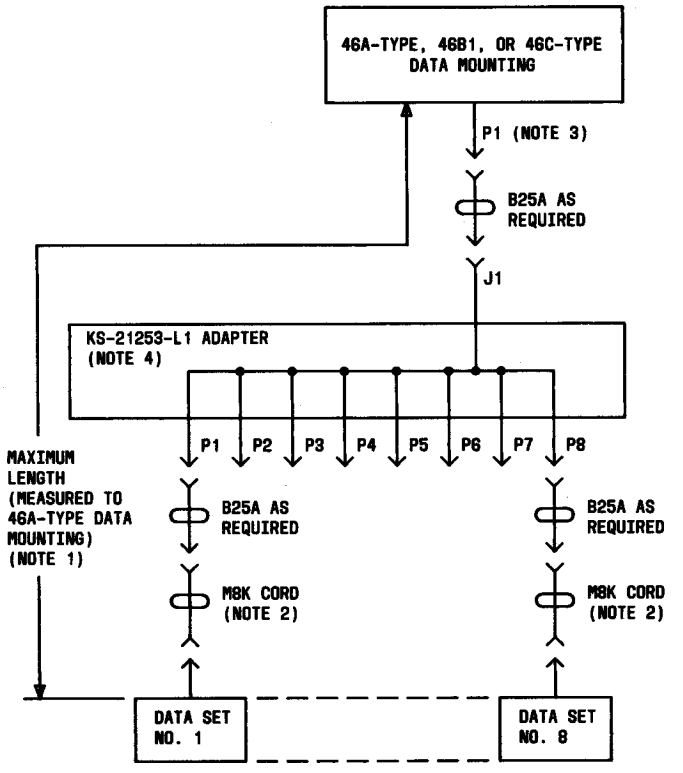
Fig. 34—Data Set 202T—2-Wire Multiple Arrangement

through 23 are also connected to connectors J8 and J9 through connector P4 of the 46C-type data mounting. The 48C1 data unit installed in connector J8 provides the switching matrix for circuits 17 through 20. Since circuits 21 through 23 do not require switched dial backup service, connector J9 is not terminated by a 48C1 data unit.

Note: Connectors J4 through J9 of the 46C-type data mounting, when unterminated, do not provide a through connection for the modem interface leads. Hence, in this example, positions 21 through 23 cannot be used to provide FD arrangements.

3.24 The pickup keys for positions 17 through 19 control FD arrangements with switched dial backup service and are designated DBU 17 through DBU 19, respectively. The pickup keys for positions 20 through 23 are left blank as these positions are not used.

3.25 Dial backup channel A, the only dial backup channel required in this example, is provided by the 48B1 or 48ER1 data unit installed in connector



NOTES:

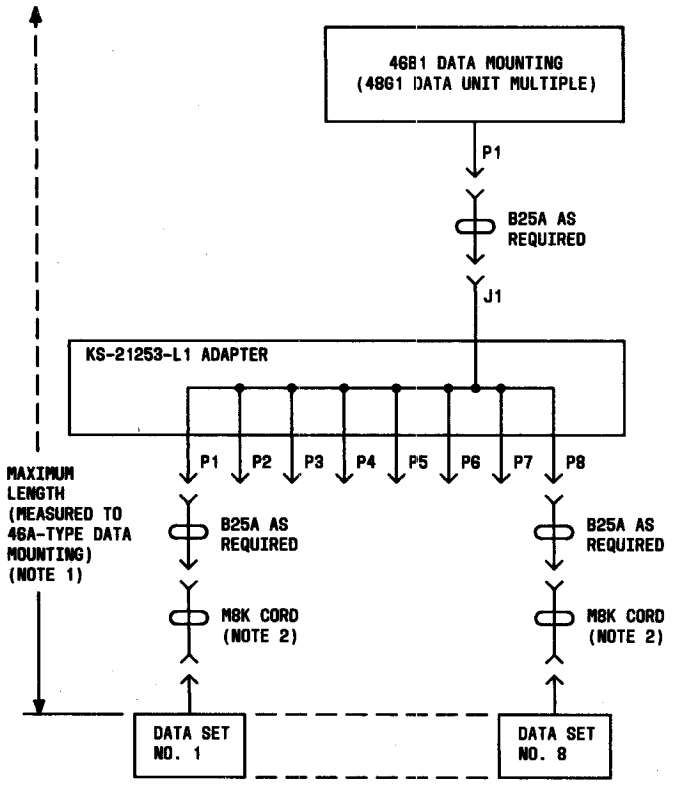
1. DATA SET — MAX LENGTH IN FT

DATA SET	MAX LENGTH IN FT
201C-L1	1400
201C-L1D	1400
202D	500
202T	200
208A	1400
209A	1400

2. THE M8K CORD IS SUPPLIED AND USED WITH ALL DATA SETS EXCEPT 202D. USE D5OAA-3 IN PLACE OF D6AA-61 SUPPLIED WITH DATA SET 202D
3. P2, P3, OR P4 ON 46C-TYPE DATA MOUNTING
4. IF THE DATA SET REQUIRES A DIAL BACKUP STATUS INDICATION, THE KS-21253-L4 ADAPTER MUST BE USED AS SHOWN IN FIG. 47

Fig. 35—Data Set 201C, 202D, 202T, 208A, or 209A—4-Wire Multiple Arrangement

J2 of the 46C-type data mounting. The two DDD lines required for dial backup channel A are connected to a terminal strip on the 46C-type data mounting. The two DDD lines and the 48B1 or 48ER1 data unit required for dial backup channel B are not provided. The key leads controlling the dial backup channels are connected through connector P1, of the 46C-type data mounting, and connector J6, of the 48D1 data unit, to the pickup keys designated DDD1A, DDD2A, and REL. The 4th and 5th pickup



NOTES:
1. DATA SET — MAX LENGTH IN FT
   - 201C-L1 — 1400
   - 201C-L1D — 1400
   - 202T — 200
2. SUPPLIED WITH DATA SET

Fig. 36—Data Set 201C or 202T—2-Wire Multiple Arrangement

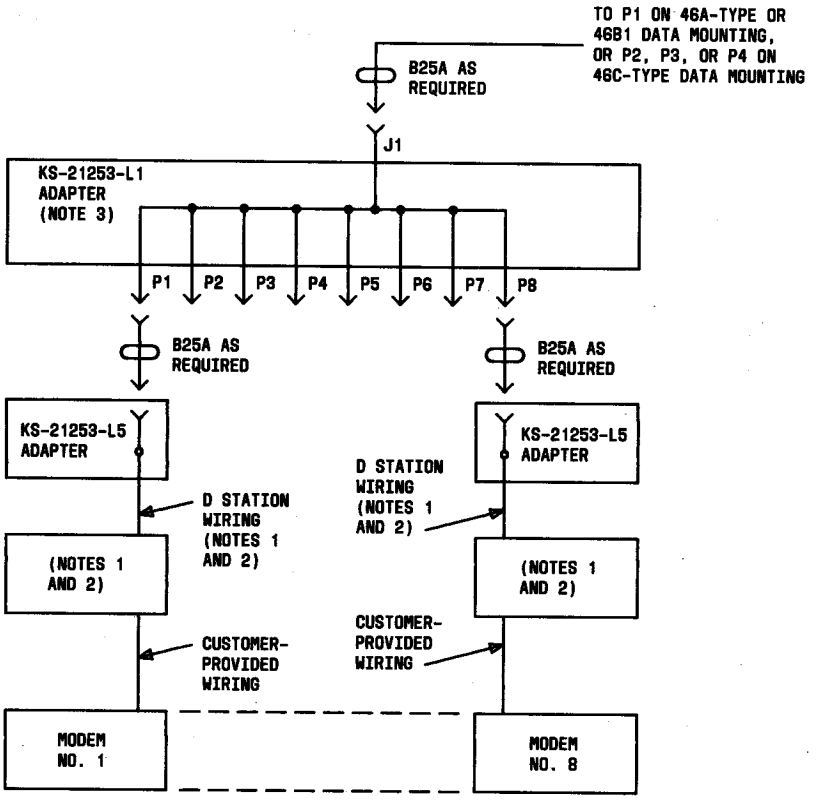
keys of the 1st key module that provide key lead control for the DDD1B and DDD2B lines are not required and are left blank.

4. OPTIONS AND ADJUSTMENTS

A. DAS 829A-L1 CIU

4.01 A sealing current option (Fig. 48) is provided on the DAS 829A-L1 CIU. If this option is specified on the service order, a plug-in strap should be placed in the sealing current option (SC) position. If the option is not specified on the service order, the plug-in strap should be placed in the sealing current storage (ST) position.

4.02 A line impedance option (Fig. 48) on the DAS 829A-L1 CIU provides a 600- or 1200-ohm line termination. The two plug-in straps used for line termination should be placed in the 600-ohm or 1200-ohm option positions as specified on the service order.

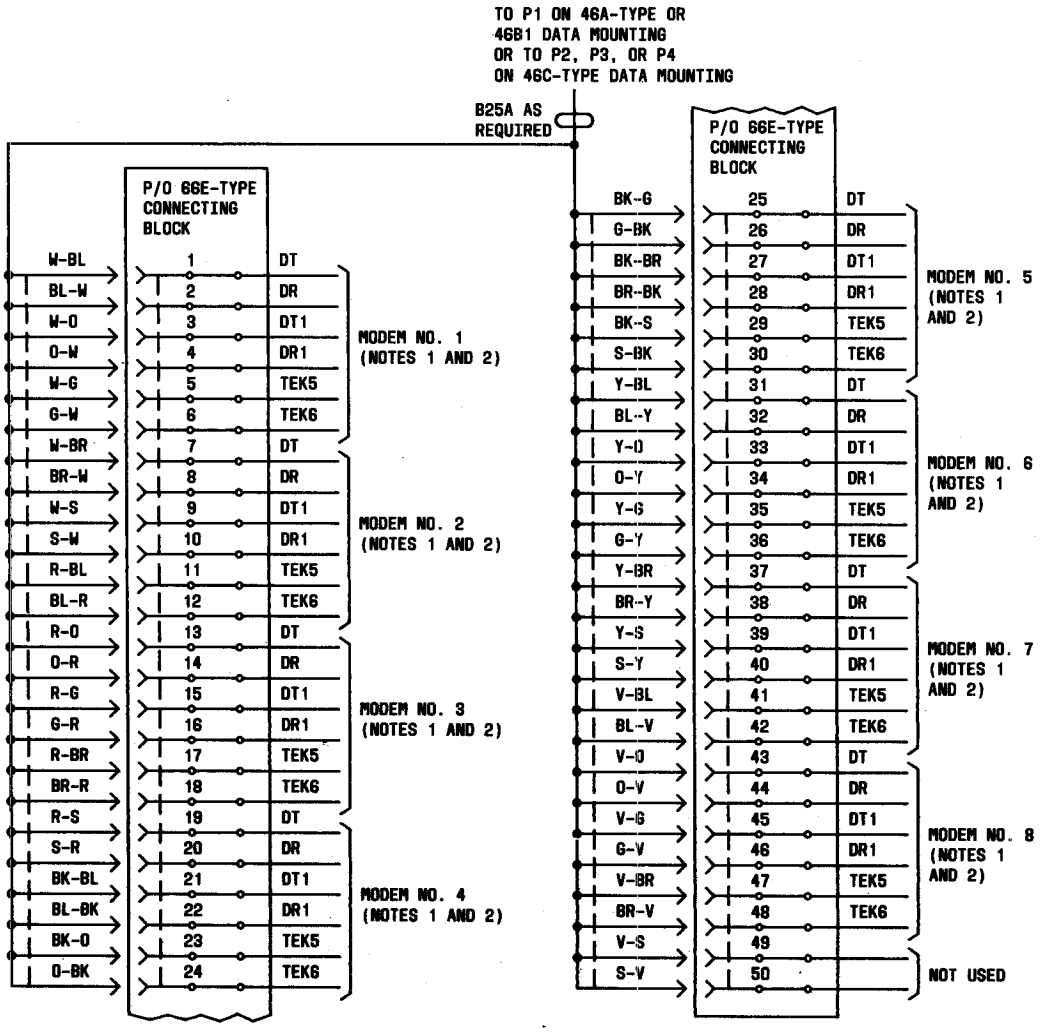


NOTES:
1. IF THE CUSTOMER-PROVIDED WIRING IS TOO SHORT, A 42A CONNECTING BLOCK CAN BE USED WITH D STATION WIRING TO CONNECT THE MODEM TO THE KS-21253-L5 ADAPTER. THE D STATION WIRING SHOULD NOT EXCEED 10 FEET IN LENGTH
2. IF A 4-WIRE MODEM REQUIRES A LINE AND/OR DIAL BACKUP STATUS INDICATION, A 44A CONNECTING BLOCK MUST BE USED WITH THE D STATION WIRING
3. IF A 4-WIRE MODEM REQUIRES A DIAL BACKUP STATUS INDICATION, THE KS-21253-L4 ADAPTER MUST BE USED AS SHOWN IN FIG. 47

Fig. 37—Customer-Provided Modem—Multiple Arrangement Using KS-21253-L1 Adapter

4.03 The transmit (TRANS) attenuator (Fig. 48) and the receive (REC) attenuator on the DAS 829A-L1 CIU should be set to the attenuation values specified on the service order. Four slide switches on each attenuator control 1.0-, 2.0-, 4.0-, and 8.0-dB pads. The attenuation value for each attenuator is variable from 0 to 15 dB in 1-dB steps and is the sum of the exposed numbers. A setting example follows:

- Service order specifies 12-dB attenuation in transmit path—set slide switches on TRANS attenuator so that numbers 4.0 and 8.0 are exposed.



NOTES:
1. THE DT AND DR LEADS ARE NOT REQUIRED FOR 2-WIRE MODEMS.
2. THE TEK5 AND TEK6 LEADS ARE NORMALLY NOT REQUIRED.

Fig. 38—Customer-Provided Modem—Multiple Arrangement Using 66E-Type Connecting Block

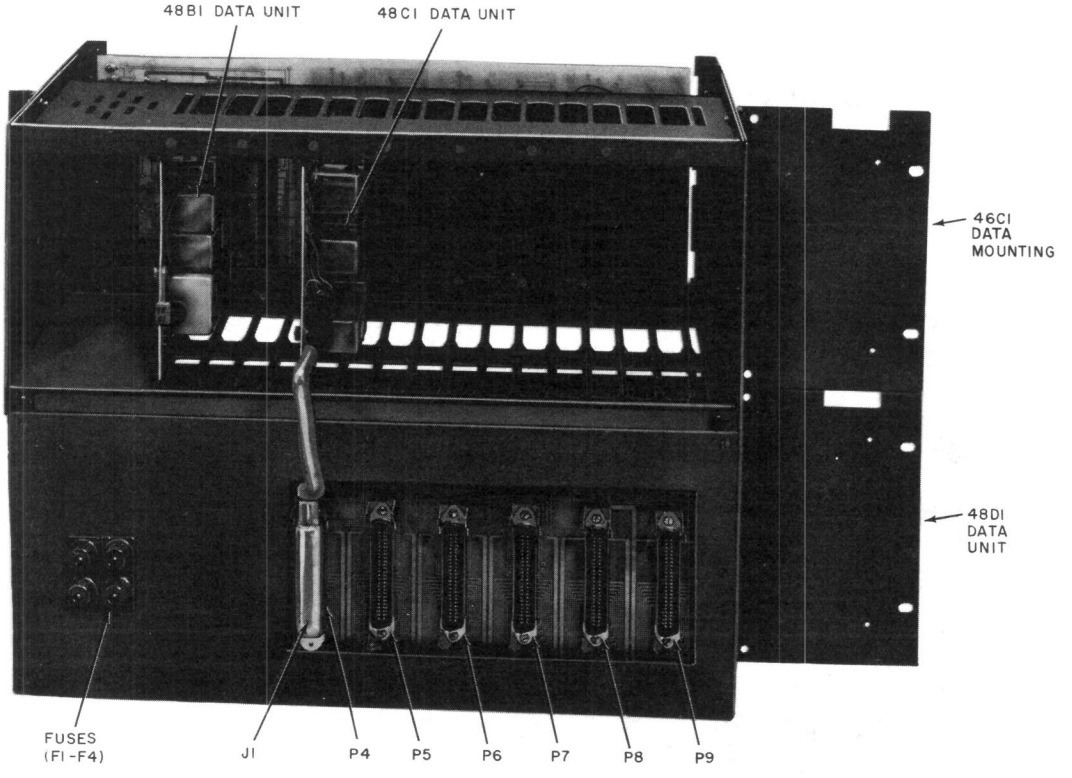


Fig. 39—46C1 Data Mounting and 48D1 Data Unit—Front View

- Service order specifies 11-dB attenuation in receive path—set slide switches on REC attenuator so that numbers 1.0, 2.0, and 8.0 are exposed.

B. DAS 829B-L1 CIU

4.04 A sealing current option (Fig. 49) is provided on the DAS 829B-L1 CIU. If this option is specified on the service order, a plug-in strap should be placed in the sealing current option (SC) position. If the option is not specified on the service order, the plug-in strap should be placed in the sealing current storage (ST) position.

4.05 A line impedance option (Fig. 49) on the DAS 829B-L1 CIU provides a 150-, 600-, or 1200-ohm line termination. The four plug-in straps used for line termination should be placed in the 150-ohm, 600-ohm, or 1200-ohm option positions as specified on the service order.

4.06 The transmit (TRANS) attenuator (Fig. 49) on the DAS 829B-L1 CIU should be set to the attenuation value specified on the service order, as described in paragraph 4.03.

4.07 A coarse gain option (Fig. 49) and a fine gain control on the DAS 829B-L1 CIU provide adjustment for the output level of the CIU receive amplifier. A plug-in strap should be placed in the receive coarse gain option position (GAIN—+10, 0, -10, -20) specified on the service order. The receive fine gain control is variable from 0 to 10

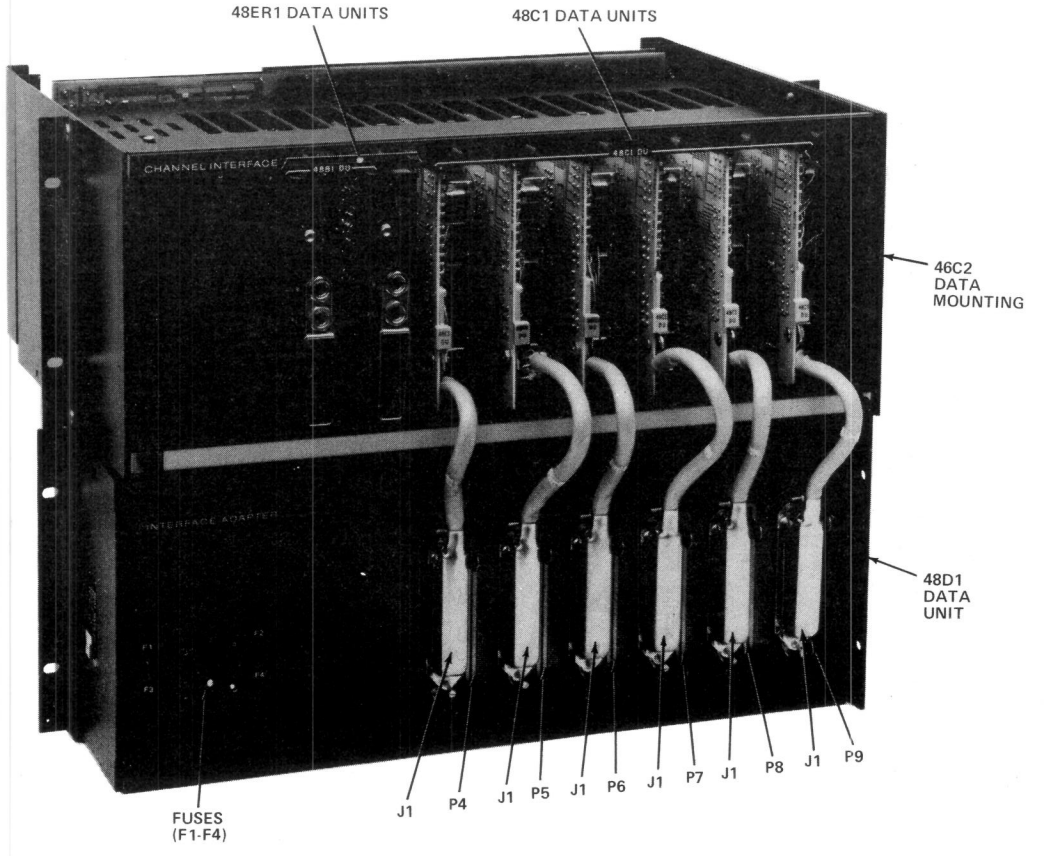


Fig. 40—46C2 Data Mounting and 48D1 Data Unit—Front View

dB and is accessible through a hole in the faceplate of the CIU. Adjustment of the fine gain control is described in Section 598-082-500.

C. DAS 829C-L1 CIU

4.08 A sealing current option (Fig. 50) is provided on the DAS 829C-L1 CIU. If this option is specified on the service order, a plug-in strap should be placed in the sealing current option (SC) position. If the option is not specified on the service order, the plug-in strap should be placed in the sealing current storage (ST) position.

4.09 A 359A or 359K equalizer equivalent option (Fig. 50) is provided on the DAS 829C-L1 CIU. This equalizer equivalent consists of a slope equalizer circuit and a line termination (1200-ohm for 359A and 600-ohm for 359K). Either the 359A or 359K equalizer equivalent should be selected as specified on the service order. The 359A equalizer equivalent is selected by inserting two plug-in straps in column 359 adjacent to the designation A. The 359K equalizer equivalent is selected by inserting two plug-in straps in column 359 adjacent to the designation K. After the equalizer is selected, the required equalizer characteristics are provided by inserting plug-in straps in the positions specified

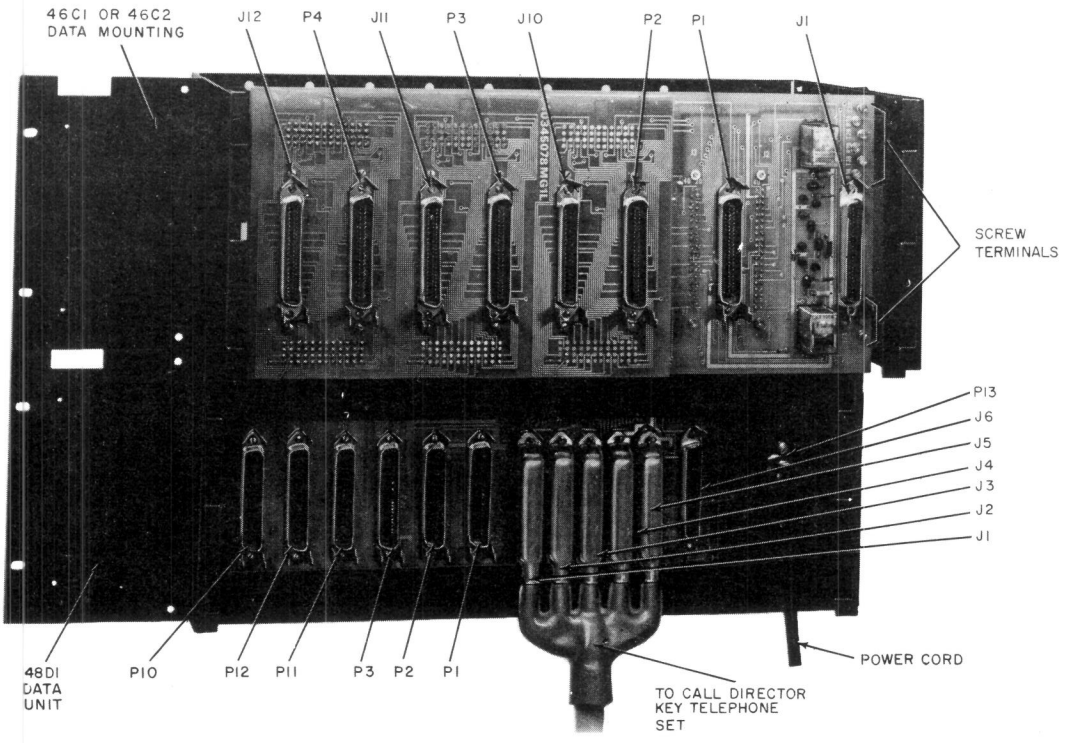


Fig. 41—46C1 or 46C2 Data Mounting and 48D1 Data Unit—Rear View

on the service order or the circuit layout record (CLR). The straps should be inserted in positions identified by columns A, B, C, and D and rows 1, 2, 3, and 4. Strap storage is provided to the left of columns A, B, C, and D in the four ST columns. Additional information is provided in Sections 332-104-500 and 332-116-201.

4.10 The transmit (TRANS) attenuator (Fig. 50) on the DAS 829C-L1 CIU should be set to the attenuation value specified on the service order, as described in paragraph 4.03.

4.11 A coarse gain option (Fig. 50) and a fine gain control on the DAS 829C-L1 CIU provide adjustment for the output level of the CIU receive amplifier. A plug-in strap should be placed in the receive coarse gain option position (GAIN—+20, +10, 0, -10, -20) specified on the service order. The receive fine gain control is variable from 0 to 10 dB and is accessible through a hole in the faceplate of the CIU. Adjustment of the fine gain control is described in Section 598-082-500.

D. DAS 829A-L1A CIU

4.12 A power supply option (Fig. 51) on the DAS 829A-L1A CIU permits operation from a 24 Vac, -24 Vdc, or -48 Vdc power source. A plug-in strap should be placed in the option position specified on the service order (N position for 24 Vac or -24 Vdc, and -48 position for -48 Vdc).

4.13 A loopback amplifier gain option (Fig. 51) on the DAS 829A-L1A CIU permits the CIU to terminate channels with an end-to-end loss of either 8 or 16 dB. A plug-in strap should be placed in the option position specified on the service order (8 position for 8-dB channels and 16 position for 16-dB channels).

TABLE A

CALL DIRECTOR KEY ASSIGNMENT

Key Assignment for 30-button Call Director

Key Assignment for 18-button Call Director

REL (NOTE 1)	RING (NOTE 4)	6	12	18
DDD1A (NOTE 2)	1 (NOTE 5)	7	13	19
DDD2A (NOTE 2)	2	8	14	20
DDD1B (NOTE 3)	3	9	15	21
DDD2B (NOTE 3)	4	10	16	22
HOLD	5	11	17	23

Note 1: When switched dial backup service is provided, the 1st pickup key of the 1st key module will be nonlocking and will be designated REL.

Note 2: When dial backup channel A is provided, designations DDD1A and DDD2A will be provided as shown.

Note 3: When dial backup channel B is provided, designations DDD1B and DDD2B will be provided as shown.

Note 4: When alternate voice service is provided, the 1st pickup key of the 2nd key module will be nonlocking and will be designated RING.

Note 5: Pickup keys numbered 1 to 23 are used to control alternate voice arrangements and/or switched dial backup arrangements provided for 4-wire private lines designated 1 through 23. The numbered pickup keys will be identified in one of the following four ways:

(a) BLANK KEY — Provided when key is not used to control alternate voice or switched dial backup service.

(b) TALK N — Provided when key is used to control the alternate voice arrangement for 4-wire private line designated N.

(c) DBU N — Provided when key is used to control the switched dial backup arrangement for 4-wire private line designated N.

(d) TALK-DBU N — Provided when key is used to control the alternate voice and the switched dial backup arrangement for 4-wire private line designated N.

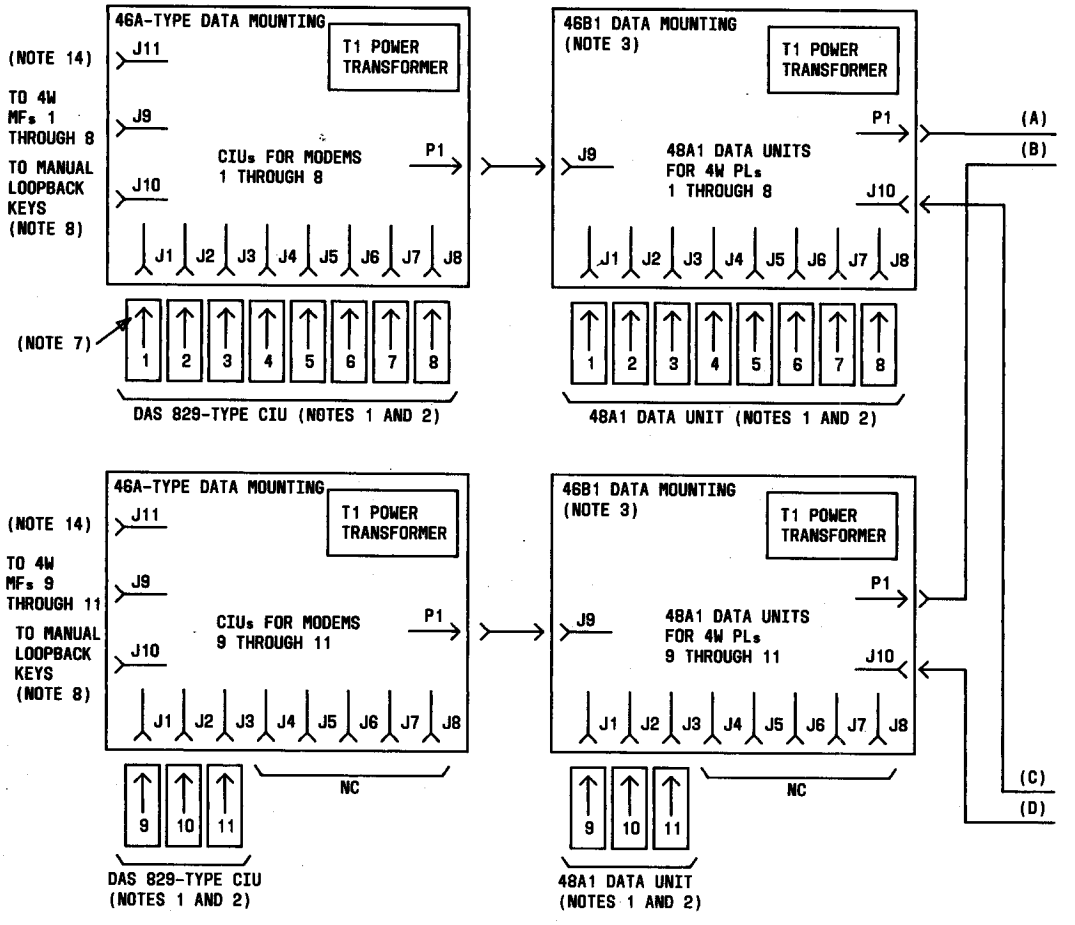


Fig. 42—Multiple 4-Wire FD or FDA Arrangement With Switched 4-Wire Dial Backup Service for 11 Modems or Less (Sheet 1 of 3)

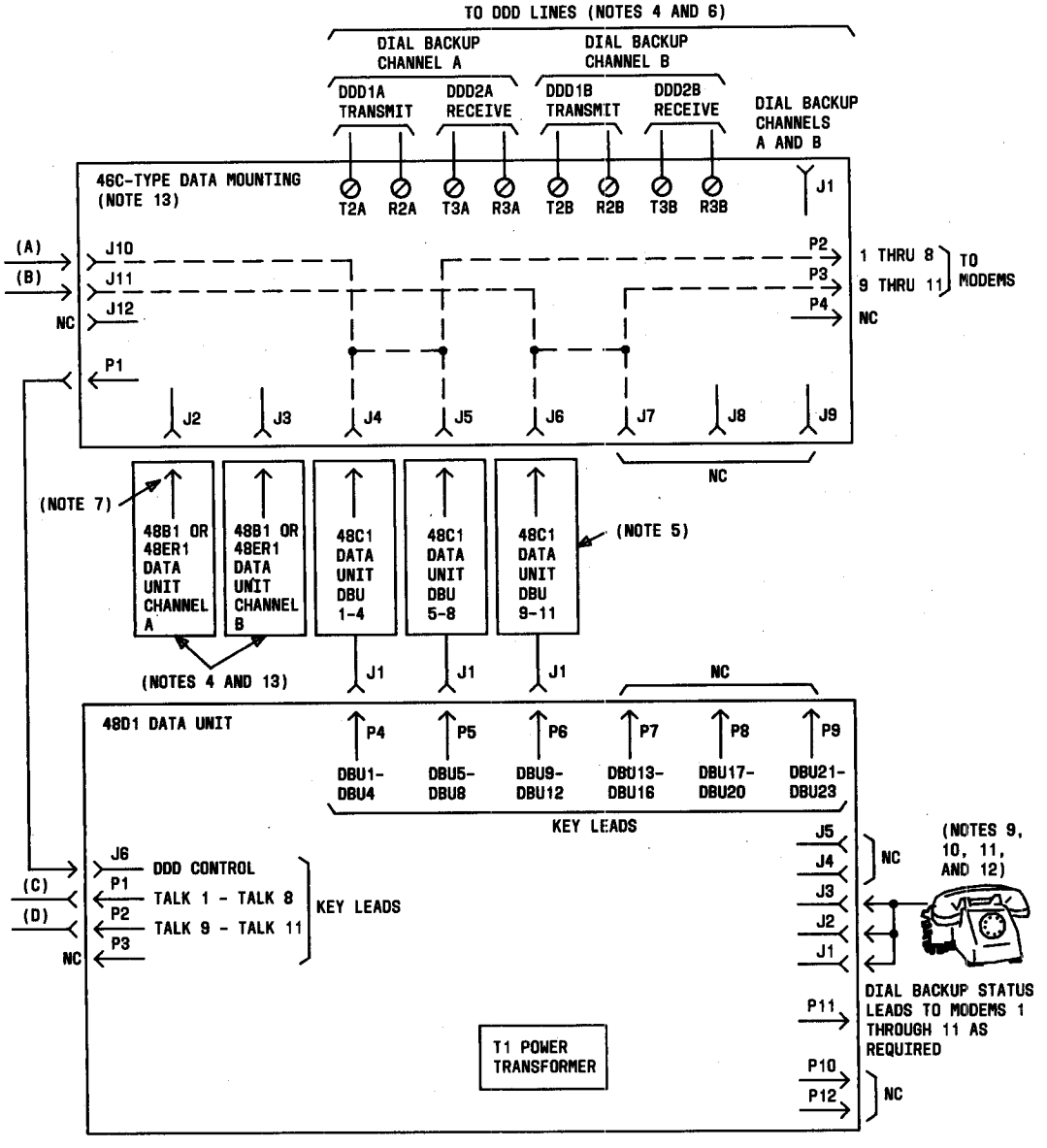


Fig. 42—Multiple 4-Wire FD or FDA Arrangement With Switched 4-Wire Dial Backup Service for 11 Modems or Less (Sheet 2 of 3)

NOTES:

1. A MAXIMUM OF ELEVEN FDA ARRANGEMENTS WITH SWITCHED DIAL BACKUP SERVICE TO EITHER ONE OF TWO DIAL BACKUP CHANNELS CAN BE PROVIDED AS SHOWN. AN FDA ARRANGEMENT IS PROVIDED FOR THE NTH 4W PL WHEN THE NTH DAS 829-TYPE CIU AND 48A1 DATA UNIT ARE PROVIDED. UNUSED POSITIONS IN BOTH THE 46A-TYPE AND THE 46B1 DATA MOUNTINGS ARE LEFT UNTERMINATED.
2. AN FD ARRANGEMENT IS PROVIDED FOR THE NTH 4W PL WHEN THE NTH DAS 829-TYPE CIU IS PROVIDED AND THE NTH 48A1 DATA UNIT IS NOT PROVIDED. UNUSED POSITIONS IN THE 46B1 DATA MOUNTING ARE LEFT UNTERMINATED.
3. WHEN ALTERNATE VOICE SERVICE IS NOT REQUIRED, OR ONLY REQUIRED ON SOME PORTION OF THE 4W PLs PROVIDED, IT MAY BE POSSIBLE TO ELIMINATE ALL, OR PART, OF THE INDICATED 46B1 DATA MOUNTINGS.
4. THE ARRANGEMENT SHOWN PROVIDES TWO DIAL BACKUP CHANNELS. WHEN ONE OF THE BACKUP CHANNELS IS NOT REQUIRED, THE 48B1 OR 48ER1 DATA UNIT ASSOCIATED WITH THAT CHANNEL AND THE DDD LINES REQUIRED FOR THAT CHANNEL ARE NOT PROVIDED.
5. WHEN SWITCHED DIAL BACKUP SERVICE IS NOT REQUIRED ON SOME PORTION OF THE SERVICE, IT MAY BE POSSIBLE TO REDUCE THE NUMBER OF 48C1 DATA UNITS REQUIRED.
6. FOR NONREGISTERED ARRANGEMENTS, THE DDD LINES MAY BE TERMINATED THROUGH USE OF THE SCREW TERMINALS OR CONNECTOR J1. FOR REGISTERED ARRANGEMENTS, THE SCREW TERMINALS MUST BE USED. THE REQUIRED CONNECTIONS ARE SHOWN IN FIG. 45.
7. PLUG SHOWN FOR EITHER THE DAS 829-TYPE CIU OR THE 48-TYPE DATA UNIT IS THE 40-PIN PLUG FORMED BY THE TERMINATIONS ON THE EDGE OF THE PRINTED WIRING BOARD.
8. MANUAL LOOPBACK KEYS ARE NORMALLY NOT PROVIDED.
9. A 630DAM OR 2630DAM 18-BUTTON KEY TELEPHONE SET MUST BE PROVIDED FOR CONTROL OF THE 2 BY 11 SWITCHING MATRIX AND ALTERNATE VOICE CIRCUITS. CONVERT THE TELEPHONE SET AS FOLLOWS:

SCREW TERMINAL LEADS				
COLOR	W-O	V-G	O-W	O-BK
REMOVE FROM	7	5	5	24
CONNECT TO	TAPE AND STORE	7	7	7

10. TO PROVIDE THE SERVICE SHOWN THE TELEPHONE KEY STRIP SHALL BE AS FOLLOWS:

REL	RING	TALK-DBU6
DDD1A	TALK-DBU1	TALK-DBU7
DDD2A	TALK-DBU2	TALK-DBU8
DDD1B	TALK-DBU3	TALK-DBU9
DDD2B	TALK-DBU4	TALK-DBU10
HOLD	TALK-DBU5	TALK-DBU11

WHEN SOME PORTION OF THE SERVICE IS NOT PROVIDED THE KEY STRIPS SHALL BE MODIFIED ACCORDINGLY.

11. CONVERT THE 1ST PICKUP KEY OF THE 1ST KEY MODULE (REL) TO A NONLOCKING KEY.
12. CONVERT THE 1ST PICKUP KEY OF THE 2ND KEY MODULE (RING) TO A NONLOCKING KEY.
13. FOR REGISTERED ARRANGEMENTS, THE 48ER1 DATA UNIT INSTALLED IN A 46C2 DATA MOUNTING IS REQUIRED.
14. CONNECTOR J1 PROVIDES ACCESS TO THE SIMPLEX PAIR SX1 AND SX2 OF THE DAS 829-TYPE CIU. THIS CONNECTOR IS NOT PROVIDED ON THE 46A1 DATA MOUNTING.

Fig. 42—Multiple 4-Wire FD or FDA Arrangement With Switched 4-Wire Dial Backup Service for 11 Modems or Less (Sheet 3 of 3)

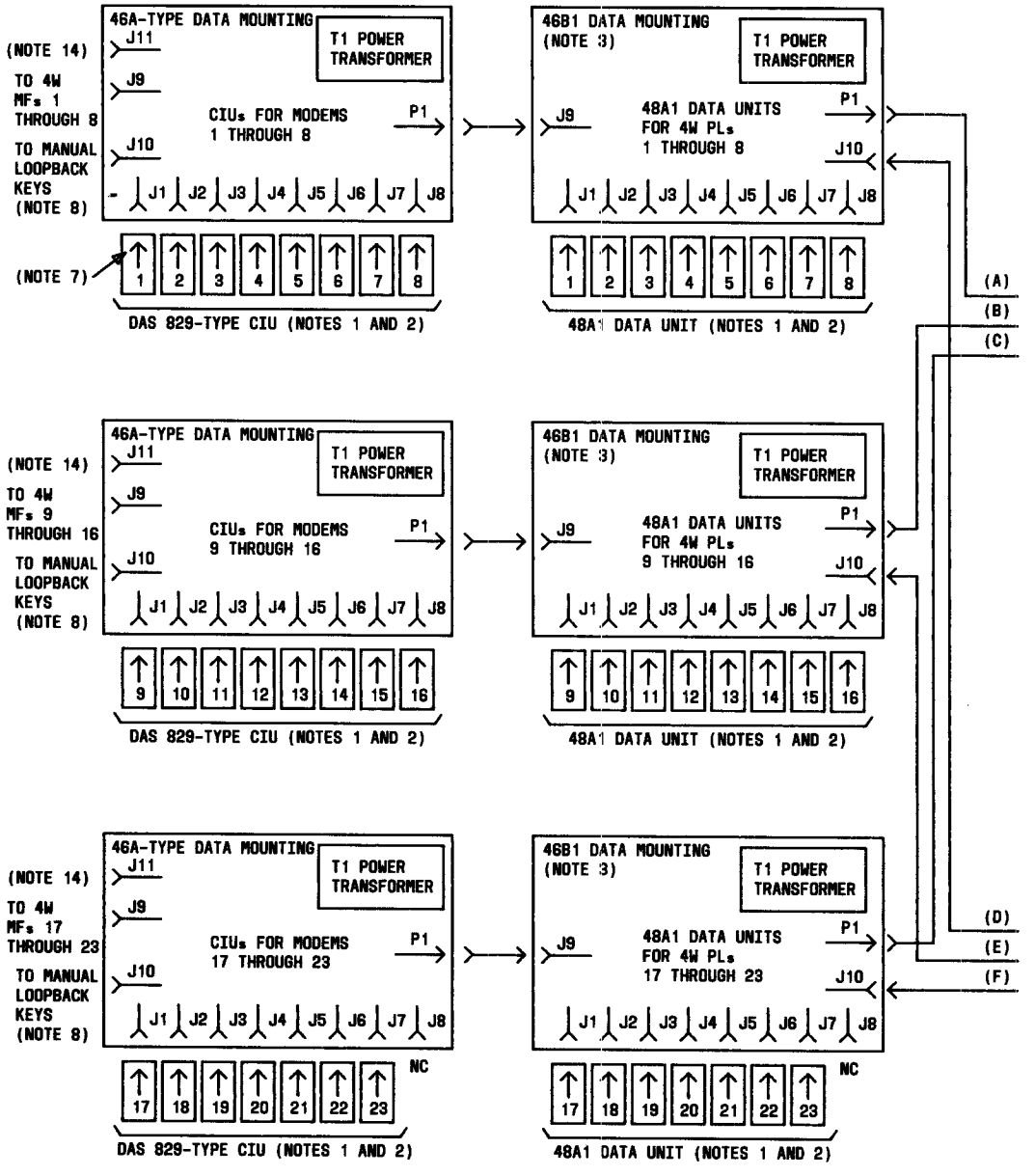


Fig. 43—Multiple 4-Wire FD or FDA Arrangement With Switched 4-Wire Dial Backup Service for 23 Modems or Less (Sheet 1 of 3)

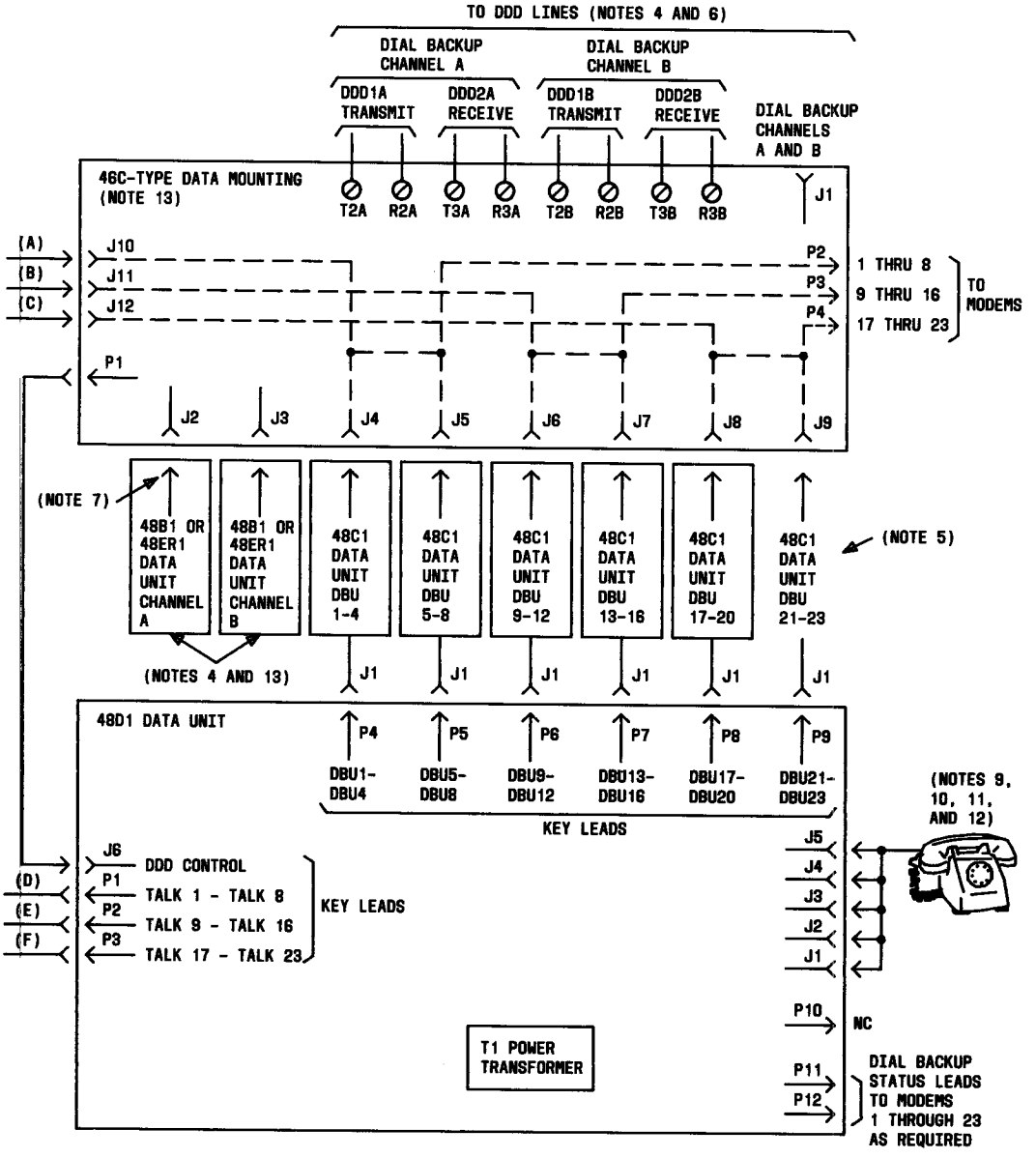


Fig. 43—Multiple 4-Wire FD or FDA Arrangement With Switched 4-Wire Dial Backup Service for 23 Modems or Less (Sheet 2 of 3)

NOTES:

1. A MAXIMUM OF TWENTY-THREE FDA ARRANGEMENTS WITH SWITCHED DIAL BACKUP SERVICE TO EITHER ONE OF TWO DIAL BACKUP CHANNELS CAN BE PROVIDED AS SHOWN. AN FDA ARRANGEMENT IS PROVIDED FOR THE NTH 4W PL WHEN THE NTH DAS 829-TYPE CIU AND 48A1 DATA UNIT ARE PROVIDED. UNUSED POSITIONS IN BOTH THE 46A-TYPE AND THE 46B1 DATA MOUNTINGS ARE LEFT UNTERMINATED.
2. AN FD ARRANGEMENT IS PROVIDED FOR THE NTH 4W PL WHEN THE NTH DAS 829-TYPE CIU IS PROVIDED AND THE NTH 48A1 DATA UNIT IS NOT PROVIDED. UNUSED POSITIONS IN THE 46B1 DATA MOUNTING ARE LEFT UNTERMINATED.
3. WHEN ALTERNATE VOICE SERVICE IS NOT REQUIRED, OR ONLY REQUIRED ON SOME PORTION OF THE 4W PLs PROVIDED, IT MAY BE POSSIBLE TO ELIMINATE ALL, OR PART, OF THE INDICATED 46B1 DATA MOUNTINGS.
4. THE ARRANGEMENT SHOWN PROVIDES TWO DIAL BACKUP CHANNELS. WHEN ONE OF THE BACKUP CHANNELS IS NOT REQUIRED, THE 48B1 OR 48ER1 DATA UNIT ASSOCIATED WITH THAT CHANNEL AND THE DDD LINES REQUIRED FOR THAT CHANNEL ARE NOT PROVIDED.
5. WHEN SWITCHED DIAL BACKUP SERVICE IS NOT REQUIRED ON SOME PORTION OF THE SERVICE, IT MAY BE POSSIBLE TO REDUCE THE NUMBER OF 48C1 DATA UNITS REQUIRED.
6. FOR NONREGISTERED ARRANGEMENTS, THE DDD LINES MAY BE TERMINATED THROUGH USE OF THE SCREW TERMINALS OR CONNECTOR J1. FOR REGISTERED ARRANGEMENTS, THE SCREW TERMINALS MUST BE USED. THE REQUIRED CONNECTIONS ARE SHOWN IN FIG. 45.
7. PLUG SHOWN FOR EITHER THE DAS 829-TYPE CIU OR THE 48-TYPE DATA UNIT IS THE 40-PIN PLUG FORMED BY THE TERMINATIONS ON THE EDGE OF THE PRINTED WIRING BOARD.
8. MANUAL LOOPBACK KEYS ARE NORMALLY NOT PROVIDED.
9. A 631DAM OR 2631DAM 30-BUTTON KEY TELEPHONE SET MUST BE PROVIDED FOR CONTROL OF THE 2 BY 23 SWITCHING MATRIX AND ALTERNATE VOICE CIRCUITS. CONVERT THE TELEPHONE SET AS FOLLOWS:

SCREW TERMINAL LEADS				
COLOR	W-O	V-G	O-W	O-BK
REMOVE FROM	7	5	5	24
CONNECT TO	TAPE AND STORE	7	7	7

10. TO PROVIDE THE SERVICE SHOWN THE TELEPHONE KEY STRIP SHALL BE AS FOLLOWS:

REL	RING	TALK-DBU6	TALK-DBU12	TALK-DBU18
DDD1A	TALK-DBU1	TALK-DBU7	TALK-DBU13	TALK-DBU19
DDD2A	TALK-DBU2	TALK-DBU8	TALK-DBU14	TALK-DBU20
DDD1B	TALK-DBU3	TALK-DBU9	TALK-DBU15	TALK-DBU21
DDD2B	TALK-DBU4	TALK-DBU10	TALK-DBU16	TALK-DBU22
HOLD	TALK-DBU5	TALK-DBU11	TALK-DBU17	TALK-DBU23

WHEN SOME PORTION OF THE SERVICE IS NOT PROVIDED THE KEY STRIPS SHALL BE MODIFIED ACCORDINGLY.

11. CONVERT THE 1ST PICKUP KEY OF THE 1ST KEY MODULE (REL) TO A NONLOCKING KEY.
12. CONVERT THE 1ST PICKUP KEY OF THE 2ND KEY MODULE (RING) TO A NONLOCKING KEY.
13. FOR REGISTERED ARRANGEMENTS, THE 48ER1 DATA UNIT INSTALLED IN A 46C2 DATA MOUNTING IS REQUIRED.
14. CONNECTOR J11 PROVIDES ACCESS TO THE SIMPLEX PAIR SX1 AND SX2 OF THE DAS 829-TYPE CIU. THIS CONNECTOR IS NOT PROVIDED ON THE 46A1 DATA MOUNTING.

Fig. 43—Multiple 4-Wire FD or FDA Arrangement With Switched 4-Wire Dial Backup Service for 23 Modems or Less (Sheet 3 of 3)

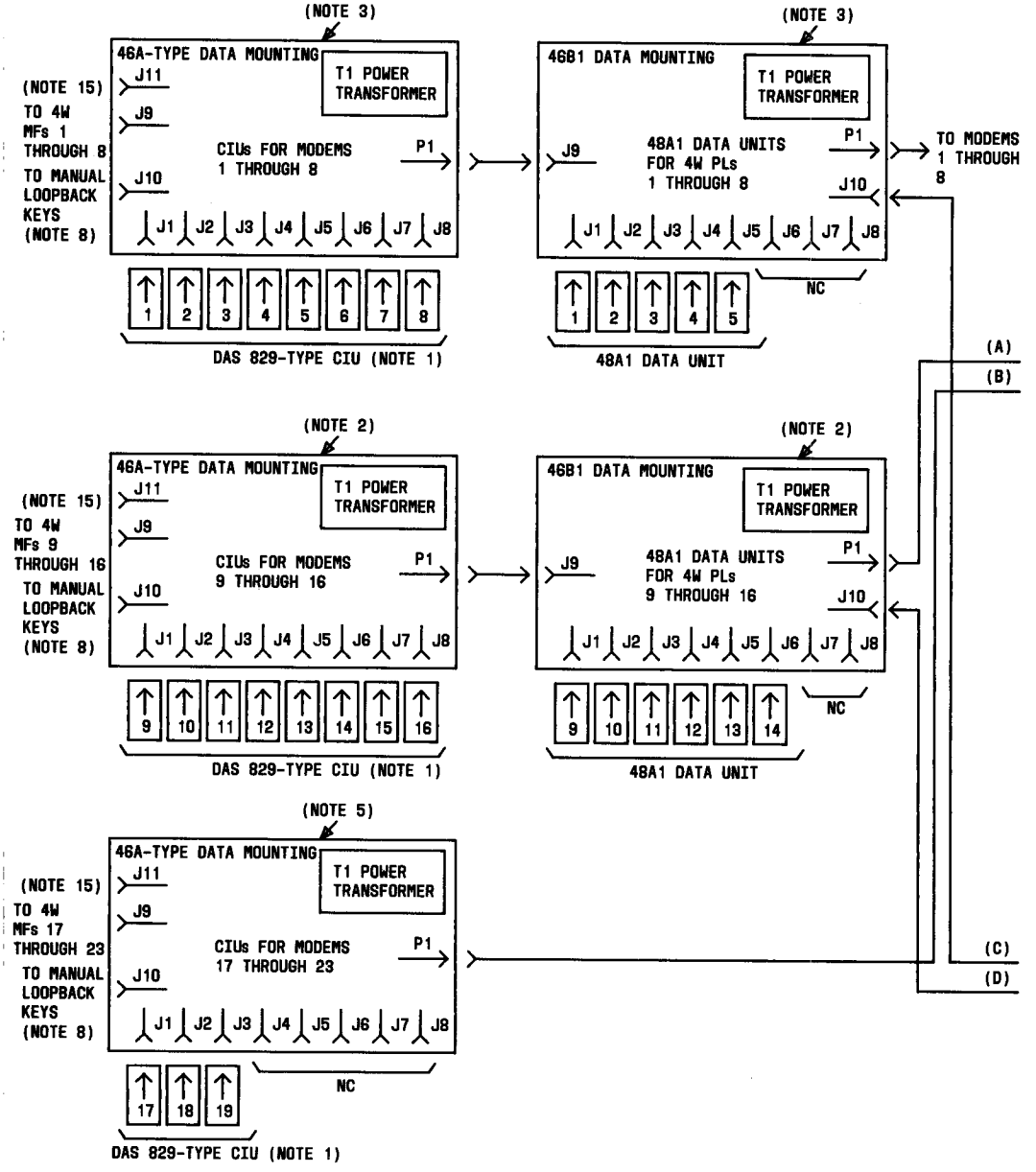


Fig. 44—Multiple 4-Wire FD and FDA Arrangements With and Without Switched 4-Wire Dial Backup Service (Sheet 1 of 3)

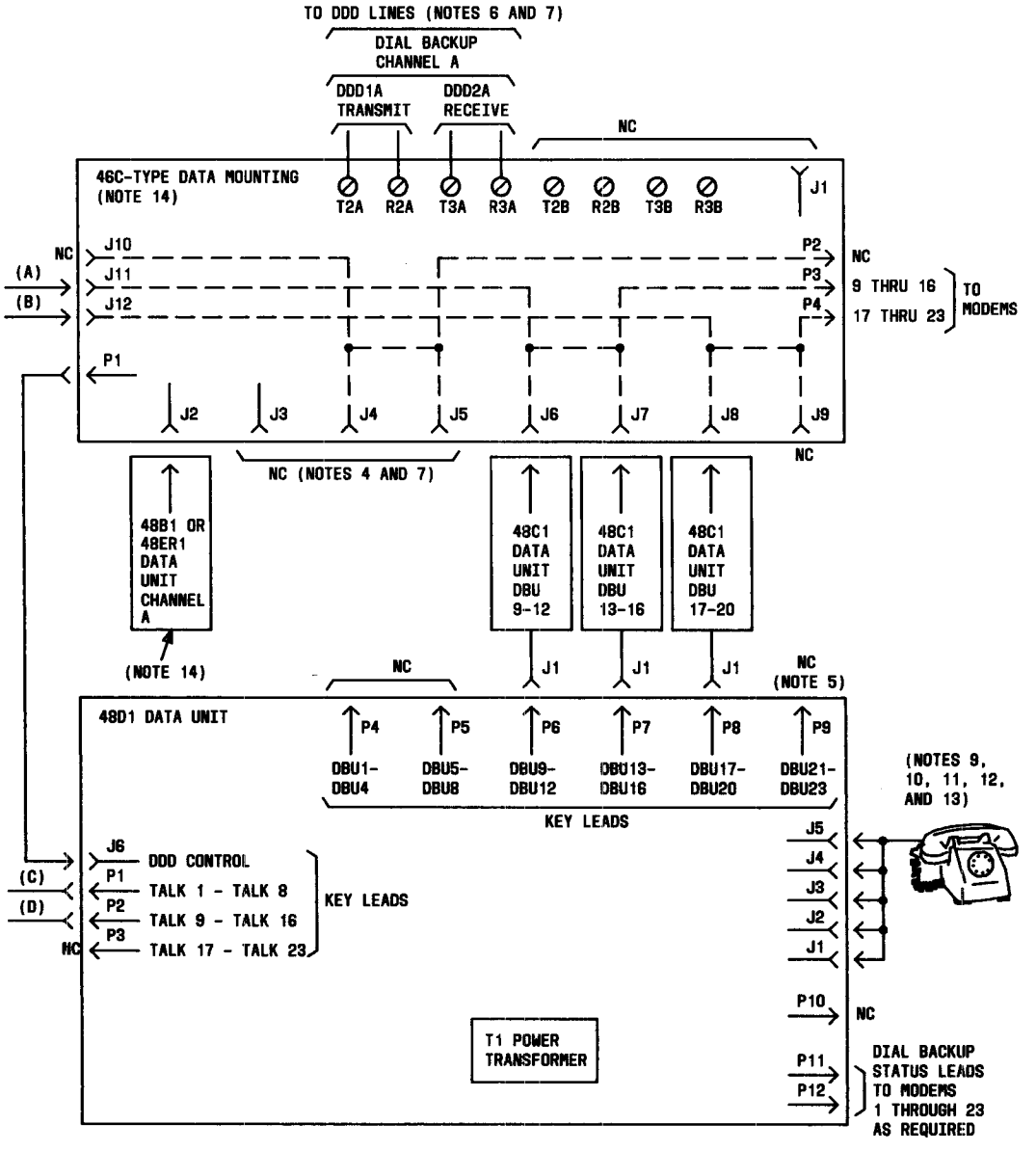


Fig. 44—Multiple 4-Wire FD and FDA Arrangements With and Without Switched 4-Wire Dial Backup Service (Sheet 2 of 3)

NOTES:

1. THE ARRANGEMENT SHOWN ILLUSTRATES THE VARIETY OF SERVICES THAT CAN BE CONTROLLED THROUGH USE OF A 30-BUTTON KEY TELEPHONE SET. THE ARRANGEMENT SHOWN PROVIDES ELEVEN FDA ARRANGEMENTS AND EIGHT FD ARRANGEMENTS. SWITCHED DIAL BACKUP SERVICE, TO ONE DIAL BACKUP CHANNEL, IS PROVIDED FOR SIX OF THE FDA ARRANGEMENTS AND FIVE OF THE FD ARRANGEMENTS.
2. A MAXIMUM OF EIGHT FDA ARRANGEMENTS WITH SWITCHED DIAL BACKUP SERVICE TO ONE DIAL BACKUP CHANNEL CAN BE PROVIDED FOR 4W PLs 9 THROUGH 16 WITH THE INDICATED 46A-TYPE AND 46B1 DATA MOUNTINGS. POSITIONS 15 AND 16 OF THE 46B1 DATA MOUNTING ARE LEFT UNTERMINATED. THESE POSITIONS PROVIDE FD ARRANGEMENTS.
3. A MAXIMUM OF EIGHT FDA ARRANGEMENTS CAN BE PROVIDED FOR 4W PLs 1 THROUGH 8 WITH THE INDICATED 46A-TYPE AND 46B1 DATA MOUNTINGS. POSITIONS 6, 7 AND 8 OF THE 46B1 DATA MOUNTING ARE LEFT UNTERMINATED. THESE POSITIONS PROVIDE FD ARRANGEMENTS. THESE DATA MOUNTINGS ARE NOT CONNECTED TO THE 46C-TYPE DATA MOUNTING AS SWITCHED DIAL BACKUP SERVICE IS NOT REQUIRED. THE 46B1 DATA MOUNTING IS CONNECTED TO THE 48D1 DATA UNIT TO PROVIDE FOR KEY CONTROL OF THE FDA ARRANGEMENTS ON 4W PLs 1 THROUGH 5.
4. THE 48C1 DATA UNITS PROVIDING SWITCHING MATRICES FOR MODEMS 1 THROUGH 4 AND 5 THROUGH 8 ARE NOT PROVIDED AS SWITCHED DIAL BACKUP SERVICE IS NOT REQUIRED FOR THESE 4W PLs.
5. A MAXIMUM OF SEVEN FD ARRANGEMENTS WITH SWITCHED DIAL BACKUP SERVICE TO ONE DIAL BACKUP CHANNEL CAN BE PROVIDED FOR 4W PLs 17 THROUGH 23 WITH THE INDICATED 46A-TYPE DATA MOUNTING. POSITIONS 17, 18 AND 19 OF THE 46A-TYPE DATA MOUNTING PROVIDE FOR THREE FD ARRANGEMENTS. THE SWITCHING MATRIX (48C1 DATA UNIT) REQUIRED TO PROVIDE SWITCHED DIAL BACKUP SERVICE FOR POSITIONS 17 THROUGH 20 IS PROVIDED. THE SWITCHING MATRIX FOR POSITIONS 21 THROUGH 23 IS NOT PROVIDED AS THESE LINES ARE NOT TERMINATED. IF LINES 21 THROUGH 23 ARE TO BE TERMINATED THE SWITCHING MATRIX FOR THESE POSITIONS IS REQUIRED.
6. THE SCREW TERMINALS ARE USED TO TERMINATE THE PAIR OF DDD LINES REQUIRED TO PROVIDE DIAL BACKUP CHANNEL A. THE REQUIRED CONNECTIONS ARE SHOWN IN FIG. 45. THE 48B1 OR 48ER1 DATA UNIT REQUIRED FOR CHANNEL A IS PROVIDED.
7. DIAL BACKUP CHANNEL B IS NOT PROVIDED; HENCE THE 48B1 OR 48ER1 DATA UNIT REQUIRED FOR CHANNEL B IS NOT PROVIDED.
8. MANUAL LOOPBACK KEYS ARE NORMALLY NOT PROVIDED.
9. A 631DAM OR 2631DAM 30-BUTTON KEY TELEPHONE SET MUST BE PROVIDED FOR CONTROL OF THE SWITCHING MATRIX AND ALTERNATE VOICE CIRCUITS. CONVERT THE TELEPHONE SET AS FOLLOWS:

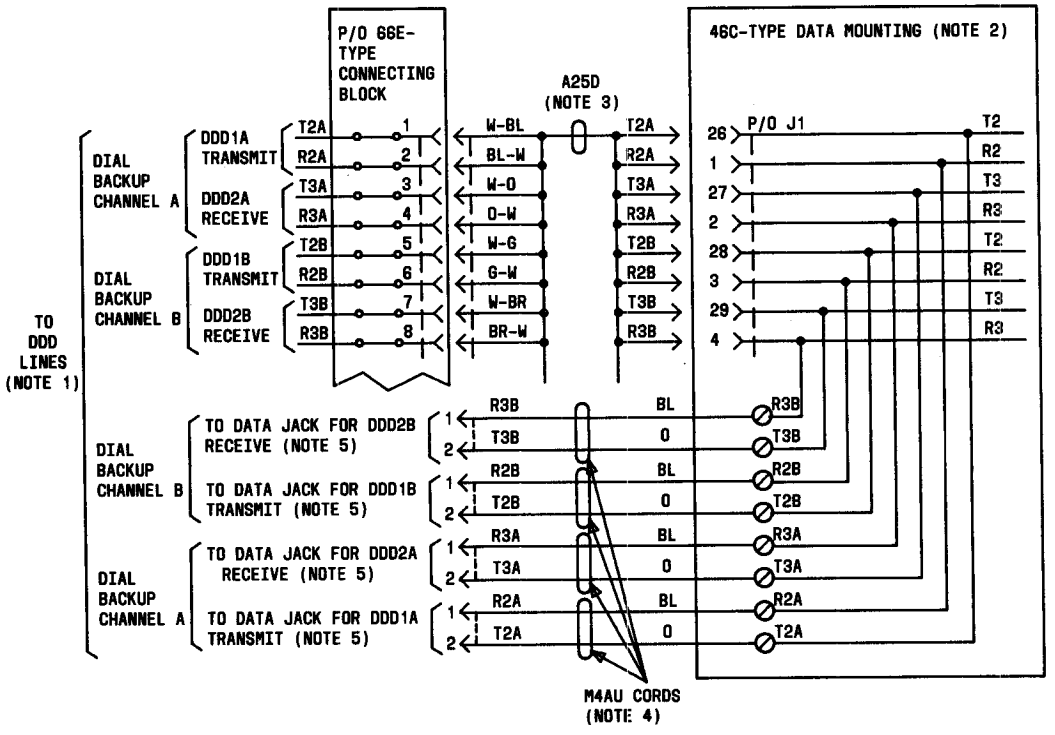
SCREW TERMINAL LEADS				
COLOR	W-O	V-G	O-W	O-BK
REMOVE FROM	7	5	5	24
CONNECT TO	TAPE AND STORE	7	7	7

10. TO PROVIDE THE SERVICE SHOWN THE TELEPHONE KEY STRIP SHALL BE AS FOLLOWS:

REL	RING		TALK-DBU12	DBU18
DDD1A	TALK 1		TALK-DBU13	DBU19
DDD2A	TALK 2		TALK-DBU14	
	TALK 3	TALK-DBU9	DBU15	
	TALK 4	TALK-DBU10	DBU16	
HOLD	TALK 5	TALK-DBU11	DBU17	

11. THE PICKUPS KEYS PROVIDING CONTROL OF 4W PLs ARE IDENTIFIED AS FOLLOWS:
    DBU N - CONTROLS THE SWITCHING MATRIX FOR POSITION N.
    TALK N - CONTROLS THE ALTERNATE VOICE CIRCUIT FOR POSITION N.
    TALK-DBU N - CONTROLS THE ALTERNATE VOICE AND SWITCHING MATRIX FOR POSITION N.
    BLANK - ALTERNATE VOICE CIRCUIT NOT PROVIDED AND SWITCHING MATRIX IS NOT PROVIDED OR IS NOT USED.
12. CONVERT THE 1ST PICKUP KEY OF THE 1ST KEY MODULE (REL) TO A NONLOCKING KEY.
13. CONVERT THE 1ST PICKUP KEY OF THE 2ND KEY MODULE (RING) TO A NONLOCKING KEY.
14. FOR REGISTERED ARRANGEMENTS, THE 48ER1 DATA UNIT INSTALLED IN A 46C2 DATA MOUNTING IS REQUIRED.
15. CONNECTOR J11 PROVIDES ACCESS TO THE SIMPLEX PAIR SX1 AND SX2 OF THE DAS 829-TYPE CIU. THIS CONNECTOR IS NOT PROVIDED ON THE 46A1 DATA MOUNTING.

Fig. 44—Multiple 4-Wire FD and FDA Arrangements With and Without Switched 4-Wire Dial Backup Service (Sheet 3 of 3)



NOTES:
1. FOR NONREGISTERED ARRANGEMENTS, THE DDD LINES MAY BE TERMINATED THROUGH USE OF THE SCREW TERMINALS OR CONNECTOR J1. FOR REGISTERED ARRANGEMENTS, THE SCREW TERMINALS MUST BE USED.
2. FOR NONREGISTERED ARRANGEMENTS, THE 46C1 OR 46C2 DATA MOUNTING MAY BE USED. FOR REGISTERED ARRANGEMENTS, THE 46C2 DATA MOUNTING MUST BE USED.
3. EXTEND WITH B25A AS REQUIRED.
4. TAPE AND STORE UNUSED LEADS.
5. USE DATA JACK USOC RJ41S WITH SWITCH SET TO FLL.

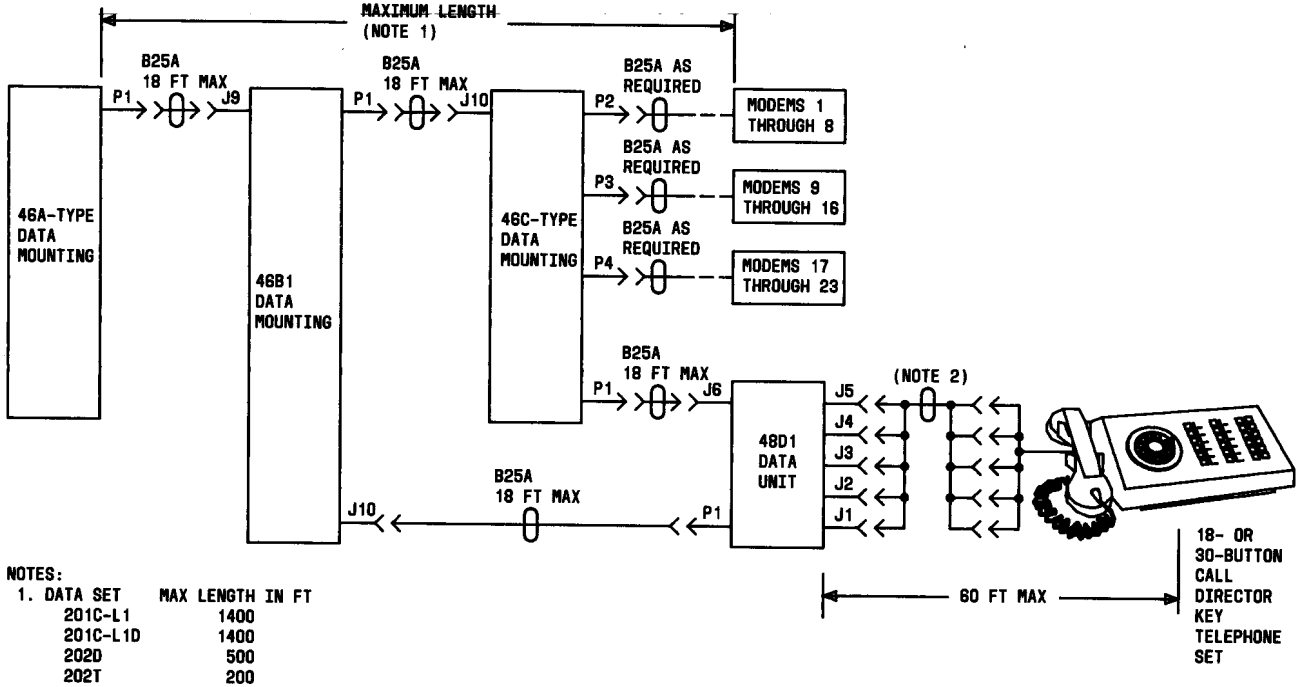
Fig. 45—46C-Type Data Mounting—Connections to DDD Lines

Note: Alternate voice and/or dial backup service cannot be provided for CIUs that terminate 8-dB channels.

4.14 A sealing current option (Fig. 51) is provided on the DAS 829A-L1A CIU. If this option is specified on the service order, a plug-in strap should be placed in the sealing current option (SC) position. If the option is not specified on the service order, the plug-in strap should be placed in the sealing current storage (ST) position.

4.15 A line impedance option (Fig. 51) on the DAS 829A-L1A CIU provides a 600- or 1200-ohm line termination. The two plug-in straps used for line termination should be placed in the 600-ohm or 1200-ohm option positions as specified on the service order.

4.16 The transmit (TRANS) attenuator (Fig. 51) and the receive (REC) attenuator on the DAS 829A-L1A CIU should be set to the attenuation values specified on the service order, as described in paragraph 4.03.



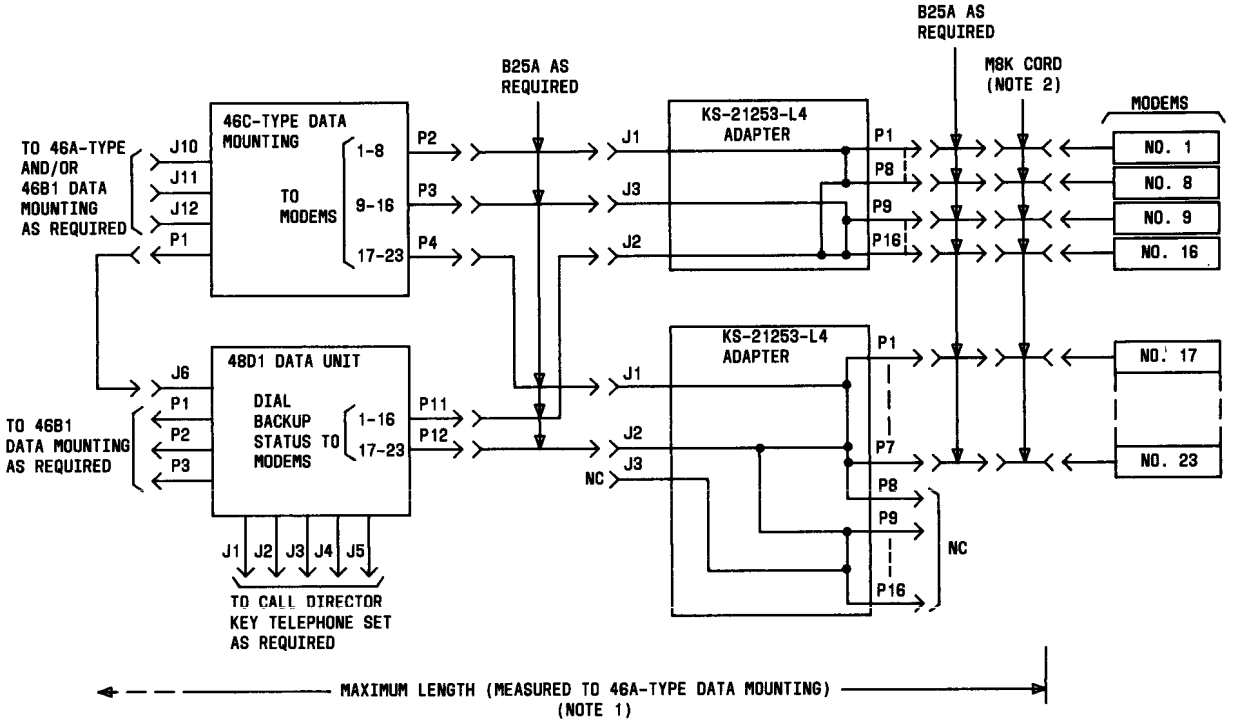
NOTES:

1. DATA SET MAX LENGTH IN FT

201C-L1	1400
201C-L1D	1400
202D	500
202T	200
208A	1400
209A	1400

2. FOR THE 18-BUTTON CALL DIRECTOR, USE 875A CABLE AS REQUIRED AND CONNECT TO J1 THROUGH J3 ON THE 48D1 DATA UNIT.
   FOR THE 30-BUTTON CALL DIRECTOR, USE 875A AND 850A CABLES AS REQUIRED AND CONNECT TO J1 THROUGH J5 ON THE 48D1 DATA UNIT.

Fig. 46—Multiple Arrangement Showing Cable Length Restrictions



NOTES:

1. DATA SET — MAX LENGTH IN FT

DATA SET	MAX LENGTH IN FT
201C-L1	1400
201C-L1D	1400
202D	500
202T	200
208A	1400
209A	1400

2. THE M8K CORD IS SUPPLIED AND USED WITH ALL DATA SETS EXCEPT 202D. USE D50AA-3 IN PLACE OF D6AA-61 SUPPLIED WITH DATA SET 202D.

Fig. 47—Multiple Arrangement Using KS-21253-L4 Adapter for Dial Backup Status to Modems

TABLE B

COMMON CONTROL OF FDA ARRANGEMENTS PROVIDED THROUGH USE OF A 30-BUTTON CALL DIRECTOR, WITH AND WITHOUT SWITCHED DIAL BACKUP SERVICE

NUMBER OF FD AND/OR FDA ARRANGEMENTS PROVIDED WITH SWITCHED DIAL BACKUP SERVICE	NUMBER OF PICKUP KEYS AVAILABLE FOR CONTROL OF FDA ARRANGEMENTS	PICKUP KEY ASSIGNMENT (SEE TABLE A)	
		FOR SWITCHED DIAL BACKUP SERVICE. KEYS DESIGNATED DBU OR TALK-DBU	FOR FDA SERVICE. KEYS DESIGNATED TALK
1 through 7	1 through 16	17 through 23	1 through 16
8 through 15	1 through 8	9 through 23	1 through 8
16	1 through 7	1 through 16	17 through 23
17 through 23	none	1 through 23	none

E. DAS 829B-L1A CIU

4.17 A power supply option (Fig. 52) on the DAS 829B-L1A CIU permits operation from a 24 Vac, -24 Vdc, or -48 Vdc power source. A plug-in strap should be placed in the option position specified on the service order (N position for 24 Vac or -24 Vdc, and -48 position for -48 Vdc).

4.18 A loopback amplifier gain option (Fig. 52) on the DAS 829B-L1A CIU permits the CIU to terminate channels with an end-to-end loss of either 8 or 16 dB. A plug-in strap should be placed in the option position specified on the service order (8 position for 8-dB channels and 16 position for 16-dB channels).

> ***Note:*** Alternate voice and/or dial backup service cannot be provided for CIUs that terminate 8-dB channels.

4.19 A sealing current option (Fig. 52) is provided on the DAS 829B-L1A CIU. If this option is specified on the service order, a plug-in strap should be placed in the sealing current option (SC) position. If the option is not specified on the service order, the plug-in strap should be placed in the sealing current storage (ST) position.

4.20 A line impedance option (Fig. 52) on the DAS 829B-L1A CIU provides a 150-, 600-, or 1200-ohm line termination. The four plug-in straps used for line termination should be placed in the 150-ohm, 600-ohm, or 1200-ohm positions as specified on the service order.

4.21 The transmit (TRANS) attenuator (Fig. 52) on the DAS 829B-L1A CIU should be set to the attenuation value specified on the service order, as described in paragraph 4.03.

4.22 A coarse gain option (Fig. 52) and a fine gain control on the DAS 829B-L1A CIU provide adjustment for the output level of the CIU receive amplifier. A plug-in strap should be placed in the receive coarse gain option position (GAIN—+10, 0, -10, -20) specified on the service order. The receive fine gain control is variable from 0 to 10 dB and is accessible through a hole in the faceplate of the CIU. Adjustment of the fine gain control is described in Section 598-082-500.

F. DAS 829C-L1A CIU

4.23 A power supply option (Fig. 53) on the DAS 829C-L1A CIU permits operation from a 24 Vac, -24 Vdc, or -48 Vdc power source. A plug-in strap should be placed in the option position specified on the service order (N position for 24 Vac or -24 Vdc, and -48 position for -48 Vdc).

4.24 A loopback amplifier gain option (Fig. 53) on the DAS 829C-L1A CIU permits the CIU to terminate channels with an end-to-end loss of either 8 or 16 dB. A plug-in strap should be placed in the option position specified on the service order

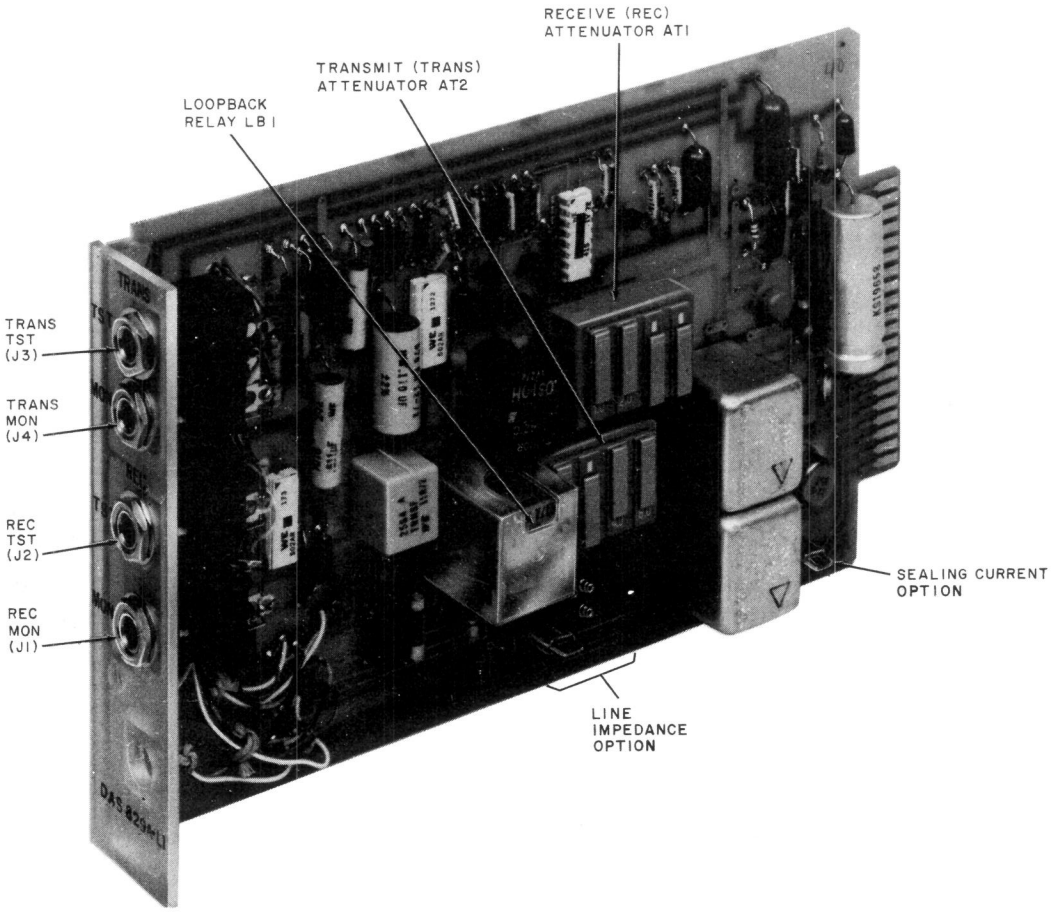


Fig. 48—DAS 829A-L1 CIU

(8 position for 8-dB channels and 16 position for 16-dB channels).

> ***Note:*** Alternate voice and/or dial backup service cannot be provided for CIUs that terminate 8-dB channels.

4.25 A sealing current option (Fig. 53) is provided on the DAS 829C-L1A CIU. If this option is specified on the service order, a plug-in strap should be placed in the sealing current option (SC) position. If the option is not specified on the service order, the plug-in strap should be placed in the sealing current storage (ST) position.

4.26 A 359A or 359K equalizer equivalent option (Fig. 53) is provided on the DAS 829C-L1A CIU. This equalizer equivalent consists of a slope equalizer circuit and a line termination (1200-ohm for 359A and 600-ohm for 359K). Either the 359A or 359K equalizer equivalent should be selected as specified on the service order. The 359A equalizer equivalent is selected by inserting two plug-in straps in column 359 adjacent to the designation A. The 359K equalizer equivalent is selected by inserting

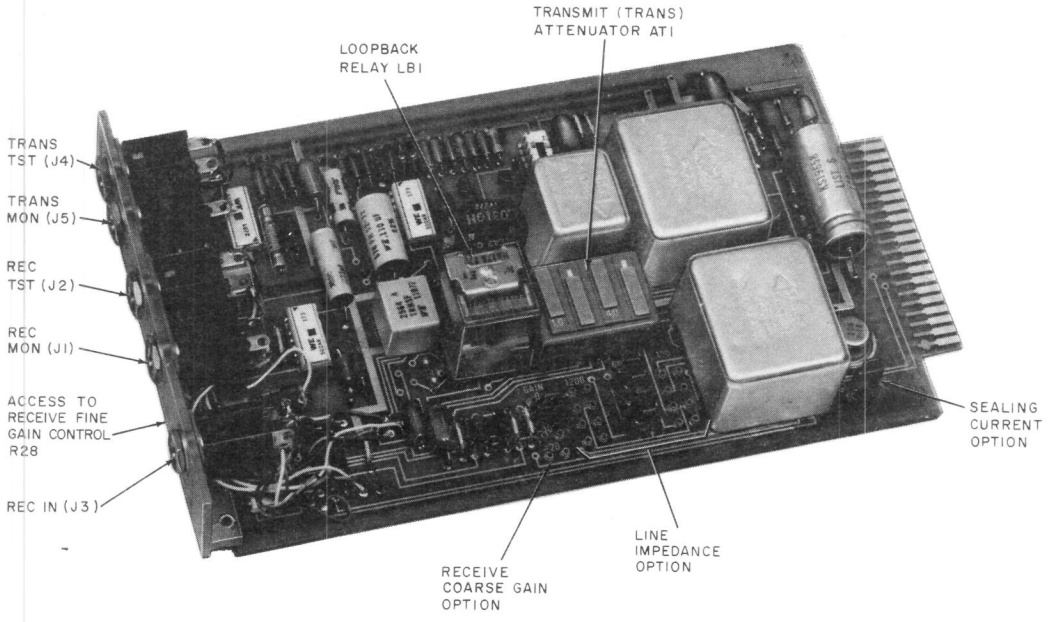


Fig. 49—DAS 829B-L1 CIU

two plug-in straps in column 359 adjacent to the designation K. After the equalizer is selected, the required equalizer characteristics are provided by inserting plug-in straps in the positions specified on the service order or the circuit layout record (CLR). The straps should be inserted in positions identified by columns A, B, C, and D and rows 1, 2, 3, and 4. Strap storage is provided to the left of columns A, B, C, and D in the four ST columns. Additional information is provided in Sections 332-104-500 and 332-116-201.

4.27 The transmit (TRANS) attenuator (Fig. 53) on the DAS 829C-L1A CIU should be set to the attenuation value specified on the service order, as described in paragraph 4.03.

4.28 A coarse gain option (Fig. 53) and a fine gain control on the DAS 829C-L1A CIU provide adjustment for the output level of the CIU receive amplifier. A plug-in strap should be placed in the receive coarse gain option position (GAIN—+20, +10, 0, -10, -20) specified on the service order. The receive fine gain control is variable from 0 to 10 dB and is accessible through a hole in the faceplate of the CIU. Adjustment of the fine gain control is described in Section 598-082-500.

G. 46A2 Data Mounting

4.29 A power supply option (Fig. 54) on the 46A2 data mounting permits operation from a 24 Vac, -24 Vdc, or -48 Vdc power source. Two plug-in straps should be placed in the option position specified on the service order (AC position for 24 Vac and DC position for -24 Vdc or -48Vdc).

H. 46B1 Data Mounting

4.30 A ringing supply option (Fig. 55) on the 46B1 data mounting uses a plug-in strap to select an internal ringing supply (plug-in strap in INT position) or an external ringing supply (plug-in strap in EXT position). When the 46B1 data mounting is used with an 830- or 2830-type key telephone set, the plug-in strap must be in the INT position. When the 46B1 data mounting is used with a 48D1 data unit or a locally engineered

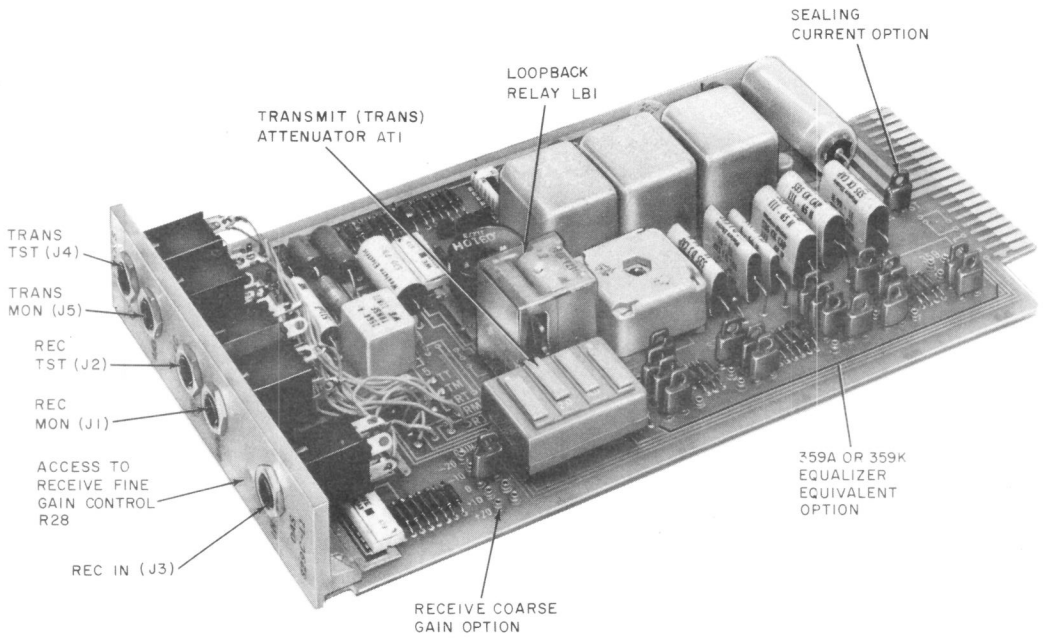


Fig. 50—DAS 829C-L1 CIU

key system, the plug-in strap must be in the EXT position.

I. 48B1 Data Unit

4.31 A slope equalizer option (Fig. 56) that inserts 4 dB of slope equalization into the receive path is provided on the 48B1 data unit. If this option is specified on the service order, a plug-in strap should be placed in the 4 position. If the option is not specified on the service order, the plug-in strap should be placed in the 0 position.

4.32 Receive gain control R9 (Fig. 56) on the 48B1 data unit provides adjustment for the output level of the receive amplifier in the data unit. Adjustment of R9 is described in Section 598-082-500.

4.33 Transmit attenuator AT1 (Fig. 56) on the 48B1 data unit is used to set the transmit signal level at the central office. This level is set as described in Section 598-082-500.

J. 48ER1 Data Unit

4.34 The 48ER1 data unit (Fig. 57) has options that must be installed prior to placing the data unit in operation. The options to be installed should be specified on the service order. Refer to Table C for a summary of the options.

4.35 ***Call Control:*** The calls required to enable the 48ER1 data unit to establish a 4-wire dial backup channel are initiated by either manual or automatic dialing.

(a) With manual dialing (option M) a key telephone set is used. If this option is specified on the service order, nine plug-in straps should be placed in the M1 through M9 positions (Fig. 58).

(b) With automatic dialing (option A), the following items are used: a station dial and a customer- or modem-provided contact; a station dial and the O/R (originate/release) switch on the faceplate of the 48ER1 data unit; or an automatic calling

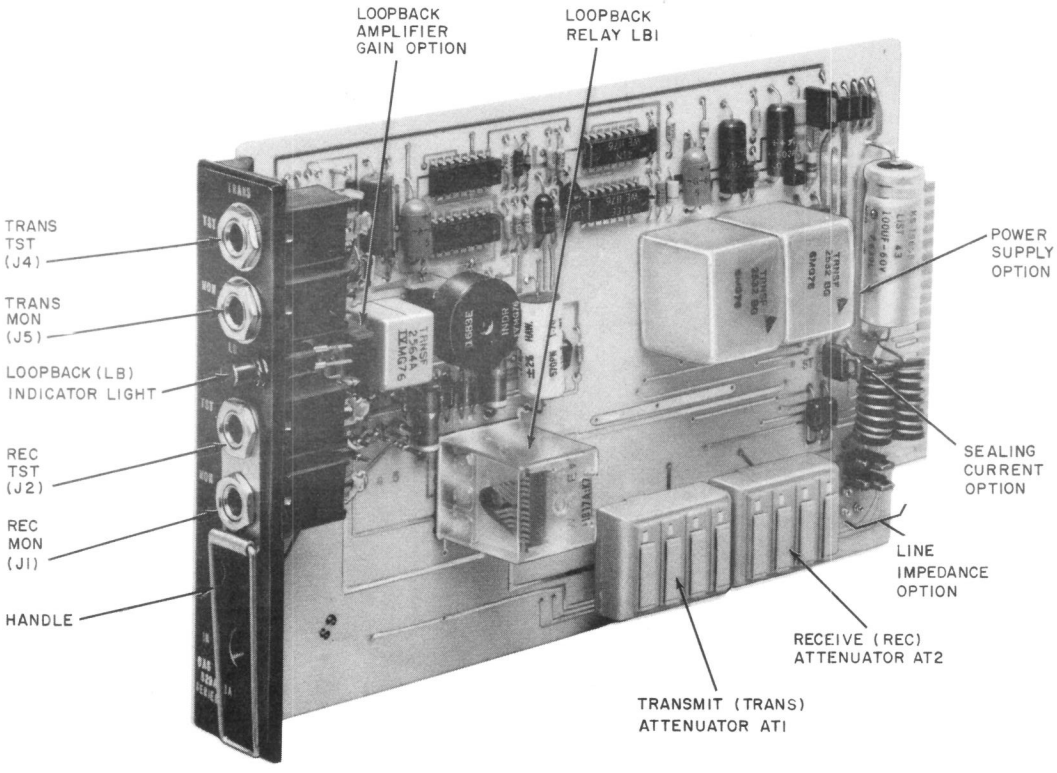


Fig. 51—DAS 829A-L1A CIU

unit (ACU) and a customer- or modem-provided contact. If this option is specified on the service order, nine plug-in straps should be placed in the A1 through A9 positions (Fig. 58).

4.36 ***Unit Control:*** Operating control of the 48ER1 data unit is provided by a key telephone set, a customer- or modem-provided contact, or the O/R (originate/release) switch on the faceplate of the 48ER1 data unit.

(a) With a key telephone set (option T), the 48ER1 data unit will establish a 4-wire dial backup channel and connect the modem to the dial backup channel when directed by control signals from the telephone set. To release the dial backup channel and return the modem to the 4-wire private line, the required control signals are again provided by the key telephone set. If this option is specified on the service order, a plug-in strap should be placed in the T position (Fig. 58).

(b) With a customer- or modem-provided contact (option D), the 48ER1 data unit and an associated station dial or ACU will attempt to establish a 4-wire dial backup channel when the customer or modem provides and maintains a contact closure. When the dial backup channel is established, the 48ER1 data unit will connect the modem to the dial backup channel. If the dial backup channel is not established within 3 minutes, the customer or modem must generate a retry request by interrupting the contact closure for a minimum of 25 ms. To release the dial backup channel and return the modem to the 4-wire private line, the customer or modem removes the contact closure. If this

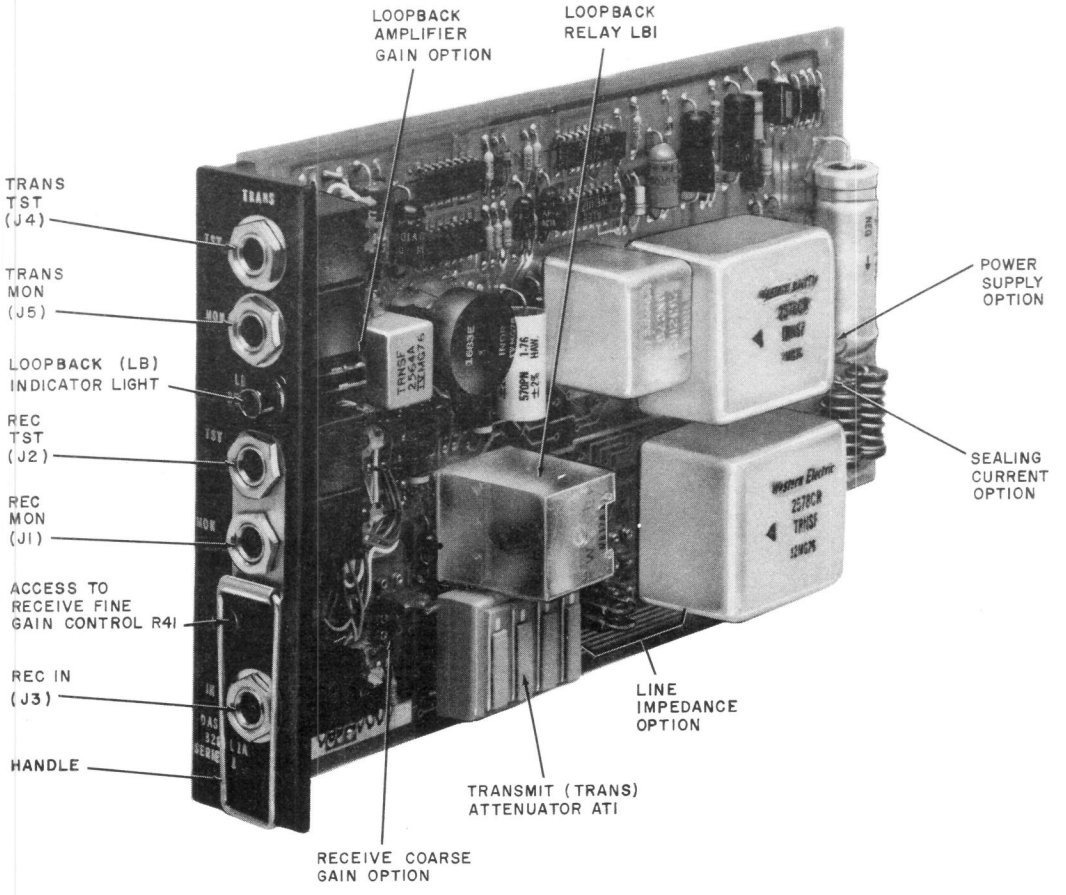


Fig. 52—DAS 829B-L1A CIU

option is specified on the service order, a plug-in strap should be placed in the D position (Fig. 58).

(c) With the O/R switch (option S), the 48ER1 data unit and an associated station dial will attempt to establish a 4-wire dial backup channel when the O/R switch is operated. When the dial backup channel is established, the 48ER1 data unit will connect the modem to the dial backup channel. If the dial backup channel is not established within 3 minutes, a retry request must be generated by releasing and then operating the O/R switch. To release the dial backup channel and return the modem to the 4-wire private line, the O/R switch is released. If this option is specified on the service order, a plug-in strap should be placed in the S position (Fig. 58).

4.37 ***Power Supply:*** Operating power for the 48ER1 data unit can be provided by either a 24 Vac (option N) or a -48 Vdc (option -48) supply. A plug-in strap should be placed in the option position specified on the service order (N position for 24 Vac and -48 position for -48 Vdc (Fig. 58).

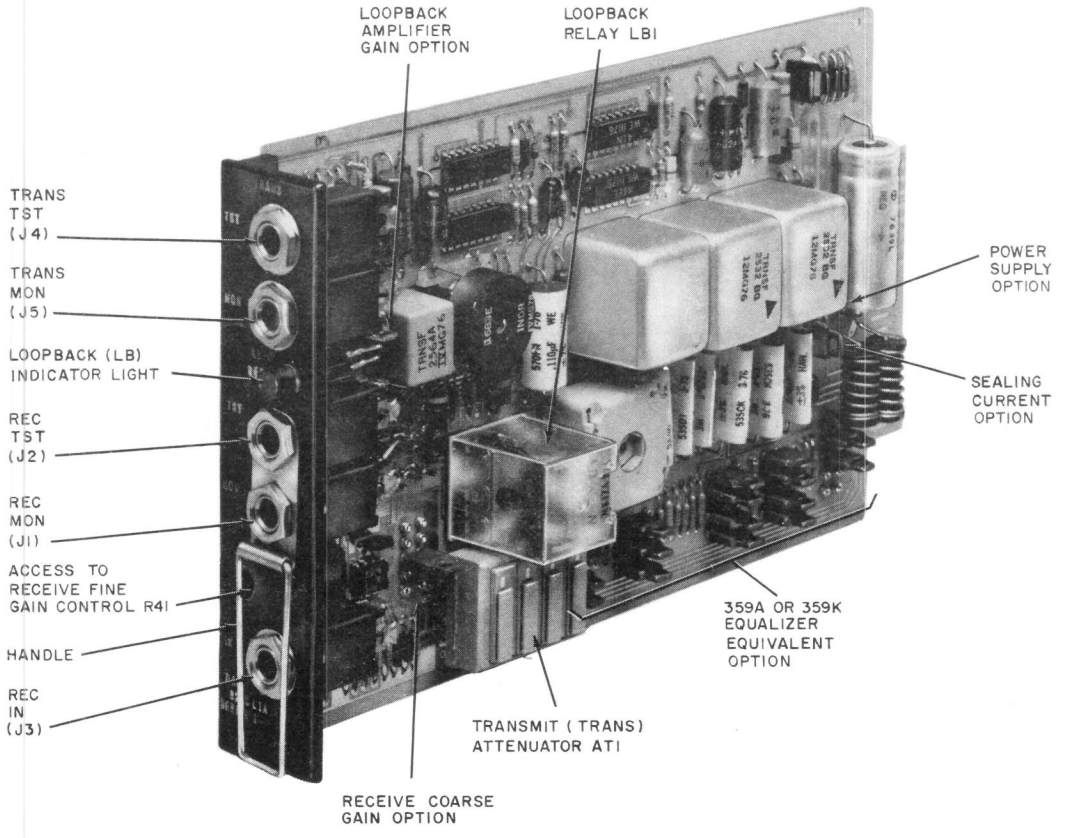


Fig. 53—DAS 829C-L1A CIU

Note: Use of a -48 Vdc supply is not permitted.

4.38 ***Adjustments:*** The transmit (XMT) switch (Fig. 58) and the receive (REC) switch (Fig. 58) on the 48ER1 data unit control the signal gain of the transmit and receive circuits. Adjustment of these switches is described in Section 598-082-500.

K. 48FR1 Data Unit

4.39 The 48FR1 data unit (Fig. 59) has options that must be installed prior to placing the data unit in operation. The options to be installed should be specified on the service order. Refer to Table D for a summary of the options.

4.40 ***Call Control:*** Two methods of automatic answering are provided.

(a) With two calls answered (option T), the 48FR1 data unit automatically answers a call on line 1 and then automatically answers a call on line 2, if the second call is received within 2 minutes of the time line 1 went on hold. If this option is specified on the service order, six plug-in straps should be placed in the T position (Fig. 60).

(b) With automatic call back (option A), the 48FR1 data unit automatically answers a call on line 1 and then automatically initiates a call on line 2. If this option is specified on the

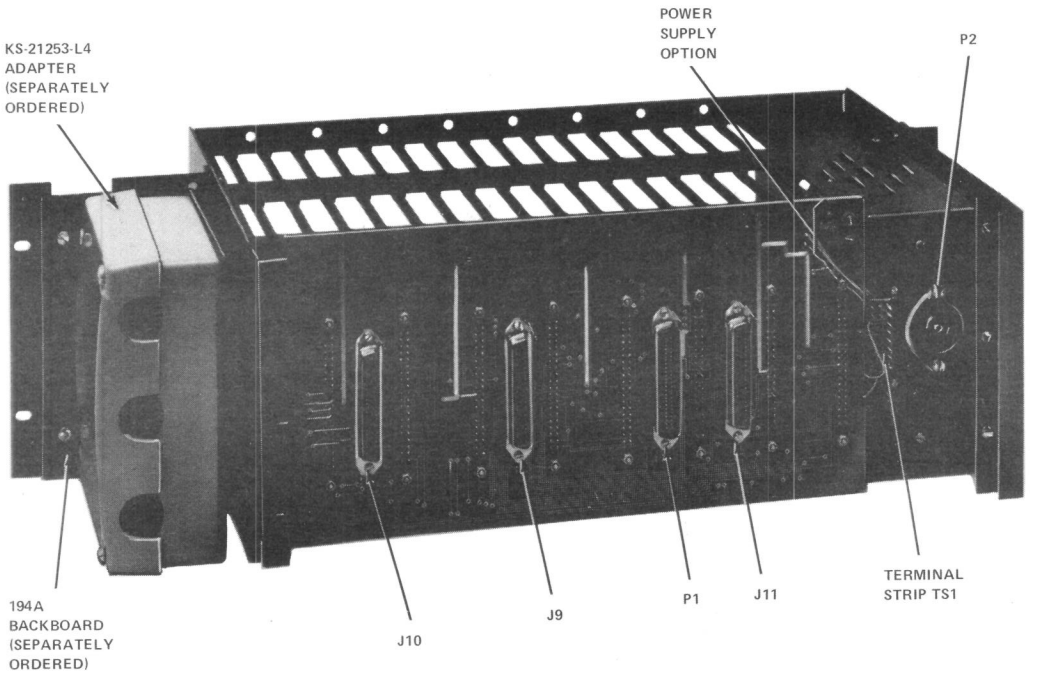


Fig. 54—46A2 Data Mounting—Rear View

service order, six plug-in straps should be placed in the A position (Fig. 60).

4.41 ***Unit Control:*** Two methods of enabling automatic answering are provided.

(a) With unit internal logic (option E), automatic answering is enabled by the internal logic in the 48FR1 data unit. The data unit can automatically answer a call on line 1 and then automatically answer or initiate a call on line 2. If this option is specified on the service order, a plug-in strap should be placed in the E position (Fig. 60).

(b) With a customer- or modem-provided contact (option D), automatic answering is enabled only when the customer or modem provides and maintains a contact closure. The data unit can automatically answer a call on line 1 and then automatically answer or initiate a call on line 2. If this option is specified on the service order, a plug-in strap should be placed in the D position (Fig. 60).

4.42 ***Power Supply:*** Operating power for the 48FR1 data unit can be provided by either a 24 Vac (option N) or a -48 Vdc (option -48) supply. A plug-in strap should be placed in the option position specified on the service order (N position for 24 Vac and -48 position for -48 Vdc (Fig. 60).

Note: Use of a -48 Vdc supply is not permitted.

4.43 ***Adjustments:*** The transmit (XMT) switch (Fig. 60) and the receive (REC) switch (Fig. 60) on the 48FR1 data unit control the signal gain of the transmit and receive circuits. Adjustment of these switches is described in Section 598-082-500.

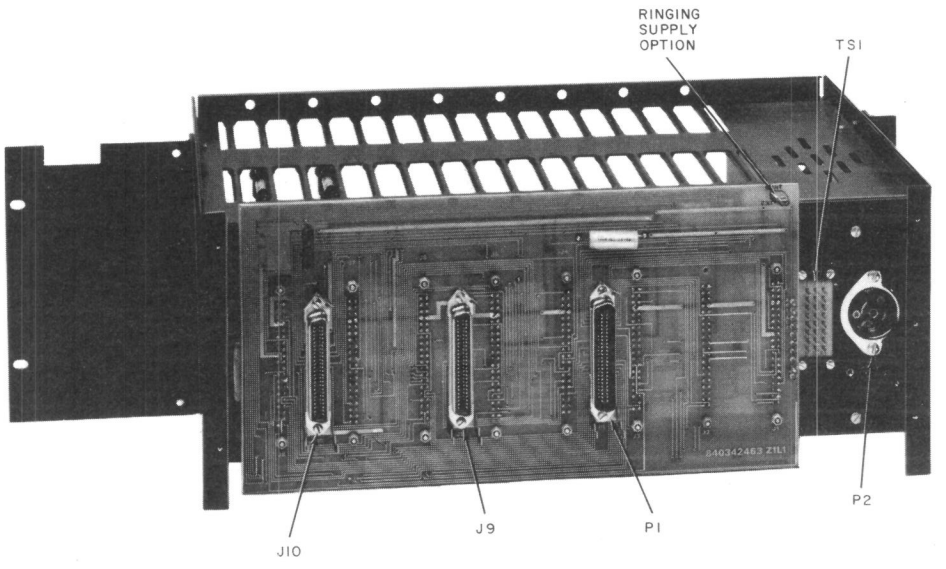


Fig. 55—46B1 Data Mounting—Rear View

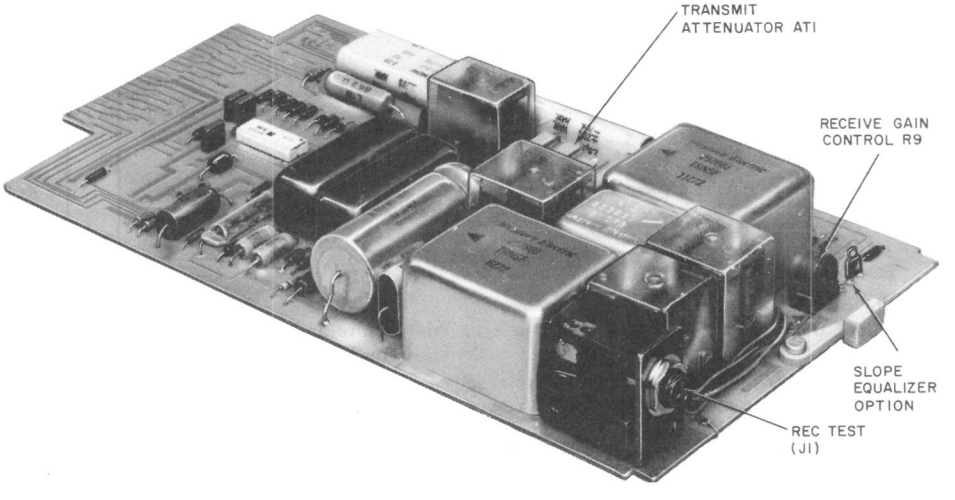


Fig. 56—48B1 Data Unit

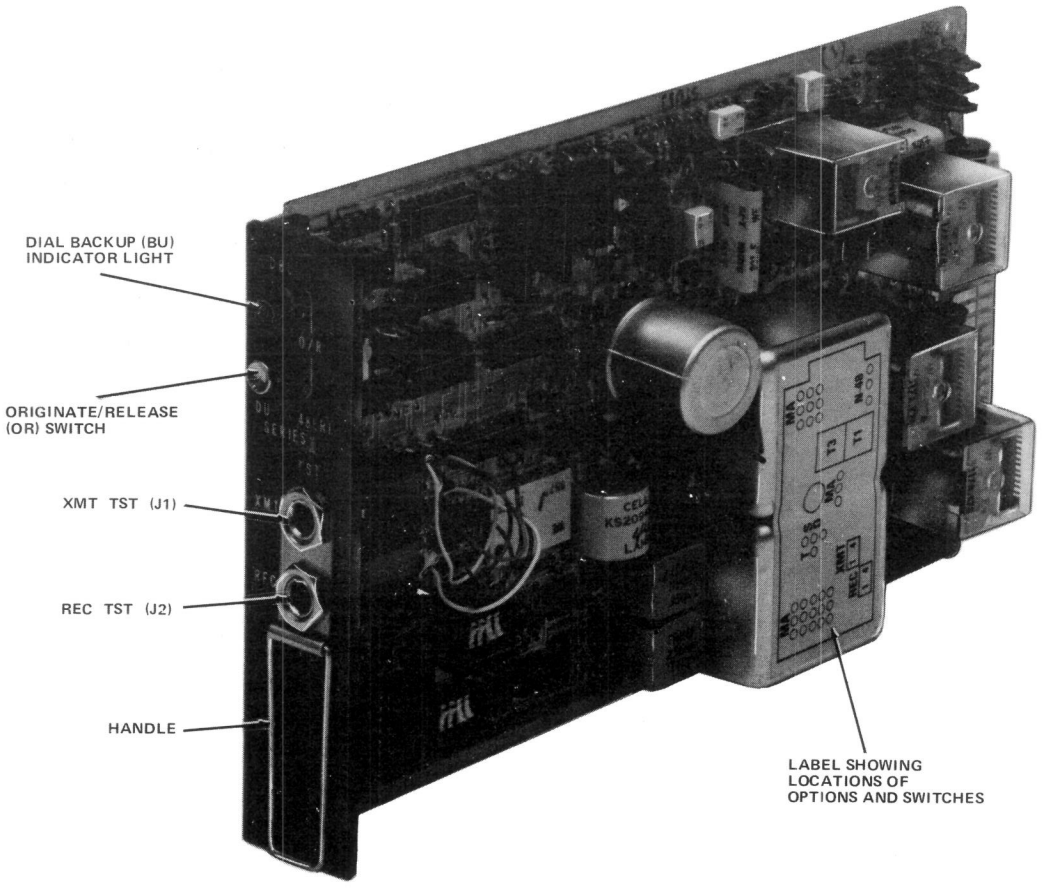


Fig. 57—48ER1 Data Unit

L. 48G1 Data Unit

4.44 A power supply option (Fig 61) on the 48G1 data unit permits operation from a 24 Vac, -24 Vdc, or -48 Vdc power source. A plug-in strap should be placed in the option position specified on the service order (N position for 24 Vac or -24 Vdc and -48 position for -48 Vdc).

5. TESTING

5.01 After the installation procedures are completed, the DAS 829-type CIUs and the supplementary data units and data mountings must be tested as described in Section 598-082-500.

5.02 A tone-activated or manual loopback test should be made by the test center to provide benchmark transmission tests. The test results should be recorded for future maintenance purposes.

5.03 Ensure that the front and rear dust covers are installed on the 44A-type, 45A1, 59A1, or 62A1 data mounting after all installation and testing is completed.

TABLE C

48ER1 DATA UNIT OPTIONS

FEATURE	OPTION	PLUG-IN STRAP(S)		PROVIDE
		QUANTITY	POSITION	
Call Control	Manual Dialing (M)	9	M1-M9	One Per Unit
	Automatic Dialing (A)	9	A1-A9	
Unit Control	Key Telephone Set (T)	1	T	One Per Unit
	Customer- or Modem-Provided Contact (D)	1	D	
	O/R (Originate/Release) Switch (S)	1	S	
Power Supply	24 Vac (N)	1	N	One Per Unit
	-48 Vdc (-48)*	1	-48	

* Use not permitted.

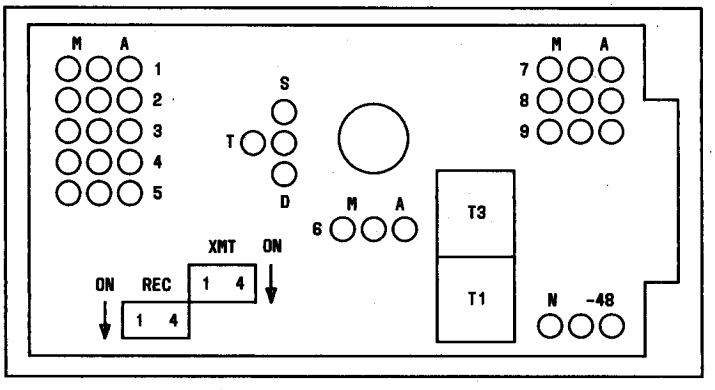


Fig. 58—48ER1 Data Unit—Locations of Options

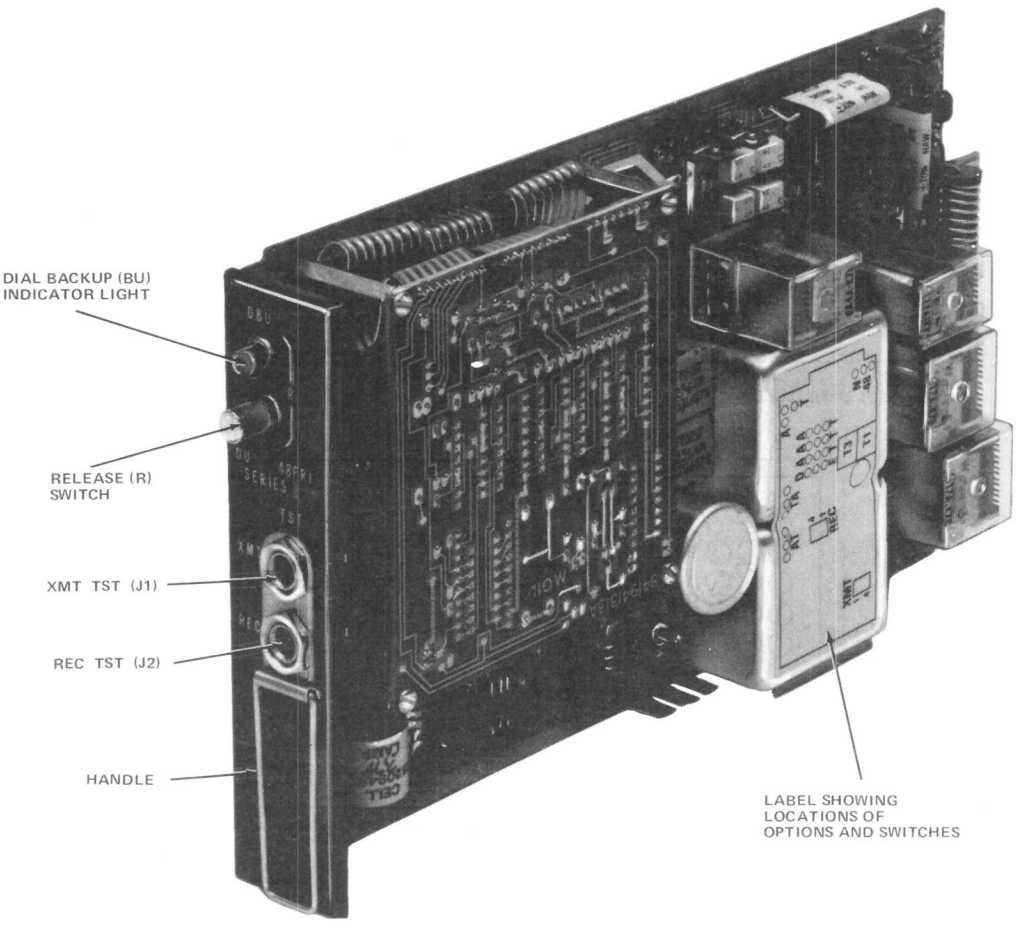


Fig. 59—48FR1 Data Unit

TABLE D

48FR1 DATA UNIT OPTIONS

FEATURE	OPTION	PLUG-IN STRAP(S)		PROVIDE
		QUANTITY	POSITION	
Call Control	Two Calls Answered (T)	6	T	One Per Unit
	Automatic Call Back (A)	6	A	
Unit Control	Unit Internal Logic (E)	1	E	One Per Unit
	Customer- or Modem-Provided Contact (D)	1	D	
Power Supply	24 Vac (N)	1	N	One Per Unit
	-48 Vdc (-48)*	1	-48	

* Use not permitted.

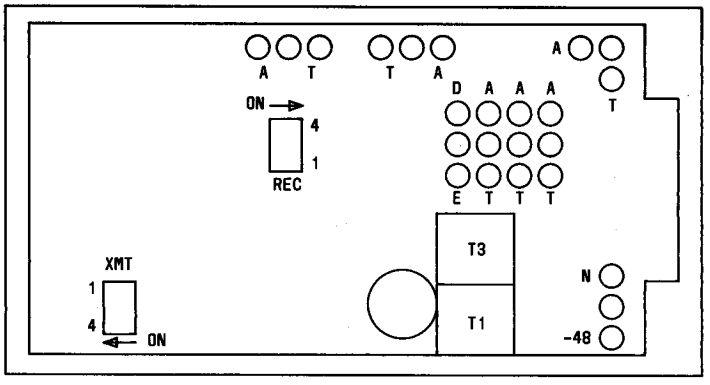


Fig. 60—48FR1 Data Unit—Locations of Options

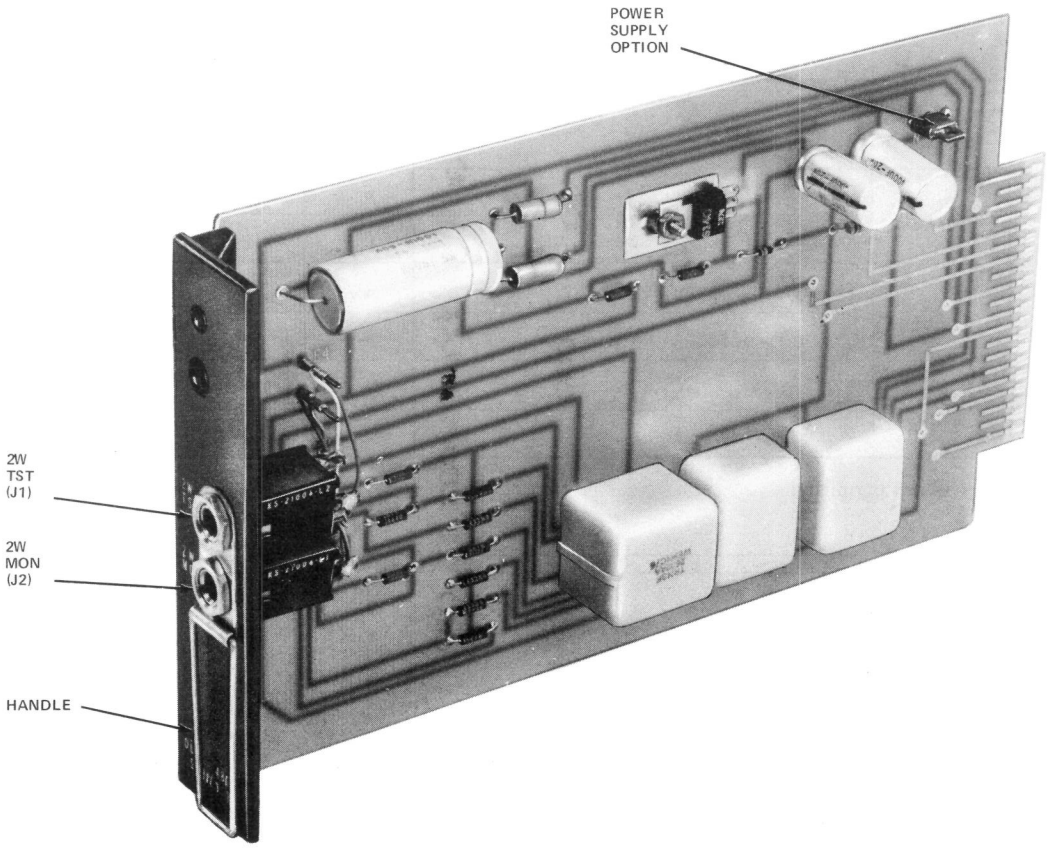


Fig. 61—48G1 Data Unit

6. REFERENCES

6.01 Additional information concerning the DAS 829-type CIU and the supplemental data units and data mountings is contained in the following publications:

SECTION	TITLE
332-104-500	V4-Type Repeaters—Initial Line-Up
332-116-201	Strapping Charts for 359A and 359D Equalizers or 4182C Network
461-200-102	Adapters—148, 149, 153, and 3-Way Bridging Types—Identification
461-604-100	Connecting Blocks 66-Type—Tools, Terminating, Adapters, and Maintenance
463-140-100	Equipment Cabinets and Apparatus Mountings—Installation
590-010-200	Data Sets and Data Access Arrangements—General Installation and Connection Information
590-010-201	Data Sets—Multiple Installation Information
598-082-100	Data Auxiliary Set 829-Type—Channel Interface Units—Voiceband Private Line Channels—Description
598-082-500	Data Auxiliary Set 829-Type—Channel Interface Units—Voiceband Private Line Channels—Maintenance and Test Procedures

6.02 Detailed information concerning the DAS 829-type CIU and the supplemental data units and data mountings is contained in CD- and SD-1D247-01.

DATA AUXILIARY SET 829-TYPE
CHANNEL INTERFACE UNITS
VOICEBAND PRIVATE LINE CHANNELS
TEST PROCEDURES

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1. GENERAL

1.01 This section contains installation and maintenance test procedures for data auxiliary set (DAS) 829-type and the supplementary data units and data mountings. This section does not contain the tests for modems used in conjunction with the DAS and the supplementary apparatus.

1.02 This section is reissued to add information on the 48ER1, 48FR1, and 48G1 data units and the 44A2, 46A2, 46C2, 59A1, and 62A1 data mountings. Since this reissue is a general revision, arrows normally used to indicate changes have been omitted.

1.03 DAS 829-type functions as a channel interface unit (CIU) to provide a prewired and tested standard termination for 4-wire private line voiceband data channels. Basic station arrangements use the DAS 829-type CIU to provide 4-wire data only service. Other station arrangements use the DAS 829-type CIU and the supplementary apparatus to provide 4-wire data with alternate voice, dial backup, and switched dial backup service. Two-wire data only and data with alternate voice service are also provided.

NOTICE
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Bell System except under written agreement

1.04 A choice of six codes for the DAS 829-type CIU provides proper termination of channels having various loop facilities.

- DAS 829A-L1 or -L1A for short loops
- DAS 829B-L1 or -L1A for longer nonloaded loops
- DAS 829C-L1 or -L1A for longer loaded loops.

1.05 A choice of seven data units combined with a DAS 829-type CIU provides the following features:

- 48A1 data unit for 4-wire or 2-wire alternate voice service.
- 48B1 data unit for 4-wire dial backup service with manual dialing.
- 48C1 data unit (switching matrix) for switching any one of four 4-wire modems to either one of two 4-wire dial backup channels.
- 48D1 data unit (interface adapter) for use with a 46C-type and/or 46B1 data mounting to concentrate control leads in an 18- or 30-button CALL DIRECTOR® key telephone set.
- 48ER1 data unit for 4-wire dial backup service with manual or automatic dialing. This data unit complies with all requirements of the FCC Registration Program. The registration number for the 48ER1 data unit is AS593M-67751-PC-E. The ringer equivalence number for each line is 0.5A.
- 48FR1 data unit for 4-wire dial backup service with automatic answering. This data unit complies with all requirements of the FCC Registration Program. The registration number for the 48FR1 data unit is AS593M-67757-PC-E. The ringer equivalence number for each line is 0.5A.
- 48G1 data unit for 2-wire to 4-wire conversion.

1.06 A choice of seven data mountings house single or multiple arrangements of DAS 829-type CIUs and/or 48-type data units without any change in wiring.

- 44A1 or 44A2 data mounting houses one DAS 829-type CIU.
- 45A1 data mounting houses one DAS 829-type CIU or one DAS 829-type CIU with the following data units: one 48A1 or 48B1, or one 48A1 and one 48B1.
- 46A1 or 46A2 data mounting houses up to eight DAS 829-type CIUs.
- 46B1 data mounting houses up to eight 48A1 or 48G1 data units.
- 46C1 data mounting houses one or two 48B1 data units and up to six 48C1 data units.
- 46C2 data mounting houses one or two 48B1 or 48ER1 data units and up to six 48C1 data units.
- 59A1 data mounting houses one DAS 829-type CIU or one DAS 829-type CIU with the following data units: one 48A1, 48B1, 48ER1, 48FR1, or 48G1; or one 48A1 and one 48B1, 48ER1, or 48G1.
- 62A1 data mounting houses one DAS 829-type CIU or one DAS 829-type CIU and one 48G1 data unit.

1.07 The test procedures given in this section are performed prior to transmission tests. The DAS 829-type CIU and the supplemental data units are considered to be part of the private line channel; transmission tests, such as slope, envelope delay, noise, etc, should be made through them. These test procedures do not replace the station-to-station or station-to-serving test center lineup procedures. These test procedures serve to assure the installer that the station is operational.

2. TEST EQUIPMENT

2.01 The following test equipment is required at the station and is used in testing the DAS 829-type CIU and the supplemental data units:

1—Voiceband transmission test set, TTS-4B or equivalent, with bridging measurement capability

2—2P4B patch cords (310 plug on both ends)

1—KS-21253-L5 adapter

1—1013B handset

1—Portable volt-ohm-milliammeter (VOM), KS-14510-L1 or equivalent (for maintenance tests)

2—2W6A patch cords (310 plug on one end and clip leads on other end) (for maintenance tests)

1—171C adapter (for maintenance tests)

1—66E-type connecting block (for maintenance tests).

3. INSTALLATION TESTS

3.01 These tests are to be performed at the time of installation to verify that the equipment is operating properly. In addition to transmission test sets required for installing the private line channel, a Northeast Electronics transmission test set TTS-4B or equivalent, is required. The sequence in which installation tests are to be performed is specified in Fig. 1.

PRIVATE LINE

3.02 The operating performance of the installed DAS 829-type CIU can be checked by performing the tests specified in Section 314-410-500 through the TRANS TST and REC TST jacks of the DAS 829-type CIU. These tests can be performed end-to-end or to the serving test center (STC). Proceed as follows:

STEP	PROCEDURE
1	Install options in DAS 829-type CIU as directed in Section 598-082-200 and as specified on service order and/or circuit layout record card. ***Note:*** If CIU is a DAS 829B- or C-type, adjust receive amplifier as described in Steps 2 through 7. If CIU is a DAS 829A-type, proceed to Step 8.
2	Place TTS-4B test set close to CIU and apply power to equipment. Allow test set to warm up and stabilize, then calibrate test set, using instructions printed on test set case.
3	Set controls on test set as follows: • SEND FREQ to 1000 • SEND LEVEL to estimated receive level at input to CIU amplifier • SEND IMP to 600Ω • FUNCTION to SEND + TALK + REC • REC IMP to 600Ω
4	Connect a 2P4B cord between SEND 310 jack on test set and REC IN jack on CIU.
5	Connect another 2P4B cord between REC 310 jack on test set and REC TST jack on CIU.
6	Adjust receive fine gain control on CIU to obtain a level reading on test set meter equal to value specified on service order (usually -16 dBm).

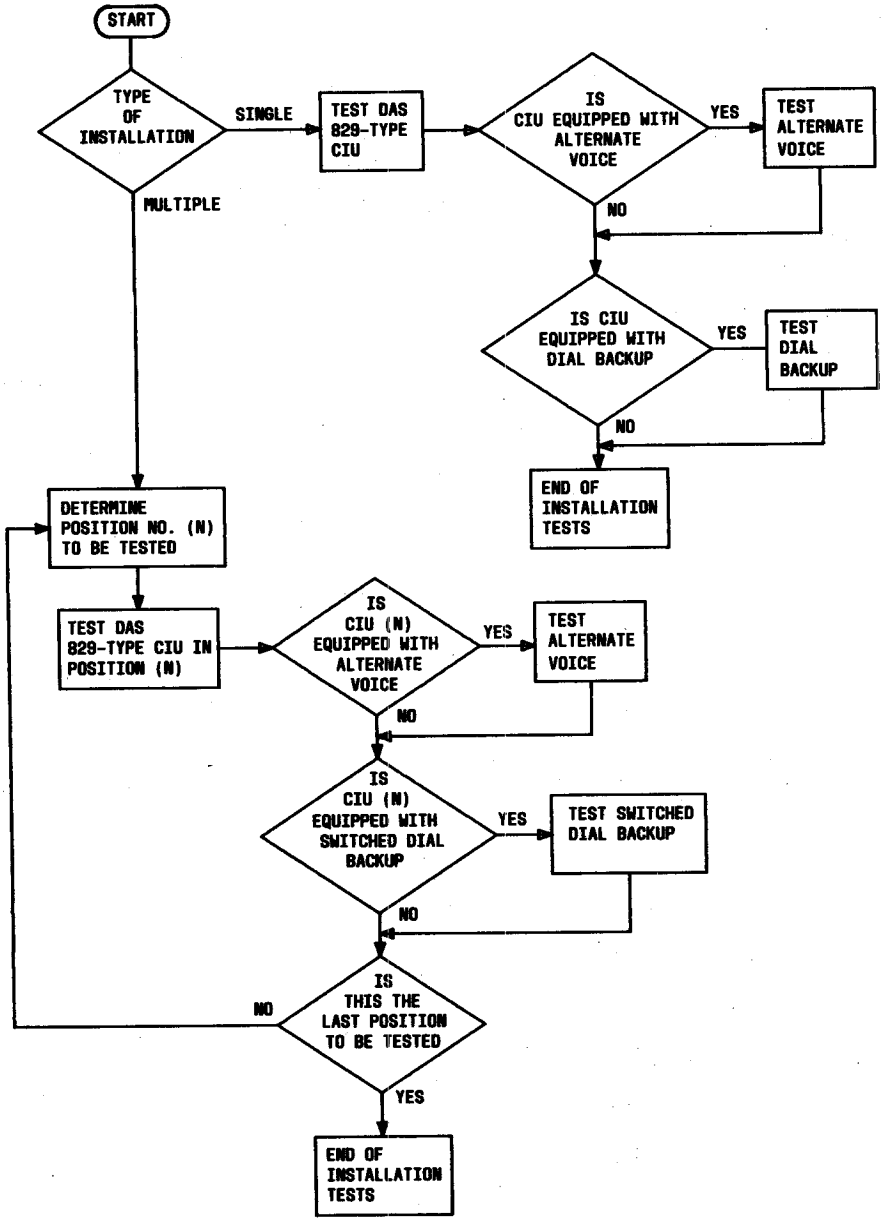


Fig. 1—Installation Test Sequence

STEP	PROCEDURE
7	Disconnect test set from CIU.
8	Perform tests for type of private line channel being installed as specified in Section 314-410-500. For 4-wire private line channels, tests to STC or distant end must be made through TRANS TST and REC TST jacks on CIU. For 2-wire private line channels, tests to STC or distant end must be made through 2W TST jack on 48G1 data unit, except tests that require a 4-wire interface.
9	Have STC perform loopback tests for benchmark purposes.
10	Refer to Fig. 1 for any remaining tests. If any remaining tests require use of TTS-4B test set, do not turn off power switch. This avoids having to recalibrate test set for each test.

ALTERNATE VOICE

3.03 This test checks the ability to switch from the data to the voice mode, checks the signaling, checks the associated telephone set for proper visual and audible indications, and checks the voice path. Two methods of testing are provided:

- Distant end available
- Distant end not available.

A. Distant End Available

3.04 If both ends are installed, perform the test of the alternate voice equipment as follows:

STEP	PROCEDURE
1	Take local handset off-hook.
2	Depress PL TALK button. ***Requirement:*** PL TALK lamp lights.
3	Depress RING button until ringback is heard (about 10 seconds). Distant end should receive ringing and answer call. ***Note:*** If distant end is in loopback mode, ringing will not be detected.
4	When distant end has answered call, request distant end to signal local end by depressing RING button until ringback is heard. Inform distant end that call will not be answered until ringing times out.
5	Place local handset on-hook.

STEP	PROCEDURE
6	When ringing is heard, do not take local handset off-hook. Allow ringing to time out. An audible indication is heard. ***Requirement:*** PL TALK lamp flashes in response to audible indication. After about 40 seconds, ringing ceases.
7	When ringing has timed out, take local handset off-hook and answer call. Verify that alternate voice path operates properly.
8	Refer to Fig. 1 for any remaining tests.

B. Distant End Not Available

3.05 If the distant end has not been installed, the alternate voice equipment can be tested using a TTS-4B test set. The test set must be capable of transmitting a 2600-Hz tone. Perform the test as follows:

STEP	PROCEDURE
1	Verify handset is on-hook and CIU is not in loopback mode.
2	Set controls on TTS-4B test set as follows: SEND FREQ to 2600 SEND LEVEL to -20 SEND IMP to 600Ω FUNCTION to SEND + TALK + REC REC IMP to BRDG
3	Connect a 2P4B cord between SEND 310 jack on test set and REC MON jack on CIU. ***Requirement:*** PL TALK lamp lights when an audible indication is heard.
4	Remove 2P4B cord from REC MON jack. ***Requirement:*** PL TALK lamp remains lighted and audible indication continues for about 40 seconds.
5	After ringing times out, plug 2P4B cord back into REC MON jack. When audible indication begins and PL TALK lamp lights, take handset off-hook.
6	Depress PL TALK button.

STEP	PROCEDURE
	Requirement: Audible indication stops. PL TALK lamp lights steady.
7	Listen in handset for 2600-Hz tone.
	Requirement: Tone is heard in handset.
8	Remove 2P4B cord from test set and CIU.
9	Connect 2P4B cord between REC 310 jack on test set and TRANS MON jack on CIU.
10	Whistle or blow into telephone handset.
	Requirement: Test set meter reads same level as sound. A loud sound should produce a peak meter reading in range of -10 to +10 dBm.
11	Depress RING button.
	Requirement: Test set meter reads signal level of about 0 dBm.
12	Refer to Fig. 1 for any remaining tests.

4-WIRE DIAL BACKUP

3.06 This test checks the ability of the 48B1 or 48ER1 data unit to switch from a 4-wire private line to a 4-wire dial backup channel, and checks the associated telephone set or station dial for proper operation. A procedure is provided for adjusting the transmit and receive levels.

Note: If a DAS 801CR-L1/2 automatic calling unit (ACU) is installed with the 48ER1 data unit, test the ACU using the test procedures in Section 598-088-500.

A. Single Installation (Manual Dialing With 48B1 Data Unit)

3.07 This installation consists of a DAS 829-type CIU and a 48B1 data unit housed in a 45A1 or 59A1 data mounting. The data mounting may also house a 48A1 data unit. The presence of a 48A1 data unit does not affect this test. A key telephone set is used to originate and answer calls. Perform the test as follows:

STEP	PROCEDURE
1	Install options in 48B1 data unit as directed in Section 598-082-200 and as specified on service order and/or circuit layout record card.
	Note: Steps 2 and 3 are for adjusting transmit attenuator AT1 on 48B1 data unit.
2	Measure loop loss of line 1 (T2, R2) using a 900-ohm loop termination and the milliwatt supply in serving central office.

STEP	PROCEDURE
3	Set transmit attenuator AT1 on 48B1 data unit as follows: Attenuator setting = 11.5 dBm - line loss. For example, if line loss is 4 dB, attenuator setting = 11.5 dBm -4 dB = 7.5 dB. Since attenuator is adjustable in 1-dB steps, in this example it would be set to provide 8 dB of loss (slide switches on attenuator would be set so that only number 8.0 is exposed). ***Note 1:*** The 11.5 dBm is arrived at by subtracting a 0.5 dB loss through transformer on 48B1 data unit from the -12 dBm required level at serving central office. ***Note 2:*** Steps 4 through 11 are for adjusting receive gain control R9 on 48B1 data unit.
4	Set controls on TTS-4B test set as follows: FUNCTION to REC + TALK REC IMP to 600Ω REC LEVEL to +7
5	Take handset off-hook and depress DDD2 button. ***Requirement:*** Dial tone is heard in handset.
6	Dial milliwatt supply in serving central office.
7	When connection to milliwatt supply is completed, depress and release HOLD button. ***Requirement:*** DDD2 lamp lights and DDD2 button releases on up-stroke of HOLD button.
8	Place handset on-hook.
9	Connect a 2P48 cord between REC 310 jack on test set and REC TST jack on 48B1 data unit.
10	Measure receive level of milliwatt supply and adjust receive gain control R9 on 48B1 data unit for a reading of +3.7 dBm on test set meter.
11	Take handset off-hook, depress and release REL button, and place handset on-hook. ***Requirement:*** DDD2 lamp goes off, indicating call is ended.
12	Disconnect test set from 48B1 data unit. ***Note:*** Steps 13 through 24 check telephone set, switching functions, and ring detection functions of 48B1 data unit.
13	Take handset off-hook and depress DDD1 button.

STEP	PROCEDURE

Requirement: DDD1 lamp does not light. Dial tone is heard in handset.

14 Dial directory number of DDD2 line.

Requirement: Audible indication is heard. DDD2 lamp flashes in response to audible indication.

15 When audible indication is heard, depress and release HOLD button.

Requirement: DDD1 lamp lights and DDD1 button releases on up-stroke of HOLD button. Audible indication continues.

16 Depress DDD2 button.

Requirement: Audible indication stops and DDD2 lamp stops flashing.

17 Depress and release HOLD button.

Requirement: DDD2 lamp lights and DDD2 button releases on up-stroke of HOLD button. Station is now in dial backup mode.

18 Depress and release REL button.

Requirement: Both DDD1 and DDD2 lamps go off. Station is now released from dial backup mode.

19 Take handset off-hook and depress DDD2 button.

Requirement: DDD2 lamp does not light. Dial tone is heard in handset.

20 Dial directory number of DDD1 line.

Requirement: Audible indication is heard. DDD1 lamp flashes in response to audible indication.

21 When audible indication is heard, depress and release HOLD button.

Requirement: DDD2 lamp lights and DDD2 button releases on up-stroke of HOLD button. Audible indication continues.

22 Depress DDD1 button.

Requirement: Audible indication stops and DDD1 lamp stops flashing.

23 Depress and release HOLD button.

Requirement: DDD1 lamp lights and DDD1 button releases on up-stroke of HOLD button. Station is now in dial backup mode.

STEP	PROCEDURE
24	Depress and release REL button. ***Requirement:*** Both DDD1 and DDD2 lamps go off. Station is now released from dial backup mode.
25	Refer to Fig. 1 for any remaining tests.

B. Single Installation (Manual Dialing With 48ER1 Data Unit)

3.08 This installation consists of a DAS 829-type CIU and a 48ER1 data unit housed in a 59A1 data mounting. The data mounting may also house a 48A1 data unit. The presence of a 48A1 data unit does not affect this test. A key telephone set is used to originate and answer calls. Perform the test as follows:

STEP	PROCEDURE
1	Install options in 48ER1 data unit as directed in Section 598-082-200 and as specified on service order and/or circuit layout record card.
2	For nonregistered arrangements, perform Steps 3 through 6. For registered arrangements, verify that transmit (XMT) and receive (REC) switches on 48ER1 data unit are set to 8 dB fixed loss loop as specified in Table A, then proceed to Step 7. ***Note:*** Steps 3 and 4 are for adjusting transmit (XMT) switch on 48ER1 data unit.
3	Measure loop loss of line 1 (T2, R2) using a 600-ohm loop termination and the milliwatt supply in serving central office.
4	Set 4-pole transmit (XMT) switch on 48ER1 data unit for measured line loss as specified in Table A. For example, if measured line loss is 4.5 dB, switch would be set with poles 1 and 4 released and poles 2 and 3 operated. ***Note:*** Steps 5 and 6 are for adjusting receive (REC) switch on 48ER1 data unit.
5	Measure loop loss of line 2 (T3, R3) using a 600-ohm loop termination and the milliwatt supply in serving central office.
6	Set 4-pole receive (REC) switch on 48ER1 data unit for measured line loss as specified in Table A. For example, if measured line loss is 4.5 dB, switch would be set with poles 1 and 4 released and poles 2 and 3 operated. ***Note:*** Steps 7 through 23 check telephone set, switching functions, and ring detection functions of 48ER1 data unit.

STEP | PROCEDURE

TABLE A

SWITCH SETTINGS FOR TRANSMIT AND RECEIVE LEVEL ADJUSTMENT

1000-Hz LOOP LOSS IN dB FOR LINE DDD1 (OR DDD2)		SWITCH DESIGNATED TRANS (OR REC)			
LOSS GREATER THAN OR EQUAL TO	LOSS LESS THAN	POLE			
		1	2	3	4
		POSITION*			
0	1	1	0	0	1
1	2	0	1	0	1
2	3	1	1	0	1
3	4	1	0	1	0
4	5	0	1	1	0
5	6	1	1	1	0
6	7	1	0	0	0
7	8	0	1	0	0
8	—	1	1	0	0
8 dB fixed loss loop		1	1	0	0

*1 = on (contact closed)
0 = off (contact open)

7 Set controls on TTS-4B test set as follows:

SEND FREQ to 1000

SEND LEVEL to 0 (CAL)

SEND IMP to 600Ω

FUNCTION to SEND + TALK + REC

REC IMP to 600Ω

8 Connect a 2P4B cord between REC 310 jack on test set and REC TST jack on 48ER1 data unit.

9 Take handset off-hook and depress DDD1 button.

STEP	PROCEDURE
	Requirement: DDD1 lamp does not light. Dial tone is heard in handset.
10	Dial directory number of DDD2 line.
	Requirement: Audible indication is heard. DDD2 lamp flashes in response to audible indication.
11	When audible indication is heard, depress and release HOLD button.
	Requirement: DDD1 lamp lights and DDD1 button releases on up-stroke of HOLD button. Audible indication continues.
12	Depress DDD2 button.
	Requirement: Audible indication stops and DDD2 lamp stops flashing.
13	Depress and release HOLD button.
	Requirement: DDD2 lamp lights and DDD2 button releases on up-stroke of HOLD button. For next 10 seconds, test set meter reads signal level of about -12 dBm. At end of signal, BU lamp on 48ER1 data unit lights. Station is now in dial backup mode.
14	Depress and release REL button.
	Requirement: BU lamp on 48ER1 data unit goes off. For next 3 seconds, test set meter reads signal level of about -12 dBm. At end of signal, both DDD1 and DDD2 lamps go off. Station is now released from dial backup mode.
15	Take handset off-hook and depress DDD2 button.
	Requirement: DDD2 lamp does not light. Dial tone is heard in handset.
16	Dial directory number of DDD1 line.
	Requirement: Audible indication is heard. DDD1 lamp flashes in response to audible indication.
17	When audible indication is heard, depress and release HOLD button.
	Requirement: DDD2 lamp lights and DDD2 button releases on up-stroke of HOLD button. Audible indication continues.
18	Depress DDD1 button.
	Requirement: Audible indication stops and DDD1 lamp stops flashing.
19	Depress and release HOLD button.

STEP	PROCEDURE
	Requirement: DDD1 lamp lights and DDD1 button releases on up-stroke of HOLD button. For next 10 seconds, test set meter reads signal level of about -12 dBm. At end of signal, BU lamp on 48ER1 data unit lights. Station is now in dial backup mode.
20	Connect a 2P4B cord between SEND 310 jack on test set and XMT TST jack on 48ER1 data unit.
	Requirement: Test set meter reads signal level of -12 ±4 dBm.
21	On test set, set SEND LEVEL to +10.
	Requirement: After 1 second, test set meter reads signal level not more than 2 dB greater than level in Step 20.
22	Remove 2P4B cord from SEND 310 jack on test set and XMT TST jack on 48ER1 data unit.
23	Depress and release REL button.
	Requirement: BU lamp on 48ER1 data unit goes off. For next 3 seconds, test set meter reads signal level of about -12 dBm. At end of signal, both DDD1 and DDD2 lamps go off. Station is now released from dial backup mode.
24	Disconnect test set from 48ER1 data unit.
25	Refer to Fig. 1 for any remaining tests.

C. Single Installation (Automatic Dialing With Station Dial)

3.09 This installation consists of a DAS 829-type CIU and a 48ER1 data unit housed in a 59A1 data mounting. A station dial is used to originate a call on DDD2 line. The 48ER1 data unit automatically answers a call on DDD1 line. When option D is installed, the 48ER1 data unit is controlled by a customer- or modem-provided contact. When option S is installed, the 48ER1 data unit is controlled by the O/R switch on the data unit. Perform the test as follows:

STEP	PROCEDURE
1	Install options in 48ER1 data unit as directed in Section 598-082-200 and as specified on service order and/or circuit layout record card.
2	If option D is installed in 48ER1 data unit, temporarily remove option D and install option S.
3	For nonregistered arrangements, perform Steps 4 through 7. For registered arrangements, verify that transmit (XMT) and receive (REC) switches on 48ER1 data unit are set to 8 dB fixed loss loop as specified in Table A, then proceed to Step 8.

STEP	PROCEDURE

Note: Steps 4 and 5 are for adjusting transmit (XMT) switch on 48ER1 data unit.

4 Measure loop loss of line 1 (T2, R2) using a 600-ohm loop termination and the milliwatt supply in serving central office.

5 Set 4-pole transmit (XMT) switch on 48ER1 data unit for measured line loss as specified in Table A. For example, if measured line loss is 4.5 dB, switch would be set with poles 1 and 4 released and poles 2 and 3 operated.

Note: Steps 6 and 7 are for adjusting receive (REC) switch on 48ER1 data unit.

6 Measure loop loss of line 2 (T3, R3) using a 600-ohm loop termination and the milliwatt supply in serving central office.

7 Set 4-pole receive (REC) switch on 48ER1 data unit for measured line loss as specified in Table A. For example, if measured line loss is 4.5 dB, switch would be set with poles 1 and 4 released and poles 2 and 3 operated.

Note: Steps 8 through 15 check station dial, switching functions, and ring detection functions of 48ER1 data unit.

8 Set controls on TTS-4B test set as follows:

SEND FREQ to 1000

SEND LEVEL to 0 (CAL)

SEND IMP to 600Ω

FUNCTION to SEND + TALK + REC

REC IMP to 600Ω

9 Connect a 2P4B cord between REC 310 jack on test set and REC TST jack on 48ER1 data unit.

10 Program station dial to dial directory number of DDD1 line of 48ER1 data unit.

11 Depress O/R switch on 48ER1 data unit.

Requirement: Station dial dials directory number of DDD1 line of 48ER1 data unit. The 48ER1 data unit automatically answers call on DDD1 line. About 5 seconds after call is answered, test set meter reads signal level of about -12 dBm for about 5 seconds. At end of signal, BU lamp on 48ER1 data unit lights. Station is now in dial backup mode.

12 Connect a 2P4B cord between SEND 310 jack on test set and XMT TST jack on 48ER1 data unit.

Requirement: Test set meter reads signal level of -12 ±4 dBm.

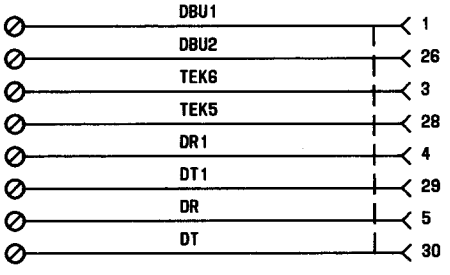
STEP	PROCEDURE
13	On test set, set SEND LEVEL to +10. ***Requirement:*** After 1 second, test set meter reads signal level not more than 2 dB greater than level in Step 12.
14	Remove 2P4B cord from SEND 310 jack on test set and XMT TST jack on 48ER1 data unit.
15	Release O/R switch on 48ER1 data unit. ***Requirement:*** BU lamp on 48ER1 data unit goes off. For next 3 seconds, test set meter reads signal level of about -12 dBm. At end of signal, station is released from dial backup mode.
16	Disconnect test set from 48ER1 data unit.
17	Program station dial to dial directory number of DDD1 line of customer's remote 48FR1 data unit. ***Note:*** If possible, use 48ER1 data unit to establish and release a dial backup channel with customer's remote 48FR1 data unit as described in Steps 18 and 19.
18	Depress O/R switch on 48ER1 data unit. ***Requirement:*** Station dial dials directory number of DDD1 line of remote 48FR1 data unit. Within next 2 minutes, remote 48FR1 data unit initiates a return call to DDD1 line of 48ER1 data unit. The 48ER1 data unit automatically answers call on DDD1 line. About 10 seconds after call is answered, BU lamp on 48ER1 data unit lights. The dial backup channel is now established.
19	Release O/R switch on 48ER1 data unit. ***Requirement:*** BU lamp on 48ER1 data unit goes off. After about 3 seconds, the 48ER1 data unit places DDD1 and DDD2 lines on-hook. The dial backup channel is now released.
20	If option S was temporarily installed in 48ER1 data unit in Step 2, remove option S and install option D.
21	Refer to Fig. 1 for any remaining tests.

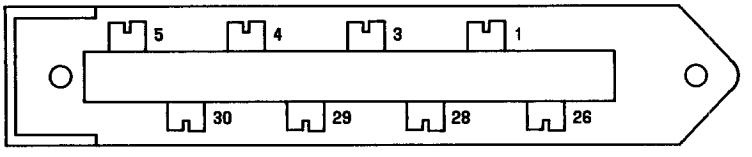
D. Single Installation (Automatic Dialing With Automatic Calling Unit)

3.10 This installation consists of a DAS 829-type CIU and a 48ER1 data unit housed in a 59A1 data mounting. A DAS 801CR-L1/2 automatic calling unit (ACU) is used to originate a call on DDD2 line. The 48ER1 data unit automatically answers a call on DDD1 line. The 48ER1 data unit (option D installed) is controlled by a customer- or modem-provided contact.

STEP	PROCEDURE
1	Install options in 48ER1 data unit as directed in Section 598-082-200 and as specified on service order and/or circuit layout record card.
2	If option D is installed in 48ER1 data unit, temporarily remove option D and install option S.
3	For nonregistered arrangements, perform Steps 4 through 7. For registered arrangements, verify that transmit (XMT) and receive (REC) switches on 48ER1 data unit are set to 8 dB fixed loss loop as specified in Table A, then proceed to Step 8.
	Note: Steps 4 and 5 are for adjusting transmit (XMT) switch on 48ER1 data unit.
4	Measure loop loss of line 1 (T2, R2) using a 600-ohm loop termination and the milliwatt supply in serving central office.
5	Set 4-pole transmit (XMT) switch on 48ER1 data unit for measured line loss as specified in Table A. For example, if measured line loss is 4.5 dB, switch would be set with poles 1 and 4 released and poles 2 and 3 operated.
	Note: Steps 6 and 7 are for adjusting receive (REC) switch on 48ER1 data unit.
6	Measure loop loss of line 2 (T3, R3) using a 600-ohm loop termination and the milliwatt supply in serving central office.
7	Set 4-pole receive (REC) switch on 48ER1 data unit for measured line loss as specified in Table A. For example, if measured line loss is 4.5 dB, switch would be set with poles 1 and 4 released and poles 2 and 3 operated.
	Note: Steps 8 through 19 check switching functions and ring detection functions of 48ER1 data unit.
8	Set controls on TTS-4B test set as follows: SEND FREQ to 1000 SEND LEVEL to 0 (CAL) SEND IMP to 600Ω FUNCTION to SEND + TALK + REC REC IMP to 600Ω
9	Connect a 2P4B cord between REC 310 jack on test set and REC TST jack on 48ER1 data unit.
10	Connect a jumper wire between screw terminals 28 and 30 on KS-21253-L5 adapter (Fig. 2).

STEP	PROCEDURE





CONNECTOR COVER OFF

Fig. 2—KS-21253-L5 Adapter

11 Disconnect ACU cord from connector J4 on rear of 59A1 data mounting and install KS-21253-L5 adapter in connector J4.

12 Connect 1013B handset to screw terminals 4 and 29 on KS-21253-L5 adapter (Fig. 2).

13 Depress O/R switch on 48ER1 data unit.

14 Take 1013B handset off-hook and dial directory number of DDD1 line of 48ER1 data unit.

Requirement: The 48ER1 data unit automatically answers call on DDD1 line and disconnects 1013B handset from switched network. About 5 seconds after call is answered, test set meter reads signal level of about -12 dBm for about 5 seconds. At end of signal, BU lamp on 48ER1 data unit lights. Station is now in dial backup mode.

15 Place 1013B handset on-hook.

16 Connect a 2P4B cord between SEND 310 jack on test set and XMT TST jack on 48ER1 data unit.

Requirement: Test set meter reads signal level of -12 ±4 dBm.

STEP	PROCEDURE
17	On test set, set SEND LEVEL to +10. ***Requirement:*** After 1 second, test set meter reads signal level not more than 2 dB greater than level in Step 16.
18	Remove 2P4B cord from SEND 310 jack on test set and XMT TST jack on 48ER1 data unit.
19	Release O/R switch on 48ER1 data unit. ***Requirement:*** BU lamp on 48ER1 data unit goes off. For next 3 seconds, test set meter reads signal level of about -12 dBm. At end of signal, station is released from dial backup mode.
20	Disconnect test set from 48ER1 data unit. ***Note:*** If possible, use 48ER1 data unit to establish and release a dial backup channel with customer's remote 48FR1 data unit as described in Steps 21 through 23.
21	Depress O/R switch on 48ER1 data unit.
22	Take 1013B handset off-hook and dial directory number of DDD1 line of remote 48FR1 data unit. ***Requirement:*** Within next 2 minutes, remote 48FR1 data unit initiates a return call to DDD1 line of 48ER1 data unit. The 48ER1 data unit automatically answers call on DDD1 line and disconnects 1013B handset from switched network. About 10 seconds after call is answered, BU lamp on 48ER1 data unit lights. The dial backup channel is now established.
23	Release O/R switch on 48ER1 data unit. ***Requirement:*** BU lamp on 48ER1 data unit goes off. After about 3 seconds, the 48ER1 data unit places DDD1 and DDD2 lines on-hook. The dial backup channel is now released.
24	Disconnect 1013B handset from KS-21253-L5 adapter.
25	Remove KS-21253-L5 adapter from connector J4 on rear of 59A1 data mounting and connect ACU cord to connector J4.
26	Remove jumper wire from KS-21253-L5 adapter.
27	If option S was temporarily installed in 48ER1 data unit in Step 2, remove option S and install option D.
28	Refer to Fig. 1 for any remaining tests.

E. Single Installation (Automatic Answering With Two Calls Answered)

3.11 This installation consists of a DAS 829-type CIU and a 48FR1 data unit housed in a 59A1 data mounting. The 48FR1 data unit automatically answers calls on DDD2 and DDD1 lines when option E is installed in the data unit or when option D is installed in the data unit and a customer- or modem-provided contact is closed.

STEP	PROCEDURE
1	Install options in 48FR1 data unit as directed in Section 598-082-200 and as specified on service order and/or circuit layout record card.
2	If option D is installed in 48FR1 data unit, temporarily remove option D and install option E.
3	For nonregistered arrangements, perform Steps 4 through 7. For registered arrangements, verify that transmit (XMT) and receive (REC) switches on 48FR1 data unit are set to 8 dB fixed loss loop as specified in Table A, then proceed to Step 8. ***Note:*** Steps 4 and 5 are for adjusting transmit (XMT) switch on 48FR1 data unit.
4	Measure loop loss for line 1 (T2, R2) using a 600-ohm loop termination and the milliwatt supply in serving central office.
5	Set 4-pole transmit (XMT) switch on 48FR1 data unit for measured line loss as specified in Table A. For example, if measured line loss is 4.5 dB, switch would be set with poles 1 and 4 released and poles 2 and 3 operated. ***Note:*** Steps 6 and 7 are for adjusting receive (REC) switch on 48FR1 data unit.
6	Measure loop loss for line 2 (T3, R3) using a 600-ohm loop termination and the milliwatt supply in serving central office.
7	Set 4-pole receive (REC) switch on 48FR1 data unit for measured line loss as specified in Table A. For example, if measured line loss is 4.5 dB, switch would be set with poles 1 and 4 released and poles 2 and 3 operated. ***Note:*** Steps 8 through 19 check switching and ring detection functions of 48FR1 data unit. This procedure requires the assistance of a serving test center (STC) equipped with a 48ER1 data unit with options M and T installed.
8	Set controls on TTS-4B test set as follows: SEND FREQ to 1000 SEND LEVEL to 0 (CAL) SEND IMP to 600Ω FUNCTION to SEND + TALK + REC REC IMP to 600Ω

STEP	PROCEDURE
9	Connect a 2P4B cord between REC 310 jack on test set and REC TST jack on 48FR1 data unit.
10	Contact STC and agree on test procedure to be performed.
11	STC uses DDD2 line of 48ER1 data unit to call directory number of DDD1 line of 48FR1 data unit. ***STC Requirement:*** STC hears 48FR1 data unit automatically answer call (trip ringing).
12	STC depresses and releases HOLD button. ***STC Requirement:*** DDD2 lamp lights.
13	STC uses DDD1 line of 48ER1 data unit to call directory number of DDD2 line of 48FR1 data unit. ***STC Requirement:*** STC hears 48FR1 data unit automatically answer call (trip ringing).
14	STC depresses and releases HOLD button. ***STC Requirement:*** DDD1 lamp lights. After about 10 seconds, BU lamp on 48ER1 data unit lights. ***Station Requirement:*** Test set meter reads signal level of -16 ±7 dBm for about 10 seconds. At end of signal, BU lamp on 48FR1 data unit lights. Station is now in dial backup mode.
15	Connect a 2P4B cord between SEND 310 jack on test set and XMT TST jack on 48FR1 data unit. ***STC Requirement:*** STC measures and records signal level of -16 ±7 dBm at REC TST jack on 48ER1 data unit (600 ohms terminating impedance).
16	STC connects a 1000-Hz 0 dBm signal source (600 ohms terminating impedance)(to XMT TST jack on 48ER1 data unit. ***Station Requirement:*** Test set meter reads signal level of -16 ±7 dBm.
17	On test set, set SEND LEVEL to +10. ***STC Requirement:*** Signal level at REC TST jack on 48ER1 data unit is not more than 2 dB greater than level recorded in Step 15.
18	After 10 dB signal has been sent to STC for about 10 seconds, set SEND LEVEL on test set to -10.
19	When STC observes a 10 dB drop in signal level for a minimum of 3 seconds, STC takes handset off-hook and depresses and releases REL button.

STEP	PROCEDURE
	Station Requirement: BU lamp on 48FR1 data unit goes off. Station is now released from dial backup mode.
20	Disconnect test set from 48FR1 data unit.
21	If option E was temporarily installed in 48FR1 data unit in Step 2, remove option E and install option D.
22	Refer to Fig. 1 for any remaining tests.

F. Single Installation (Automatic Answering With Automatic Call Back)

3.12 This installation consists of a DAS 829-type CIU and a 48FR1 data unit housed in a 59A1 data mounting. A station dial is used to originate a call on DDD2 line. The 48FR1 data unit automatically answers a call on DDD1 line when option E is installed in the data unit or when option D is installed in the data unit and a customer- or modem-provided contact is closed.

STEP	PROCEDURE
1	Install options in 48FR1 data unit as directed in Section 598-082-200 and as specified on service order and/or circuit layout record card.
2	If option D is installed in 48FR1 data unit, temporarily remove option D and install option E.
3	For nonregistered arrangements, perform Steps 4 through 7. For registered arrangements, verify that transmit (XMT) and receive (REC) switches on 48FR1 data unit are set to 8 dB fixed loss loop as specified in Table A, then proceed to Step 8.
	Note: Steps 4 and 5 are for adjusting transmit (XMT) switch on 48FR1 data unit.
4	Measure loop loss for line 1 (T2, R2) using a 600-ohm loop termination and the milliwatt supply in serving central office.
5	Set 4-pole transmit (XMT) switch on 48FR1 data unit for measured line loss as specified in Table A. For example, if measured line loss is 4.5 dB, switch would be set with poles 1 and 4 released and poles 2 and 3 operated.
	Note: Steps 6 and 7 are for adjusting receive (REC) switch on 48FR1 data unit.
6	Measure loop loss for line 2 (T3, R3) using a 600-ohm loop termination and the milliwatt supply in serving central office.

STEP	PROCEDURE

7 Set 4-pole receive (REC) switch on 48FR1 data unit for measured line loss as specified in Table A. For example, if measured line loss is 4.5 dB, switch would be set with poles 1 and 4 released and poles 2 and 3 operated.

Note: Steps 8 through 20 check station dial, switching functions, and ring detection functions of 48FR1 data unit. This procedure requires the assistance of a serving test center (STC) equipped with a 48ER1 data unit with options M and T installed.

8 Set controls on TTS-4B test set as follows:

SEND FREQ TO 1000

SEND LEVEL to 0 (CAL)

SEND IMP to 600Ω

FUNCTION to SEND + TALK + REC

REC IMP to 600Ω

9 Connect a 2P4B cord between REC 310 jack on test set and REC TST jack on 48FR1 data unit.

10 Contact STC and agree on test procedure to be performed.

11 Program station dial to dial directory number of DDD1 line of 48ER1 data unit at STC.

12 STC uses DDD2 line of 48ER1 data unit to call directory number of DDD1 line of 48FR1 data unit.

STC Requirement: STC hears 48FR1 data unit automatically answer call (trip ringing).

13 STC depresses and releases HOLD button.

STC Requirement: DDD2 lamp lights.

14 STC waits up to 1 minute for call on DDD1 line of 48ER1 data unit. When ringing is heard on DDD1 line, STC answers call.

15 STC depresses and releases HOLD button.

STC Requirement: DDD1 lamp lights. After about 10 seconds, BU lamp on 48ER1 data unit lights.

Station Requirement: Test set meter reads signal level of -16 ±7 dBm for about 10 seconds. At end of signal, BU lamp on 48FR1 data unit lights. Station is now in dial backup mode.

STEP	PROCEDURE
16	Connect a 2P4B cord between SEND 310 jack on test set and XMT TST jack on 48FR1 data unit.
	STC Requirement: STC measures and records signal level of -16 ±7 dBm at REC TST jack on 48ER1 data unit (600 ohms terminating impedance).
17	STC connects a 1000-Hz 0 dBm signal source (600 ohms terminating impedance) to XMT TST jack on 48ER1 data unit.
	Station Requirement: Test set meter reads signal level of -16 ±7 dBm.
18	On test set, set SEND LEVEL to +10.
	STC Requirement: Signal level at REC TST jack on 48ER1 data unit is not more than 2 dB greater than level recorded in Step 16.
19	After 10 dB signal has been sent to STC for about 10 seconds, set SEND LEVEL on test set to -10.
20	When STC observes a 10 dB drop in signal level for a minimum of 3 seconds, STC takes handset off-hook and depresses and releases REL button.
	Station Requirement: BU lamp on 48FR1 data unit goes off. Station is now released from dial backup mode.
21	Disconnect test set from 48FR1 data unit.
22	If option E was temporarily installed in 48FR1 data unit in Step 2, remove option E and install option D.
23	Program station dial to dial number specified by customer.
	Note: Do not leave station dial programmed to dial STC number.
24	Refer to Fig. 1 for any remaining tests.

G. Multiple Installation (Manual Dialing With 48B1 or 48ER1 Data Unit)

3.13 This installation uses switched 4-wire dial backup and consists of a maximum of twenty-three DAS 829-type CIUs housed in 46A-type data mountings, one or two 48B1 or 48ER1 data units, a maximum of six 48C1 data units, and one 48D1 data unit. The 48B1 or 48ER1 data units and the 48C1 data units are housed in a 46C-type data mounting. A maximum of twenty-three 48A1 data units housed in 46B1 data mountings may also be provided. The presence of 48A1 data units does not affect this test.

Note: Use of the 48B1 data unit or the 46C1 data mounting is not permitted in registered arrangements.

3.14 With switched 4-wire dial backup, the 4-wire dial backup channel must first be established; then, using an 18- or 30-button CALL DIRECTOR key telephone set, a modem is selected and switched to the dial backup channel. Two 4-wire dial backup

channels, designated A and B, can be provided. The two 2-wire lines required for channel A are controlled by the pickup keys designated DDD1A and DDD2A. For channel B the keys are designated DDD1B and DDD2B. Each channel provided is terminated by a 48B1 or 48ER1 data unit. Perform the test as follows:

Note: Only the indicated channels can be used for dial backup. For example, a dial backup channel cannot be established using pickup keys DDD1A and DDD2B.

STEP	PROCEDURE
1	For channel A and/or channel B, perform installation test for a single installation (manual dialing with 48B1 data unit) as described in paragraph 3.07 or for a single installation (manual dialing with 48ER1 data unit) as described in paragraph 3.08. ***Note:*** Steps 2 through 8 check switching matrix and telephone set for each position equipped with switched 4-wire dial backup.
2	Take handset off-hook. Depress DDD1A (channel A) or DDD1B (channel B) button, then depress HOLD button. ***Requirement:*** DDD1A (channel A) or DDD1B (channel B) lamp lights.
3	Depress DDD2A (channel A) or DDD2B (channel B) button, then depress HOLD button. ***Requirement:*** DDD2A (channel A) or DDD2B (channel B) lamp lights. When station uses a 48ER1 data unit, BU lamp on 48ER1 data unit lights after about 10 seconds.
4	Depress DBU(N) button, that is, DBU button for Nth position. Start with lowest number position equipped with switched 4-wire dial backup. ***Requirement:*** DBU(N) lamp lights. ***Note:*** If alternate voice is also provided for Nth position, button will be labeled TALK-DBU.
5	Depress HOLD button to release DBU(N) button. ***Requirement:*** DBU(N) lamp remains lighted.
6	Depress DBU(N) button, then depress and release REL button. ***Requirement:*** DDD1A or DDD1B, DDD2A or DDD2B, and DBU(N) lamps go off immediately when station uses a 48B1 data unit or after about 3 seconds when station uses a 48ER1 data unit. If DBU(N) button is labeled TALK-DBU, it remains lighted.
7	Depress and release HOLD button. ***Requirement:*** All lamps go off.

STEP	PROCEDURE
8	Repeat Steps 2 through 7 for each position equipped with switched 4-wire dial backup.
9	Refer to Fig. 1 for any remaining tests.

4. TROUBLE ISOLATION TESTS

4.01 There are four methods of isolating trouble encountered on CIUs and their associated equipment:

- Loopback from STC
- Access channel through test jacks
- Access CIU and channel through 171C test adapter
- Access interface leads through KS-21253-L5 adapter or through 66E-type connecting block.

4.02 Whenever trouble is encountered on the private line channel, the first test to be performed is the loopback test by the STC. The STC personnel may compare actual measurements against benchmark tests recorded at time of installation. Local policy should dictate the conditions under which personnel will be dispatched to the CIU location.

4.03 Test jacks on the DAS 829-type CIU provide access to the transmit and receive circuits of a 4-wire private line channel, or provide access to the transmit and receive circuits of the 4-wire portion of a 2-wire private line channel. Four-wire private line channel transmission tests, either end-to-end or end-to-STC, must be made through these test jacks. Two-wire private line transmission tests, either end-to-end or end-to-STC, must be made through the 2W TST jack on the 48G1 data unit, except tests that require a 4-wire interface.

4.04 The 171C adapter is a card extender that can be used to access the CIU for voltage measurements and to access T, R, T1, and R1 leads of the 4-wire metallic facilities without going through the CIU.

4.05 The KS-21253-L5 adapter is a 50-pin Amphenol-type connector for accessing the DT, DR, DT1, DR1, TEK5, TEK6, DBU1, and DBU2 leads (for a single 4-wire private line modem interface), or for accessing the DT1, DR1, TEK5, and TEK6 leads (for a single 2-wire private line modem interface), at the point where 25-pair cables normally interconnect the various pieces of equipment. This adapter can be used for making continuity checks through the data mountings.

4.06 To clear a trouble report involving a CIU and its associated equipment, the type of trouble must be determined:

(a) Trouble with transmitting or receiving data on private line

(b) Trouble with alternate voice equipment

(c) Trouble with switching from 4-wire private line to 4-wire dial backup channel

(d) Trouble with transmitting or receiving data on 4-wire dial backup channel.

A. Private Line

4.07 If the loopback test from the STC determines that trouble exists in the private line, the trouble must be cleared by following procedures specified in Section 314-410-300. If the station equipment is suspected of being defective, a dispatch to the station location is required.

4.08 To determine if a CIU (4-wire private line channel) or a CIU and a 48G1 data unit (2-wire private line channel) operate properly, perform tests specified for the type of channel as called for in Section 314-410-500. For 4-wire private line channels, tests to the STC or distant end must be made through the TRANS TST and REC TST jacks on the CIU. For 2-wire private line channels, tests to the STC or distant end

must be made through the 2W TST jack on the 48G1 data unit, except tests that require a 4-wire interface.

4.09 The trouble may be due to failure of the low voltage power supply. Verify that the CIU has the required voltage by using a KS-14510-L1 VOM (or equivalent). Measure for a voltage of approximately 24 Vac on terminals AC1 and AC2 of the 44A-type, 45A1, 59A1, or 62A1 data mounting. If a 46A-type data mounting is used, measure for a voltage of approximately 24 Vac between terminals AC1(1) and AC2(1) located on the backplane.

4.10 Replace any defective CIU or 48G1 data unit. If the private line channel then tests good at the test jacks and the trouble is not cleared, the trouble may be in the station wiring or in the data mounting wiring. This may be determined by checking the continuity of the telco-provided station wiring. It is necessary to access the DT, DR, DT1, DR1, TEK5, and TEK6 leads at a 4-wire modem interface, or to access the DT1, DR1, TEK5, and TEK6 leads at a 2-wire modem interface.

4.11 If the modem is telco-provided, there are two ways of connecting the modem to the CIU.

- Some arrangements provide access to the interface of a single modem, such as single installations using a 44A-type, 45A1, 59A1, or 62A1 data mounting or multiple installations using a KS-21253-L1 or -L4 adapter.
- Some arrangements do not provide access to the interface of a single modem. An example of this is data sets 202T installed in a 40B1 data mounting. To access the interface of a single modem, it is necessary to interrupt service to the other seven modems associated with the same connector.

4.12 If the modem is customer-provided, access to the modem interface can be made at the demarcation point, such as the 42A, 44A, or 66E-type connecting block.

4.13 The general procedure is to disconnect the modem at the private line demarcation point and then test for continuity between the demarcation point and the CIU and/or 48G1 data unit. When the demarcation point is for a single telco-provided modem, convenient access to pairs DT and DR, DT1 and DR1, TEK5 and TEK6, and DBU1 and DBU2 is provided through use of the KS-21235-L5 adapter (Fig. 2). When the demarcation point is for a multiple arrangement of modems, use a 66E-type connecting block to access individual leads per Table B, or use the connector terminals to access individual leads per Table C.

4.14 For 2-wire private line modems, tests for continuity on pair DT1 and DR1 can be made from the demarcation point to the 2W MON jack on the 48G1 data unit as per local company practice. Likewise, tests for continuity on pair TEK5 and TEK6 can be made from the demarcation point to the CIU.

TABLE B

CONNECTIONS AT 66E-TYPE CONNECTING BLOCK USED IN PLACE OF MODEM

DAS 829-TYPE CIU INSERTED IN POSITION DESIGNATED (N)	TERMINAL CONNECTIONS ON 66E-TYPE CONNECTING BLOCK					
	DT(N)	DR(N)	DT1(N)	DR1(N)	TEK5(N)	TEK6(N)
1 or 9 or 17	1	2	3	4	5	6
2 or 10 or 18	7	8	9	10	11	12
3 or 11 or 19	13	14	15	16	17	18
4 or 12 or 20	19	20	21	22	23	24
5 or 13 or 21	25	26	27	28	29	30
6 or 14 or 22	31	32	33	34	35	36
7 or 15 or 23	37	38	39	40	41	42
8 or 16	43	44	45	46	47	48

TABLE C

MULTIPLE CONNECTIONS FOR STANDARD 6-LEAD INTERFACE

DAS 829-TYPE CIU INSERTED IN POSITION DESIGNATED (N)	PIN NUMBERS ON STANDARD 50-PIN CONNECTORS					
	DT(N)	DR(N)	DT1(N)	DR1(N)	TEK5(N)	TEK6(N)
1 or 9 or 17	26	1	27	2	28	3
2 or 10 or 18	29	4	30	5	31	6
3 or 11 or 19	32	7	33	8	34	9
4 or 12 or 20	35	10	36	11	37	12
5 or 13 or 21	38	13	39	14	40	15
6 or 14 or 22	41	16	42	17	43	18
7 or 15 or 23	44	19	45	20	46	21
8 or 16	47	22	48	23	49	24

4.15 For 4-wire private line modems, tests for continuity on pair DT and DR can be made from the demarcation point to the REC MON jack on the CIU as per local company practice. Likewise, tests for continuity on pair DT1 and DR1 can be made from the demarcation point to the TRANS MON jack on the CIU. Finally, tests for continuity on pair TEK5 and TEK6 can be made from the demarcation point to the CIU.

B. Alternate Voice

4.16 If the trouble report indicates problems associated with the alternate voice service, the trouble may be due to failure of the low voltage power supply. Verify that the 48A1 data unit has the required voltage by using a KS-14510-L1 VOM (or equivalent). Measure for a voltage of approximately 24 Vac on terminals AC1 and AC2 of the 45A1 or 59A1 data mountings. If a 46B1 data mounting is used, measure for a voltage of approximately 24 Vac between terminals AC1(1) and AC2(1) located on the backplane.

4.17 If the power supplied to the 48A1 data unit is proper, then proceed as follows:

STEP	PROCEDURE
1	Check data-to-talk transfer by performing installation tests for an installation equipped with alternate voice.
2	If installation tests pass, proceed to Step 4.
3	If installation tests fail, replace 48A1 data unit and retest. If retest fails, replace telephone set and retest. ***Note:*** Steps 4 through 7 check that TEK5, TEK6 connection is broken when station is in talk mode.
4	If 48A1 data unit is installed in a 45A1 or 59A1 data mounting, connect KS-21253-L5 adapter in place of modem. If 48A1 data unit is installed in a 46B1 data mounting, disconnect

STEP	PROCEDURE
	modem and use a 66E-type connecting block to access TEK5 and TEK6 per Table B, or use the connector terminals to access TEK5 and TEK6 per Table C.
5	With CIU in data mode, test for continuity on pair TEK5 and TEK6 as per local company policy. ***Requirement:*** Test indicates continuity (short circuit).
6	Transfer to talk mode by taking handset off-hook and depressing TALK button. ***Requirement:*** TALK lamp lights.
7	Test for continuity on pair TEK5 and TEK6 as per local company policy. ***Requirement:*** Test indicates open circuit.
8	If step 6 or 7 fails, replace 48A1 data unit.
9	Restore station to pretest condition.

C. 4-Wire Dial Backup

4.18 If the trouble report indicates problems associated with the 4-wire dial backup equipment:

(a) For single installations, perform the installation tests. If these tests fail, replace the 48B1, 48ER1, or 48FR1 data unit and retest. If the tests still fail, replace the telephone set.

(b) For multiple installations equipped with switched 4-wire dial backup, perform the tests specified in paragraph 4.19. If when performing these tests, a telephone set lamp fails to light, check the bulb for failure before replacing any equipment. If the telephone set is replaced, ensure wiring is modified as specified in Section 598-082-200.

4.19 Proceed as follows:

STEP	PROCEDURE
1	Perform Steps 2 through 20 for each 4-wire dial backup channel provided. ***Note:*** Steps 2 through 8 check the operation of the 48B1 or 48ER1 data unit providing 4-wire dial backup channel A or channel B.
2	Take handset off-hook and depress DDD1A (channel A) or DDD1B (channel B) button. ***Requirement:*** DDD1A (channel A) or DDD1B (channel B) lamp does not light. Dial tone is heard in handset.
3	Dial directory number of DDD2A (channel A) or DDD2B (channel B) line.

STEP	PROCEDURE

Requirement: Audible indication is heard. DDD2A (channel A) or DDD2B (channel B) lamp flashes in response to audible indication.

4 When audible indication is heard, depress and release HOLD button.

Requirement: DDD1A (channel A) or DDD1B (channel B) lamp lights and DDD1A or DDD1B button releases on up-stroke of HOLD button. Audible indication continues.

5 Depress DDD2A (channel A) or DDD2B (channel B) button.

Requirement: Audible indication ceases. DDD2A (channel A) or DDD2B (channel B) lamp stops flashing.

6 Depress and release HOLD button.

Requirement: DDD2A (channel A) or DDD2B (channel B) lamp lights and DDD2A or DDD2B button releases on up-stroke of HOLD button. When station uses a 48ER1 data unit, BU lamp on 48ER1 data unit lights after about 10 seconds. Station is now in dial backup mode using dial backup channel A or channel B.

7 Depress and release REL button.

Requirement: Both DDD1A and DDD2A (channel A) or DDD1B and DDD2B (channel B) lamps go off immediately when station uses a 48B1 data unit or after about 3 seconds when station uses a 48ER1 data unit. Station is now released from dial backup mode.

8 Repeat Steps 2 through 7 using DDD2A line to call DDD1A line (channel A) or DDD2B line to call DDD1B line (channel B).

9 If any of Steps 2 through 8 fails, replace 48B1 or 48ER1 data unit associated with that channel and retest. If test still fails, replace telephone set.

Note 1: Ensure telephone set wiring is modified as specified in Section 598-082-200.

Note 2: Steps 10 through 15 check switching matrix and telephone set for each position equipped with switched 4-wire dial backup.

10 Take handset off-hook. Depress DDD1A (channel A) or DDD1B (channel B) button, then depress HOLD button.

Requirement: DDD1A (channel A) or DDD1B (channel B) lamp lights.

11 Depress DDD2A (channel A) or DDD2B (channel B) button, then depress HOLD button.

Requirement: DDD2A (channel A) or DDD2B (channel B) lamp lights. When station uses a 48ER1 data unit, BU lamp on 48ER1 data unit lights after about 10 seconds.

12 Depress DBU(N) button, that is, DBU button for Nth position. Start with lowest number position equipped with switched 4-wire dial backup.

STEP	PROCEDURE
	Requirement: DBU(N) lamp lights.
	Note: If alternate voice is also provided for Nth position, button will be labeled TALK-DBU.
13	Depress HOLD button to release DBU(N) button.
	Requirement: DBU(N) lamp remains lighted.
14	Depress DBU(N) button, then depress and release REL button.
	Requirement: DDD1A or DDD1B, DDD2A or DDD2B, and DBU(N) lamps go off immediately when station uses a 48B1 data unit or after about 3 seconds when station uses a 48ER1 data unit. If DBU(N) button is labeled TALK-DBU, it remains lighted.
15	Depress and release HOLD button.
	Requirement: All lamps go off.
16	Repeat Steps 10 through 15 for each position equipped with switched 4-wire dial backup.
17	If Step 13 fails, replace 48C1 data unit associated with Nth position and retest. If test still fails, replace telephone set.
	Note: Ensure telephone set wiring is modified as specified in Section 598-082-200.
18	If Steps 10 through 15 pass ***except*** that none of DBU(N) or TALK-DBU(N) lamps light, check fuses in 48D1 data unit and replace fuses or 48D1 data unit as required.
19	If step 12 or 13 fails for all positions, check wiring modification in telephone set.
20	If Step 12 passes, but Step 13 fails, replace 48B1 or 48ER1 data unit associated with that channel.
21	Restore station to pretest condition.

4.20 After completing tests specified in paragraph 4.18, perform the following test to determine if the 4-wire dial backup channel meets requirements.

STEP	PROCEDURE
1	Plug KS-21253-L5 adapter in place of modem (N). If it is not possible to access a single modem interface, use a 66E-type connecting block to access individual leads. Refer to Table B for appropriate terminals.

STEP	PROCEDURE

2 Set controls on TTS-4B test set as follows:

- SEND FREQ to 1000
- SEND LEVEL to 0
- SEND IMP to 600Ω
- FUNCTION to SEND + TALK + REC
- REC IMP to 600Ω

3 Insert plug of a 2W6A cord into SEND 310 jack on test set. Connect the alligator clips to DR1 and DT1.

4 Insert plug of another 2W6A cord into REC 310 jack on test set. Connect the alligator clips to DR and DT.

5 Use DDD1 line to call DDD2 line. When audible indication is heard, depress and release HOLD button.

Requirement: DDD1 lamp lights.

6 Depress DDD2 button, then depress and release HOLD button. If station is a single installation, it is immediately in dial backup mode when station uses a 48B1 data unit or after about 10 seconds when station uses a 48ER1 data unit.

Requirement: DDD2 lamp lights. After about 10 seconds, BU lamp on 48ER1 data unit lights.

7 If station is a multiple installation, depress DBU(N) button, then depress and release HOLD button. Station is immediately in dial backup mode when station uses a 48B1 data unit or after about 10 seconds when station uses a 48ER1 data unit.

Requirement: DBU(N) lamp lights. After about 10 seconds, BU lamp on 48ER1 data unit lights.

8 Check test set meter for level of received signal.

Requirement: -8 to -16 dBm.

Note: The test set is transmitting a 0-dBm signal. The transmit side is arranged so that the signal to the serving central office is no greater than -12 dBm. There is a 3- to 4-dB loss through the central office and a +3.7 dB gain in the receive side to the modem. Therefore the received signal should be a nominal -12 dBm.

9 If there is no received signal, or if there is difficulty in placing call, clear trouble in same way as a telephone trouble.

STEP	PROCEDURE
10	If telephone portion of a single station installation functions properly, but trouble is encountered in switching from 4-wire private line to 4-wire dial backup channel, replace 48B1 or 48ER1 data unit.
11	If telephone portion of a multiple station installation functions properly, but trouble is encountered in switching from 4-wire private line to 4-wire dial backup channel, replace 48C1 data unit associated with channel (N) and retest. If retest fails, replace 48B1 or 48ER1 data unit and retest.
12	Restore station to pretest condition.

5. REFERENCES

5.01 Additional information concerning testing of the DAS 829-type CIU and the supplemental data units and data mountings is contained in the following publications:

SECTION	TITLE
314-410-300	Voice Bandwidth Private Line Data Circuits—Maintenance
314-410-500	Voice Bandwidth Private Line Data Circuits—Tests and Requirements
598-082-100	Data Auxiliary Set 829-Type—Channel Interface Units—Voiceband Private Line Channels—Description
598-082-200	Data Auxiliary Set 829-Type—Channel Interface Units—Voiceband Private Line Channels—Installation and Connections
598-088-500	Data Auxiliary Set 801CR-L1/2—Test Procedures

5.02 Detailed information concerning the DAS 829-type CIU and the supplemental data units and data mountings is contained in CD- and SD-1D247-01.

DATA AUXILIARY SET 830D

IDENTIFICATION

1. GENERAL

1.01 This section provides an identification and general description of data auxiliary set (DAS) 830D (Fig. 1).



Fig. 1—Data Auxiliary Set 830D

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

1.03 The DAS 830D is used in conjunction with data set (DS) 108F, 108G, or any data set in a DAS 830A to provide a clear-to-send timer for use in polling applications.

2. PHYSICAL DESCRIPTION

2.01 The DAS 830D consists of a single printed circuit board mounted in a housing assembly and having two attached cords, each equipped with a 25-pin connector.

2.02 The DAS 830D housing assembly consists of a connecting block and a cover. One of the 25-pin connectors is female (for connection to customer-provided equipment [CPE]) the other connector is male (for connection to the data set).

2.03 Data auxiliary set 830D measures approximately 2 inches wide by 3.9 inches long by 1.2 inches high and weighs approximately 6.4 ounces.

2.04 The DAS 830D operates over a temperature range of 40°F to 120°F with relative humidity of 20 to 95 percent.

3. FUNCTIONAL DESCRIPTION

3.01 Data auxiliary set 830D provides a clear-to-send timer by introducing a time delay between the turning on of the request-to-send lead CA and the turning on of the clear-to-send lead CB.

3.02 Data auxiliary set 830D can provide a long time delay (nominally 500 ms ±75 ms) or a short time delay (nominally 200 ms ±30 ms). The long time delay is option Z and the short time delay is option Y.

3.03 Data auxiliary set 830D will keep clear-to-send lead CB ***off*** until received carrier is detected if option W is selected in the associated DS 108F or 108G.

3.04 The customer interface circuit Electronic Industries Association (EIA) designations, functions, and connector pin assignments are shown in Table A.

4. REFERENCES

4.01 The following Bell System Practices provide additonal information on DAS 830D and associated equipment:

SECTION	TITLE
591-816-100	Private Line Station Arrangements using Data Auxiliary Sets 830A

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TABLE A

EIA DESIGNATION	FUNCTION	CONNECTOR PIN ASSIGNMENT
BA	Transmitted Data	2
BB	Received Data	3
CA	Request-to-Send	4
CB	Clear-to-Send	5
CC	Data Set Ready	6
AB	Signal Ground	7
CF	Received Line Signal Detector	8
	Test (Note)	18

Note: Used in some Bell System applications.

and 830B With Data Sets 108- and 109-Type—Description and Operation

591-816-200 Private Line Station Arrangements Using Data Auxiliary Sets 830A and 830B With Data Sets 108- and 109-Type—Installation and Connections

591-816-300 Private Line Station Arrangements using Data Auxiliary Sets 830A and 830B With Data Sets 108- and 109-Type—Maintenance

591-816-500 Private Line Station Arrangements Using Data Auxiliary Sets 830A and 830B With Data Sets 108- and 109-Type—Test Procedures

591-818-100 Private Line Station Arrangements using Data Sets 108F and 108G With Data Auxiliary Sets 830B and 830C—Description

591-818-200 Private Line Station Arrangements Using Data Sets 108F and 108G With Data Auxiliary Sets 830B and 830C—Installation and Connections

591-818-500 Private Line Station Arrangements Using Data Sets 108F and 108G With Data Auxiliary Sets 830B and 830C—Maintenance and Test Procedures

4.02 Detailed information concerning DAS 830D is contained in Circuit Description (CD) and Schematic Drawing (SD) 1D250-01, entitled Data Auxiliary Sets 830A, 830B, 830C, and 830D Type.

Notes
Data Auxiliary Set 837A-L1

1. Introduction

1.01 These notes describe equipment and arrangements for physically separating the data auxiliary set (DAS) 829-type from the dial backup equipment. This is necessary after January 1, 1983 as a result of the FCC's Computer Inquiry II (CI-II) decision to require that regulated network equipment be physically separate from the unregulated customer premises equipment (CPE).

1.02 The DAS 829-type provides a standard termination for 4-Wire Private Line (4WPL) channels. Although these units are located on a customer's premise, they are part of the transmission plant equipment.

1.03 The 48ER1 and 48FR1 data units are customer premises equipment that permit a 4WPL modem to be connected to either a 4WPL channel or a 4W backup channel. The 4W backup channel is established through the use of a pair of switched network (DDD) lines. The 48ER1 and 48FR1 data units are registered protective circuits and are not part of the transmission plant equipment.

1.04 The 59A1 data mounting provides a common housing for a DAS 829-type and either a 48ER1 or 48FR1 data unit. The 59A1 data mounting provides internal wiring to connect the DAS 829-type to the 48ER1 or 48FR1. Beginning January 1, 1983 it will be necessary to be able to physically separate the DAS 829-type from the 48ER1 or 48FR1 data units: i.e., provision for separate housings must be made.

1.05 To accomplish the separation, a special strap card, coded DAS 837A-L1, has been designed to bypass the DAS 829-type function and connect the 48ER1 or 48FR1, housed in a 59A1 data mounting, directly to a 4WPL channel. The standard connection would be to a DAS 829-type housed in a 44A-type data mounting for single units or a 46A-type data mounting for multiple units. It should be noted there is no requirement that the DAS 829-type be used as part of the 4WPL termination.

2. Description, Installation and Connections

2.01 A simplified block diagram of the old arrangement of using a common housing for the DAS 829-type and the 48ER1 or 48FR1 data unit is shown in Fig. 1.

2.02 A simplified block diagram of the new arrangement of separate housings is shown in Fig. 2.

2.03 The DAS 837A-L1 card is installed in the 59A1 data mounting in place of the DAS 829-type. The DAS 837A-L1 card provides 6 straps to bypass the function of the DAS 829-type.

2.04 The CPE interface defined by the DAS 829-type is as follows:

1. DT-DR; input signal pair to CPE
2. DT1-DR1; output signal pair from CPE
3. TEK5-TEK6; line status pair. Note: When the 4WPL channel interface is not provided by a DAS 829-type or equivalent the TEK5-TEK6 pair may not be provided.

2.05 Connections between the CPE and the DAS 829-type are made from screw terminals on the rear of the 59A1 data mounting to a 50-pin connector on the 44A-type or 46A-type data mounting.

2.06 Connections for a 44A-type data mounting (single DAS 829-type) are shown in Fig. 3.

2.07 Connections for a 46A-type data mounting (up to eight DAS 829-type) are shown in Figs. 4 and 5.

3. Other Arrangements

3.01 The 48ER1 data unit (but not the 48FR1) can also be installed in a 46C2 data mounting along with 48C1 data units to provide a switching matrix between dial backup channels and data sets. The DAS 829-type is not used in this data mounting therefore no changes are required for this arrangement.

3.02 Arrangements which are non-registered and out of production may still be in service. These arrangements may use a 45A1 data mounting to provide a common housing for a DAS 829-type, a 48A1 data unit (alternate voice) and a 48B1 data unit (manual dial backup). The DAS 837A-L1 can be used to bypass the DAS 829-type function in the 45A1 data mounting with the exception that the TEK5-TEK6 line status pair will not be passed through from the DAS 829-type to the modem. The connection between the externally housed DAS 829-type and the 45A1 data mounting will consist of only the DT-DR and DT1-DR1 pairs.

4. Bibliography

4.01 Bell System Practices for the DAS 837A-L1 are covered by:

Addendum 598-082-200	Data Auxiliary Set 829-Type
	Channel Interface Units
	Voiceband Private Line Circuits
	Installation and Connections

Att.
Figures 1-5

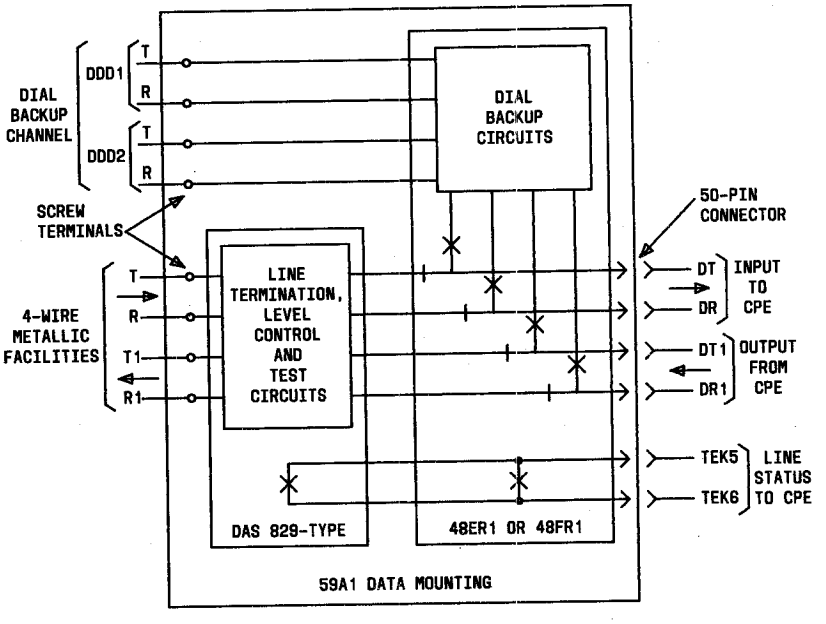


Fig. 1--Common Housing Arrangement for DAS 829-Type and 48ER1 or 48FR1 Data Unit

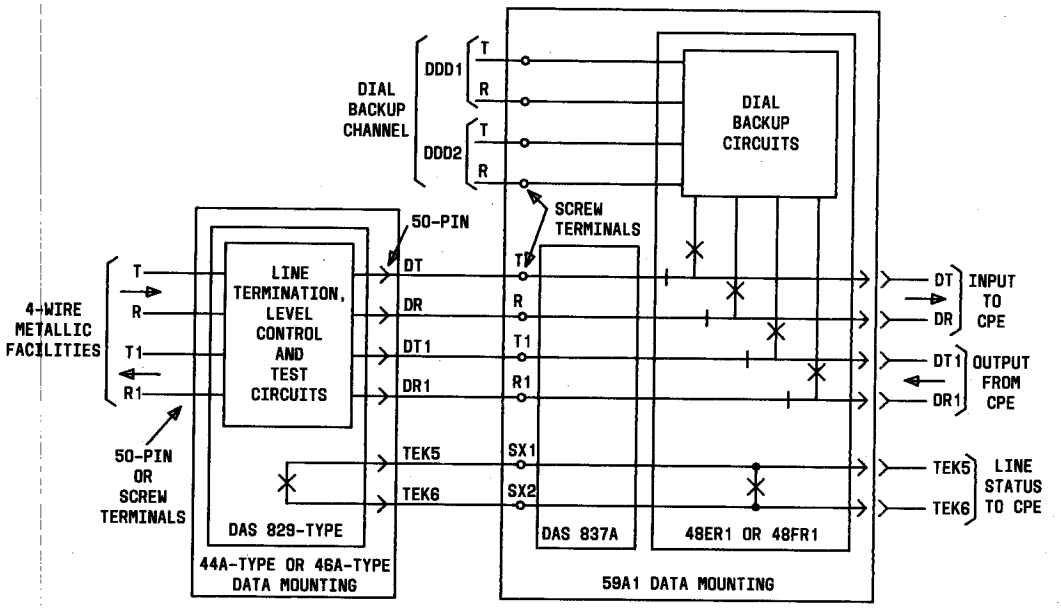


Fig. 2--Separate Housing Arrangement for DAS 829-Type and 48ER1 or 48FR1 Data Unit

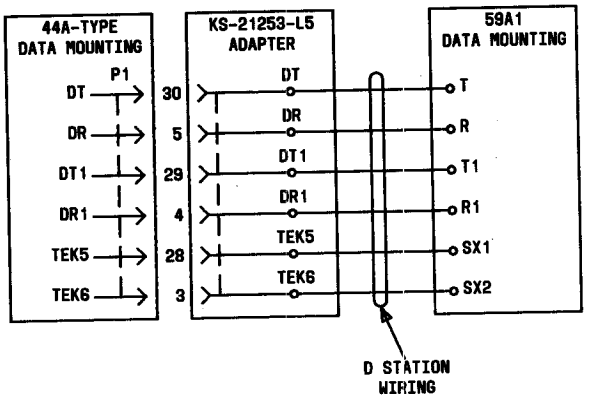


Fig. 3--44A-Type Data Mounting--Connections to 59A1 Data Mounting Using KS-21253-L5 Adapter

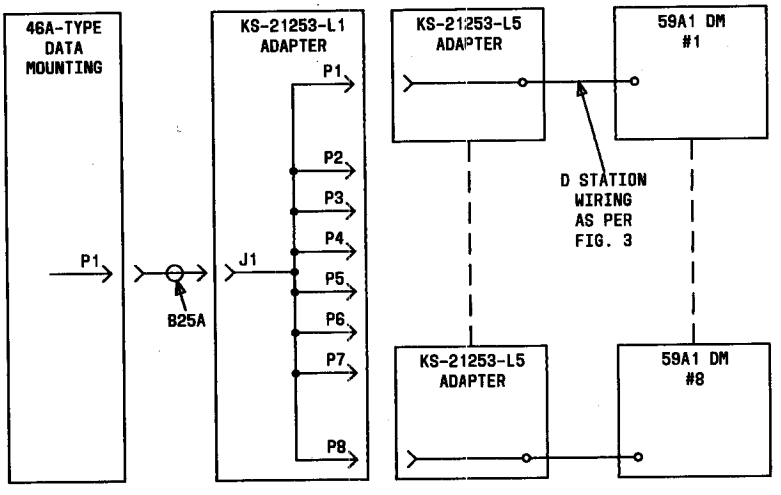


Fig. 4--46A-Type Data Mounting--Connections to 59A1 Data Mounting Using KS-21253-L1 and KS-21253-L5 Adapters

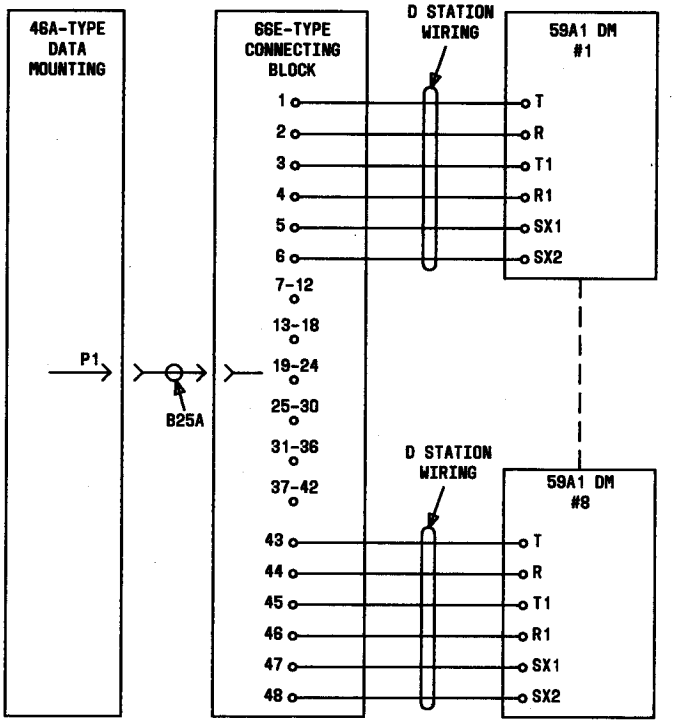


Fig. 5--46A-Type Data Mounting--Connections to 59A1 Data Mounting Using 66E-Type Connecting Block

Part 6

Part 6 — ADTS Testing

DESCRIPTION	NUMBER
DS 103J	591-039-502 (6-1)
DS 113B-L1	591-814-502 (6-3)
DS 113C-L1/2	591-041-502 (6-4)
DS 113D-L1/2	591-040-502 (6-5)
DS 201C-L1/C	592-029-512 (6-6)
DS 202S	592-028-502 (6-7)
DS 208B	592-030-502 (6-8)
DS 212A	592-034-502 (6-9)

TESTING DATA SET 103J-L1/2
FROM FIELD LOCATIONS
USING J1P005 AUTOMATIC DATA TEST SYSTEM (ADTS)

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1. GENERAL

1.01 This section provides self test and field test information for data set (DS) 103J-L1/2. Loopback and error run tests are provided using the J1P005 ADTS. These procedures are to be used when testing DS 103J-L1/2 on an initial installation or during a maintenance visit.

1.02 When this section is reissued, the reason for reissue will be presented in this paragraph.

1.03 The self tests require no external test equipment, and are included here for completeness.

1.04 This section contains information for testing DS 103J-L1/2 by means of DIVA (Digital Inquiry Voice Answer). DIVA requires a TOUCH-TONE® dial telephone, or a rotary dial telephone used with a KS-21799-L1 (or equivalent) portable TOUCH-TONE pad.

1.05 In this section, the term "user" refers to telephone company (telco) personnel at the data set responsible for interfacing the data set with the ADTS.

1.06 Test circuitry built into DS 103J-L1/2 permits the following self tests to be performed: analog loopback, digital loopback, and end-to-end. Additional tests require the use of external test equipment such as a 921A data test set (DTS) and/or the ADTS.

1.07 Detailed self test procedures are presented in paragraphs 4.02 through 4.07.

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1.08 General ADTS test information is presented in paragraphs 5.01 through 5.26. Detailed ADTS test procedures are presented in paragraphs 5.27 through 5.69.

2. INSTALLATION TESTS

2.01 This part provides the sequence in which tests are to be performed following installation of the data set. This test sequence (Fig. 1) provides a method of verifying that the installation is satisfactory. Before proceeding with the tests, verify that the local loop meets the requirements specified in Section 314-205-501.

3. MAINTENANCE TESTS

3.01 This part provides the sequence in which tests are to be performed when clearing a trouble report and during a maintenance visit to the data station.

3.02 When a trouble report is received, a test center or ADTS is responsible for isolating the trouble to the data station or the transmission facility. The procedure for doing this is shown in Fig. 2.

3.03 The data station equipment must be tested prior to dispatching a telco employee. If the trouble seems to be in the data station equipment, a telco employee must be dispatched to conduct more extensive tests at the data station. The following equipment should be taken on a trouble visit:

- 921A or 914-type DTS
- Spare DS 103J-L1/2.

3.04 Troubleshooting is performed by the ADTS using the loopback test or error run test. If the trouble is isolated to the data set, replace the data set and repeat the test.

3.05 If the trouble persists after the tests have been completed, proceed as follows:

(a) Check for physical damage to data station equipment.

(b) Verify that all cords and connectors are properly connected.

(c) Check that options installed in data set agree with those specified on service order.

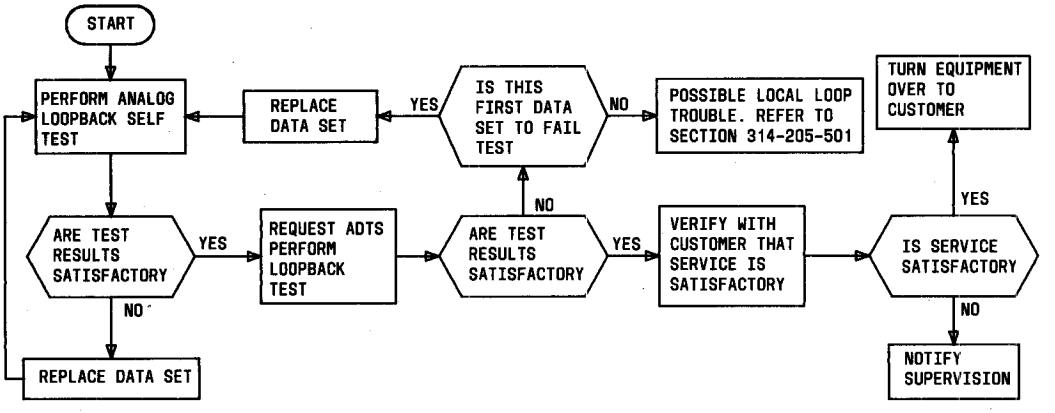


Fig. 1—Installation Test Sequence

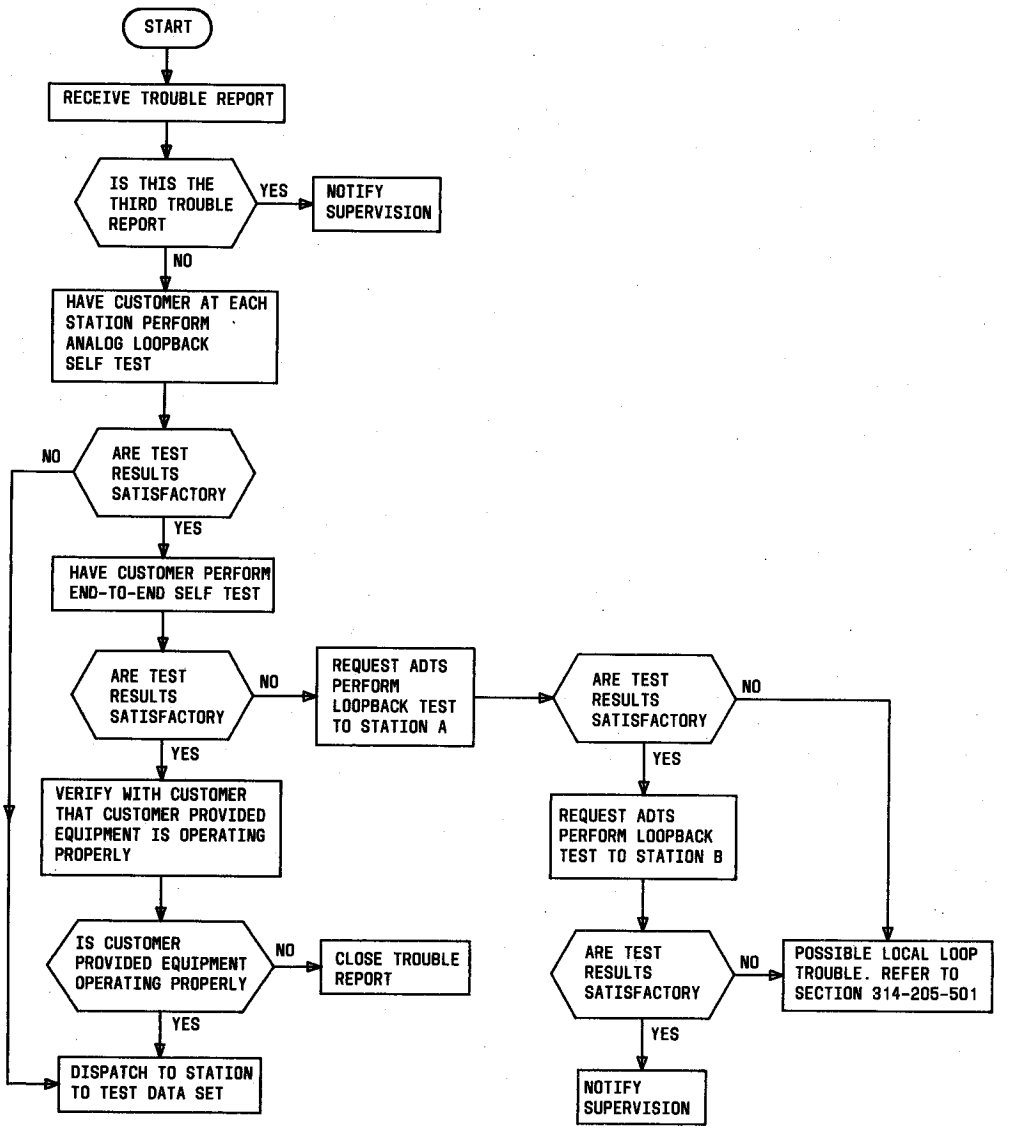


Fig. 2—Clearing Trouble Report

(d) Verify that customer-provided equipment (CPE) has been tested and is operating properly.

(e) Check for intermittent trouble in station wiring.

(f) Verify that data set and CPE are connected to a common ground.

(g) If trouble persists, request help from immediate supervisor, who may then obtain

technical support from DATEC (Data Technical Support) per Section 010-521-100.

4. SELF TEST PROCEDURES

4.01 This part provides procedures for the installation and maintenance self tests.

A. Analog Loopback Self Test

4.02 This test checks the data set transmitter and receiver. The customer interface is not checked. Test data generated by the data set is looped back internally from the transmitter output to the receiver input. The received data is compared to the transmitted data. If the distortion threshold (20 percent) is not exceeded, the MC lamp goes off after a short interval.

4.03 Perform the test as follows:

(1) Depress AL and ST switches on data set.

Requirements: MB, MR, and TM lamps light and MC lamp goes off after SD and RD lamps light.

(2) Observe MC lamp for 1 minute.

Requirement: MC lamp remains off.

(3) Release AL and ST switches.

B. Digital Loopback Self Test

4.04 This test checks the transmitter and receiver of a local and a distant data set and the facilities connecting the data sets. The customer interfaces are not checked. Test data generated and transmitted by the local data set is looped back internally from the receiver output to the transmitter input of the distant data set and retransmitted. This data is received by the local data set and compared to the original transmitted data. If the distortion threshold (35 percent) is not exceeded, the MC lamp goes off after a short interval.

Note: The distant data set can be a 103J, 103JR, 113C, 113CR, 113D, or 113DR.

4.05 Perform the test as follows:

(1) Place a call to distant station. If distant data set is already in DL mode, it will answer automatically.

(2) If distant data set does not answer automatically, instruct attendant at distant station to depress DL switch on data set and go to data mode.

(3) On local data set, depress ST switch and go to data mode.

Requirements: On local data set, MR and TM lamps light and MC lamp goes off after SD and RD lamps light.

(4) Observe MC lamp on local data set for 2 minutes.

Requirements: If MC lamp remains off, both data sets and the line facilities are operating properly. If MC lamp remains lighted, the round-trip distortion exceeds 35 percent. Since the distortion in the two directions may be additive, no conclusion about the proper operability of the data sets and the line facilities may be drawn.

(5) Release ST switch on local data set. Call distant station and have DL switch released.

C. End-to-End Self Test

4.06 This test checks the transmitter and receiver of a local and a distant data set and the facilities connecting the data sets. The customer interfaces are not checked. Both data sets generate and transmit test data to each other. If the distortion threshold (35 percent) is not exceeded, the MC lamps on both data sets go off after a short interval.

Note: The distant data set can be a DS 103J, 103JR, 113C, 113CR, 113D, or 113DR.

4.07 Perform the test as follows:

(1) Call distant station and arrange to conduct an end-to-end self test.

(2) Depress ST switch on both data sets.

(3) Go to data mode at both stations.

Requirements: On both data sets, MR and TM lamps light and MC lamp goes off after SD and RD lamps light.

(4) Observe MC lamp on both data sets for 2 minutes.

Requirements: If MC lamps remain off, both data sets and the line facilities are operating properly. If MC lamps remain lighted, the distortion exceeds 35 percent.

(5) At end of test, go to talk mode and then release ST switch on both data sets.

5. ADTS TEST PROCEDURES

A. General

5.01 This part provides instructions necessary for the proper operation of ADTS from field data sets. Included are instructions for entering and leaving the system and for performing installation and maintenance tests.

5.02 Operations involving ADTS require man/machine interaction. With DIVA, the information is entered into ADTS by tones from a TOUCH-TONE dial. The system outputs a message by a voice response unit, and the user receives the message via the telephone handset.



Every entry from a TOUCH-TONE dial must be followed by a TOUCH-TONE star (*) except when calling the DIVA port number. To avoid repetition, the star entry has not been included in the text but should be understood as included whenever an entry is mentioned.

5.03 The ADTS must be on-line and DIVA must be up to accept DIVA tests.

Functions Available Via DIVA (Table B)

5.04 The test functions available via DIVA initiate a static or dynamic test of a data set. When 3 is used as a prefix with a test function, a fast test is performed on the data set without review of the line card information and without receiving test instructions.

5.05 ***Test Function List:*** With an entry of 8, DIVA will respond with a message of all test functions that can be performed on DS 103J.

5.06 ***Loopback Test:*** This function provides a loopback test of DS 103J by the ADTS. The loopback test is initiated by entering 52; the fast loopback test by entering 352.

5.07 ***Error Run Test:*** This function provides an error run test between the data set and the ADTS in both directions (full duplex). A 921A or a 914-type DTS is required at the data set. Bit or block errors are automatically recorded for various combinations of pseudorandom data sequences and for various periods of time. The data sequences and the periods of time are user specified. Use of the 921A or 914-type DTS requires an initial test setup as described in paragraphs 5.45 and 5.64, respectively. The error run test is initiated by entering 37; the fast error run test by entering 337.

5.08 ***Results:*** This function provides results of the most recent test of the data set. The results function is initiated by entering 7. In response to the results function entry, the ADTS gives the audible query WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After receiving a number, the ADTS outputs the results in a format similar to the following:

THE TEST RESULTS ARE:

THE DATA SET CODE IS (data set code)

THE RECEIVED SIGNAL LEVEL IS OUT OF LIMITS

WHAT IS THE FUNCTION YOU WISH TO PERFORM?

5.09 ***Stop:*** This function stops the present function and requests a new function. The stop function is initiated by entering #73.

5.10 ***Off:*** This function stops the present function and disconnects the DIVA port. The off function is initiated by entering #63.

Accessing ADTS

5.11 Access to ADTS by DIVA is obtained by placing a call to a DIVA port number.

Depending on the mode of ADTS and the mode of DIVA, one of four actions will occur:

(a) Busy signal; all DIVA ports are busy. Try again later.

(b) Call not answered; DIVA is in the down mode.

(c) Call answered; the user will hear a 1-second burst of answer tone. Following the answer tone will be the audible query: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD. Once the password has been entered, the system responds with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

(d) Call answered; the user will hear: THE ADTS IS OFF-LINE. The ADTS will automatically abort the task. The ADTS must be put on-line by entering ONLIN to the function query on a terminal at the ADTS. The user may then place a call to a DIVA port number and access the ADTS.

5.12 The user may shorten the password-function request formalities by inputting both the password and the desired function in one entry (no intervening *). If both the password and function are valid, ADTS begins executing the function immediately. To shorten the time required to set up a test, answers to familiar questions asked by DIVA may be given while the question is in progress.

5.13 Information is entered into ADTS by letters or numbers on the TOUCH-TONE dial. Numbers are entered into ADTS by depressing the desired digits on the TOUCH-TONE dial. Letters are entered into ADTS by using the following format:

(a) Depress #.

(b) Depress button with desired letter on it.

(c) Depress a number (1, 2, or 3) corresponding to the letter's position on the button [depressed in (b)].

5.14 In response to a YES or NO question, the following format is used:

(a) YES, enter one (1).

(b) NO, enter zero (0).

5.15 The user can again listen to the last spoken message, by entering #* (Table A).

Performing Tests

5.16 To start a test, the user enters the desired number code from Table B. The ADTS response is WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After the number has been entered, the ADTS response is YOU HAVE ENTERED (telephone or special service circuit number). IS THAT CORRECT? The user enters 1 for YES or 0 for NO. If the response is incorrect, ADTS repeats the original query.

5.17 If the response is correct, ADTS will attempt to find a line card file (LCF). If an LCF is found, ADTS will use the data set code to find the test program. If there is a test program for the data set code and test function entered, ADTS will continue. If no test program is found, ADTS will abort the test with the following message: THE ADTS CANNOT RUN SELECTED TEST ON THIS DATA SET. (Since there are test programs available for DS 103J—52 and 37—this response indicates that the wrong test code was entered.)

5.18 If both an LCF and test program are found, the LCF information is given to the user. The user is then given a chance to make any necessary changes.

5.19 If no LCF is found, the ADTS response is THE DATA SET IS NOT ON FILE. ENTER THE DATA SET CODE. The user must then answer this question and others to create an LCF. In this case the entry would be 103#51*. After entry of the data set code, ADTS checks for the test program.

5.20 After the LCF information has been given or after new line card information has been entered ADTS instructs the user TO CORRECT ERRORS ENTER ONE. IF NO ERRORS, ENTER ZERO. If a 1 is entered, ADTS repeats the line card information query.

TABLE A

TOUCH-TONE CODES FOR DIVA

FUNCTION	DEPRESS BUTTON(S)	DESCRIPTION
1, 2, 3, . . .etc.	Appropriate button(s)	Digits
#	#	Prefix character.
*	*	TOUCH-TONE star. Used at end of all entries as EOL character.
A,B,C, . . .etc.	Depress number sign, button on which character appears, and digit corresponding to the relative position of the letter (1,2, or 3). Example: For the letter A #21	Alphabetic characters.
Yes	1*	Answer yes to a question.
No	0*	Answer no to a question.
Repeat	#*	Repeats last message spoken by the system.
Telephone Number	Example: 3115552368*	Enter telephone number in sequence followed by EOL.
Data Set Code	Example: 202#23* Example: 202#235* Example: 401#515*	202C 202C5 401J5
Data Set Transmit Level	Example: 12*	-12 dBm. Eliminate sign and units designation. Enter numerical value.

TABLE B

FUNCTIONS AVAILABLE FROM DIVA

FUNCTION	DESCRIPTION	NORMAL	FAST
Test List	Lists valid test functions.	8 *	
Loopback Test	Static test of a data set.	52 *	352 *
Error Run Test	Tests a data set with data test set connected.	37 *	337 *
Results	Outputs results of most recent test of a data set.	7 *	
STOP	Stops present function and requests new function.	#73 *	
OFF	Stops present function and disconnects.	#63 *	

5.21 If no corrections are made to the LCF, ADTS asks ARE YOU CALLING FROM THE DATA SET? If the user is calling from a data set, the user must hang up prior to running the test. ADTS will then call the data set for testing. After the test has been completed, the user must call ADTS to obtain the results of the test. The test instructions direct the user on this procedure.

5.22 The ADTS asks the user DO YOU WANT INSTRUCTIONS? If requested, ADTS will supply test instructions. These instructions are to prompt the user, not to replace the data set BSP instructions.

5.23 After the instructions, ADTS gives the following message: WHEN READY, ENTER ONE. Upon receipt of a 1, ADTS responds THANK YOU. A pause will follow the thank you message as ADTS attempts to seize the hardware needed for the test. If the test hardware is busy performing another test or a self test, ADTS gives the following message: THE ADTS TEST EQUIPMENT IS BUSY, PLEASE WAIT. When the test hardware becomes available, ADTS outputs THE TEST IS READY TO START.

5.24 At completion of the test, the user receives a short message describing the test results. When the data set fails, the system gives the reason(s) for failure. After giving the results of the data set test, the system returns to the function query.

Leaving ADTS

5.25 ***Manual Abort:*** Whenever the system is expecting user input, the user can abort the operation by entering #73 (the letter S) or #63 (the letter O). The letter S, for STOP, causes ADTS to abort the operation and return to the function query. The letter O, for OFF, causes ADTS to abort the operation and the DIVA port to hang up.

5.26 ***Automatic Abort:*** The ADTS automatically performs the equivalent of a user OFF if the user does not respond to a system request. Thirty seconds without a user entry after the original function query, ADTS will repeat the query. Thirty seconds after the second query without a user entry, ADTS will repeat the query for the third time. Thirty seconds after the third query without a user entry, ADTS will abort the task and hang up. If incorrect or illogical entries are made three successive times, ADTS will perform the equivalent of an OFF. After each invalid entry, an appropriate error message such as THE NUMBER IS INVALID, PLEASE REENTER will be spoken. After a third invalid entry, ADTS will abort the task and hang up.

B. Loopback Test

5.27 Call the DIVA port number of the serving ADTS, using a TOUCH-TONE (TT) dial or pad. A 1-second answer tone will be heard in the handset. After the answer tone will be the following: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD.

> ***Note 1:*** If the above message is not heard, refer to paragraph 5.11.
>
> ***Note 2:*** TOUCH-TONE stars are shown hereafter as required.

5.28 Enter the 4-character password, followed by a *, on the TT dial. ADTS will respond with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.29 Enter 52* on the TT dial. (The fast test, which omits line card review and test instructions, may be requested by entering 352*.) ADTS will respond with WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER?

5.30 Enter the data set telephone number, followed by *, on the TT dial. ADTS will respond with YOU HAVE ENTERED (telephone number). IS THAT CORRECT?

5.31 If the number is correct, enter 1* on the TT dial. If the number is incorrect, enter 0* on the TT dial.

5.32 If 0* was entered, the query in paragraph 5.29 will be repeated. If 1* was entered, ADTS will respond with THE DATA SET CODE IS 103J. TO CORRECT ERRORS ENTER 1; IF NO ERRORS ENTER ZERO. Enter 1* to change the data set code. Follow this with an entry of 103#51* to select DS 103J.

5.33 ADTS continues: ARE YOU CALLING FROM THE DATA SET? To respond "yes" enter 1*; to respond "no" enter 0*.

5.34 This question follows: DO YOU WANT INSTRUCTIONS? A 1* reply requests instructions, which are as follows:

(1) When ADTS is called from a telephone other than the data set: THE ADTS WILL CALL THE DATA SET. ANSWER IN TALK MODE. DEPRESS THE TM BUTTON. GO TO DATA MODE AND HANG UP.

(2) When ADTS is called from the data set telephone: DEPRESS THE TM BUTTON. ON THE TONE GO TO DATA MODE AND HANG UP. AFTER TWO MINUTES CALL THE ADTS FOR RESULTS.

ADTS continues: DO YOU WANT THESE INSTRUCTIONS REPEATED? Enter 1* for "yes" or 0* for "no". A "yes" answer causes the instructions to be repeated.

The ADTS then gives the message WHEN READY ENTER ONE.

5.35 When the user is satisfied that the instructions are understood, enter 1*, to which the ADTS responds THANK YOU. THE TEST IS READY TO START.

5.36 On conclusion of the test the ADTS gives the results as follows:

THE TEST RESULTS ARE:

THE DATA SET TESTS OK. PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM. If no other test is to be performed at this time, enter #63*.

5.37 If the data set failed the test, one or more of the following messages is given:

- BUSY TONE DETECTED. TEST ABORTED.
- REORDER TONE DETECTED. TEST ABORTED.
- THE ANSWER WAS NOT RECEIVED. TEST ABORTED.
- THE F1 MARK FREQUENCY IS OUT OF LIMITS.
- THE SPACE TONES DID NOT COME ON.
- THE F2 SLICE FREQUENCY IS OUT OF LIMITS.
- THE F1 SPACE FREQUENCY IS OUT OF LIMITS.
- THE DATA SET DID NOT RELEASE FROM THE TEST MODE.
- DATA SET SENSITIVITY FAILED.

5.38 If the data set failed the test, ADTS responds DO YOU WANT DETAILED RESULTS? Enter 1* for "yes" or 0* for "no". An entry of "no" causes the ADTS to respond PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.39 An entry of "yes" causes the ADTS to respond with one or more of the error messages listed in paragraph 5.37, followed by PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.40 If the call was initiated by the data set telephone, call the ADTS at the end of the test. The ADTS will respond with THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD. Enter the 4-digit password, followed by *.

5.41 ADTS responds with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM. Enter 7* to request test results.

5.42 ADTS continues: WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? Enter the data set telephone number.

5.43 ADTS responds YOU HAVE ENTERED (telephone number). IS THAT CORRECT? Enter 1* for "yes" or 0* for "no". A "no" answer causes the ADTS to repeat the question in paragraph 5.42.

5.44 ADTS responds to a "yes" answer as follows:

THE TEST RESULTS ARE:

THE DATA SET IS 103J.

THE DATA SET TESTS OK.

WHAT IS THE FUNCTION YOU WISH TO PERFORM?

If no other test is to be performed at this time, enter #63*.

C. End-to-ADTS Error Run Test Using 921A DTS

Initial Test Setup for 921A DTS

5.45 Perform the initial test setup for the 921A DTS when used to test DS 103J-L1/2 as follows:

STEP	ACTION	VERIFICATION
1	Connect data set to DTS using interface cable and Electronic Industries Association (EIA) adapter cord provided with DTS. ***Note:*** The interface cable is equipped with two 37-pin connectors. The 6-inch adapter cord is equipped with a 37-pin female connector and a 25-pin male connector. Connect interface cable from DATA SET (DCE) connector on DTS to 37-pin connector on adapter cord. Insert 25-pin connector on adapter cord into customer interface connector on data set.	
2	Connect DTS to a 105- to 129-Vac 60-Hz power source.	
3	Apply power to data set.	
4	On front of DTS, set POWER switch to ON.	POWER lamp lights.
5	Press RST on keyboard. ***Note:*** If RST is pressed during a test, the test is ended and the DTS recycles to this step.	Display reads (briefly) version number of DTS. DTS then performs self tests. If DTS is defective, display reads— TEST FAILED If DTS is satisfactory, display reads— DATA SET:
6	Remove EIA interface module from storage and ensure that all 25 interface module switches are in TERM position.	
7	On right side of DTS, ensure that locking lever is in OPEN position.	
8	Insert interface module into slot.	
9	Move locking lever to CLOSE position.	
10	On front of DTS, ensure that all 37 DCE interface lead switches are in NORM position.	
11	Enter 20.	Display reads— DATA SET: 20

STEP	ACTION	VERIFICATION
	Note: To delete a wrong entry on keyboard during any test, press back arrow (←).	
12	Press GO.	Display reads— BIT RATE:
13	Enter 03.	Display reads— BIT RATE: 03
14	Press GO. ***Note:*** If GO or TST is pressed at an unauthorized point in a test, the test is ended and the DTS recycles to this step.	Display reads— TEST SEQ:

5.46 Call the DIVA port number of the serving ADTS, using a TOUCH-TONE (TT) dial or pad. A 1-second answer tone will be heard in the handset. After the answer tone will be the following: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD.

Note: If the above message is not heard, refer to paragraph 5.11.

5.47 Enter the 4-character password, followed by a *, on the TT dial. ADTS will respond with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.48 Enter 37* on the TT dial. (The fast test, which omits line card review and test instructions, may be requested by entering 337*.) ADTS will respond with WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER?

5.49 Enter the data set telephone number, followed by *, on the TT dial. ADTS will respond with YOU HAVE ENTERED (telephone number). IS THAT CORRECT?

5.50 If the number is correct, enter 1* on the TT dial. If the number is incorrect, enter 0* on the TT dial.

5.51 If 0* was entered, the query in paragraph 5.48 will be repeated. If 1* was entered, ADTS will respond with THE DATA SET CODE IS 103J. ACCESS TYPE LAST USED WAS DDD, ADTS ORIGINATED. TO CORRECT ERRORS ENTER ONE. IF NO ERRORS ENTER ZERO.

5.52 Enter 1* to change the data set code. Follow this with an entry of 103#51* to select DS 103J.

5.53 Enter 1* to change the data set access type. The ADTS responds with ENTER THE DATA SET ACCESS TYPE.

1. DDD, ADTS ORIGINATED
2. DDD, DATA SET ORIGINATED
3. RTAU
4. RTS.

5.54 If there are no more corrections, the ADTS asks the following question: DO YOU WANT THE ADTS TO TRANSMIT TO THE DATA SET?

5.55 A "yes" or "no" answer is followed by the following question: DO YOU WANT TO USE THE STANDARD TEST PARAMETERS? (Standard test parameters are: test time, 15 minutes; word bit length, 511; bit error count). A "yes" answer is followed by PLEASE WAIT; a "no" answer by the following: ENTER THE TEST TIME IN MINUTES. ENTER THE WORD BIT LENGTH: 15, 63, 511, OR 2047 BITS.

5.56 If the answer to the question in paragraph 5.55 was "no", the following message is given: DO YOU WANT TO DETECT BLOCK ERRORS? The response to a "yes" is ENTER THE BLOCK WORD LENGTH. An acceptable answer is 1, 2, 4, 8, or 16. If response is "no", a bit error count is made. With the proper

answer, the ADTS responds PLEASE WAIT, then ARE YOU CALLING FROM THE DATA SET? A "yes" or "no" answer is acceptable.

5.57 A "yes" reply to the question DO YOU WANT INSTRUCTIONS? prompts the following message if the ADTS is originating the call and the call is not initiated from the data set: THE ADTS WILL CALL THE DATA SET AND START THE TEST AFTER THE DATA SET ANSWERS. LEAVE THIS TELPHONE OFF-HOOK TO RECEIVE THE TEST RESULTS. WHEN READY ENTER ONE.

5.58 When the call is from the data set the instructions are: ON THE TONE, HANG UP. THE ADTS WILL CALL AND TEST THE DATA SET. WHEN THE TEST IS COMPLETED, CALL ADTS AND REQUEST THE TEST RESULTS.

ADTS Transmitting Data

5.59 If the ADTS is to transmit to the data set, this message follows: ADTS TEST DATA TRANSMISSION WILL BE PRECEDED BY 30 SECONDS OF GOOD DATA FOLLOWED BY THE INJECTION OF 10 BIT ERRORS.

5.60 During this initial period of data transmission, prepare the 921A DTS to receive the test data as indicated in the steps below. Receipt of bit errors is a positive indication that transmission is taking place. The time entered in Step 8 must be less than the time requested for the ADTS test, since erroneous errors will be produced if the 921A DTS looks for data when none is being transmitted.

STEP	ACTION	VERIFICATION
1	Ensure that initial test setup described in paragraph 5.45 has been performed.	Display reads— TEST SEQ:
2	Enter 55.	Display reads— TEST SEQ: 55
3	Press GO.	Display reads— TRANSMITTER=? 1=921 2=914 3=903
4	Enter 1.	Typical display reads (briefly)— TRANSMITTER=1 1=921 2=914 3=903 Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63
5	Enter 5.	Display reads (briefly)— 511 BIT ERROR TEST Display then reads— 1=BIT ERRORS 2=BLOCK ERRORS
6	Enter 1.	Display reads— ???? SECONDS
7	Place data set in data mode.	On DTS, DSR indicator lights.
8	Enter 0900. ***Note:*** To perform functions listed below, press associated key.	Display reads (briefly)— 0900 SECONDS Display then reads— 0000 BITS IN ERROR From this point, display counts number of bits in error. If sync is lost during test, display flashes OSYN. If this occurs, test must be repeated by pressing A.

STEP	ACTION	VERIFICATION
	KEY FUNCTION A Repeat test. B Display time remaining in test. C Clear display. D End test. E Inject 8 errors into data stream. F Force out-of-sync condition.	At end of test, display reads TEST COMPLETE, total sync losses, and total bits in error. ***Requirement:*** Total bits in error are less than 6.

ADTS Receiving Data

5.61 If the ADTS is to receive data from the data set, repeat the steps in paragraph 5.60 at the transmitting station.

5.62 After all instructions are performed and the test is complete, the ADTS gives this message: THE TEST RESULTS ARE (results). THE TEST TIME WAS (number of) MINUTES. DO YOU WANT TO RUN ANOTHER TEST?

5.63 The ADTS gives error message(s) as shown in paragraph 5.37 if the data set test was not performed successfully.

D. End-to-ADTS Error Run Test Using 914-Type DTS

Initial Test Setup for 914-Type DTS

5.64 Perform the initial test setup for the 914-type DTS when used to test DS 103J as shown in Fig. 3.

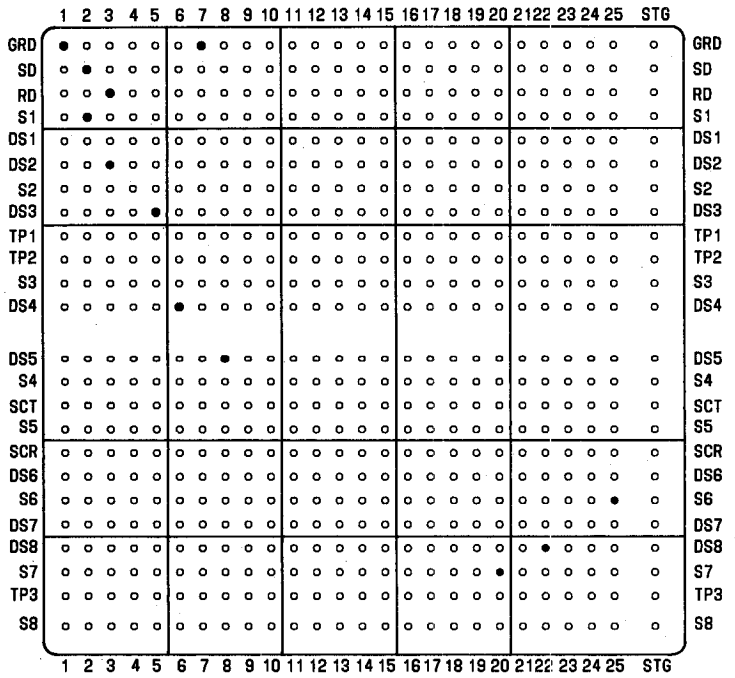
5.65 Repeat paragraphs 5.46 through 5.59 as for the error run test using the 921A DTS.

ADTS Transmitting Data

5.66 If the ADTS is to transmit to the data set, this message follows: ADTS TEST DATA TRANSMISSION WILL BE PRECEDED BY 30 SECONDS OF GOOD DATA FOLLOWED BY THE INJECTION OF 10 BIT ERRORS. Following this, the ADTS sends good data for the time specified.

5.67 During this initial period of data transmission, prepare the 914-type data test set to receive the test data as indicated in the steps below. Receipt of bit errors is a positive indication that transmission is taking place. The time counter set in Step 6 must be shorter than the time requested for the ADTS test, since erroneous errors will be produced if the 914-type DTS looks for data when none is being transmitted.

STEP	PROCEDURE
1	Set COUNTER switch to BLOCK ERRORS 16 WL, (63-bit word) or 2 WL (511-bit word).
2	Apply power to the data set and then to the 914-type DTS.
3	Coordinate test procedure with transmitting end.
4	On the 914 DTS, move switch S3 (DTR) to ON.



914-TYPE DTS MATRIX

NOTES:

1. SET SWITCHES ON 914-TYPE DTS AS FOLLOWS:

SWITCH	SETTING
INTERFACE SELECTOR A	ALL DEPRESSED
INTERFACE MODE	VOLTAGE
TEST SET MODE	SER (914C DTS) RCV SER (914B DTS)
COUNTER	BIT ERRORS
RCV BIT RATE	300
RCV WORD LENGTH	63
TRANSMIT BIT RATE (914C)	300
TRANSMIT WORD LENGTH (914C)	±4V
SIG LEV	OFF
SWITCH S1, S3	ON
SWITCH S6	30%
SAMPLE WIDTH	

2. 914 DTS INDICATOR LAMPS AND SWITCHES CORRESPOND TO THE FOLLOWING INTERFACE LEADS.
3. INSTALL RED MATRIX PINS AS NOTED.

SWITCH	LEAD
S1	REQUEST TO SEND
S6	DATA TERMINAL READY

Fig. 3—End-to-ADTS Error Run Test Setup Using 914-Type DTS

STEP	PROCEDURE
5	Go to data mode.
6	Reset counter.
7	Counter should count at least once and shortly thereafter the NO DATA lamp should illuminate.
8	Reset counter. The NO DATA lamp should extinguish.
9	Counter should record less than 6 counts (less than 6 block errors).
10	At end of 15-minute interval, go to talk mode and give results.
11	End of test. Return equipment to normal operating condition.

ADTS Receiving Data

5.68 If the ADTS is to receive data from the data set, perform the following steps at the transmitting station:

STEP	PROCEDURE
1	Set TEST SET MODE to SER (914C) or TRMT SER (914B).
2	Apply power to the data set and then to the 914-type DTS.
3	Call the receiving end to coordinate test procedure.
4	On the 914 DTS, move switch S3 (DTR) to ON.
5	Go to data mode.
6	Set S1 (RS) to ON.
7	To verify equipment is operating properly, set switch S1 (RS) to OFF.
8	Set switch S1 (RS) to ON.
9	Conduct 15-minute error run.
10	At end of 15-minute interval, go to talk mode.
11	End of test. Return equipment to normal operating condition.

5.69 After all instructions are performed and the test is complete, the ADTS gives this message: THE TEST RESULTS ARE (results). THE TEST TIME WAS (number of) MINUTES. DO YOU WANT TO RUN ANOTHER TEST? If another test will not be run at this time, enter #63* to disconnect.

6. REFERENCES

6.01 Additional information concerning DS 103J and use of the ADTS is contained in the following publications:

SECTION	TITLE
107-101-100	914-Type Data Test Sets—Description and Operation
107-402-100	921A Data Test Set—Description and Operation
314-205-501	Data Systems—DATAPHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines
590-010-500	J1P005 Automatic Data Test System (ADTS)—Operation From Field Locations
591-039-100	Data Set 103J-L1/2 Transmitter-Receiver—Description and Operation
591-039-200	Data Set 103J-L1/2 Transmitter-Receiver—Installation and Connections
591-039-500	Data Set 103J-L1/2 Transmitter-Receiver—Test Procedures Using 914-Type Data Test Set
591-039-501	Data Set 103J-L1/2 Transmitter-Receiver—Test Procedures Using 921A Data Test Set

TESTING DATA SET 113B-L1
FROM FIELD LOCATIONS
USING J1P005 AUTOMATIC DATA TEST SYSTEM (ADTS)

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1. GENERAL 1

2. ADTS TEST PROCEDURES 2

A. General 2

Functions Available Via DIVA . . . 2

Accessing ADTS 2

Performing Tests 3

Leaving ADTS 3

B. Loopback Test 4

3. REFERENCES 6

1. GENERAL

1.01 This section provides field test information for data set (DS) 113B-L1. A loopback test is provided using the J1P005 ADTS. These procedures are to be used when testing DS 113B-L1 on an initial installation or during a maintenance visit.

1.02 When this section is reissued, the reason for reissue will be presented in this paragraph.

1.03 This section contains information for testing DS 113B-L1 by means of DIVA (Digital Inquiry Voice Answer). DIVA requires a TOUCH-TONE® dial telephone, or a rotary dial telephone used with a KS-21799-L1 (or equivalent) portable TOUCH-TONE pad.

1.04 In this section, the term "user" refers to telephone company (telco) personnel at the data set responsible for interfacing the data set with the ADTS.

1.05 General ADTS test information is presented in paragraphs 2.01 through 2.25. Detailed ADTS test procedures are presented in paragraphs 2.26 through 2.42.

1.06 Troubleshooting is performed by the ADTS using the loopback test. If the trouble is isolated to the data set, replace the data set and repeat the test.

1.07 If the trouble persists after the tests have been completed, proceed as follows:

(a) Check that options installed in data set agree with those specified on service order.

(b) Verify that customer-provided equipment (CPE) has been tested and is operating properly.

(c) Check for physical damage to data station equipment.

(d) Verify that all cords and connectors are properly connected.

(e) Check for intermittent trouble in station wiring.

(f) Verify that data set and CPE are connected to a common ground.

(g) If trouble persists, request help from immediate supervisor, who may then obtain technical support from DATEC (Data Technical Support) per Section 010-521-100.

NOTICE
Not for use or disclosure outside the
Bell System except under written agreement

2. ADTS TEST PROCEDURES

A. General

2.01 This part provides instructions necessary for the proper operation of ADTS from field data sets. Included are instructions for entering and leaving the system.

2.02 Operations involving ADTS require man/machine interaction. With DIVA, the information is entered into ADTS by tones from a TOUCH-TONE dial. The system outputs a message by a voice response unit, and the user receives the message via the telephone handset.



Every entry from a TOUCH-TONE dial must be followed by a TOUCH-TONE star (*) except when calling the DIVA port number. To avoid repetition, the star entry has not been included in the text but should be understood as included whenever an entry is mentioned.

2.03 The ADTS must be on-line and DIVA must be up to accept DIVA tests.

Functions Available Via DIVA (Table B)

2.04 The test functions available via DIVA initiate a static or dynamic test of a data set. When 3 is used as a prefix with a test function, a fast test is performed on the data set without review of the line card information and without receiving test instructions.

2.05 ***Test Function List:*** With an entry of 8, DIVA will respond with a message of all test functions that can be performed on DS 113B-L1.

2.06 ***Loopback Test:*** This function provides a loopback test of DS 113B-L1 by the ADTS. The loopback test is initiated by entering 52; the fast loopback test by entering 352.

2.07 ***Results:*** This function provides results of the most recent test of the data set. The results function is initiated by entering 7. In response to the results function entry, the ADTS gives the audible query WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After receiving a number, the ADTS outputs the results in a format similar to the following:

THE TEST RESULTS ARE:

THE DATA SET CODE IS (data set code)

THE RECEIVED SIGNAL LEVEL IS OUT OF LIMITS

WHAT IS THE FUNCTION YOU WISH TO PERFORM?

2.08 ***Stop:*** This function stops the present function and requests a new function. The stop function is initiated by entering #73.

2.09 ***Off:*** This function stops the present function and disconnects the DIVA port. The off function is initiated by entering #63.

Accessing ADTS

2.10 Access to ADTS by DIVA is obtained by placing a call to a DIVA port number. Depending on the mode of ADTS and the mode of DIVA, one of four actions will occur:

(a) Busy signal; all DIVA ports are busy. Try again later.

(b) Call not answered; either ADTS or DIVA is in the down mode.

(c) Call answered; the user will hear a 1-second burst of answer tone. Following the answer tone will be the audible statement: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD. Once the password has been entered, the system responds with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

(d) Call answered; the user will hear the password statement and then the following: THE ADTS IS OFF-LINE. PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM. This is only a temporary situation. Retry the access in a minute or two.

2.11 The user may shorten the password-function request formalities by inputting both the password and the desired function in one entry (no

intervening *). If both the password and function are valid, ADTS begins executing the function immediately. To shorten the time required to set up a test, answers to familiar questions asked by DIVA may be given while the question is in progress.

2.12 Information is entered into ADTS by letters or numbers on the TOUCH-TONE dial. Numbers are entered into ADTS by depressing the desired digits on the TOUCH-TONE dial. Letters are entered into ADTS by using the following format:

(a) Depress #.

(b) Depress button with desired letter on it.

(c) Depress a number (1, 2, or 3) corresponding to the letter's position on the button [depressed in (b)].

2.13 In response to a YES or NO question, the following format is used:

(a) YES, enter one (1).

(b) NO, enter zero (0).

2.14 The user can again listen to the last spoken message, by entering #* (Table A).

Performing Tests

2.15 To start a test, the user enters the desired number code from Table B. The ADTS response is WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After the number has been entered, the ADTS response is YOU HAVE ENTERED (telephone or special service circuit number). IS THAT CORRECT? The user enters 1 for YES or 0 for NO. If the response is incorrect, ADTS repeats the original query.

2.16 If the response is correct, ADTS will attempt to find a line card file (LCF). If an LCF is found, ADTS will use the data set code to find the test program. If there is a test program for the data set code and test function entered, ADTS will continue. If no test program is found, ADTS will abort the test with the following message: THE ADTS CANNOT RUN SELECTED TEST ON THIS DATA SET. (Since there is a test program available for DS 113B — 52—this response indicates that the wrong test code was entered.)

2.17 If both an LCF and test program are found, the LCF information is given to the user. The user is then given a chance to make any necessary changes.

2.18 If no LCF is found, the ADTS response is THE DATA SET IS NOT ON FILE. ENTER THE DATA SET CODE. The user must then answer this question and others to create an LCF. In this case the entry would be 113#22 *. After entry of the data set code, ADTS checks for the test program.

2.19 After the LCF information has been given or after new line card information has been entered ADTS instructs the user TO CORRECT ERRORS ENTER ONE. IF NO ERRORS, ENTER ZERO. If a 1 is entered, ADTS repeats the line card information query.

2.20 If no corrections are made to the LCF, ADTS asks ARE YOU CALLING FROM THE DATA SET? If the user is calling from a data set, the user must hang up. ADTS will then call the data set for testing. After the test has been completed, ADTS must be called to obtain the results of the test. The test instructions direct the user on this procedure.

2.21 The ADTS asks the user DO YOU WANT INSTRUCTIONS? If requested, ADTS will supply test instructions. These instructions are to prompt the user, not to replace the data set BSP instructions.

2.22 After the instructions, ADTS gives the following message: WHEN READY, ENTER ONE. Upon receipt of a 1, ADTS responds THANK YOU. A pause will follow the thank you message as ADTS attempts to seize the hardware needed for the test. If the test hardware is busy performing another test or a self test, ADTS gives the following message: The ADTS TEST EQUIPMENT IS BUSY, PLEASE WAIT. When the test hardware becomes available, ADTS outputs THE TEST IS READY TO START.

2.23 At completion of the test, the user receives a short message describing the test results. When the data set fails, the system gives the reason(s) for failure. After giving the results of the data set test, the system returns to the function query.

Leaving ADTS

2.24 ***Manual Abort:*** Whenever the system is expecting user input, the user can abort the operation by entering #73 (the letter S) or #63 (the

TABLE A

TOUCH-TONE CODES FOR DIVA

FUNCTION	DEPRESS BUTTON(S)	DESCRIPTION
1, 2, 3, . . .etc.	Appropriate button(s)	Digits
#	#	Prefix character.
*	*	TOUCH-TONE star. Used at end of all entries as EOL character.
A,B,C, . . .etc.	Depress number sign, button on which character appears, and digit corresponding to the relative position of the letter (1,2, or 3). Example: For the letter A #21	Alphabetic characters.
Yes	1*	Answer yes to a question.
No	0*	Answer no to a question.
Repeat	#*	Repeats last message spoken by the system.
Telephone Number	Example: 3115552368*	Enter telephone number in sequence followed by EOL.
Data Set Code	Example: 202#23* Example: 202#235* Example: 401#515*	202C 202C5 401J5
Data Set Transmit Level	Example: 12*	-12 dBm. Eliminate sign and units designation. Enter numerical value.

letter O). The letter S, for STOP, causes ADTS to abort the operation and return to the function query. The letter O, for OFF, causes ADTS to abort the operation and the DIVA port to hang up.

2.25 ***Automatic Abort:*** The ADTS automatically performs the equivalent of a user OFF if the user does not respond to a system request. Thirty seconds without a user entry after the original function query, ADTS will repeat the query. Thirty seconds after the second query without a user entry, ADTS will repeat the query for the third time. Thirty seconds after the third query without a user entry, ADTS will abort the task and hang up. If incorrect or illogical entries are made three successive times, ADTS will perform the equivalent of an OFF. After each invalid entry, an appropriate error message such as THE NUMBER IS INVALID, PLEASE RE-ENTER will be spoken. After a third invalid entry, ADTS will abort the task and hang up.

B. Loopback Test

2.26 Call the DIVA port number of the serving ADTS, using a TOUCH-TONE (TT) dial or pad. A 1-second answer tone will be heard in the

TABLE B

FUNCTIONS AVAILABLE FROM DIVA

FUNCTION	DESCRIPTION	NORMAL	FAST
Test List	Lists valid test functions.	8 *	
Loopback Test	Static test of a data set.	52 *	352 *
Error Run Test	Tests a data set with data test set connected.	37 *	337 *
Results	Outputs results of most recent test of a data set.	7 *	
STOP	Stops present function and requests new function.	#73 *	
OFF	Stops present function and disconnects.	#63 *	

handset. After the answer tone will be the following: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD.

Note 1: If the above message is not heard, refer to paragraph 2.10.

Note 2: TOUCH-TONE stars are shown hereafter as required.

2.27 Enter the 4-character password, followed by *, on the TT dial. ADTS will respond with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

2.28 Enter 52* on the TT dial. (The fast test, which omits line card review and test instructions, may be requested by entering 352*.) ADTS will respond with LOOPBACK TEST. WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER?

2.29 Enter the data set telephone number, followed by *, on the TT dial. ADTS will respond with YOU HAVE ENTERED (telephone number). IS THAT CORRECT?

2.30 If the number is correct, enter 1* on the TT dial. If the number is incorrect, enter 0* on the TT dial.

2.31 If 0* was entered, the query in paragraph 2.28 will be repeated. If 1* was entered, ADTS will respond with THE DATA SET CODE IS 113B. TO CORRECT ERRORS ENTER ONE. IF NO ERRORS ENTER ZERO. Enter 1* to change the data set code. Follow this with an entry of 113#22 to select DS 113B.

2.32 ADTS continues: ARE YOU CALLING FROM THE DATA SET? To respond "yes" enter 1*; to respond "no" enter 0*.

2.33 This question follows: DO YOU WANT INSTRUCTIONS? A 1* reply requests instructions, which are as follows:

(1) When ADTS is called from a telephone other than at the data set: REPLACE THE CUSTOMER INTERFACE CONNECTOR WITH THE TM CONNECTOR. CONNECT THE SERVICE LINE TWIN PLUG FROM THE DATA MOUNTING TO THE TWIN JACK ON THE FACEPLATE OF THE DATA SET. THE ADTS WILL CALL TO TEST THE DATA SET. IF THE DATA SET IS EQUIPPED WITH THE Z OPTION, OPERATE THE TALK/CLEAR KEY AT END OF TEST.

(2) When ADTS is called from the data set telephone: REPLACE THE CUSTOMER INTERFACE CONNECTOR WITH THE TM CONNECTOR. CONNECT THE SERVICE LINE TWIN PLUG FROM THE DATA MOUNTING TO THE TWIN JACK ON THE FACEPLATE OF THE DATA SET. ON THE TONE, HANG UP THE DATA SET. THE ADTS WILL CALL TO TEST THE DATA SET. PLEASE WAIT 2 MINUTES. GO TO TALK MODE. CALL THE ADTS AND REQUEST TEST RESULTS.

The ADTS then gives the message WHEN READY ENTER ONE.

2.34 ADTS continues: DO YOU WANT THESE INSTRUCTIONS REPEATED? To respond "yes" enter 1*; to respond "no" enter 0*.

2.35 When the user is satisfied that the instructions are understood, enter one, to which the

ADTS responds THANK YOU. THE TEST IS READY TO START.

2.36 On satisfactory conclusion of the test the ADTS gives the results as follows:

THE TEST RESULTS ARE:
THE DATA SET TESTS OK.
PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

If another test will not be performed at this time, enter #63* to disconnect.

2.37 If the data set failed the test, one or more of the following messages is given:

- BUSY TONE DETECTED. TEST ABORTED.
- REORDER TONE DETECTED. TEST ABORTED.
- THE ANSWER TONE WAS NOT RECEIVED. TEST ABORTED.
- THE F2 MARK FREQUENCY IS OUT OF LIMITS.
- THE F2 SPACE FREQUENCY DID NOT COME ON.
- THE F1 SLICE FREQUENCY IS OUT OF LIMITS.
- THE F2 SLICE FREQUENCY IS OUT OF LIMITS.
- THE DATA SET DID NOT RELEASE FROM THE TEST MODE.
- DATA SET SENSITIVITY FAILED.

DO YOU WANT DETAILED RESULTS? To respond "yes" enter 1*; to respond "no" enter 0*.

2.38 In response to 0* the ADTS responds with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM. In response to 1* the ADTS responds with one or more of the error messages in paragraph 2.37, then PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM. If another test is not to be performed at this time, enter #63* to terminate the test and disconnect.

2.39 Call the ADTS at the end of test (about 1 minute). The ADTS responds with THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD. Enter the 4-character password followed by *.

2.40 The ADTS continues: PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM. Enter 7* to request test results. Next, ADTS querries WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER?

2.41 Enter the data set telephone number. The ADTS responds YOU HAVE ENTERED (telephone number). IS THAT CORRECT? Enter 1* for "yes" or 0* for "no".

2.42 A "no" answer causes the ADTS to repeat the query in paragraph 2.40. The ADTS responds to a "yes" as follows:

THE TEST RESULTS ARE:

THE DATA SET IS 113B.

THE DATA SET TESTS OK.

WHAT IS THE FUNCTION YOU WISH TO PERFORM?

If no further tests are to be made at this time, enter #63* to terminate the test and disconnect.

3. REFERENCES

3.01 Additional information concerning DS 113B-L1 and use of the ADTS is contained in the following publications:

SECTION	TITLE
314-205-501	Data Systems—DATAPHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines
590-010-500	J1P005 Automatic Data Test System (ADTS)—Operation From Field Locations
591-033-100	Data Set 113A-Type Transmitter-Receiver—Description and Operation

SECTION	TITLE
591-033-200	Data Set 113A-Type Transmitter-Receiver—Installation and Connections
591-033-500	Data Set 113A-Type Transmitter-Receiver—Test Procedures
591-814-501	113-Type Data Station—Test Procedures Using 921A Data Test Set

TESTING DATA SET 113C-L1/2 FROM FIELD LOCATIONS USING J1P005 AUTOMATIC DATA TEST SYSTEM (ADTS)

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1. GENERAL

1.01 This section provides self test and field test information for data set (DS) 113C-L1/2. Loopback and error run tests are provided using the J1P005 ADTS. These procedures are to be used when testing DS 113C-L1/2 on an initial installation or during a maintenance visit.

1.02 When this section is reissued, the reason for reissue will be presented in this paragraph.

1.03 The self tests require no external test equipment, and are included here for completeness.

1.04 This section contains information for testing DS 113C-L1/2 by means of DIVA (Digital Inquiry Voice Answer). DIVA requires a TOUCH-TONE® dial telephone, or a rotary dial telephone used with a KS-21799-L1 (or equivalent) portable TOUCH-TONE pad.

1.05 In this section, the term "user" refers to telephone company (telco) personnel at the data set responsible for interfacing the data set with the ADTS.

1.06 Test circuitry built into DS 113C-L1/2 permits the following self tests to be performed: analog loopback, digital loopback, and end-to-end. Additional tests require the use of external test equipment such as a 921A data test set (DTS) and/or the ADTS.

1.07 Detailed self test procedures are presented in paragraphs 4.02 through 4.07.

1.08 General ADTS test information is presented in paragraphs 5.01 through 5.26. Detailed ADTS test procedures are presented in paragraphs 5.27 through 5.57.

2. INSTALLATION TESTS

2.01 This part provides the sequence in which tests are to be performed following installation of the data set. This test sequence (Fig. 1)

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provides a method of verifying that the installation is satisfactory. Before proceeding with the tests, verify that the local loop meets the requirements specified in Section 314-205-501.

3. MAINTENANCE TESTS

3.01 This part provides the sequence in which tests are to be performed when clearing a trouble report and during a maintenance visit to the data station.

3.02 When a trouble report is received, a test center or ADTS is responsible for isolating the trouble to the data station or the transmission facility. The procedure for doing this is shown in Fig. 2.

3.03 The data station equipment must be tested prior to dispatching a telco employee. If the trouble seems to be in the data station equipment, a telco employee must be dispatched to conduct more extensive tests at the data station. The following equipment should be taken on a trouble visit:

- 921A DTS
- Spare DS 113C-L1/2.

3.04 Troubleshooting is performed by the ADTS using the loopback test or error run test. If the trouble is isolated to the data set, replace the data set and repeat the test.

3.05 If the trouble persists after the tests have been completed, proceed as follows:

(a) Check for physical damage to data station equipment.

(b) Verify that all cords and connectors are properly connected.

(c) Check that options installed in data set agree with those specified on service order.

(d) Verify that customer-provided equipment (CPE) has been tested and is operating properly.

(e) Check for intermittent trouble in station wiring.

(f) Verify that data set and CPE are connected to a common ground.

(g) If trouble persists, request help from immediate supervisor, who may then obtain technical support from DATEC (Data Technical Support) per Section 010-521-100.

4. SELF TEST PROCEDURES

4.01 This part provides procedures for the installation and maintenance self tests.

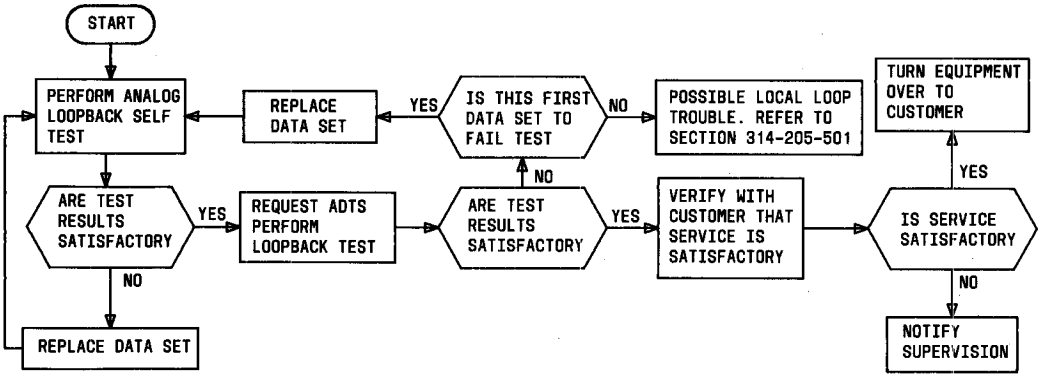


Fig. 1—Installation Test Sequence

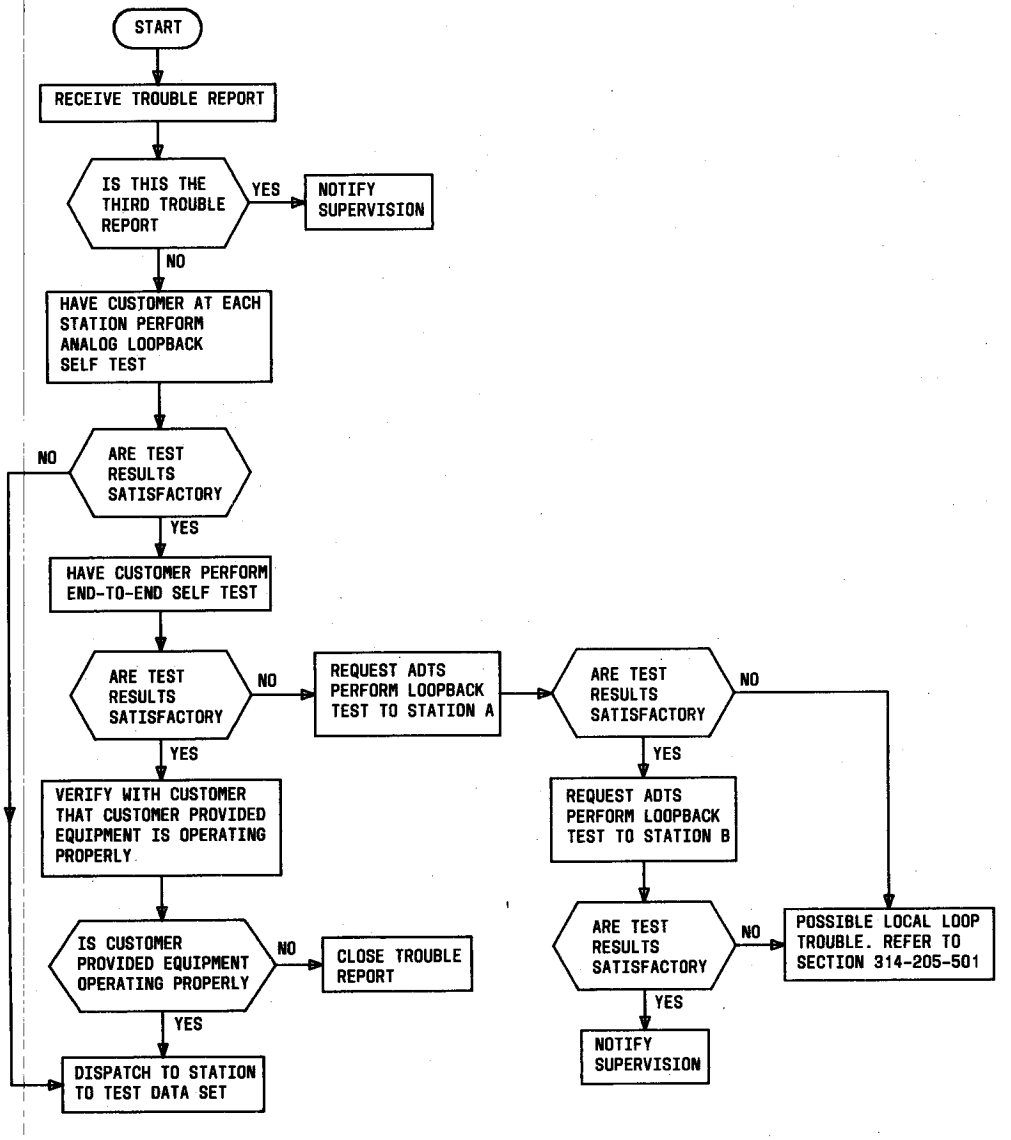


Fig. 2—Clearing Trouble Report

A. Analog Loopback Self Test

4.02 This test checks the data set transmitter and receiver. The customer interface is not checked. Test data generated by the data set is looped back internally from the transmitter output to the receiver input. The received data is compared to the transmitted data. If the distortion threshold (20 percent) is not exceeded, the MC lamp goes off after a short interval.

4.03 Perform the test as follows:

(1) Depress AL and ST switches on data set.

Requirements: MB, MR, and TM lamps light and MC lamp goes off after SD and RD lamps light.

(2) Observe MC lamp for 1 minute.

Requirement: MC lamp remains off.

(3) Release AL and ST switches.

B. Digital Loopback Self Test

4.04 This test checks the transmitter and receiver of a local and a distant data set and the facilities connecting the data sets. The customer interfaces are not checked. Test data generated and transmitted by the local data set is looped back internally from the receiver output to the transmitter input of the distant data set and retransmitted. This data is received by the local data set and compared to the original transmitted data. If the distortion threshold (35 percent) is not exceeded, the MC lamp goes off after a short interval.

Note: The distant data set can be a 103J, 103JR, 113C, 113CR, 113D, or 113DR.

4.05 Perform the test as follows:

(1) Place a call to distant station. If distant data set is already in DL mode, it will answer automatically.

(2) If distant data set does not answer automatically, instruct attendant at distant station to depress DL switch on data set and go to data mode.

(3) On local data set, depress ST switch and go to data mode.

Requirements: On local data set, MR and TM lamps light and MC lamp goes off after SD and RD lamps light.

(4) Observe MC lamp on local data set for 2 minutes.

Requirements: If MC lamp remains off, both data sets and the line facilities are operating properly. If MC lamp remains lighted, the round-trip distortion exceeds 35 percent. Since the distortion in the two directions may be additive, no conclusion about the proper operability of the data sets and the line facilities may be drawn.

(5) Release ST switch on local data set. Call distant station and have DL switch released.

C. End-to-End Self Test

4.06 This test checks the transmitter and receiver of a local and a distant data set and the facilities connecting the data sets. The customer interfaces are not checked. Both data sets generate and transmit test data to each other. If the distortion threshold (35 percent) is not exceeded, the MC lamps on both data sets go off after a short interval.

Note: The distant data set can be a DS 103J, 103JR, 113C, 113CR, 113D, or 113DR.

4.07 Perform the test as follows:

(1) Call distant station and arrange to conduct an end-to-end self test.

(2) Depress ST switch on both data sets.

(3) Go to data mode at both stations.

Requirements: On both data sets, MR and TM lamps light and MC lamp goes off after SD and RD lamps light.

(4) Observe MC lamp on both data sets for 2 minutes.

Requirements: If MC lamps remain off, both data sets and the line facilities are

operating properly. If MC lamps remain lighted, the distortion exceeds 35 percent.

(5) At end of test, go to talk mode and then release ST switch on both data sets.

5. ADTS TEST PROCEDURES

A. General

5.01 This part provides instructions necessary for the proper operation of ADTS from field data sets. Included are instructions for entering and leaving the system and for performing installation and maintenance tests.

5.02 Operations involving ADTS require man/machine interaction. With DIVA, the information is entered into ADTS by tones from a TOUCH-TONE dial. The system outputs a message by a voice response unit, and the user receives the message via the telephone handset.



Every entry from a TOUCH-TONE dial must be followed by a TOUCH-TONE star (*) except when calling the DIVA port number. To avoid repetition, the star entry has not been included in the text but should be understood as included whenever an entry is mentioned.

5.03 The ADTS must be on-line and DIVA must be up to accept DIVA tests.

Functions Available Via DIVA (Table B)

5.04 The test functions available via DIVA initiate a static or dynamic test of a data set. When 3 is used as a prefix with a test function, a fast test is performed on the data set without review of the line card information and without receiving test instructions.

5.05 ***Test Function List:*** With an entry of 8, DIVA will respond with a message of all test functions that can be performed on DS 113C.

5.06 ***Loopback Test:*** This function provides a loopback test of DS 113C by the ADTS. The loopback test is initiated by entering 52; the fast loopback test by entering 352.

5.07 ***Error Run Test:*** This function provides an error run test between the data set and the ADTS in both directions (full duplex). A 921A DTS is required at the data set. Bit errors are automatically recorded for various combinations of pseudorandom data sequences and for various periods of time. The data sequences and the periods of time are user specified. Use of the 921A DTS requires an initial test setup as described in paragraph 5.39. The error run test is initiated by entering 37; the fast error run test by entering 337.

5.08 ***Results:*** This function provides results of the most recent test of the data set. The results function is initiated by entering 7. In response to the results function entry, the ADTS gives the audible query WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After receiving a number, the ADTS outputs the results in a format similar to the following:

THE TEST RESULTS ARE:

THE DATA SET CODE IS (data set code)

THE RECEIVED SIGNAL LEVEL IS OUT OF LIMITS

WHAT IS THE FUNCTION YOU WISH TO PERFORM?

5.09 ***Stop:*** This function stops the present function and requests a new function. The stop function is initiated by entering #73.

5.10 ***Off:*** This function stops the present function and disconnects the DIVA port. The off function is initiated by entering #63.

Accessing ADTS

5.11 Access to ADTS by DIVA is obtained by placing a call to a DIVA port number. Depending on the mode of ADTS and the mode of DIVA, one of four actions will occur:

(a) Busy signal; all DIVA ports are busy. Try again later.

(b) Call not answered; DIVA is in the down mode.

(c) Call answered; the user will hear a 1-second burst of answer tone. Following the answer tone will be the audible query: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD. Once the password has been entered, the system responds with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

(d) Call answered; the user will hear: THE ADTS IS OFF-LINE. The ADTS will automatically abort the task. The ADTS must be put on-line by entering ONLIN to the function query on a terminal at the ADTS. The user may then place a call to a DIVA port number and access the ADTS.

5.12 The user may shorten the password-function request formalities by inputting both the password and the desired function in one entry (no intervening *). If both the password and function are valid, ADTS begins executing the function immediately. To shorten the time required to set up a test, answers to familiar questions asked by DIVA may be given while the question is in progress.

5.13 Information is entered into ADTS by letters or numbers on the TOUCH-TONE dial. Numbers are entered into ADTS by depressing the desired digits on the TOUCH-TONE dial. Letters are entered into ADTS by using the following format:

(a) Depress #.

(b) Depress button with desired letter on it.

(c) Depress a number (1, 2, or 3) corresponding to the letter's position on the button [depressed in (b)].

5.14 In response to a YES or NO question, the following format is used:

(a) YES, enter one (1).

(b) NO, enter zero (0).

5.15 The user can again listen to the last spoken message, by entering #* (Table A).

Performing Tests

5.16 To start a test, the user enters the desired number code from Table B. The ADTS response is WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After the number has been entered, the ADTS response is YOU HAVE ENTERED (telephone or special service circuit number). IS THAT CORRECT? The user enters 1 for YES or 0 for NO. If the response is incorrect, ADTS repeats the original query.

5.17 If the response is correct, ADTS will attempt to find a line card file (LCF). If an LCF is found, ADTS will use the data set code to find the test program. If there is a test program for the data set code and test function entered, ADTS will continue. If no test program is found, ADTS will abort the test with the following message: THE ADTS CANNOT RUN SELECTED TEST ON THIS DATA SET. (Since there are test programs available for DS 113C—52 and 37—this response indicates that the wrong test code was entered.)

5.18 If both an LCF and test program are found, the LCF information is given to the user. The user is then given a chance to make any necessary changes.

5.19 If no LCF is found, the ADTS response is THE DATA SET IS NOT ON FILE. ENTER THE DATA SET CODE. The user must then answer this question and others to create an LCF. In this case the entry would be 113#23*. After entry of the data set code, ADTS checks for the test program.

5.20 After the LCF information has been given or after new line card information has been entered ADTS instructs the user TO CORRECT ERRORS ENTER ONE. IF NO ERRORS, ENTER ZERO. If a 1 is entered, ADTS repeats the line card information query.

5.21 If no corrections are made to the LCF, ADTS asks ARE YOU CALLING FROM THE DATA SET? If the user is calling from a data set, the user must hang up prior to running the test. ADTS will then call the data set for testing. After the test has been completed, ADTS calls the data set again to give the user the results of the test. The test instructions direct the user on this procedure.

TABLE A

TOUCH-TONE CODES FOR DIVA

FUNCTION	DEPRESS BUTTON(S)	DESCRIPTION
1, 2, 3, . . .etc.	Appropriate button(s)	Digits
#	#	Prefix character.
*	*	TOUCH-TONE star. Used at end of all entries as EOL character.
A,B,C, . . .etc.	Depress number sign, button on which character appears, and digit corresponding to the relative position of the letter (1,2, or 3). Example: For the letter A #21	Alphabetic characters.
Yes	1*	Answer yes to a question.
No	0*	Answer no to a question.
Repeat	#*	Repeats last message spoken by the system.
Telephone Number	Example: 3115552368*	Enter telephone number in sequence followed by EOL.
Data Set Code	Example: 202#23* Example: 202#235* Example: 401#515*	202C 202C5 401J5
Data Set Transmit Level	Example: 12*	-12 dBm. Eliminate sign and units designation. Enter numerical value.

TABLE B

FUNCTIONS AVAILABLE FROM DIVA

FUNCTION	DESCRIPTION	NORMAL	FAST
Test List	Lists valid test functions.	8 *	
Loopback Test	Static test of a data set.	52 *	352 *
Error Run Test	Tests a data set with data test set connected.	37 *	337 *
Results	Outputs results of most recent test of a data set.	7 *	
STOP	Stops present function and requests new function.	#73 *	
OFF	Stops present function and disconnects.	#63 *	

5.22 The ADTS asks the user DO YOU WANT INSTRUCTIONS? If requested, ADTS will supply test instructions. These instructions are to prompt the user, not to replace the data set BSP instructions.

5.23 After the instructions, ADTS gives the following message: WHEN READY, ENTER ONE. Upon receipt of a 1, ADTS responds THANK YOU. A pause will follow the thank you message as ADTS attempts to seize the hardware needed for the test. If the test hardware is busy performing another test or a self test, ADTS gives the following message: THE ADTS TEST EQUIPMENT IS BUSY, PLEASE WAIT. When the test hardware becomes available, ADTS outputs THE TEST IS READY TO START.

5.24 At completion of the test, the user receives a short message describing the test results. When the data set fails, the system gives the reason(s) for failure. After giving the results of the data set test, the system returns to the function query.

Leaving ADTS

5.25 ***Manual Abort:*** Whenever the system is expecting user input, the user can abort the operation by entering #73 (the letter S) or #63 (the letter O). The letter S, for STOP, causes ADTS to abort the operation and return to the function query. The letter O, for OFF, causes ADTS to abort the operation and the DIVA port to hang up.

5.26 ***Automatic Abort:*** The ADTS automatically performs the equivalent of a user OFF if the user does not respond to a system request. Thirty seconds without a user entry after the original function query, ADTS will repeat the query. Thirty seconds after the second query without a user entry, ADTS will repeat the query for the third time. Thirty seconds after the third query without a user entry, ADTS will abort the task and hang up. If incorrect or illogical entries are made three successive times, ADTS will perform the equivalent of an OFF. After each invalid entry, an appropriate error message such as THE NUMBER IS INVALID, PLEASE REENTER will be spoken. After a third invalid entry, ADTS will abort the task and hang up.

B. Loopback Test

5.27 Call the DIVA port number of the serving ADTS, using a TOUCH-TONE (TT) dial or pad. A 1-second answer tone will be heard in the handset. After the answer tone will be the following: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD.

Note 1: If the above message is not heard, refer to paragraph 5.11.

Note 2: TOUCH-TONE stars are shown hereafter as required.

5.28 Enter the 4-character password, followed by a *, on the TT dial. ADTS will respond with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.29 Enter 52* on the TT dial. (The fast test, which omits line card review and test instructions, may be requested by entering 352*.) ADTS will respond with WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER?

5.30 Enter the data set telephone number, followed by *, on the TT dial. ADTS will respond with YOU HAVE ENTERED (telephone number). IS THAT CORRECT?

5.31 If the number is correct, enter 1* on the TT dial. If the number is incorrect, enter 0* on the TT dial.

5.32 If 0* was entered, the query in paragraph 5.29 will be repeated. If 1* was entered, ADTS will respond with THE DATA SET CODE IS 113C. TO CORRECT ERRORS ENTER ONE. IF NO ERRORS ENTER ZERO. Enter 1* to change the data set code. ADTS will respond ENTER THE DATA SET CODE. Follow this with an entry of 113#23* to select DS 113C.

5.33 ADTS continues: ARE YOU CALLING FROM THE DATA SET? Enter 1* for "yes"; enter 0* for "no".

5.34 This question follows: DO YOU WANT INSTRUCTIONS? A 1* reply requests instructions, which are as follows:

(1) When ADTS is called from a telephone other than the data set: ADTS WILL CALL

THE DATA SET. ANSWER IN TALK MODE. DEPRESS THE DL BUTTON AND GO TO DATA MODE.

(2) When ADTS is called from the data set telephone: DEPRESS THE DL BUTTON. ON THE TONE GO TO DATA MODE. THE ADTS WILL CALL TO REPORT THE TEST RESULTS.

ADTS continues: DO YOU WANT THESE INSTRUCTIONS REPEATED? Enter 1* for "yes"; enter 0* for "no".

The ADTS then gives the message WHEN READY ENTER ONE.

5.35 When the user is satisfied that the instructions are understood, enter 1*, to which the ADTS responds THANK YOU. THE TEST IS READY TO START.

5.36 On satisfactory conclusion of the test the ADTS gives the results as follows:

THE TEST RESULTS ARE:

THE DATA SET TESTS OK. PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM. If another test will not be performed at this time, enter #63* to disconnect.

5.37 If the data set failed the test, one or more of the following messages is given:

- BUSY TONE DETECTED. TEST ABORTED.
- REORDER TONE DETECTED. TEST ABORTED.
- THE ANSWER TONE WAS NOT RECEIVED. TEST ABORTED.
- THE F1 MARK FREQUENCY IS OUT OF LIMITS.
- THE SPACE TONES DID NOT COME ON.
- THE F2 SLICE FREQUENCY IS OUT OF LIMITS.
- THE F1 SPACE FREQUENCY IS OUT OF LIMITS.
- THE DATA SET DID NOT RELEASE FROM THE TEST MODE.
- DATA SET SENSITIVITY FAILED.

5.38 The ADTS repeats the function query.

If another test will not be performed at this time, enter #63* to disconnect.

C. End-to-ADTS Error Run Test Using 921A DTS

Initial Test Setup for 921A DTS

5.39 Perform the initial test setup for the 921A DTS when used to test DS 113C as follows:

STEP	ACTION	VERIFICATION
1	Connect data set to DTS using interface cable and Electronic Industries Association (EIA) adapter cord provided with DTS. ***Note:*** The interface cable is equipped with two 37-pin connectors. The 6-inch adapter cord is equipped with a 37-pin female connector and a 25-pin male connector. Connect interface cable from DATA SET (DCE) connector on DTS to 37-pin connector on adapter cord. Insert 25-pin connector on adapter cord into customer interface connector on data set.	
2	Connect DTS to a 105- to 129-Vac 60-Hz power source.	

STEP	ACTION	VERIFICATION
3	Apply power to data set.	
4	On front of DTS, set POWER switch to ON.	POWER lamp lights.
5	Press RST on keyboard. ***Note:*** If RST is pressed during a test, the test is ended and the DTS recycles to this step.	Display reads (briefly) version number of DTS. DTS then performs self tests. If DTS is defective, display reads— TEST FAILED If DTS is satisfactory, display reads— DATA SET:
6	Remove EIA interface module from storage and ensure that all 25 interface module switches are in TERM position.	
7	On right side of DTS, ensure that locking lever is in OPEN position.	
8	Insert interface module into slot.	
9	Move locking lever to CLOSE position.	
10	On front of DTS, ensure that all 37 DCE interface lead switches are in NORM position.	
11	Enter 20. ***Note:*** To delete a wrong entry on keyboard during any test, press back arrow (←).	Display reads— DATA SET: 20
12	Press GO.	Display reads— BIT RATE:
13	Enter 03.	Display reads— BIT RATE: 03
14	Press GO. ***Note:*** If GO or TST is pressed at an unauthorized point in a test, the test is ended and the DTS recycles to this step.	Display reads— TEST SEQ:

5.40 Call the DIVA port number of the serving ADTS, using a TOUCH-TONE (TT) dial or pad. A 1-second answer tone will be heard in the handset. After the answer tone will be the following: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD.

Note: If the above message is not heard, refer to paragraph 5.11.

5.41 Enter the 4-character password, followed by a *, on the TT dial. ADTS will respond with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.42 Enter 37* on the TT dial. (The fast test, which omits line card review and test instructions, may be requested by entering 337*.)

ADTS will respond with WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER?

5.43 Enter the data set telephone number, followed by *, on the TT dial. ADTS will respond with YOU HAVE ENTERED (telephone number). IS THAT CORRECT?

5.44 If the number is correct, enter 1* on the TT dial. If the number is incorrect, enter 0* on the TT dial.

5.45 If 0* was entered, the query in paragraph 5.42 will be repeated. If 1* was entered, ADTS will respond with THE DATA SET CODE IS 113C. ACCESS TYPE LAST USED WAS DDD, ADTS ORIGINATED. TO CORRECT ERRORS ENTER ONE. IF NO ERRORS ENTER ZERO.

5.46 Enter 1* to change the data set code. Follow this with an entry of 113#23* to select DS 113C.

5.47 Enter 1* to change the data set access type. The ADTS responds with ENTER THE DATA SET ACCESS TYPE.

1. DDD, ADTS ORIGINATED
2. DDD, DATA SET ORIGINATED
3. RTAU
4. RTS.

5.48 If there are no more corrections, the ADTS asks the following question: DO YOU WANT THE ADTS TO TRANSMIT TO THE DATA SET?

5.49 A "yes" or "no" answer is followed by the following question: DO YOU WANT TO USE THE STANDARD TEST PARAMETERS? (Standard test parameters are: test time, 15 minutes; word bit length, 511; bit error count). A "yes" answer is followed by PLEASE WAIT; a "no" answer by the following: ENTER THE TEST TIME IN MINUTES. ENTER THE WORD BIT LENGTH: 15, 63, 511, OR 2047 BITS.

5.50 If the answer to the question in paragraph 5.49 was "no", the following message is given: DO YOU WANT TO DETECT BLOCK ERRORS? The response to a "yes" is ENTER THE BLOCK WORD LENGTH. An acceptable answer is 1, 2, 4, 8, or 16. If response is "no", a bit error count is made. With the proper answer, the ADTS responds PLEASE WAIT, then ARE YOU CALLING FROM THE DATA SET? A "yes" or "no" answer is acceptable.

5.51 A "yes" reply to the question DO YOU WANT INSTRUCTIONS? prompts the following message if the ADTS is originating the call and the call is not initiated from the data set: THE ADTS WILL CALL THE DATA SET AND START THE TEST AFTER THE DATA SET ANSWERS. LEAVE THIS TELPHONE OFF-HOOK TO RECEIVE THE TEST RESULTS. WHEN READY ENTER ONE.

5.52 When the call is from the data set the instructions are: ON THE TONE, HANG UP. THE ADTS WILL CALL AND TEST THE DATA SET. WHEN THE TEST IS COMPLETED, CALL ADTS AND REQUEST THE TEST RESULTS.

ADTS Transmitting Data

5.53 If the ADTS is to transmit to the data set, this message follows: ADTS TEST DATA TRANSMISSION WILL BE PRECEDED BY 30 SECONDS OF GOOD DATA FOLLOWED BY THE INJECTION OF 10 BIT ERRORS.

5.54 During this initial period of data transmission, prepare the 921A data test set to receive the test data as indicated in the steps below. Receipt of bit errors is a positive indication that transmission is taking place. The time entered in Step 8 must be less than the time requested for the ADTS test, since erroneous errors will be produced if the 921A DTS looks for data when none is being transmitted.

STEP	ACTION	VERIFICATION
1	Ensure that initial test setup described in paragraph 5.39 has been performed.	Display reads— TEST SEQ:
2	Enter 55.	Display reads— TEST SEQ: 55

STEP	ACTION	VERIFICATION
3	Press GO.	Display reads— TRANSMITTER=? 1=921 2=914 3=903
4	Enter 1, 2, or 3 to correspond to the type of DTS being used at distant end.	Typical display reads (briefly)— TRANSMITTER=1 1=921 2=914 3=903 Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63
5	Enter 5.	Display reads (briefly)— 511 BIT ERROR TEST Display then reads— 1=BIT ERRORS 2=BLOCK ERRORS
6	Enter 1.	Display reads— ???? SECONDS
7	Place data set in data mode.	On DTS, DSR indicator lights.
8	Enter 0900. ***Note:*** To perform functions listed below, press associated key. **KEY FUNCTION** A Repeat test. B Display time remaining in test. C Clear display. D End test. E Inject 8 errors into data stream. F Force out-of-sync condition.	Display reads (briefly)— 0900 SECONDS Display then reads— 0000 BITS IN ERROR From this point, display counts number of bits in error. If sync is lost during test, display flashes OSYN. If this occurs, test must be repeated by pressing A. At end of test, display reads TEST COMPLETE, total sync losses, and total bits in error. ***Requirement:*** Total bits in error are less than 6.

ADTS Receiving Data

5.55 If the ADTS is to receive data from the data set, perform the following steps at the transmitting station:

STEP	ACTION	VERIFICATION
1	Ensure that initial test setup described in paragraph 5.39 has been performed.	Display reads— TEST SEQ:
2	Enter 55.	Display reads— TEST SEQ: 55

STEP	ACTION	VERIFICATION
3	Press GO.	Display reads (briefly)— SELECT ERROR TEST Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63
4	Enter 5.	Display reads— 511 BIT ERROR TEST
5	Place data set in data mode.	On DTS, DSR indicator lights (data set ready lead ***on***) Display continues to read— 511 BIT ERROR TEST

5.56 After all instructions are performed and the test is complete, the ADTS gives this message: THE TEST RESULTS ARE (results). THE TEST TIME WAS (number of) MINUTES. DO YOU WANT TO RUN ANOTHER TEST?

5.57 The ADTS gives error message(s) as shown in paragraph 5.37 if the data set test was not performed successfully.

6. REFERENCES

6.01 Additional information concerning DS 113C and use of the ADTS is contained in the following publications:

SECTION	TITLE
107-402-100	921A Data Test Set—Description and Operation
314-205-501	Data Systems—DATAPHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines
590-010-500	J1P005 Automatic Data Test System (ADTS)—Operation From Field Locations
591-041-100	Data Set 113C-L1/2 Transmitter-Receiver—Description and Operation
591-041-200	Data Set 113C-L1/2 Transmitter-Receiver—Installation and Connections
591-041-500	Data Set 113C-L1/2 Transmitter-Receiver—Test Procedures
591-041-501	Data Set 113C-L1/2 Transmitter-Receiver—Test Procedures Using 921A Data Test Set

TESTING DATA SET 113D-L1/2
FROM FIELD LOCATIONS
USING J1P005 AUTOMATIC DATA TEST SYSTEM (ADTS)

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1. GENERAL

1.01 This section provides self test and field test information for data set (DS) 113D-L1/2. Loopback and error run tests are provided using the J1P005 ADTS. These procedures are to be used when testing DS 113D-L1/2 on an initial installation or during a maintenance visit.

1.02 When this section is reissued, the reason for reissue will be presented in this paragraph.

1.03 The self tests require no external test equipment, and are included here for completeness.

1.04 This section contains information for testing DS 113D-L1/2 by means of DIVA (Digital Inquiry Voice Answer). DIVA requires a TOUCH-TONE® dial telephone, or a rotary dial telephone used with a KS-21799-L1 (or equivalent) portable TOUCH-TONE pad.

1.05 In this section, the term "user" refers to telephone company (telco) personnel at the data set responsible for interfacing the data set with the ADTS.

1.06 Test circuitry built into DS 113D-L1/2 permits the following self tests to be performed: analog loopback, digital loopback, and end-to-end. Additional tests require the use of external test equipment such as a 921A data test set (DTS) and/or the ADTS.

1.07 Detailed self test procedures are presented in paragraphs 4.02 through 4.07.

1.08 General ADTS test information is presented in paragraphs 5.01 through 5.26. Detailed ADTS test procedures are presented in paragraphs 5.27 through 5.57.

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2. INSTALLATION TESTS

2.01 This part provides the sequence in which tests are to be performed following installation of the data set. This test sequence (Fig. 1) provides a method of verifying that the installation is satisfactory. Before proceeding with the tests, verify that the local loop meets the requirements specified in Section 314-205-501.

3. MAINTENANCE TESTS

3.01 This part provides the sequence in which tests are to be performed when clearing a trouble report and during a maintenance visit to the data station.

3.02 When a trouble report is received, a test center or ADTS is responsible for isolating the trouble to the data station or the transmission facility. The procedure for doing this is shown in Fig. 2.

3.03 If the trouble seems to be in the data station equipment, a telco employee must be dispatched to conduct more extensive tests at the data station. The following equipment should be taken on a trouble visit:

- 921A DTS
- Spare DS 113D-L1/2

3.04 Troubleshooting is performed by the ADTS using the loopback test or error run test. If the trouble is isolated to the data set, replace the data set and repeat the test.

3.05 If the trouble persists after the tests have been completed, proceed as follows:

(a) Check that options installed in data set agree with those specified on service order.

(b) Verify that customer-provided equipment (CPE) has been tested and is operating properly.

(c) Check for physical damage to data station equipment.

(d) Verify that all cords and connectors are properly connected.

(e) Check for intermittent trouble in station wiring.

(f) Verify that data set and CPE are connected to a common ground.

(g) If trouble persists, request help from immediate supervisor, who may then obtain technical support from DATEC (Data Technical Support) per Section 010-521-100.

4. SELF TEST PROCEDURES

4.01 This part provides procedures for the installation and maintenance self tests.

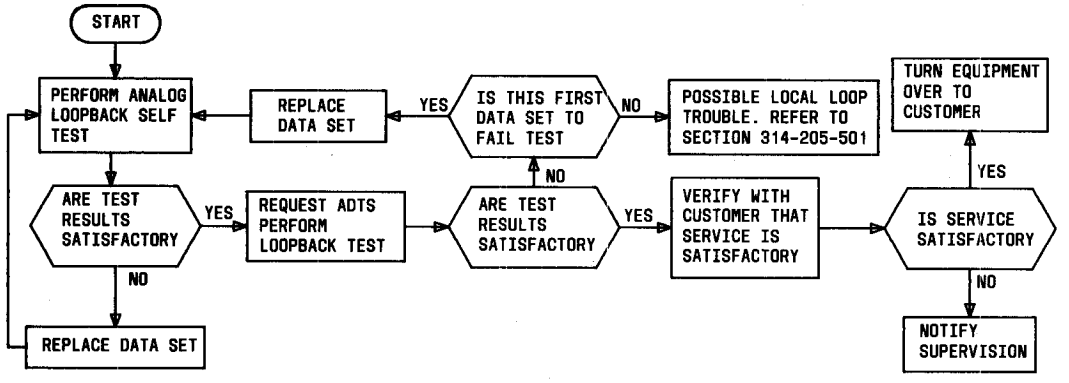


Fig. 1—Installation Test Sequence

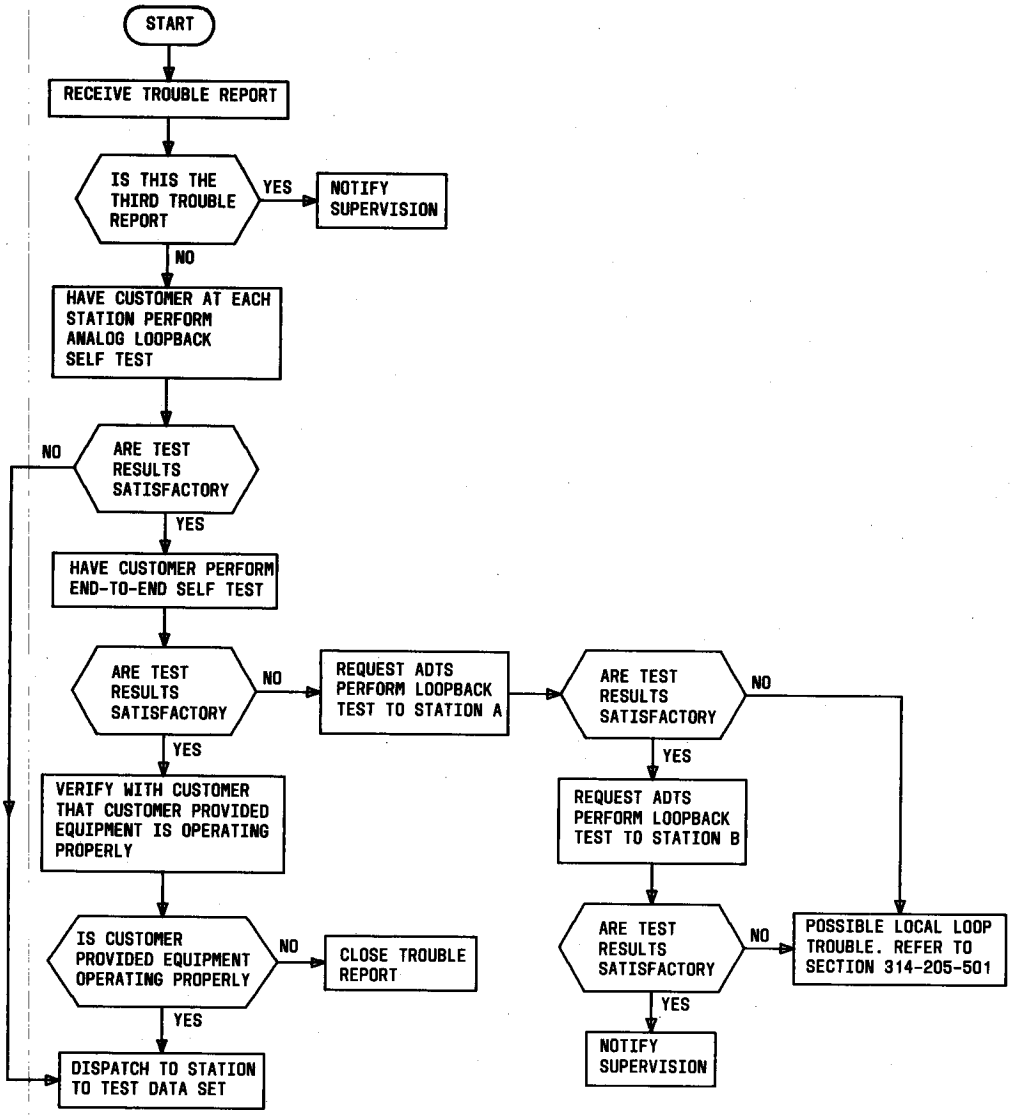


Fig. 2—Clearing Trouble Report

A. Analog Loopback Self Test

4.02 This test checks the data set transmitter and receiver. The customer interface is not checked. Test data generated by the data set is looped back internally from the transmitter output to the receiver input. The received data is compared to the transmitted data. If the distortion threshold (20 percent) is not exceeded, the MC lamp goes off after a short interval.

4.03 Perform the test as follows:

(1) Depress AL and ST switches on data set.

Requirements: MB, MR, and TM lamps light and MC lamp goes off after SD and RD lamps light.

(2) Observe MC lamp for 1 minute.

Requirement: MC lamp remains off.

(3) Release AL and ST switches.

B. Digital Loopback Self Test

4.04 This test checks the transmitter and receiver of a local and a distant data set and the facilities connecting the data sets. The customer interfaces are not checked. Test data generated and transmitted by the local data set is looped back internally from the receiver output to the transmitter input of the distant data set and retransmitted. This data is received by the local data set and compared to the original transmitted data. If the distortion threshold (35 percent) is not exceeded, the MC lamp goes off after a short interval.

Note: The distant data set can be a 103J, 103JR, 113C, 113CR, 113D, or 113DR.

4.05 Perform the test as follows:

(1) Place a call to distant station. If distant data set is already in DL mode, it will answer automatically.

(2) If distant data set does not answer automatically, instruct attendant at distant station to depress DL switch on data set and go to data mode.

(3) On local data set, depress ST switch and go to data mode.

Requirements: On local data set, MR and TM lamps light and MC lamp goes off after SD and RD lamps light.

(4) Observe MC lamp on local data set for 2 minutes.

Requirements: If MC lamp remains off, both data sets and the line facilities are operating properly. If MC lamp remains lighted, the round-trip distortion exceeds 35 percent. Since the distortion in the two directions may be additive, no conclusion about the proper operability of the data sets and the line facilities may be drawn.

(5) Release ST switch on local data set. Call distant station and have DL switch released.

C. End-to-End Self Test

4.06 This test checks the transmitter and receiver of a local and a distant data set and the facilities connecting the data sets. The customer interfaces are not checked. Both data sets generate and transmit test data to each other. If the distortion threshold (35 percent) is not exceeded, the MC lamps on both data sets go off after a short interval.

Note: The distant data set can be a DS 103J, 103JR, 113C, 113CR, 113D, or 113DR.

4.07 Perform the test as follows:

(1) Call distant station and arrange to conduct an end-to-end self test.

(2) Depress ST switch on both data sets.

(3) Go to data mode at both stations.

Requirements: On both data sets, MR and TM lamps light and MC lamp goes off after SD and RD lamps light.

(4) Observe MC lamp on both data sets for 2 minutes.

Requirements: If MC lamps remain off, both data sets and the line facilities are operating properly. If MC lamps remain lighted, the distortion exceeds 35 percent.

(5) At end of test, go to talk mode and then release ST switch on both data sets.

5. ADTS TEST PROCEDURES

A. General

5.01 This part provides instructions necessary for the proper operation of ADTS from field data sets. Included are instructions for entering and leaving the system and for performing installation and maintenance tests.

5.02 Operations involving ADTS require man/machine interaction. With DIVA, the information is entered into ADTS by tones from a TOUCH-TONE dial. The system outputs a message by a voice response unit, and the user receives the message via the telephone handset.



Every entry from a TOUCH-TONE dial must be followed by a TOUCH-TONE star (*) except when calling the DIVA port number. To avoid repetition, the star entry has not been included in the text but should be understood as included whenever an entry is mentioned.

5.03 The ADTS must be on-line and DIVA must be up to accept DIVA tests.

Functions Available Via DIVA (Table B)

5.04 The test functions available via DIVA initiate a static or dynamic test of a data set. When 3 is used as a prefix with a test function, a fast test is performed on the data set without review of the line card information and without receiving test instructions.

5.05 ***Test Function List:*** With an entry of 8, DIVA will respond with a message of all test functions that can be performed on DS 113D-L1/2.

5.06 ***Loopback Test:*** This function provides a loopback test of DS 113D-L1/2 by the ADTS. The loopback test is initiated by entering 52; the fast loopback test by entering 352.

5.07 ***Error Run Test:*** This function provides an error run test between the data set and the ADTS in each direction (half duplex). A 921A DTS is required at the data set. Bit errors are automatically recorded for various combinations of pseudorandom data sequences and for various periods of time. The data sequences and the periods of time are user specified. Use of the 921A DTS requires an initial test setup as described in paragraph 5.39. The error run test is initiated by entering 37; the fast error run test by entering 337.

5.08 ***Results:*** This function provides results of the most recent test of the data set. The results function is initiated by entering 7. In response to the results function entry, the ADTS gives the audible query WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After receiving a number, the ADTS outputs the results in a format similar to the following:

THE TEST RESULTS ARE:

THE DATA SET CODE IS (data set code)

THE RECEIVED SIGNAL LEVEL IS OUT OF LIMITS

WHAT IS THE FUNCTION YOU WISH TO PERFORM?

5.09 ***Stop:*** This function stops the present function and requests a new function. The stop function is initiated by entering #73.

5.10 ***Off:*** This function stops the present function and disconnects the DIVA port. The off function is initiated by entering #63.

Accessing ADTS

5.11 Access to ADTS by DIVA is obtained by placing a call to a DIVA port number. Depending on the mode of ADTS and the mode of DIVA, one of four actions will occur:

(a) Busy signal; all DIVA ports are busy. Try again later.

(b) Call not answered; either ADTS or DIVA is in the down mode.

(c) Call answered; the user will hear a 1-second burst of answer tone. Following the answer tone will be the audible query: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD. Once the password has been entered, the system responds with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

(d) Call answered; the user will hear the password query and then the following: THE ADTS IS OFF-LINE. PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM. This is only a temporary situation. Retry the access in a minute or two.

5.12 The user may shorten the password-function request formalities by inputting both the password and the desired function in one entry (no intervening *). If both the password and function are valid, ADTS begins executing the function immediately. To shorten the time required to set up a test, answers to familiar questions asked by DIVA may be given while the question is in progress.

5.13 Information is entered into ADTS by letters or numbers on the TOUCH-TONE dial. Numbers are entered into ADTS by depressing the desired digits on the TOUCH-TONE dial. Letters are entered into ADTS by using the following format:

(a) Depress #.

(b) Depress button with desired letter on it.

(c) Depress a number (1, 2, or 3) corresponding to the letter's position on the button [depressed in (b)].

5.14 In response to a YES or NO question, the following format is used:

(a) YES, enter one (1).

(b) NO, enter zero (0).

5.15 The user can again listen to the last spoken message, by entering #* (Table A).

Performing Tests

5.16 To start a test, the user enters the desired number code from Table B. The ADTS response is WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After the number has been entered, the ADTS response is YOU HAVE ENTERED (telephone or special service circuit number). IS THAT CORRECT? The user enters 1 for YES or 0 for NO. If the response is incorrect, ADTS repeats the original query.

5.17 If the response is correct, ADTS will attempt to find a line card file (LCF). If an LCF is found, ADTS will use the data set code to find the test program. If there is a test program for the data set code and test function entered, ADTS will continue. If no test program is found, ADTS will abort the test with the following message: THE ADTS CANNOT RUN SELECTED TEST ON THIS DATA SET. (Since there are test programs available for DS 113D—52 and 37—this response indicates that the wrong test code was entered.)

5.18 If both an LCF and test program are found, the LCF information is given to the user. The user is then given a chance to make any necessary changes.

5.19 If no LCF is found, the ADTS response is THE DATA SET IS NOT ON FILE. ENTER THE DATA SET CODE. The user must then answer this question and others to create an LCF. After entry of the data set code, ADTS checks for the test program.

5.20 After the LCF information has been given or after new line card information has been entered ADTS instructs the user TO CORRECT ERRORS ENTER ONE. IF NO ERRORS, ENTER ZERO. If a 1 is entered, ADTS repeats the line card information query.

5.21 If no corrections are made to the LCF, ADTS asks ARE YOU CALLING FROM THE DATA SET? If the user is calling from a data set, the user must hang up. ADTS will then call the data set for testing. After the test has been completed, ADTS calls the data set again to give the user the results of the test. The test instructions direct the user on this procedure.

5.22 The ADTS asks the user DO YOU WANT INSTRUCTIONS? If requested, ADTS will supply test instructions. These instructions are to prompt the user, not to replace the data set BSP instructions.

5.23 After the instructions, ADTS gives the following message: WHEN READY, ENTER ONE. Upon receipt of a 1, ADTS responds THANK YOU. A pause will follow the thank you message as ADTS attempts to seize the hardware needed for the test. If the test hardware is busy performing another test or a self test, ADTS gives the following message: THE ADTS TEST EQUIPMENT IS BUSY, PLEASE WAIT. When the test hardware becomes available, ADTS outputs THE TEST IS READY TO START.

5.24 At completion of the test, the user receives a short message describing the test results.

TABLE A

TOUCH-TONE CODES FOR DIVA

FUNCTION	DEPRESS BUTTON(S)	DESCRIPTION
1, 2, 3, . . .etc.	Appropriate button(s)	Digits
#	#	Prefix character.
*	*	TOUCH-TONE star. Used at end of all entries as EOL character.
A,B,C, . . .etc.	Depress number sign, button on which character appears, and digit corresponding to the relative position of the letter (1,2, or 3). Example: For the letter A #21	Alphabetic characters.
Yes	1*	Answer yes to a question.
No	0*	Answer no to a question.
Repeat	#*	Repeats last message spoken by the system.
Telephone Number	Example: 3115552368*	Enter telephone number in sequence followed by EOL.
Data Set Code	Example: 202#23* Example: 202#235* Example: 401#515*	202C 202C5 401J5
Data Set Transmit Level	Example: 12*	-12 dBm. Eliminate sign and units designation. Enter numerical value.

When the data set fails, the system gives the reason(s) for failure. After giving the results of the data set test, the system returns to the function query.

Leaving ADTS

5.25 ***Manual Abort:*** Whenever the system is expecting user input, the user can abort the operation by entering #73 (the letter S) or #63 (the letter O). The letter S, for STOP, causes ADTS to abort the operation and return to the function query. The letter O, for OFF, causes ADTS to abort the operation and the DIVA port to hang up.

5.26 ***Automatic Abort:*** The ADTS automatically performs the equivalent of a user OFF if the user does not respond to a system request. Thirty seconds without a user entry after the original function query, ADTS will repeat the query. Thirty seconds after the second query without a user entry, ADTS will repeat the query for the third time. Thirty seconds after the third query without a user entry, ADTS will abort the task and hang up. If incorrect or illogical entries are made three successive times, ADTS will perform the equivalent of an OFF. After each invalid entry, an appropriate error message such as THE NUMBER IS INVALID, PLEASE RE-ENTER will be spoken. After a third invalid entry, ADTS will abort the task and hang up.

TABLE B

FUNCTIONS AVAILABLE FROM DIVA

FUNCTION	DESCRIPTION	NORMAL	FAST
Test List	Lists valid test functions.	8 *	
Loopback Test	Static test of a data set.	52 *	352 *
Error Run Test	Tests a data set with data test set connected.	37 *	337 *
Results	Outputs results of most recent test of a data set.	7 *	
STOP	Stops present function and requests new function.	#73 *	
OFF	Stops present function and disconnects.	#63 *	

B. Loopback Test

5.27 Call the DIVA port number of the serving ADTS, using a TOUCH-TONE (TT) dial or pad. A 1-second answer tone will be heard in the handset. After the answer tone will be the following: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD.

Note 1: If the above message is not heard, refer to paragraph 5.11.

Note 2: TOUCH-TONE stars are shown hereafter as required.

5.28 Enter the 4-character password, followed by a *, on the TT dial. ADTS will respond with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.29 Enter 52* on the TT dial. (The fast test, which omits line card review and test instructions, may be requested by entering 352*.) ADTS will respond with LOOPBACK TEST. WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER?

5.30 Enter the data set telephone number, followed by *, on the TT dial. ADTS will respond with YOU HAVE ENTERED (telephone number). IS THAT CORRECT?

5.31 If the number is correct, enter 1* on the TT dial. If the number is incorrect, enter 0* on the TT dial.

5.32 If 0* was entered, the query in paragraph 5.29 will be repeated. If 1* was entered, ADTS will respond with THE DATA SET CODE IS 113D. TO CORRECT ERRORS ENTER ONE. IF NO ERRORS ENTER ZERO. Enter 1* to change the data set code. ADTS will respond ENTER THE DATA SET CODE. Follow this with an entry of 113#31* to select DS 113D.

5.33 ADTS continues: ARE YOU CALLING FROM THE DATA SET? Enter 1* for "yes"; enter 0* for "no".

5.34 This question follows: DO YOU WANT INSTRUCTIONS? A 1* reply requests instructions, which are as follows:

(1) When ADTS is called from a telephone other than at the data set: DEPRESS THE DL BUTTON. THE ADTS WILL CALL TO TEST THE DATA SET.

(2) When ADTS is called from the data set telephone: DEPRESS THE DL BUTTON. ON THE TONE HANG UP THE DATA SET. THE ADTS WILL CALL TO TEST THE DATA SET. AT THE COMPLETION OF THE TEST, THE ADTS WILL CALL THE DATA SET AGAIN TO REPORT THE TEST RESULTS.

ADTS continues: DO YOU WANT THESE INSTRUCTIONS REPEATED? Enter 1* for "yes"; enter 0* for "no". A "yes" answer causes the instructions to be repeated.

The ADTS then gives the message WHEN READY ENTER ONE.

5.35 When the user is satisfied that the instructions are understood, enter 1*, to which the

ADTS responds THANK YOU. THE TEST IS READY TO START.

5.36 On satisfactory conclusion of the test the ADTS gives the results as follows:

THE TEST RESULTS ARE:

THE DATA SET TESTS OK. PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM. If another test will not be performed at this time, enter #63* to disconnect from the DIVA port.

5.37 If the data set failed the test, one or more of the following messages is given:

- BUSY TONE DETECTED. TEST ABORTED.
- REORDER TONE DETECTED. TEST ABORTED.
- THE ANSWER TONE WAS NOT RECEIVED. TEST ABORTED.
- THE F2 MARK FREQUENCY IS OUT OF LIMITS.
- THE F2 SPACE FREQUENCY DID NOT COME ON.
- The F1 SLICE FREQUENCY IS OUT OF LIMITS.
- THE F2 SPACE FREQUENCY IS OUT OF LIMITS.
- THE DATA SET DID NOT RELEASE FROM THE TEST MODE.
- DATA SET SENSITIVITY FAILED.

ADTS then asks DO YOU WANT DETAILED RESULTS? Enter 1* for "yes"; enter 0* for "no". With an entry of 1*, ADTS responds with the error data.

5.38 The ADTS repeats the function query. If another test will not be performed at this time, enter #63* to disconnect from the DIVA port.

C. End-to-ADTS Error Run Test Using 921A DTS

Initial Test Setup for 921A DTS

5.39 Perform the initial test setup for the 921A DTS when used to test DS 113D-L1/2 as follows:

STEP	ACTION	VERIFICATION
1	Connect data set to DTS using interface cable and Electronic Industries Association (EIA) adapter cord provided with DTS. ***Note:*** The interface cable is equipped with two 37-pin connectors. The 6-inch adapter cord is equipped with a 37-pin female connector and a 25-pin male connector. Connect interface cable from DATA SET (DCE) connector on DTS to 37-pin connector on adapter cord. Insert 25-pin connector on adapter cord into customer interface connector on data set.	
2	Connect DTS to a 105- to 129-Vac 60-Hz power source.	
3	Apply power to data set.	
4	On front of DTS, set POWER switch to ON.	POWER lamp lights.

STEP	ACTION	VERIFICATION
5	Press RST on keyboard. ***Note:*** If RST is pressed during a test, the test is ended and the DTS recycles to this step.	Display reads (briefly) version number of DTS. DTS then performs self tests. If DTS is defective, display reads— TEST FAILED If DTS is satisfactory, display reads— DATA SET:
6	Remove EIA interface module from storage and ensure that all 25 interface module switches are in TERM position.	
7	On right side of DTS, ensure that locking lever is in OPEN position.	
8	Insert interface module into slot.	
9	Move locking lever to CLOSE position.	
10	On front of DTS, ensure that all 37 DCE interface lead switches are in NORM position.	
11	Enter 20. ***Note:*** To delete a wrong entry on keyboard during any test, press back arrow (←).	Display reads— DATA SET: 20
12	Press GO.	Display reads— BIT RATE:
13	Enter 03.	Display reads— BIT RATE: 03
14	Press GO. ***Note:*** If GO or TST is pressed at an unauthorized point in a test, the test is ended and the DTS recycles to this step.	Display reads— TEST SEQ:

5.40 Call the DIVA port number of the serving ADTS, using a TOUCH-TONE (TT) dial or pad. A 1-second answer tone will be heard in the handset. After the answer tone will be the following: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD.

Note: If the above message is not heard, refer to paragraph 5.11.

5.41 Enter the 4-character password, followed by a *, on the TT dial. ADTS will respond with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.42 Enter 37* on the TT dial. (The fast test, which omits line card review and test instructions, may be requested by entering 337*.) ADTS will respond with WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER?

5.43 Enter the data set telephone number, followed by *, on the TT dial. ADTS will respond with YOU HAVE ENTERED (telephone number). IS THAT CORRECT?

5.44 If the number is correct, enter 1* on the TT dial. If the number is incorrect, enter 0* on the TT dial.

5.45 If 0* was entered, the query in paragraph 5.42 will be repeated. If 1* was entered, ADTS will respond with THE DATA SET CODE is 113D. ACCESS TYPE LAST USED WAS DDD, ADTS ORIGINATED. TO CORRECT ERRORS ENTER ONE. IF NO ERRORS ENTER ZERO.

5.46 Enter 1* to change the data set code. Follow this with an entry of 113#31* to select DS 113D.

5.47 Enter 1* to change the data set access type. The ADTS responds with ENTER THE DATA SET ACCESS TYPE.

1. DDD, ADTS ORIGINATED
2. DDD, DATA SET ORIGINATED
3. RTAU
4. RTS.

5.48 If there are no more corrections, the ADTS asks the following question: DO YOU WANT THE ADTS TO TRANSMIT TO THE DATA SET?

5.49 A "yes" or "no" answer is followed by the following question: DO YOU WANT TO USE THE STANDARD TEST PARAMETERS? (Standard test parameters are: test time, 15 minutes; word bit length, 511; bit error count). A "yes" answer is followed by PLEASE WAIT; a "no" answer by the following: ENTER THE TEST TIME IN MINUTES. ENTER THE WORD BIT LENGTH: 15, 63, 511, OR 2047 BITS.

5.50 If the answer to the question in paragraph 5.49 was "no", the following message is given: DO YOU WANT TO DETECT BLOCK ERRORS? The response to a "yes" is ENTER THE BLOCK WORD LENGTH. An acceptable answer is 1, 2, 4, 8, or 16. If response is "no", a bit error count is made. With the proper answer, the ADTS responds PLEASE WAIT, then ARE YOU CALLING FROM THE DATA SET? A "yes" or "no" answer is acceptable.

5.51 A "yes" reply to the question DO YOU WANT INSTRUCTIONS? prompts the following message if the ADTS is originating the call and the call is not initiated from the data set: THE ADTS WILL CALL THE DATA SET AND START THE TEST AFTER THE DATA SET ANSWERS. LEAVE THIS TELPHONE OFF-HOOK TO RECEIVE THE TEST RESULTS. WHEN READY ENTER ONE.

5.52 When the call is from the data set the instructions are: ON THE TONE, HANG UP. THE ADTS WILL CALL AND TEST THE DATA SET. WHEN THE TEST IS COMPLETED, THE ADTS WILL CALL THE DATA SET TO REPORT THE TEST RESULTS OR YOU MAY CALL ADTS AND REQUEST THE TEST RESULTS.

ADTS Transmitting Data

5.53 If the ADTS is to transmit to the data set, this message follows: ADTS TEST DATA TRANSMISSION WILL BE PRECEDED BY 30 SECONDS OF GOOD DATA FOLLOWED BY THE INJECTION OF 10 BIT ERRORS.

5.54 During this initial period of data transmission, prepare the 921A data test set to receive the test data as indicated in the steps below. Receipt of bit errors is a positive indication that transmission is taking place. The time entered in Step 8 must be less than the time requested for the ADTS test, since erroneous errors will be produced if the 921A DTS looks for data when none is being transmitted.

STEP	ACTION	VERIFICATION
1	Ensure that initial test setup described in paragraph 5.39 has been performed.	Display reads— TEST SEQ:
2	Enter 55.	Display reads— TEST SEQ: 55

STEP	ACTION	VERIFICATION
3	Press GO.	Display reads— TRANSMITTER=? 1=921 2=914 3=903
4	Enter 1, 2, or 3 to correspond to the type of DTS being used at distant end.	Typical display reads (briefly)— TRANSMITTER=1 1=921 2=914 3=903 Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63
5	Enter 5.	Display reads (briefly)— 511 BIT ERROR TEST Display then reads— 1=BIT ERRORS 2=BLOCK ERRORS
6	Enter 1.	Display reads— ???? SECONDS
7	Place data set in data mode.	On DTS, DSR indicator lights.
8	Enter 0900. ***Note:*** To perform functions listed below, press associated key. **KEY FUNCTION** A Repeat test. B Display time remaining in test. C Clear display. D End test. E Inject 8 errors into data stream. F Force out-of-sync condition.	Display reads (briefly)— 0900 SECONDS Display then reads— 0000 BITS IN ERROR From this point, display counts number of bits in error. If sync is lost during test, display flashes OSYN. If this occurs, test must be repeated by pressing A. At end of test, display reads TEST COMPLETE, total sync losses, and total bits in error. ***Requirement:*** Total bits in error are less than 6.

ADTS Receiving Data

5.55 If the ADTS is to receive data from the data set, repeat the steps in paragraph 5.54 at the transmitting station.

5.56 After all instructions are performed and the test is complete, the ADTS gives this message: THE TEST RESULTS ARE (results). THE TEST TIME WAS (number of) MINUTES. DO YOU WANT TO RUN ANOTHER TEST?

5.57 The ADTS gives error message(s) as shown in paragraph 5.37 if the data set test was not performed successfully.

6. REFERENCES

6.01 Additional information concerning DS 113D and use of the ADTS is contained in the following publications:

SECTION	TITLE
107-402-100	921A Data Test Set—Description and Operation
314-205-501	Data Systems—DATAPHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines

SECTION	TITLE
590-010-500	J1P005 Automatic Data Test System (ADTS)—Operation From Field Locations
591-040-100	Data Set 113D-L1/2 Transmitter-Receiver—Description and Operation
591-040-200	Data Set 113D-L1/2 Transmitter-Receiver—Installation and Connections
591-040-500	Data Set 113D-L1/2 Transmitter-Receiver—Test Procedures
591-040-501	Data Set 113D-L1/2 Transmitter-Receiver—Test Procedures Using 921A Data Test Set

TESTING DATA SET 201C-L1C
FROM FIELD LOCATIONS
USING J1P005 AUTOMATIC DATA TEST SYSTEM (ADTS)

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1. GENERAL

1.01 This section provides self test and field test information for data set (DS) 201C-L1C. Remote and error run tests are provided using the J1P005 ADTS. These procedures are to be used when testing DS 201C-L1C on an initial installation or during a maintenance visit.

1.02 When this section is reissued, the reason for reissue will be presented in this paragraph.

1.03 The self tests require no external test equipment, and are included here for completeness.

1.04 This section contains information for testing DS 201C-L1C by means of DIVA (Digital Inquiry Voice Answer). DIVA requires a TOUCH-TONE® dial telephone, or a rotary dial telephone used with a KS-21799-L1 (or equivalent) portable TOUCH-TONE pad.

1.05 In this section, the term "user" refers to telephone company (telco) personnel at the data set responsible for interfacing the data set with the ADTS.

1.06 Test circuitry built into DS 201C-L1C permits the following self tests to be performed: analog loopback, end-to-end, and receiver margin. Additional tests require the use of external test equipment such as a 921A data test set (DTS) and/or the ADTS.

1.07 Detailed self test procedures are presented in paragraphs 4.02 through 4.07.

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1.08 General ADTS test information is presented in paragraphs 5.01 through 5.26. Detailed ADTS test procedures are presented in paragraphs 5.27 through 5.63.

2. INSTALLATION TESTS

2.01 This part provides the sequence in which tests are to be performed following installation of the data set. This test sequence (Fig. 1) provides a method of verifying that the installation is satisfactory. Before proceeding with the tests, verify that the local loop meets the requirements specified in Section 314-205-501.

3. MAINTENANCE TESTS

3.01 This part provides the sequence in which tests are to be performed when clearing a trouble report and during a maintenance visit to the data station.

3.02 When a trouble report is received, a test center or ADTS is responsible for isolating the trouble to the data station or the transmission facility. The procedure for doing this is shown in Fig. 2.

3.03 The data station equipment must be tested prior to dispatching a telco employee. If the trouble seems to be in the data station equipment, a telco employee must be dispatched to conduct more extensive tests at the data station. The following equipment should be taken on a trouble visit:

- 921A or 914-type DTS
- Spare DS 201C-L1C.

3.04 Troubleshooting is performed by the ADTS using the remote test or error run test. If the trouble is isolated to the data set, replace the data set and repeat the test.

3.05 If the trouble persists after the tests have been completed, proceed as follows:

(a) Check for physical damage to data station equipment.

(b) Verify that all cords and connectors are properly connected.

(c) Check that options installed in data set agree with those specified on service order.

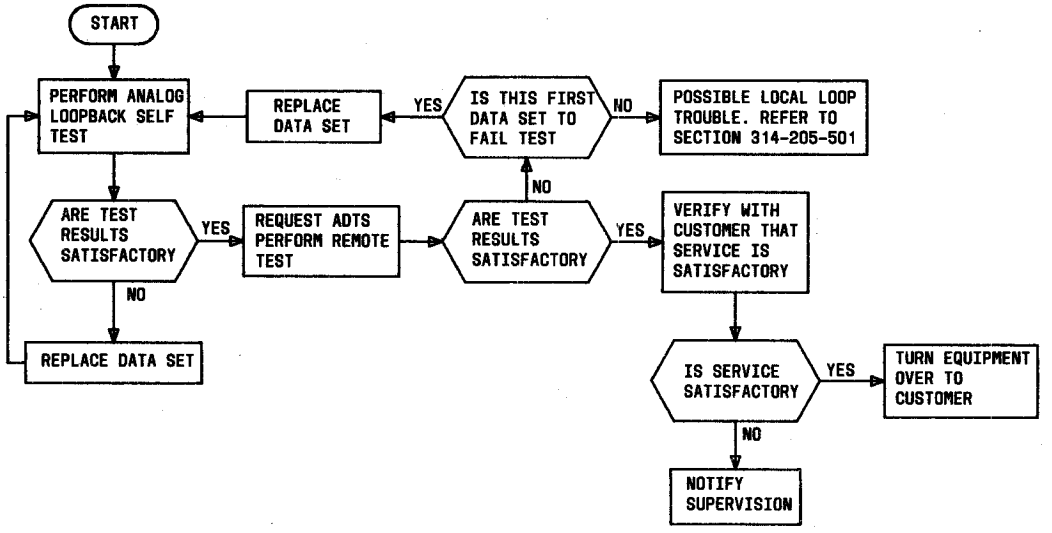


Fig. 1—Installation Test Sequence

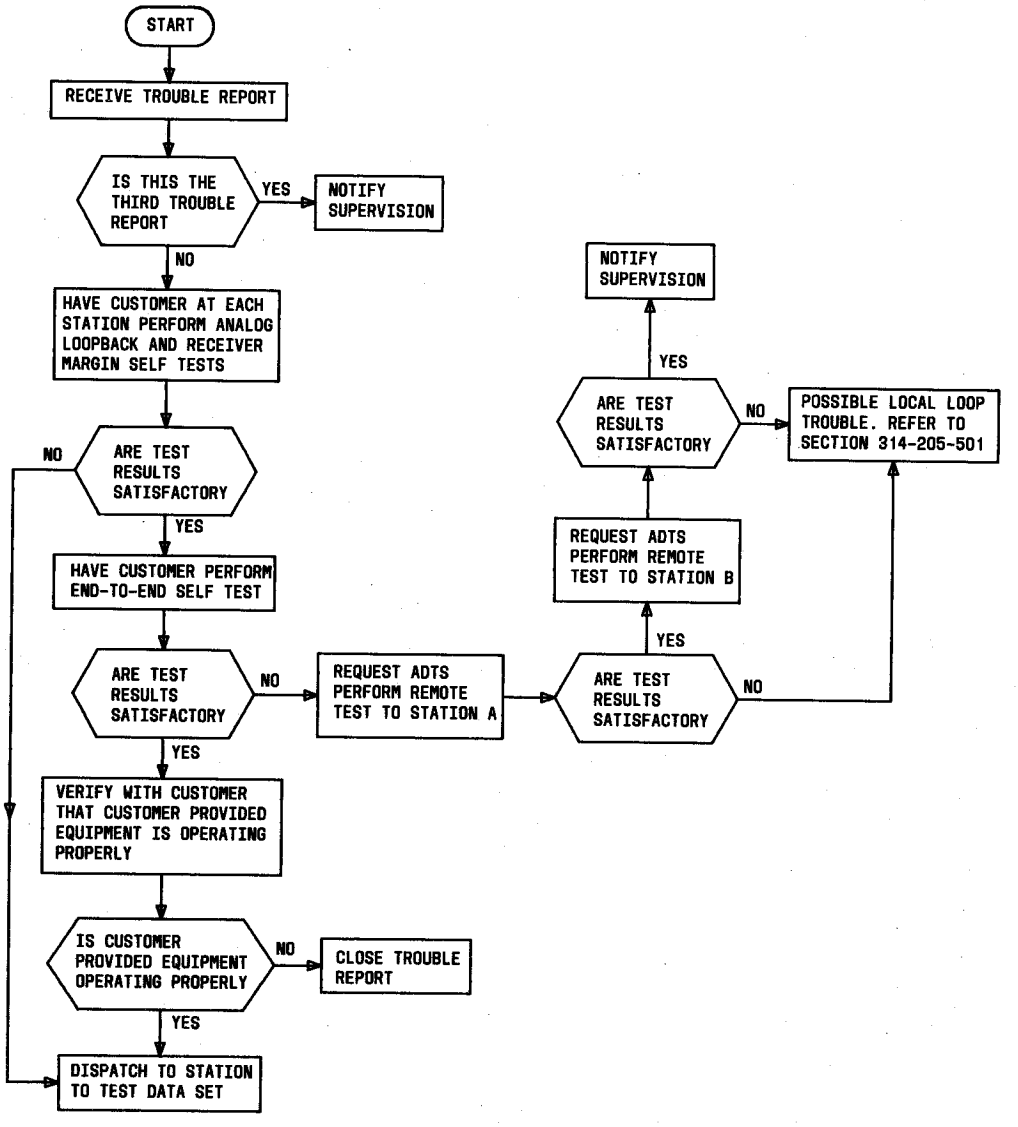


Fig. 2—Clearing Trouble Report

(d) Verify that customer-provided equipment (CPE) has been tested and is operating properly.

(e) Check for intermittent trouble in station wiring.

(f) Verify that data set and CPE are connected to a common ground.

(g) If trouble persists, request help from immediate supervisor, who may then obtain technical support from DATEC (Data Technical Support) per Section 010-521-100.

4. SELF TEST PROCEDURES

4.01 This part provides procedures for the installation and maintenance self tests.

A. Analog Loopback Self Test

4.02 This test checks the data set transmitter and receiver. The customer interface is not checked. Test data generated by the data set is looped back internally from the transmitter output to the receiver input. The received data is compared to the original data. Data errors and data set condition are indicated by the data set status lamps. The DL switch can be used to force a loss of synchronization to verify that the data set will recognize a data set failure condition.

4.03 Perfom the test as follows:

(1) Ensure that data set is not transmitting or receiving data.

(2) Depress AL and ST switches on data set.

(3) Observe data set status lamps for at least 30 seconds.

Requirement: MC lamp is off continuously. All other lamps are lighted.

(4) Depress RO switch on data set.

Requirement: RS, CS, and CO lamps go off. MC lamp lights.

(5) Release RO switch.

Requirement: All lamps are lighted except MC.

(6) Depress DL switch on data set.

Requirement: MC lamp blinks. All other lamps are lighted.

(7) Release DL, AL, and ST switches.

Requirement: ON and MC lamps are lighted. All other lamps are off.

B. End-to-End Self Test

4.04 This test checks the receiver and transmitter of a local and a distant data set and the facilities connecting the data sets. The customer interfaces are not checked. Since the data sets operate half-duplex, the transmitters and receivers are tested separately. This test requires that the local DS 201C-L1C be connected to a distant DS 201C-type through a telephone channel and that both data sets be in the data mode. The distant data set may be a 201CR-L1C, 201C-L1C, or 201C-L1. If the distant data set is a 201CR-L1C or 201C-L1C, the DL switch on the distant data set can be used to inject errors into the data stream to verify proper operation of the test.

4.05 Perform the test as follows:

(1) Establish voice communication between the data stations and arrange to conduct an end-to-end self test.

(2) Ensure that neither data set is transmitting nor receiving data.

(3) On transmitting data set, depress ST switch.

(4) On receiving data set, depress ST and RO switches.

(5) Place both data sets in data mode.

Requirement: On transmitting data set, all lamps are lighted except CO.

Requirement: On receiving data set, all lamps are lighted except RS, CS, and MC.

(6) On transmitting data set, depress DL switch.

Requirement: On receiving data set, MC lamp blinks.

(7) On transmitting data set, release DL switch.

(8) On receiving data set, observe MC lamp for ten 1-minute periods.

Requirement: MC lamp does not blink more than an average of two blinks per 1-minute period.

(9) Perform end-to-end test in opposite direction by releasing RO switch on original receiving data set and depressing RO switch on original transmitting data set.

(10) Repeat (6) through (8).

(11) On both data sets, release test switches.

Requirement: On both data sets, TM lamp goes off.

C. Receiver Margin Self Test

4.06 In this test, the data set is in the analog loopback mode, but the receiver compromise equalizer is bypassed and the distortion threshold at which the MC indicator will light is reduced. The MC indicator acts not only as an indicator of errors in the locally looped data stream, but also blinks on for 50 ms whenever the peak signal distortion measured by the demodulator exceeds the "half-way" point to the receiver decision threshold. The DL switch can be used to force an out-of-sync condition and cause the MC indicator to blink.

4.07 Perform the test as follows:

(1) Ensure that data set is not transmitting or receiving data.

(2) Depress AL and RT switches on data set.

(3) Observe data set status lamps for at least 30 seconds.

Requirement: MC and MR lamps are off. All other lamps are lighted.

(4) Depress DL switch on data set.

Requirement: MC lamp blinks.

(5) Release DL switch.

Requirement: MC lamp goes off.

(6) Release AL and RT switches.

Requirement: ON and MC lamps are lighted. All other lamps are off.

5. ADTS TEST PROCEDURES

A. General

5.01 This part provides instructions necessary for the proper operation of ADTS from field data sets. Included are instructions for entering and leaving the system and for performing installation and maintenance tests.

5.02 Operations involving ADTS require man/machine interaction. With DIVA, the information is entered into ADTS by tones from a TOUCH-TONE dial. The system outputs a message by a voice response unit, and the user receives the message via the telephone handset.



Every entry from a TOUCH-TONE dial must be followed by a TOUCH-TONE star (*) except when calling the DIVA port number. To avoid repetition, the star entry has not been included in the text but should be understood as included whenever an entry is mentioned.

5.03 The ADTS must be on-line and DIVA must be up to accept DIVA tests.

Functions Available Via DIVA (Table B)

5.04 The test functions available via DIVA initiate a static or dynamic test of a data set. When 3 is used as a prefix with a test function, a fast test is performed on the data set without review of the line card information and without receiving test instructions.

5.05 ***Test Function List:*** With an entry of 8, DIVA will respond with a message of all test functions that can be performed on DS 201C-L1C.

5.06 ***Remote Test:*** This function provides a remote test of DS 201C-L1C by the ADTS. The remote test is initiated by entering 78; the fast remote test by entering 378.

5.07 ***Error Run Test:*** This function provides an error run test between the data set and the ADTS in each direction (half duplex). A 921A or a 914-type DTS is required at the data set. Bit or block errors are automatically recorded for various combinations of pseudorandom data sequences and for various periods of time. The data sequences and the periods of time are user specified. Use of the 921A or 914-type DTS requires an initial test setup as described in paragraphs 5.39 and 5.58, respectively. The error run test is initiated by entering 37; the fast error run test by entering 337.

5.08 ***Results:*** This function provides results of the most recent test of the data set. The results function is initiated by entering 7. In response to the results function entry, the ADTS gives the audible query WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After receiving a number, the ADTS outputs the results in a format similar to the following:

THE TEST RESULTS ARE:

THE DATA SET CODE IS (data set code)

THE RECEIVED SIGNAL LEVEL IS OUT OF LIMITS

WHAT IS THE FUNCTION YOU WISH TO PERFORM?

5.09 ***Stop:*** This function stops the present function and requests a new function. The stop function is initiated by entering #73.

5.10 ***Off:*** This function stops the present function and disconnects the DIVA port. The off function is initiated by entering #63.

Accessing ADTS

5.11 Access to ADTS by DIVA is obtained by placing a call to a DIVA port number. Depending on the mode of ADTS and the mode of DIVA, one of four actions will occur:

(a) Busy signal; all DIVA ports are busy. Try again later.

(b) Call not answered; DIVA is in the down mode.

(c) Call answered; the user will hear a 1-second burst of answer tone. Following the answer tone will be the audible query: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD. Once the password has been entered, the system responds with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

(d) Call answered; the user will hear: THE ADTS IS OFF-LINE. The ADTS will automatically abort the task. The ADTS must be put on-line by entering ONLIN to the function query on a terminal at the ADTS. The user may then place a call to a DIVA port number and access the ADTS.

5.12 The user may shorten the password-function request formalities by inputting both the password and the desired function in one entry (no intervening *). If both the password and function are valid, ADTS begins executing the function immediately. To shorten the time required to set up a test, answers to familiar questions asked by DIVA may be given while the question is in progress.

5.13 Information is entered into ADTS by letters or numbers on the TOUCH-TONE dial. Numbers are entered into ADTS by depressing the desired digits on the TOUCH-TONE dial. Letters are entered into ADTS by using the following format:

(a) Depress #.

(b) Depress button with desired letter on it.

(c) Depress a number (1, 2, or 3) corresponding to the letter's position on the button [depressed in (b)].

5.14 In response to a YES or NO question, the following format is used:

(a) YES, enter one (1).

(b) NO, enter zero (0).

5.15 The user can again listen to the last spoken message, by entering #* (Table A).

Performing Tests

5.16 To start a test, the user enters the desired number code from Table B. The ADTS response is WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After the number has been entered, the ADTS response is YOU HAVE ENTERED (telephone or special service circuit number). IS THAT CORRECT? The user enters 1 for YES or 0 for NO. If the response is incorrect, ADTS repeats the original query.

5.17 If the response is correct, ADTS will attempt to find a line card file (LCF). If an LCF is found, ADTS will use the data set code to find the test program. If there is a test program for the data set code and test function entered, ADTS will continue. If no test program is found, ADTS

TABLE A

TOUCH-TONE CODES FOR DIVA

FUNCTION	DEPRESS BUTTON(S)	DESCRIPTION
1, 2, 3, . . .etc.	Appropriate button(s)	Digits
#	#	Prefix character.
*	*	TOUCH-TONE star. Used at end of all entries as EOL character.
A,B,C, . . .etc.	Depress number sign, button on which character appears, and digit corresponding to the relative position of the letter (1,2, or 3). Example: For the letter A #21	Alphabetic characters.
Yes	1*	Answer yes to a question.
No	0*	Answer no to a question.
Repeat	#*	Repeats last message spoken by the system.
Telephone Number	Example: 3115552368*	Enter telephone number in sequence followed by EOL.
Data Set Code	Example: 202#23* Example: 202#235* Example: 401#515*	202C 202C5 401J5
Data Set Transmit Level	Example: 12*	-12 dBm. Eliminate sign and units designation. Enter numerical value.

TABLE B

FUNCTIONS AVAILABLE VIA DIVA

FUNCTION	DESCRIPTION	NORMAL	FAST
Test List	Lists valid test functions.	8*	
Remote Test	Dynamic test of a data set.	78*	378*
Error Run Test	Tests a data set with data test set connected.	37*	337*
Results	Outputs results of most recent test of a data set.	7*	
Stop	Stops present function and requests new function.	#73*	
Off	Stops present function and disconnects.	#63*	

will abort the test with the following message: THE ADTS CANNOT RUN SELECTED TEST ON THIS DATA SET. (Since there are test programs available for DS 201C—78 and 37—this response indicates that the wrong test code was entered.)

5.18 If both an LCF and test program are found, the LCF information is given to the user. The user is then given a chance to make any necessary changes.

5.19 If no LCF is found, the ADTS response is THE DATA SET IS NOT ON FILE. ENTER THE DATA SET CODE. The user must then answer this question and others to create an LCF. After entry of the data set code, ADTS checks for the test program.

5.20 After the LCF information has been given or after new line card information has been entered ADTS instructs the user TO CORRECT ERRORS ENTER ONE. IF NO ERRORS, ENTER ZERO. If a 1 is entered, ADTS repeats the line card information query.

5.21 If no corrections are made to the LCF, ADTS asks ARE YOU CALLING FROM THE DATA SET? If the user is calling from a data set, the user must hang up prior to running the test. ADTS will then call the data set for testing. After the test has been completed, ADTS calls the data set again to give the user the results of the test. The test instructions direct the user on this procedure.

5.22 The ADTS asks the user DO YOU WANT INSTRUCTIONS? If requested, ADTS will supply test instructions. These instructions are to prompt the user, not to replace the data set BSP instructions.

5.23 After the instructions, ADTS gives the following message: WHEN READY, ENTER ONE. Upon receipt of a 1, ADTS responds THANK YOU. A pause will follow the thank you message as ADTS attempts to seize the hardware needed for the test. If the test hardware is busy performing another test or a self test, ADTS gives the following message: THE ADTS TEST EQUIPMENT IS BUSY, PLEASE WAIT. When the test hardware becomes available, ADTS outputs THE TEST IS READY TO START.

5.24 At completion of the test, the user receives a short message describing the test results. When the data set fails, the system gives the reason(s) for failure. After giving the results of the data set test, the system returns to the function query.

Leaving ADTS

5.25 ***Manual Abort:*** Whenever the system is expecting user input, the user can abort the operation by entering #73 (the letter S) or #63 (the letter O). The letter S, for STOP, causes ADTS to abort the operation and return to the function query. The letter O, for OFF, causes ADTS to abort the operation and the DIVA port to hang up.

5.26 ***Automatic Abort:*** The ADTS automatically performs the equivalent of a user OFF if the user does not respond to a system request.

Thirty seconds without a user entry after the original function query, ADTS will repeat the query. Thirty seconds after the second query without a user entry, ADTS will repeat the query for the third time. Thirty seconds after the third query without a user entry, ADTS will abort the task and hang up. If incorrect or illogical entries are made three successive times, ADTS will perform the equivalent of an OFF. After each invalid entry, an appropriate error message such as THE NUMBER IS INVALID, PLEASE REENTER will be spoken. After a third invalid entry, ADTS will abort the task and hang up.

B. Remote Test

5.27 Call the DIVA port number of the serving ADTS, using a TOUCH-TONE (TT) dial or pad. A 1-second answer tone will be heard in the handset. After the answer tone will be the following: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD.

Note 1: If the above message is not heard, refer to paragraph 5.11.

Note 2: TOUCH-TONE stars are shown hereafter as required.

5.28 Enter the 4-character password, followed by a *, on the TT dial. ADTS will respond with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.29 Enter 78* on the TT dial. (The fast test, which omits line card review and test instructions, may be requested by entering 378*.) ADTS will respond with WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER?

5.30 Enter the data set telephone number, followed by *, on the TT dial. ADTS will respond with YOU HAVE ENTERED (telephone number). IS THAT CORRECT?

5.31 If the number is correct, enter 1* on the TT dial. If the number is incorrect, enter 0* on the TT dial.

5.32 If 0* was entered, the query in paragraph 5.29 will be repeated. If 1* was entered, ADTS will respond with THE DATA SET CODE IS 201C. ARE YOU CALLING FROM THE DATA SET? To respond "yes" enter one; to respond "no", enter zero.

5.33 ADTS continues: TO CORRECT ERRORS ENTER ONE. IF NO ERRORS ENTER ZERO. Enter 1* to change the data set code. Follow this with an entry of 201#23* to select DS 201C.

5.34 This question follows: DO YOU WANT INSTRUCTIONS? A 1* reply requests instructions, which are as follows:

(1) When ADTS is called from a telephone other than the data set: RELEASE ALL SWITCHES ON THE DATA SET TO THE OUT POSITION. DEPRESS THE RT SWITCH ON THE DATA SET. THE ADTS WILL CALL THE DATA SET. LEAVE THIS TELEPHONE OFF-HOOK TO RECEIVE THE TEST RESULTS AT THE COMPLETION OF THE TEST.

(2) When ADTS is called from the data set telephone: RELEASE ALL SWITCHES ON THE DATA SET TO THE OUT POSITION. ON THE TONE DEPRESS THE RT SWITCH ON THE DATA SET AND THEN HANG UP. THE ADTS WILL CALL THE DATA SET. WHEN THE TEST IS COMPLETED, THE ADTS WILL CALL THE DATA SET AGAIN TO REPORT THE TEST RESULTS.

The ADTS then gives the message WHEN READY ENTER ONE.

5.35 When the user is satisfied that the instructions are understood, enter 1*, to which the ADTS responds THANK YOU. THE TEST IS READY TO START.

5.36 On conclusion of the test the ADTS gives the results as follows:

THE TEST RESULTS ARE:

THE RECEIVED LEVEL IS (negative number) DBM.
THE NUMBER OF BLOCKS RECEIVED WAS (positive number).
THE NUMBER OF TRANSMITTER ERRORS WAS (positive number).
THE NUMBER OF RECEIVER ERRORS WAS (positive number).
THE DATA SET TESTS OK.

5.37 If the data set failed the test, one or more of the following messages is given:

- THE DDD CONNECTION WAS LOST. TEST ABORTED.
- CARRIER WAS NOT RECEIVED.
- THE CARRIER SIGNAL DID NOT GO OFF.
- THE RECEIVED SIGNAL LEVEL IS OUT OF LIMITS.
- THE NUMBER OF TRANSMITTER ERRORS WAS TOO HIGH.
- THE NUMBER OF RECEIVER ERRORS WAS TOO HIGH.
- THE DATA SET DID NOT SEND THE RECEIVER ERROR SIGNAL.
- THERE HAS BEEN AN ADTS TEST EQUIPMENT MALFUNCTION. TRY AGAIN LATER.
- THE RECEIVED SIGNAL WENT OFF DURING MEASUREMENT.
- THE DATA SET DID NOT RELEASE FROM THE TEST MODE.
- THE ANSWER TONE DID NOT GO OFF.

5.38 The ADTS repeats the function query.

C. End-to-ADTS Error Run Test Using 921A DTS

Initial Test Setup for 921A DTS

5.39 Perform the initial test setup for the 921A DTS when used to test DS 201C-L1C as follows:

STEP	ACTION	VERIFICATION
1	Connect data set to DTS using interface cable and Electronic Industries Association (EIA) adapter cord provided with DTS. ***Note:*** The interface cable is equipped with two 37-pin connectors. The 6-inch adapter cord is equipped with a 37-pin female connector and a 25-pin male connector. Connect interface cable from DATA SET (DCE) connector on DTS to 37-pin connector on adapter cord. Insert 25-pin connector on adapter cord into customer interface connector on data set.	
2	Connect DTS to a 105- to 129-Vac 60-Hz power source.	
3	Apply power to data set.	Data set ON lamp lights.
4	On front of DTS, set POWER switch to ON.	POWER lamp lights.
5	Press RST on keyboard. ***Note:*** If RST is pressed during a test, the test is ended and the DTS recycles to this step.	Display reads (briefly) version number of DTS. DTS then performs self tests. If DTS is defective, display reads— TEST FAILED

STEP	ACTION	VERIFICATION
		If DTS is satisfactory, display reads— DATA SET:
6	Remove EIA interface module from storage and ensure that all 25 interface module switches are in TERM position.	
7	On right side of DTS, ensure that locking lever is in OPEN position.	
8	Insert interface module into slot.	
9	Move locking lever to CLOSE position.	
10	On front of DTS, ensure that all 37 DCE interface lead switches are in NORM position.	
11	Enter 62. ***Note:*** To delete a wrong entry on keyboard during any test, press back arrow (←).	Display reads— DATA SET: 62
12	Press GO.	Display reads— BIT RATE:
13	Enter 24.	Display reads— BIT RATE: 24
14	Press GO. ***Note:*** If GO or TST is pressed at an unauthorized point in a test, the test is ended and the DTS recycles to this step.	Display reads— TEST SEQ:

5.40 Call the DIVA port number of the serving ADTS, using a TOUCH-TONE (TT) dial or pad. A 1-second answer tone will be heard in the handset. After the answer tone will be the following: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD.

Note: If the above message is not heard, refer to paragraph 5.11.

5.41 Enter the 4-character password, followed by a *, on the TT dial. ADTS will respond with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.42 Enter 37* on the TT dial. (The fast test, which omits line card review and test instructions, may be requested by entering 337*.) ADTS will respond with WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER?

5.43 Enter the data set telephone number, followed by *, on the TT dial. ADTS will respond with YOU HAVE ENTERED (telephone number). IS THAT CORRECT?

5.44 If the number is correct, enter 1* on the TT dial. If the number is incorrect, enter 0* on the TT dial.

5.45 If 0* was entered, the query in paragraph 5.42 will be repeated. If 1* was entered, ADTS will respond with THE DATA SET CODE IS 201C. ACCESS TYPE LAST USED WAS DDD, ADTS ORIGINATED. TO CORRECT ERRORS ENTER ONE. IF NO ERRORS ENTER ZERO.

5.46 Enter 1* to change the data set code. Follow this with an entry of 201#23* to select DS 201C.

5.47 Enter 1* to change the data set access type. The ADTS responds with ENTER THE DATA SET ACCESS TYPE.

1. DDD, ADTS ORIGINATED
2. DDD, DATA SET ORIGINATED
3. RTAU
4. RTS.

5.48 If there are no more corrections, the ADTS asks the following question: DO YOU WANT THE ADTS TO TRANSMIT TO THE DATA SET?

5.49 A "yes" or "no" answer is followed by the following question: DO YOU WANT TO USE THE STANDARD TEST PARAMETERS? (Standard test parameters are: test time, 1 minute; word bit length, 511; bit error count). A "yes" answer is followed by PLEASE WAIT; a "no" answer by the following: ENTER THE TEST TIME IN MINUTES. ENTER THE WORD BIT LENGTH: 15, 63, 511, OR 2047 BITS.

5.50 If the answer to the question in paragraph 5.49 was "no", the following message is given: DO YOU WANT TO DETECT BLOCK ERRORS? The response to a "yes" is ENTER THE BLOCK WORD LENGTH. An acceptable answer is 1, 2, 4, 8, or 16. If response is "no", a bit error count is made. With the proper answer, the ADTS responds PLEASE WAIT, then ARE YOU CALLING FROM THE DATA SET? A "yes" or "no" answer is acceptable.

5.51 A "yes" reply to the question DO YOU WANT INSTRUCTIONS? prompts the following message if the ADTS is originating the call and the call is not initiated from the data set: THE ADTS WILL CALL THE DATA SET AND START THE TEST AFTER THE DATA SET ANSWERS. LEAVE THIS TELPHONE OFF-HOOK TO RECEIVE THE TEST RESULTS. WHEN READY ENTER ONE.

5.52 When the call is from the data set the instructions are: ON THE TONE, HANG UP. THE ADTS WILL CALL AND TEST THE DATA SET. WHEN THE TEST IS COMPLETED, THE ADTS WILL CALL THE DATA SET TO REPORT THE TEST RESULTS OR YOU MAY CALL ADTS AND REQUEST THE TEST RESULTS.

ADTS Transmitting Data

5.53 If the ADTS is to transmit to the data set, this message follows: ADTS TEST DATA TRANSMISSION WILL BE PRECEDED BY 30 SECONDS OF GOOD DATA FOLLOWED BY THE INJECTION OF 10 BIT ERRORS.

5.54 During this initial period of data transmission, prepare the 921A data test set to receive the test data as indicated in the steps below. Receipt of bit errors is a positive indication that transmission is taking place. The time entered in Step 8 must be less than the time requested for the ADTS test, since erroneous errors will be produced if the 921A DTS looks for data when none is being transmitted.

STEP	ACTION	VERIFICATION
1	Ensure that initial test setup described in paragraph 5.39 has been performed. ***Note:*** If GO or TST is pressed at an unauthorized point in the following tests, the test in progress is ended and the DTS recycles to the start of test.	Display reads— TEST SEQ:
2	Enter 54.	Display reads— TEST SEQ: 54
3	Press GO.	Display reads (briefly)— SELECT ERROR TEST

STEP	ACTION	VERIFICATION
		Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63
4	Enter 5.	Display reads (briefly)— 511 BIT ERROR TEST Display then reads— 1=BIT ERRORS 2=BLOCK ERRORS
5	Enter 2.	Display reads— ????? BITS IN A BLOCK
6	Enter 01024.	Display reads (briefly)— 01024 BITS IN A BLOCK Display then reads— ???? SECONDS
7	Place data set in data mode.	On DTS, DSR indicator lights (data set ready lead ***on***) Display continues to read— ???? SECONDS
8	Enter 0900.	Display reads (briefly)— 0900 SECONDS Display then reads— BLK RCVD=0000 ERR=0000
		Note: From this point, display counts number of blocks received and number of blocks in error. If sync is lost during test, display flashes OSYN. If this occurs, test must be repeated by pressing A.
		At end of test, display reads TEST COMPLETE, total sync losses, total blocks received, and total blocks in error.
		Requirement: Total blocks in error are less than 23. Record block errors.

ADTS Receiving Data

5.55 If the ADTS is to receive data from the data set, perform the following steps at the transmitting station:

STEP	ACTION	VERIFICATION
1	Ensure that initial test setup described in paragraph 5.39 has been performed.	Display reads— TEST SEQ:
2	Enter 53.	Display reads— TEST SEQ: 53

STEP	ACTION	VERIFICATION
3	Press GO.	Display reads (briefly)— SELECT ERROR TEST Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63
4	Enter 5.	Display reads— 511 BIT ERROR TEST
5	Place data set in data mode.	On DTS, DSR indicator lights (data set ready lead ***on***) Display continues to read— 511 BIT ERROR TEST

5.56 After all instructions are performed and the test is complete, the ADTS gives this message: THE TEST RESULTS ARE (results). THE TEST TIME WAS (number of) MINUTES. DO YOU WANT TO RUN ANOTHER TEST?

5.57 The ADTS gives error message(s) as shown in paragraph 5.37 if the data set test was not performed successfully.

D. End-to-ADTS Error Run Test Using 914-Type DTS

Initial Test Setup for 914-Type DTS

5.58 Perform the initial test setup for the 914-type DTS when used to test DS 201C-L1C as shown in Fig. 3.

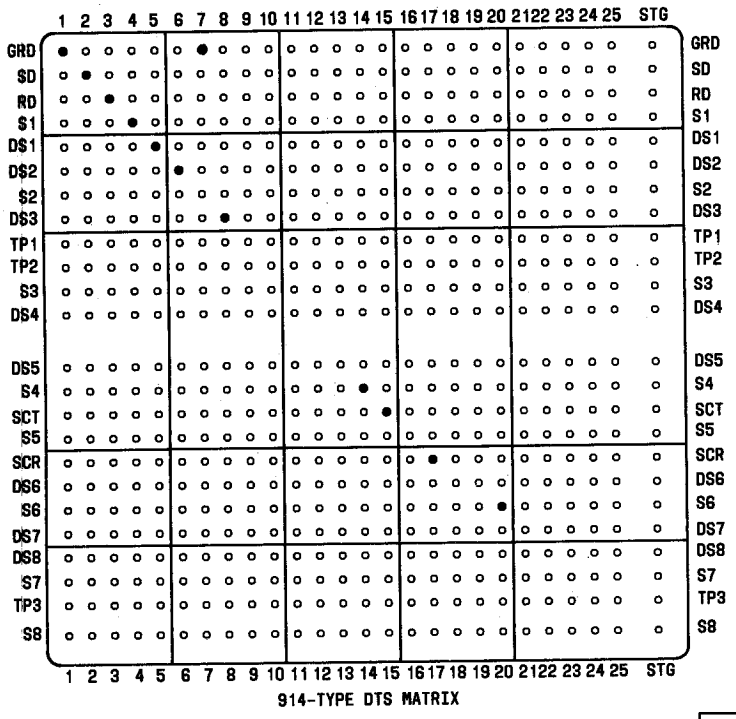
5.59 Repeat paragraphs 5.40 through 5.53 as for the error run test using the 921A DTS.

ADTS Transmitting Data

5.60 If the ADTS is to transmit to the data set, this message follows: ADTS TEST DATA TRANSMISSION WILL BE PRECEDED BY 30 SECONDS OF GOOD DATA FOLLOWED BY THE INJECTION OF 10 BIT ERRORS. Following this, the ADTS sends good data for the time specified.

5.61 During this initial period of data transmission, prepare the 914-type DTS to receive the test data as indicated in the steps below. Receipt of bit errors is a positive indication that transmission is taking place. The time counter set in Step 6 must be shorter than the time requested for the ADTS test, since erroneous errors will be produced if the 914-type DTS looks for data when none is being transmitted.

STEP	PROCEDURE
1	Set COUNTER switch to BLOCK ERRORS 16 WL, (63-bit word).
2	Apply power to the data set and then to the 914-type DTS.
3	Coordinate test procedure with transmitting end.
4	On the 914 DTS, move switch S1 (RS) to OFF.
5	Go to data mode.
6	Reset counter.

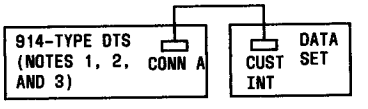


914-TYPE DTS MATRIX

NOTES:

1. SET SWIICHES ON 914-TYPE DTS AS FOLLOWS:

SWIITCH	SETTING
INTERFACE	
SELECTOR A	ALL DEPRESSED
INTERFACE MODE	VOLTAGE
TEST SET MODE	SER (914C) RCV SER (914B)
COUNTER	BLOCK ERRORS-16WL
FUNCTION	OFF
SAMPLE WIDTH	.5μS
RCV BIT RATE (914C)	EXT+
RCV WORD LENGTH (914C)	63
TRANSMIT BIT RATE (914C)	EXT+
TRANSMIT WORD LENGTH (914C)	63
SIG LEV (914C)	±4V
BIT RATE (914B)	EXT+
WORD LENGTH (914B)	63
SIGNAL LEVEL 914B)	±4V
S1	ON
S6	ON



2. INSERT RED PROGRAMMING PINS IN 914-TYPE DTS MATRIX IN POSITIONS INDICATED.
3. 914-TYPE SWITCHES CORRESPOND TO THE FOLLOWING INTERFACE LEADS:

SWITCH	LEAD	EIA
S1	REQUEST TO SEND (RS)	CA
S6	DATA TERMINAL READY (DTR)	CD

Fig. 3—End-to-ADTS Error Run Test Setup Using 914-Type DTS

STEP	PROCEDURE
7	Counter should count at least once and shortly thereafter the NO DATA lamp should illuminate.
8	Reset counter. The NO DATA lamp should extinguish.
9	Conduct 15-minute error run.
10	Counter should record less than 23 counts (less than 23 block errors).
11	At end of test interval, go to talk mode and give results.
12	End of test. Return equipment to normal operating condition.

ADTS Receiving Data

5.62 If the ADTS is to receive data from the data set, perform the following steps at the transmitting station:

STEP	PROCEDURE
1	Set TEST SET MODE to SER (914C) or TRMT SER (914B).
2	Apply power to the data set and then to the 914-type DTS.
3	Call the receiving end to coordinate test procedure.
4	Go to data mode.
5	Set S1 (RS) to ON.
6	To verify equipment is operating properly, set switch SI (RS) to OFF.
7	Set switch S1 (RS) to ON.
8	Conduct 15-minute error run.
9	At end of test interval, go to talk mode.
10	End of test. Return equipment to normal operating condition.

5.63 After all instructions are performed and the test is complete, the ADTS gives this message: THE TEST RESULTS ARE (results). THE TEST TIME WAS (number of) MINUTES. DO YOU WANT TO RUN ANOTHER TEST? At the conclusion of test, enter #63* on the TT dial to end the test and hang up the DIVA port.

6. REFERENCES

6.01 Additional information concerning the DS 201C-L1C and use of the ADTS is contained in the following publications:

SECTION	TITLE
107-101-100	914-Type Data Test Sets—Description and Operation
107-402-100	921A Data Test Set—Description and Operation
314-205-501	Data Systems—DATAPHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines
590-010-500	J1P005 Automatic Data Test System (ADTS)—Operation From Field Locations
592-029-100	Data Set 201C Transmitter-Receiver—Description and Operation
592-029-150	Data Set 201C Transmitter-Receiver—Supplementary Information
592-029-200	Data Set 201C Transmitter-Receiver—Installation and Connections
592-029-500	Data Set 201C Transmitter-Receiver—Test Procedures Using 914-Type Data Test Set
592-029-511	Data Set 201C-L1C Transmitter-Receiver—Test Procedures Using 921A Data Test Set

TESTING DATA SET 202S
FROM FIELD LOCATIONS
USING J1P005 AUTOMATIC DATA TEST SYSTEM (ADTS)

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1. GENERAL

1.01 This section provides self test and field test information for data set (DS) 202S. Remote and error run tests are provided using the J1P005 ADTS. These procedures are to be used when testing DS 202S on an initial installation or during a maintenance visit.

1.02 When this section is reissued, the reason for reissue will be presented in this paragraph.

1.03 The self test requires no external test equipment, and is included here for completeness.

1.04 This section contains information for testing DS 202S by means of DIVA (Digital Inquiry Voice Answer). DIVA requires a TOUCH-TONE® dial telephone, or a rotary dial telephone used with a KS-21799-L1 (or equivalent) portable TOUCH-TONE pad.

1.05 In this section, the term "user" refers to telephone company (telco) personnel at the data set responsible for interfacing the data set with the ADTS.

1.06 Test circuitry built into DS 202S permits a local self-test to be performed. Additional tests require the use of external test equipment such as a 921A data test set (DTS) and/or the ADTS.

1.07 Detailed self test procedures are presented in paragraphs 4.02 and 4.03.

1.08 General ADTS test information is presented in paragraphs 5.01 through 5.26. Detailed ADTS test procedures are presented in paragraphs 5.27 through 5.67.

2. INSTALLATION TESTS

2.01 This part provides the sequence in which tests are to be performed following installation of the data set. This test sequence (Fig. 1) provides a method of verifying that the installation is satisfactory. Before proceeding with the tests, verify that the local loop meets the requirements specified in Section 314-205-501.

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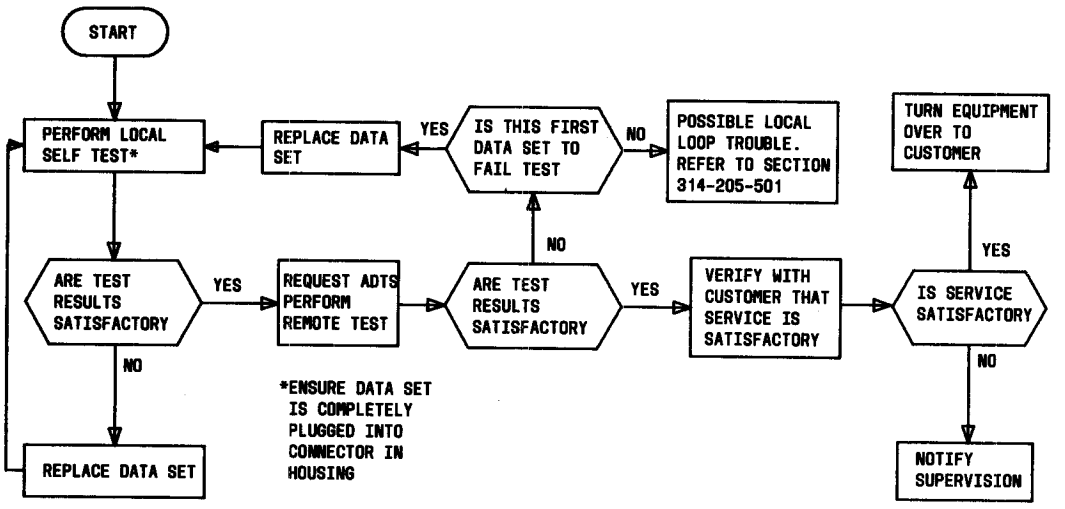


Fig. 1—Installation Test Sequence

3. MAINTENANCE TESTS

3.01 This part provides the sequence in which tests are to be performed when clearing a trouble report and during a maintenance visit to the data station.

3.02 When a trouble report is received, a test center or ADTS is responsible for isolating the trouble to the data station or the transmission facility. The procedure for doing this is shown in Fig. 2.

3.03 The data station equipment must be tested prior to dispatching a telco employee. If the trouble seems to be in the data station equipment, a telco employee must be dispatched to conduct more extensive tests at the data station. The following equipment should be taken on a trouble visit:

- 921A or 914-type DTS
- Spare DS 202S.

3.04 Troubleshooting is performed by the ADTS using the remote test or error run test. If the trouble is isolated to the data set, replace the data set and repeat the test.

3.05 If the trouble persists after the tests have been completed, proceed as follows:

(a) Check fo physical damage to data station equipment.

(b) Verify that all cords and connectors are properly connected.

(c) Check that options installed in data set agree with those specified on service order.

(d) Verify that customer-provided equipment (CPE) has been tested and is operating properly.

(e) Check for intermittent trouble in station wiring.

(f) Verify that data set and CPE are connected to a common ground.

(g) If trouble persists, request help from immediate supervisor, who may then obtain technical support from DATEC (Data Technical Support) per Section 010-521-100.

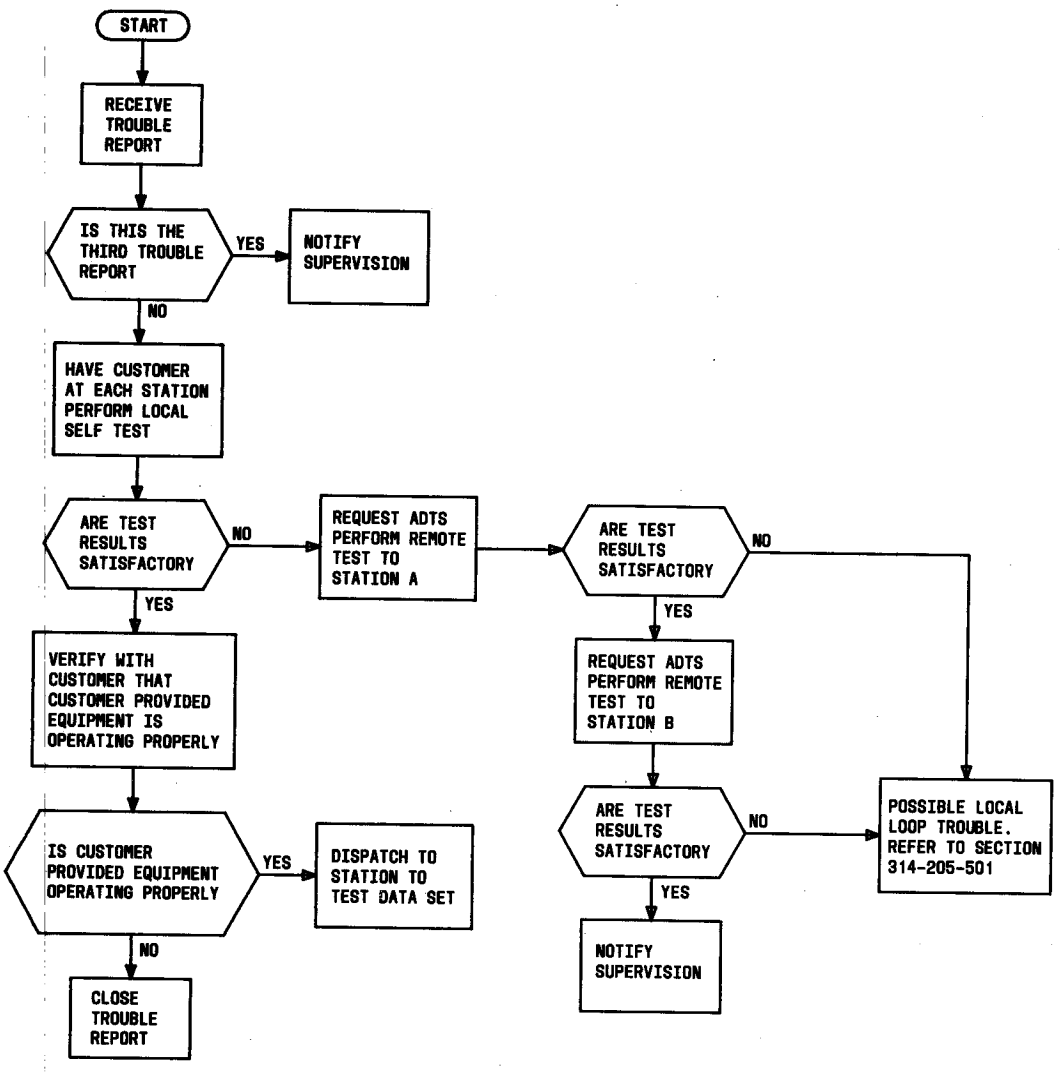


Fig. 2—Clearing Trouble Report

4. SELF TEST PROCEDURES

4.01 This part provides procedures for the installation and maintenance self tests.

4.02 This test checks the data set transmitter and receiver. The customer interface is not checked. Test data generated by the data set is looped back internally from the transmitter output to the receive input. The received data is compared

to the original data. Under normal conditions, all the data set indicator lamps are lighted; however, if an error is detected, the TM lamp goes off.

4.03 Perform the test as follows:

(1) Ensure that data set is not transmitting or receiving data.

(2) Firmly depress and hold LT switch for at least 15 seconds.

Note: If LT switch is depressed slowly, TM lamp may go off in a nondefective data set.

Requirement: TM lamp remains lighted while LT switch is depressed.

(3) If requirement specified in (2) is not met, repeat (2) four more times.

Requirement: TM lamp remains lighted during all four repeats.

5. ADTS TEST PROCEDURES

A. General

5.01 This part provides instructions necessary for the proper operation of ADTS from field data sets. Included are instructions for entering and leaving the system and for performing installation and maintenance tests.

5.02 Operations involving ADTS require man/machine interaction. With DIVA, the information is entered into ADTS by tones from a TOUCH-TONE dial. The system outputs a message by a voice response unit, and the user receives the message via the telephone handset.



Every entry from a TOUCH-TONE dial must be followed by a TOUCH-TONE star (*) except when calling the DIVA port number. To avoid repetition, the star entry has not been included in the text but should be understood as included whenever an entry is mentioned.

5.03 The ADTS must be on-line and DIVA must be up to accept DIVA tests.

Functions Available Via DIVA (Table B)

5.04 The test functions available via DIVA initiate a static or dynamic test of a data set. When 3 is used as a prefix with a test function, a fast test is performed on the data set without review of the line card information and without receiving test instructions.

5.05 ***Test Function List:*** With an entry of 8, DIVA will respond with a message of all test functions that can be performed on DS 202S.

5.06 ***Remote Test:*** This function provides a remote test of DS 202S by the ADTS. The remote test is initiated by entering 78; the fast remote test by entering 378.

5.07 ***Error Run Test:*** This function provides an error run test between the data set and the ADTS in each direction (half duplex). A 921A or a 914-type DTS is required at the data set. Bit or block errors are automatically recorded for various combinations of pseudorandom data sequences and for various periods of time. The data sequences and the periods of time are user specified. Use of the 921A or 914-type DTS requires an initial test setup as described in paragraphs 5.43 and 5.62, respectively. The error run test is initiated by entering 37; the fast error run test by entering 337.

5.08 ***Results:*** This function provides results of the most recent test of the data set. The results function is initiated by entering 7. In response to the results function entry, the ADTS gives the audible query WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After receiving a number, the ADTS outputs the results in a format similar to the following:

THE TEST RESULTS ARE:

THE DATA SET CODE IS (data set code)

THE RECEIVED SIGNAL LEVEL IS OUT OF LIMITS

WHAT IS THE FUNCTION YOU WISH TO PERFORM?

5.09 ***Stop:*** This function stops the present function and requests a new function. The stop function is initiated by entering #73.

5.10 *Off:* This function stops the present function and disconnects the DIVA port. The off function is initiated by entering #63.

Accessing ADTS

5.11 Access to ADTS by DIVA is obtained by placing a call to a DIVA port number. Depending on the mode of ADTS and the mode of DIVA, one of four actions will occur:

(a) Busy signal; all DIVA ports are busy. Try again later.

(b) Call not answered; DIVA is in the down mode.

(c) Call answered; the user will hear a 1-second burst of answer tone. Following the answer tone will be the audible query: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD. Once the password has been entered, the system responds with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

(d) Call answered; the user will hear: THE ADTS IS OFF-LINE. The ADTS will automatically abort the task. The ADTS must be put on-line by entering ONLIN to the function query on a terminal at the ADTS. The user may then place a call to a DIVA port number and access the ADTS.

5.12 The user may shorten the password-function request formalities by inputting both the password and the desired function in one entry (no intervening *). If both the password and function are valid, ADTS begins executing the function immediately. To shorten the time required to set up a test, answers to familiar questions asked by DIVA may be given while the question is in progress.

5.13 Information is entered into ADTS by letters or numbers on the TOUCH-TONE dial. Numbers are entered into ADTS by depressing the desired digits on the TOUCH-TONE dial. Letters are entered into ADTS by using the following format:

(a) Depress #.

(b) Depress button with desired letter on it.

(c) Depress a number (1, 2, or 3) corresponding to the letter's position on the button [depressed in (b)].

5.14 In response to a YES or NO question, the following format is used:

(a) YES, enter one (1).

(b) NO, enter zero (0).

5.15 The user can again listen to the last spoken message, by entering #* (Table A).

Performing Tests

5.16 To start a test, the user enters the desired number code from Table B. The ADTS response is WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After the number has been entered, the ADTS response is YOU HAVE ENTERED (telephone or special service circuit number). IS THAT CORRECT? The user enters 1 for YES or 0 for NO. If the response is incorrect, ADTS repeats the original query.

5.17 If the response is correct, ADTS will attempt to find a line card file (LCF). If an LCF is found, ADTS will use the data set code to find the test program. If there is a test program for the data set code and test function entered, ADTS will continue. If no test program is found, ADTS will abort the test with the following message: THE ADTS CANNOT RUN SELECTED TEST ON THIS DATA SET. (Since there are test programs available for data set 202S—78 and 37—this response indicates that the wrong test code was entered.)

5.18 If both an LCF and test program are found, the LCF information is given to the user. The user is then given a chance to make any necessary changes.

5.19 If no LCF is found, the ADTS response is THE DATA SET IS NOT ON FILE. ENTER THE DATA SET CODE. The user must then answer this question and others to create an LCF. In this case the entry would be 202#73*. After entry of the data set code, ADTS checks for the test program.

5.20 After the LCF information has been given or after new line card information has been

TABLE A

TOUCH-TONE CODES FOR DIVA

FUNCTION	DEPRESS BUTTON(S)	DESCRIPTION
1, 2, 3, . . .etc.	Appropriate button(s)	Digits
#	#	Prefix character.
*	*	TOUCH-TONE star. Used at end of all entries as EOL character.
A,B,C, . . .etc.	Depress number sign, button on which character appears, and digit corresponding to the relative position of the letter (1,2, or 3). Example: For the letter A #21	Alphabetic characters.
Yes	1*	Answer yes to a question.
No	0*	Answer no to a question.
Repeat	#*	Repeats last message spoken by the system.
Telephone Number	Example: 3115552368*	Enter telephone number in sequence followed by EOL.
Data Set Code	Example: 202#23* Example: 202#235* Example: 401#515*	202C 202C5 401J5
Data Set Transmit Level	Example: 12*	-12 dBm. Eliminate sign and units designation. Enter numerical value.

TABLE B

FUNCTIONS AVAILABLE VIA DIVA

FUNCTION	DESCRIPTION	NORMAL	FAST
Test List	Lists valid test functions.	8*	
Remote Test	Dynamic test of a data set.	78*	378*
Error Run Test	Tests a data set with data test set connected.	37*	337*
Results	Outputs results of most recent test of a data set.	7*	
Stop	Stops present function and requests new function.	#73*	
Off	Stops present function and disconnects.	#63*	

entered ADTS instructs the user TO CORRECT ERRORS ENTER ONE. IF NO ERRORS, ENTER ZERO. If a 1 is entered, ADTS repeats the line card information query.

5.21 If no corrections are made to the LCF, ADTS asks ARE YOU CALLING FROM THE DATA SET? If the user is calling from a data set, the user must hang up prior to running the test. ADTS will then call the data set for testing. After the test has been completed, ADTS calls the data set again to give the user the results of the test. The test instructions direct the user on this procedure.

5.22 The ADTS asks the user DO YOU WANT INSTRUCTIONS? If requested, ADTS will supply test instructions. These instructions are to prompt the user, not to replace the data set BSP instructions.

5.23 After the instructions, ADTS gives the following message: WHEN READY, ENTER ONE. Upon receipt of a 1, ADTS responds THANK YOU. A pause will follow the thank you message as ADTS attempts to seize the hardware needed for the test. If the test hardware is busy performing another test or a self test, ADTS gives the following message: THE ADTS TEST EQUIPMENT IS BUSY, PLEASE WAIT. When the test hardware becomes available, ADTS outputs THE TEST IS READY TO START.

5.24 At completion of the test, the user receives a short message describing the test results. When the data set fails, the system gives the reason(s) for failure. After giving the results of the data set test, the system returns to the function query.

Leaving ADTS

5.25 ***Manual Abort:*** Whenever the system is expecting user input, the user can abort the operation by entering #73 (the letter S) or #63 (the letter O). The letter S, for STOP, causes ADTS to abort the operation and return to the function query. The letter O, for OFF, causes ADTS to abort the operation and the DIVA port to hang up.

5.26 ***Automatic Abort:*** The ADTS automatically performs the equivalent of a user OFF if the user does not respond to a system request. Thirty seconds without a user entry after the original function query, ADTS will repeat the query. Thirty seconds after the second query without a user entry, ADTS will repeat the query for the third time. Thirty seconds after the third query without a user entry, ADTS will abort the task and hang up. If incorrect or illogical entries are made three successive times, ADTS will perform the equivalent of an OFF. After each invalid entry, an appropriate error message such as THE NUMBER IS INVALID, PLEASE REENTER will be spoken. After a third invalid entry, ADTS will abort the task and hang up.

B. Remote Test

5.27 Call the DIVA port number of the serving ADTS, using a TOUCH-TONE (TT) dial or pad. A 1-second answer tone will be heard in the handset. After the answer tone will be the following: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD.

> ***Note 1:*** If the above message is not heard, refer to paragraph 5.11.
>
> ***Note 2:*** TOUCH-TONE stars are shown hereafter as required.

5.28 Enter the 4-character password, followed by a *, on the TT dial. ADTS will respond with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.29 Enter 78* on the TT dial. (The fast test, which omits line card review and test instructions, may be requested by entering 378*.) ADTS will respond with REMOTE TEST. WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER?

5.30 Enter the data set telephone number, followed by *, on the TT dial. ADTS will respond with YOU HAVE ENTERED (telephone number). IS THAT CORRECT?

5.31 If the number is correct, enter 1* on the TT dial. If the number is incorrect, enter 0* on the TT dial.

5.32 If 0* was entered, the query in paragraph 5.29 will be repeated. If 1* was entered, ADTS will respond with THE DATA SET CODE IS 202S. NO REVERSE CHANNEL. ARE YOU

CALLING FROM THE DATA SET? To respond "yes" enter 1*: to respond "no", enter 0*.

5.33 ADTS continues: TO CORRECT ERRORS ENTER ONE. IF NO ERRORS ENTER ZERO. Enter 1* to change the data set code. Follow this with an entry of 202#73* to select DS 202S.

5.34 This question follows: DO YOU WANT INSTRUCTIONS? A 1* reply requests instructions, which are as follows:

(1) When ADTS is called from a telephone other than the data set: RELEASE ALL SWITCHES ON THE DATA SET TO THE OUT POSITION. DEPRESS THE RT SWITCH ON THE DATA SET. THE ADTS WILL CALL THE DATA SET. LEAVE THIS TELEPHONE OFF-HOOK TO RECEIVE THE TEST RESULTS AT THE COMPLETION OF THE TEST.

(2) When ADTS is called from the data set telephone: RELEASE ALL SWITCHES ON THE DATA SET TO THE OUT POSITION. ON THE TONE DEPRESS THE RT SWITCH ON THE DATA SET AND THEN HANG UP. THE ADTS WILL CALL THE DATA SET. WHEN THE TEST IS COMPLETED, THE ADTS WILL CALL THE DATA SET AGAIN TO REPORT THE TEST RESULTS.

5.35 The ADTS then responds: DO YOU WANT THESE INSTRUCTIONS REPEATED? Enter 1* for "yes" or 0* for "no". A "yes" answer causes the instructions to be repeated.

5.36 The ADTS then gives the message WHEN READY ENTER ONE.

5.37 When the user is satisfied that the instructions are understood, enter 1*, to which the ADTS responds PLEASE WAIT. THE TEST IS READY TO START.

5.38 On conclusion of the test the ADTS will call the data set. The user answers the call in the talk mode. The ADTS then gives the following message: TO RECEIVE TEST RESULTS, ENTER ONE.

5.39 If the test was satisfactorily completed the ADTS gives the results as follows:

THE TEST RESULTS ARE:

THE RECEIVED LEVEL IS (-11 to -38) DBM.
THE NUMBER OF BIT ERRORS WAS (20 or less).
THE DATA SET TESTS OK. PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.40 Enter next function or enter #63* if another test will not be performed at this time.

5.41 If the data set failed the test, one or more of the following messages is given:

- NO ANSWER. TEST ABORTED.
- CARRIER WAS NOT RECEIVED.
- NO DIAL TONE. TEST ABORTED.
- THE RECEIVED SIGNAL LEVEL IS OUT OF LIMITS.
- THE NUMBER OF BIT ERRORS DETECTED WAS TOO HIGH.
- THE ANSWER TONE WAS NOT RECEIVED. TEST ABORTED.
- THE DATA SET DID NOT SEND STEADY MARK IN RESPONSE TO REVERSE CHANNEL.
- THERE HAS BEEN AN ADTS TEST EQUIPMENT MALFUNCTION. TRY AGAIN LATER.
- THE RECEIVED SIGNAL WENT OFF DURING MEASUREMENT.
- THE DATA SET SENT STEADY SPACE DURING THE TWO-MINUTE 63-BIT PSEUDORANDOM TEST INTERVAL.
- THE REVERSE CHANNEL TONE WAS NOT RECEIVED.
- THE DATA SET DID NOT SEND STEADY SPACE IN RESPONSE TO THE STEADY SPACE ERROR INJECT SIGNAL.

- THE DATA SET DID NOT SEND STEADY SPACE IN RESPONSE TO REMOVAL OF REVERSE CHANNEL.
- THE DATA SET FAILED THE TEST.

5.42 The ADTS repeats the function query. Enter next function or enter #63* if another test will not be performed.

C. End-to-ADTS Error Run Test Using 921A DTS

Initial Test Setup for 921A DTS

5.43 Perform the initial test setup for the 921A DTS when used to test DS 202S as follows:

STEP	ACTION	VERIFICATION
1	Connect data set to DTS using interface cable and Electronic Industries Association (EIA) adapter cord provided with DTS. ***Note:*** The interface cable is equipped with two 37-pin connectors. The 6-inch adapter cord is equipped with a 37-pin female connector and a 25-pin male connector. Connect interface cable from DATA SET (DCE) connector on DTS to 37-pin connector on adapter cord. Insert 25-pin connector on adapter cord into customer interface connector on data set.	
2	Connect DTS to a 105- to 129-Vac 60-Hz power source.	
3	Apply power to data set.	Data set ON lamp lights.
4	On front of DTS, set POWER switch to ON.	POWER lamp lights.
5	Press RST on keyboard. ***Note:*** If RST is pressed during a test, the test is ended and the DTS recycles to this step.	Display reads (briefly) version number of DTS. DTS then performs self tests. If DTS is defective, display reads— TEST FAILED If DTS is satisfactory, display reads— DATA SET:
6	Remove EIA interface module from storage and ensure that all 25 interface module switches are in TERM position.	
7	On right side of DTS, ensure that locking lever is in OPEN position.	
8	Insert interface module into slot.	
9	Move locking lever to CLOSE position.	
10	On front of DTS, ensure that all 37 DCE interface lead switches are in NORM position except that switch 11 is in OPEN position.	

STEP	ACTION	VERIFICATION
11	Enter 24. ***Note:*** To delete a wrong entry on keyboard during any test, press back arrow (←).	Display reads— DATA SET: 24
12	Press GO.	Display reads— BIT RATE:
13	Enter 12.	Display reads— BIT RATE: 12
14	Press GO. ***Note:*** If GO or TST is pressed at an unauthorized point in a test, the test is ended and the DTS recycles to this step.	Display reads— TEST SEQ:
15	For Version 1 DTS, set DCE interface lead switch 20 to OPEN and connect a jumper wire between DCE interface lead jacks 9 and 20.	

5.44 Call the DIVA port number of the serving ADTS, using a TOUCH-TONE (TT) dial or pad. A 1-second answer tone will be heard in the handset. After the answer tone will be the following: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD.

Note: If the above message is not heard, refer to paragraph 5.11.

5.45 Enter the 4-character password, followed by a ✱, on the TT dial. ADTS will respond with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.46 Enter 37✱ on the TT dial. (The fast test, which omits line card review and test instructions, may be requested by entering 337✱.) ADTS will respond with WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER?

5.47 Enter the data set telephone number, followed by ✱, on the TT dial. ADTS will respond with YOU HAVE ENTERED (telephone number). IS THAT CORRECT?

5.48 If the number is correct, enter 1✱ on the TT dial. If the number is incorrect, enter 0✱ on the TT dial.

5.49 If 0✱ was entered, the query in paragraph 5.46 will be repeated. If 1✱ was entered, ADTS will respond with THE DATA SET CODE IS 202S. ACCESS TYPE LAST USED WAS DDD, ADTS ORIGINATED. TO CORRECT ERRORS ENTER ONE. IF NO ERRORS ENTER ZERO.

5.50 Enter 1✱ to change the data set code. Follow this with an entry of 202#73✱ to select DS 202S.

5.51 Enter 1✱ to change the data set access type. The ADTS responds with ENTER THE DATA SET ACCESS TYPE.

1. DDD, ADTS ORIGINATED
2. DDD, DATA SET ORIGINATED
3. RTAU
4. RTS.

5.52 If there are no more corrections, the ADTS asks the following question: DO YOU WANT THE ADTS TO TRANSMIT TO THE DATA SET?

5.53 A "yes" or "no" answer is followed by the following question: DO YOU WANT TO USE THE STANDARD TEST PARAMETERS?

(Standard test parameters are: test time, 1 minute; word bit length, 511; bit error count.) A "yes" answer is followed by PLEASE WAIT; a "no" answer by the following: ENTER THE TEST TIME IN MINUTES. ENTER THE WORD BIT LENGTH: 15, 63, 511, OR 2047 BITS.

5.54 If the answer to the question in paragraph 5.53 was "no", the following message is given: DO YOU WANT TO DETECT BLOCK ERRORS? The response to a "yes" is ENTER THE BLOCK WORD LENGTH. An acceptable answer is 1, 2, 4, 8, or 16. If response is "no", a bit error count is made. With the proper answer, the ADTS responds PLEASE WAIT, then ARE YOU CALLING FROM THE DATA SET? A "yes" or "no" answer is acceptable.

5.55 A "yes" reply to the question DO YOU WANT INSTRUCTIONS? prompts the following message if the ADTS is originating the call and the call is not initiated from the data set: THE ADTS WILL CALL THE DATA SET AND START THE TEST AFTER THE DATA SET ANSWERS. LEAVE THIS TELPHONE OFF-HOOK TO RECEIVE THE TEST RESULTS. WHEN READY ENTER ONE.

5.56 When the call is from the data set the instructions are: ON THE TONE, HANG UP. THE ADTS WILL CALL AND TEST THE DATA SET. WHEN THE TEST IS COMPLETED, THE ADTS WILL CALL THE DATA SET TO REPORT THE TEST RESULTS OR YOU MAY CALL ADTS AND REQUEST THE TEST RESULTS.

ADTS Transmitting Data

5.57 If the ADTS is to transmit to the data set, this message follows: ADTS TEST DATA TRANSMISSION WILL BE PRECEDED BY 30 SECONDS OF GOOD DATA FOLLOWED BY THE INJECTION OF 10 BIT ERRORS.

5.58 During this initial period of data transmission, prepare the 921A DTS to receive the test data as indicated in the steps below. Receipt of bit errors is a positive indication that transmission is taking place. The time entered in Step 9 must be less than the time requested for the ADTS test, since erroneous errors will be produced if the 921A DTS looks for data when none is being transmitted.

STEP	ACTION	VERIFICATION
1	Ensure that initial test setup described in paragraph 5.43 has been performed. ***Note:*** If GO or TST is pressed at an unauthorized point in the following tests, the test in progress is ended and the DTS recycles to the start of that test (last preceding step that display read TEST SEQ:).	Display reads— TEST SEQ:
2	On data set, depress AL switch. TM lamp lights.	
3	Enter 55.	Display reads— TEST SEQ: 55
4	Press GO.	Display reads— TRANSMITTER=? 1=921 2=914 3=903
5	Enter 1.	Display reads (briefly)— TRANSMITTER=1 1=921 2=914 3=903 Display then reads (briefly)— SELECT ERROR TEST Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63

STEP	ACTION	VERIFICATION
6	Enter 5.	Display reads (briefly)— 511 BIT ERROR TEST Display then reads— 1=BIT ERRORS 2=BLOCK ERRORS
7	Enter 2.	Display reads— ????? BITS IN A BLOCK
8	Enter 01024.	Display reads (briefly)— 01024 BITS IN A BLOCK Display then reads— ???? SECONDS
9	Enter 0060. ***Note:*** To perform functions listed below, press associated key.	Display reads (briefly)— 0060 SECONDS Display then reads— BLK RCVD=0000 ERR=0000 From this point, display counts number of blocks received and number of blocks in error. If sync is lost during test, display flashes OSYN. If this occurs, test must be repeated by pressing A. At end of test, display reads TEST COMPLETE, total snyc losses, total blocks received, and total blocks in error.

KEY	FUNCTION
A	Repeat test.
B	Display time remaining in test.
C	Clear display.
D	End test.
E	Inject 8 errors into data stream.
F	Force out-of-sync condition.

10	Press TST.	Display reads— TEST SEQ:

ADTS Receiving Data

5.59 If the ADTS is to receive data from the data set, perform the following steps at the transmitting station:

STEP	ACTION	VERIFICATION
1	Ensure that initial test setup described in paragraph 5.43 has been performed.	Display reads— TEST SEQ:
2	Enter 53.	Display reads— TEST SEQ: 53

STEP	ACTION	VERIFICATION
3	Press GO.	Display reads (briefly)— SELECT ERROR TEST Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63
4	Enter 5.	Display reads— 511 BIT ERROR TEST
5	Place data set in data mode.	On DTS, DSR indicator lights (data set ready lead ***on***) Display continues to read— 511 BIT ERROR TEST

5.60 After all instructions are performed and the test is complete, the ADTS gives this message: THE TEST RESULTS ARE (results). THE TEST TIME WAS (number of) MINUTES. DO YOU WANT TO RUN ANOTHER TEST?

5.61 The ADTS gives error message(s) as shown in paragraph 5.41 if the data set test was not performed successfully.

D. End-to-ADTS Error Run Test Using 914-Type DTS

Initial Test Setup for 914-Type DTS

5.62 Perform the initial test setup for the 914-type DTS when used to test DS 202S as shown in Fig. 3.

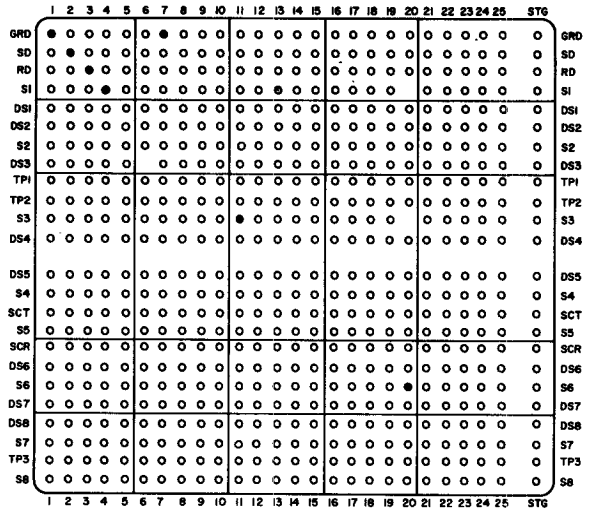
5.63 Repeat paragraphs 5.44 through 5.57 as for the error run test using the 921A DTS.

ADTS Transmitting Data

5.64 If the ADTS is to transmit to the data set, this message follows: ADTS TEST DATA TRANSMISSION WILL BE PRECEDED BY 30 SECONDS OF GOOD DATA FOLLOWED BY THE INJECTION OF 10 BIT ERRORS. Following this, the ADTS sends good data for the time specified.

5.65 During this initial period of data transmission, prepare the 914-type DTS to receive the test data as indicated in the steps below. Receipt of bit errors is a positive indication that transmission is taking place. The time counter set in Step 8 must be shorter than the time requested for the ADTS test, since erroneous errors will be produced if the 914-type DTS looks for data when none is being transmitted.

STEP	PROCEDURE
1	Set COUNTER switch to BLOCK ERRORS 16 WL, (63-bit word).
2	Apply power to the data set and then to the 914-type DTS.
3	Depress locking AL switch on data set. (With DS 202S-L1, wait 3 seconds before proceeding.)
4	Operate switch S1 to ON.
5	Coordinate test procedure with transmitting end.
6	On the 914 DTS, move switch S3 (DTR) to ON.



914 DTS MATRIX

NOTES:

1. SET SWITCHES ON THE 914 DTS AS FOLLOWS:

SWITCH	SETTING
INTERFACE SELECTOR A	ALL DEPRESSED
INTERFACE MODE	VOLTAGE
TEST SET MODE	SER (914C DTS)
	RCV SER (914B DTS)
COUNTER	BIT ERRORS
RCV BIT RATE	1200
RCV WORD LENGTH	63
TRANSMIT BIT RATE (914C)	1200
TRANSMIT WORD LENGTH (914C)	63
SIG LEV	±4V
SWITCH S1, S3	OFF
SWITCH S6	ON
SAMPLE WIDTH	30%

2. 914 DTS INDICATOR LAMPS AND SWITCHES CORRESPOND TO THE FOLLOWING INTERFACE LEADS.
3. INSTALL RED MATRIX PINS AS NOTED.

SWITCH	LEAD
S1	REQUEST TO SEND
S3	SECONDARY REQUEST TO SEND
S6	DATA TERMINAL READY

Fig. 3—End-to-ADTS Error Run Test Setup Using 914-Type DTS

STEP	PROCEDURE
7	Go to data mode.
8	Reset counter.
9	Counter should count at least once and shortly thereafter the NO DATA lamp should illuminate.
10	Reset counter. The NO DATA lamp should extinguish.
11	Counter should record zero counts (zero block errors).
12	At end of 5-minute interval, go to talk mode and give results.
13	End of test. Return equipment to normal operating condition.

ADTS Receiving Data

5.66 If the ADTS is to receive data from the data set, perform the following steps at the transmitting station:

STEP	PROCEDURE
1	Remove all programming pins.
2	Insert programming pins at GRD-1, SD-2, RD-3, S1-4, GRD-7, S3-11, and S6-20.
3	Set TEST SET MODE to SER (914C) or TRMT SER (914B).
4	Set counter to BIT ERRORS.
5	Set RCV BIT RATE to 1200.
6	Set RCV WORD LENGTH to 63.
7	Set TRANSMIT BIT RATE to 1200.
8	Set TRANSMIT WORD LENGTH to 63.
9	Set switches S1 and S3 to OFF.
10	Set switch S6 to ON.
11	Apply power to the data set and then to the 914-type DTS.

STEP	PROCEDURE
12	Call the receiving end to coordinate test procedure.
13	On the 914 DTS, move switch S3 (DTR) to ON.
14	Go to data mode.
15	Set S1 (RS) to ON.
16	To verify equipment is operating properly, set switch S1 (RS) to OFF.
17	Set switch S1 (RS) to ON.
18	Conduct 5-minute error run.
19	At end of 5-minute interval, go to talk mode.
20	End of test. Return equipment to normal operating condition.

5.67 After all instructions are performed and the test is complete, the ADTS gives this message: THE TEST RESULTS ARE (results). THE TEST TIME WAS (number of) MINUTES. DO YOU WANT TO RUN ANOTHER TEST? At the conclusion of test, enter #63* on the TT dial to end the test and hang up the DIVA port.

6. REFERENCES

6.01 Additional information concerning DS 202S and use of the ADTS is contained in the following publications:

SECTION	TITLE
107-101-100	914-Type Data Test Sets—Description and Operation
107-402-100	921A Data Test Set—Description and Operation
314-205-501	Data Systems—DATAPHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines
590-010-500	J1P005 Automatic Data Test System (ADTS)—Operation From Field Locations
592-028-100	Data Set 202S Transmitter-Receiver—Description and Operation
592-028-150	Data Set 202S Transmitter-Receiver—Supplementary Information
592-028-200	Data Set 202S Transmitter-Receiver—Installation and Connections
592-028-500	Data Set 202S Transmitter-Receiver—Test Procedures Using 914-Type Data Test Set
592-028-501	Data Set 202S Transmitter-Receiver—Test Procedures Using 921A Data Test Set

TESTING DATA SET 208B-TYPE FROM FIELD LOCATIONS USING J1P005 AUTOMATIC DATA TEST SYSTEM (ADTS)

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1. GENERAL

1.01 This section provides self test and field test information for data set (DS) 208B-type. Remote and error run tests are provided using the J1P005 ADTS. These procedures are to be used when testing DS 208B-type on an initial installation or during a maintenance visit.

1.02 When this section is reissued, the reason for reissue will be presented in this paragraph.

1.03 The self tests require no external test equipment, and are included here for completeness.

1.04 This section contains information for testing DS 208B by means of DIVA (Digital Inquiry Voice Answer). DIVA requires a TOUCH-TONE® dial telephone, or a rotary dial telephone used with a KS-21799-L1 (or equivalent) portable TOUCH-TONE pad.

1.05 In this section, the term "user" refers to telephone company (telco) personnel at the data set responsible for interfacing the data set with the ADTS.

1.06 Test circuitry built into DS 208B-type permits the following self tests to be performed: lamp, analog loopback, end-to-end, and end-to-end start-up. Additional tests require the use of external test equipment such as a 921A data test set (DTS) and/or the ADTS.

NOTICE
Not for use or disclosure outside the
Bell System except under written agreement

A. Self Tests

1.07 General self-test information is presented in paragraphs 1.08 through 1.11. Detailed self test procedures are presented in paragraphs 4.02 through 4.07.

Lamp Test

1.08 The lamp test (LP) nonlocking switch, when depressed, lights the TR, MR, RS, CS, CO, and ER lamps to verify proper operation of these lamps. The LP switch can be depressed at any time, as it does not affect normal data set operation. On DS 208B-L1B, when the AL and ST switches are depressed, the LP switch circuit is reconfigured to introduce errors (spaces) for test purposes.

Analog Loopback Self Test

1.09 This test is initiated by depressing the analog loopback (AL) and self-test (ST) locking switches. Depressing the AL switch connects the data set transmitter to the data set receiver through an internal pad. Depressing the ST switch turns ***on*** the internal request-to-send (CA) lead, transmits a steady mark on the internal send-data (BA) lead, and conditions the ER lamp to indicate received errors. On DS 208B-L1B, depressing the LP switch causes steady spaces to be sent.

End-to-End Self Test

1.10 This test is initiated, after a call connection has been established, by depressing the ST locking switch at the transmitting end and the ST and RO (receive only) locking switches at the receiving end and then transferring to the data mode. This conditions the transmitting end to transmit steady marks. The ER lamp at the receiving end indicates any errors made in transmission. The direction of transmission can be reversed by releasing the RO switch at the receiving end (which now becomes the transmitting end) and depressing the RO switch at the transmitting end (which now becomes the receiving end). On DS 208B-L1B, depressing the LP switch causes steady spaces to be sent.

End-to-End Start-Up Self Test (DS 208B-L1A or -L1B)

1.11 This test is initiated, after a call connection has been established, by depressing the ST locking switch on the far-end data set and the ST and RO locking switches on the near-end data set and transferring to data mode. The ER lamp on the near end indicates any errors made in transmission. On DS 208B-L1B, depressing the LP switch causes steady spaces to be sent.

B. ADTS Tests

1.12 General ADTS test information is presented in paragraphs 5.01 through 5.26. Detailed ADTS test procedures are presented in paragraphs 5.27 through 5.63.

2. INSTALLATION TESTS

2.01 This part provides the sequence in which tests are to be performed following installation of the data set. This test sequence (Fig. 1) provides a method of verifying that the installation is satisfactory. Before proceeding with the tests, verify that the local loop meets the requirements specified in Section 314-205-501.

3. MAINTENANCE TESTS

3.01 This part provides the sequence in which tests are to be performed when clearing a trouble report and during a maintenance visit to the data station.

3.02 When a trouble report is received, a test center or ADTS is responsible for isolating the trouble to the data station or the transmission facility. The procedure for doing this is shown in Fig. 2.

3.03 If the trouble seems to be in the data station equipment, a telephone company (telco) employee must be dispatched to conduct more extensive tests at the data station. The following equipment should be taken on a trouble visit:

- 921A or 914-type DTS
- Maintenance kit

3.04 The maintenance kits consist of replacement circuit packs for DS 208-type. Circuit packs in the maintenance kits not used in DS 208B-type are used to support DS 208A-type. The available maintenance kits are as follows:

- D-180497 for DS 208B-L1

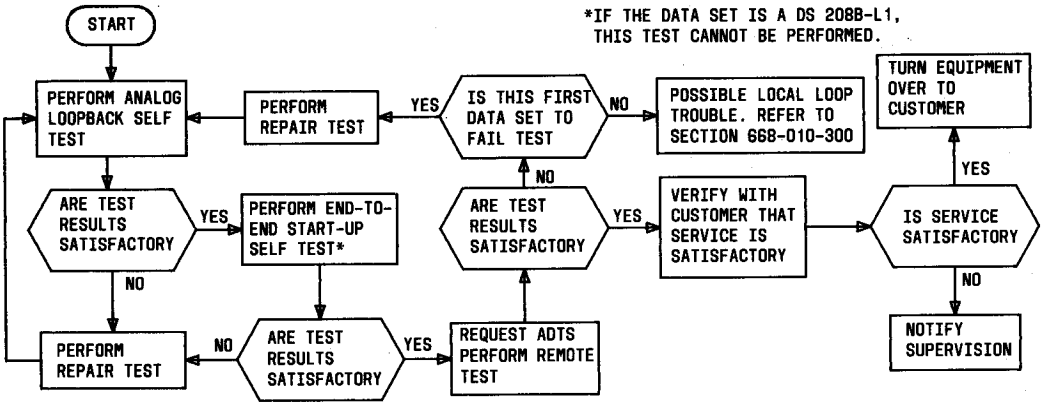


Fig. 1—Installation Test Sequence

- D-180657 for DS 208B-L1 or -L1A
- D-180718 for DS 208B-L1, -L1A, or -L1B

3.05 Troubleshooting is performed by the ADTS using the remote test or block error test. If the trouble is isolated to the data set, the repair test procedures in paragraphs 5.64 and 5.65 are to be performed to isolate the trouble to a circuit pack in the data set.

3.06 If a circuit pack is replaced, tag the defective circuit pack with a description of the trouble and carefully pack the circuit pack in the shipping carton supplied with the maintenance kit. Mark the carton with the data set code, circuit pack code, and date of manufacture. For example:

Data set 208B

HG11 IV 75

Send the properly packed and marked carton to the telco supplies operation group and notify that group in the normal manner that a replacement circuit pack is needed. The telco supplies operation group will place a requisition for a replacement circuit pack with the local Western Electric service center which will expedite the requisition to the Montgomery (ILL) merchandise organization to ensure its receipt within 24 hours. The Montgomery merchandise organization will ship the circuit pack (via fastest method) directly to the designated telco location within 24 hours after receiving the requisition.

3.07 If the trouble persists after the tests have been completed, proceed as follows:

(a) Check that options installed in data set agree with those specified on service order.

(b) Verify that customer-provided equipment (CPE) has been tested and is operating properly.

(c) Check for physical damage to data station equipment.

(d) Verify that all cords and connectors are properly connected.

(e) Check for intermittent trouble in station wiring.

(f) Verify that data set and CPE are connected to a common ground.

(g) If trouble persists, request help from immediate supervisor.

4. SELF TEST PROCEDURES

4.01 This part provides procedures for the installation and maintenance self tests.

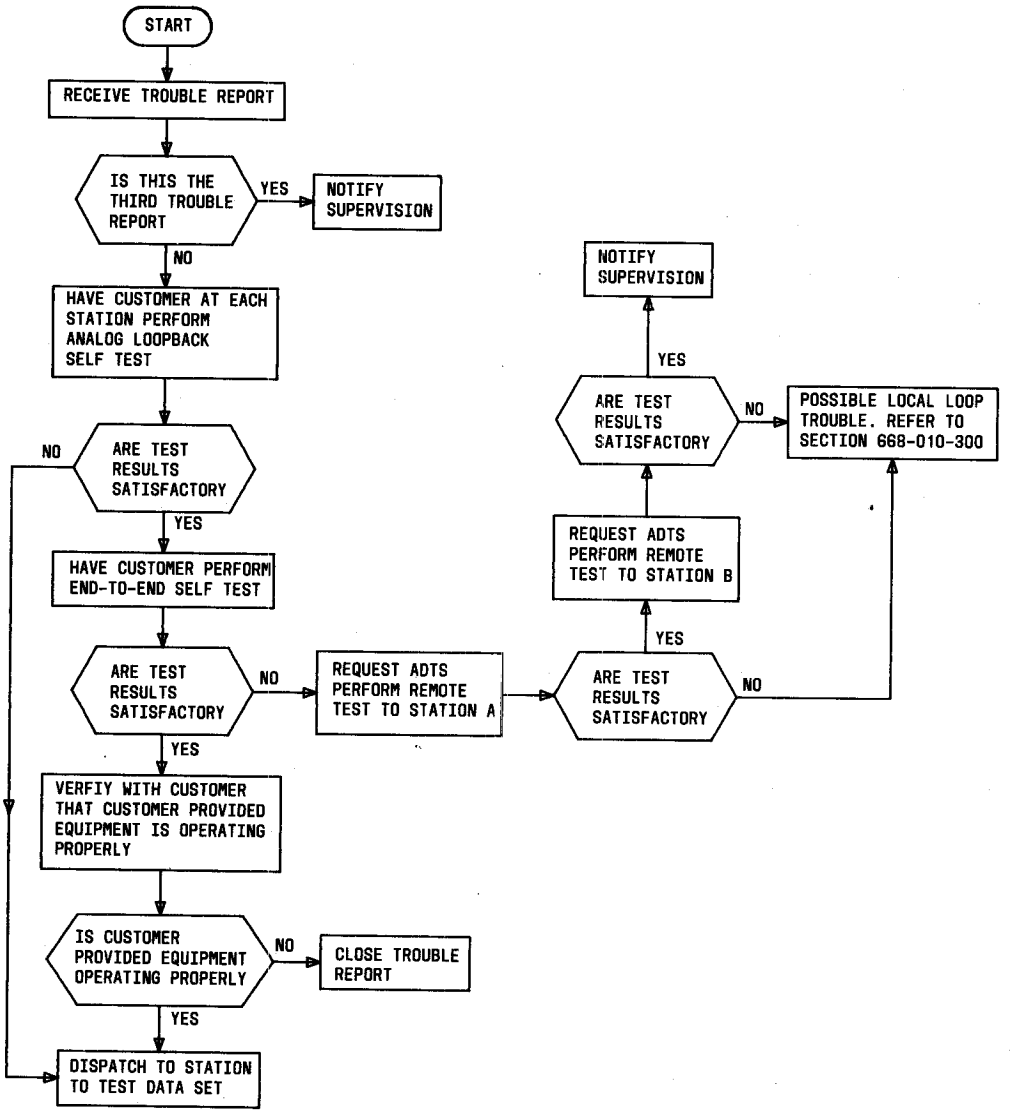


Fig. 2—Clearing Trouble Report

A. Analog Loopback Self Test

4.02 This test checks the data set transmitter and receiver. The customer interface is not checked.

4.03 Perform the test as follows:

(1) Ensure that data set is not transmitting or receiving data.

(2) Depress LP switch on data set.

Requirement: All lamps are lighted.

(3) Depress AL and ST switches on data set.

Requirements: ON, RS, CS, and CO lamps are lighted. ER and MR lamps are off. On DS 208B-L1 and -L1A, TR lamp may be lighted or off, depending on state of CD lead. On DS 208B-L1B, TR lamp is extinguished.

Note: ER lamp goes off immediately. If ER lamp is lighted or blinks, data set has failed analog loopback self test.

(4) Depress LP switch on data set (DS 208B-L1B).

Requirements: ER lamp lights. TR and MR lamps remain off.

(5) Release ST and AL switches on data set.

B. End-to-End Self Test

4.04 This test checks the transmitter and receiver of both data sets and the facilities connecting the data sets. The customer interfaces are not checked.

4.05 Perform the test as follows:

(1) Call far-end data set and arrange to conduct an end-to-end self test.

(2) Request ST switch on far-end data set be depressed, and far-end data set be transferred to data mode by depressing DATA button on associated telephone set.

Requirements: ON, RS, CS, and ER lamps on far-end data set are lighted. On DS 208B-L1 and -L1A, MR and CO lamps are off. TR lamp may be lighted or off, depending on state of CD lead. On DS 208B-L1B, TR and MR lamps are lighted.

(3) Depress ST and RO switches on near-end data set, and then transfer to data mode by depressing DATA button on associated telephone set.

Requirements: ON and CO lamps on near-end data set are lighted. RS, CS, MR, and ER lamps are off. On DS 208B-L1 and -L1A, TR lamp may be lighted or off, depending on state of CD lead. On DS 208B-L1B, TR and MR lamps are lighted.

(4) Observe ER lamp on near-end data set for ten 1-minute periods.

Requirement: ER lamp does not blink more than an average of three blinks per 1-minute period.

(5) At a prearranged time, have LP switch on far-end data set (DS 208B-L1B only) depressed.

Requirements: ER lamp lights on near-end data set. TR and MR lamps remain off at far-end data set.

(6) After a prearranged time, return to talk mode to discuss results of test. If test failed, terminate call, place a second call to involve a different connecting path, and repeat test.

(7) Request ST switch on far-end data set be released.

(8) Release RO and ST switches on near-end data set.

C. End-to-End Start-Up Self Test (DS 208B-L1A or -L1B)

4.06 This test checks start-up performance with the 4-dB and 8-dB slope compromise equalizers.

4.07 Perform the test as follows:

(1) Call far-end data set and arrange to conduct an end-to-end start-up self test. (Far-end data set should be one customer will normally call or receive calls from.)

(2) Request ST switch on far-end data set be depressed, and far-end data set be transferred to data mode by depressing DATA button on associated telephone set.

Requirements: ON, RS, CS, and ER lamps on far-end data set are lighted. On DS 208B-L1 and -L1A, MR and CO lamps are off. TR lamp may be lighted or off, depending on state of CD lead. On DS 208B-L1B, TR and MR lamps are lighted.

(3) Depress ST and RO switches on near-end data set, and then transfer to data mode by depressing DATA button on associated telephone set.

Requirements: ON and CO lamps on near-end data set are lighted. On DS 208B-L1 and -L1A, RS, CS, MR, and ER lamps are off. TR lamp may be lighted or off, depending on state of CD lead. On DS 208B-L1B, TR and MR lamps are lighted.

(4) Install 4-dB slope compromise equalizer option (S2B up; S2C up) in near-end data set.

(5) Request RO switch on far-end data set be depressed and released at 5-second intervals for 1 minute.

Requirements: On near-end data set, CO lamp lights and ER lamp goes off at same time. ER lamp does not flicker.

(6) If ER lamp flickers more than twice during 1-minute period, install 8-dB slope compromise equalizer option (S2B down; S2C up) in near-end data set and repeat Step (5).

(7) Install 4-dB slope compromise equalizer option (S2B up; S2C up) in near-end data set, unless 8-dB slope compromise equalizer option produced at least three fewer flickers of ER lamp.

(8) Request ST switch on far-end data set be released.

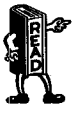
(9) Release RO and ST switches on near-end data set.

5. ADTS TEST PROCEDURES

A. General

5.01 This part provides instructions necessary for the proper operation of ADTS from field data sets. Included are instructions for entering and leaving the system and for performing installation and maintenance tests.

5.02 Operations involving ADTS require man/machine interaction. With DIVA, the information is entered into ADTS by tones from a TOUCH-TONE dial. The system outputs a message by a voice response unit, and the user receives the message via the telephone handset.



Every entry from a TOUCH-TONE dial must be followed by a TOUCH-TONE star (*) except when calling the DIVA port number. To avoid repetition, the star entry has not been included in the text but should be understood as included whenever an entry is mentioned.

5.03 The ADTS must be on-line and DIVA must be up to accept DIVA tests.

Functions Available Via DIVA (Table B)

5.04 The test functions available via DIVA initiate a static or dynamic test of a data set. When 3 is used as a prefix with a test function, a fast test is performed on the data set without review of the line card information and without receiving test instructions.

5.05 ***Test Function List:*** With an entry of 8, DIVA will respond with a message of all test functions that can be performed on DS 208B-type.

5.06 ***Remote Test:*** This function provides a remote test of DS 208B-type by the ADTS. The remote test is initiated by entering 78; the fast remote test by entering 378.

5.07 ***Error Run Test:*** This function provides an error run test between the data set and the ADTS in each direction (half duplex). A 921A or a 914-type DTS is required at the data set. Bit or block errors are automatically recorded for various combinations of pseudorandom data sequences and for various periods of time. The data sequences

and the periods of time are user specified. Use of the 921A or 914-type DTS requires an initial test setup as described in paragraphs 5.39 and 5.58, respectively. The error run test is initiated by entering 37; the fast error run test by entering 337.

5.08 ***Results:*** This function provides results of the most recent test of the data set. The results function is initiated by entering 7. In response to the results function entry, the ADTS gives the audible query WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After receiving a number, the ADTS outputs the results in a format similar to the following:

THE TEST RESULTS ARE:

THE DATA SET CODE IS (data set code)

THE RECEIVED SIGNAL LEVEL IS OUT OF LIMITS

WHAT IS THE FUNCTION YOU WISH TO PERFORM?

5.09 ***Stop:*** This function stops the present function and requests a new function. The stop function is initiated by entering #73.

5.10 ***Off:*** This function stops the present function and disconnects the DIVA port. The off function is initiated by entering #63.

Accessing ADTS

5.11 Access to ADTS by DIVA is obtained by placing a call to a DIVA port number. Depending on the mode of ADTS and the mode of DIVA, one of four actions will occur:

(a) Busy signal; all DIVA ports are busy. Try again later.

(b) Call not answered; either ADTS is off-line or DIVA is in the down mode.

(c) Call answered; the user will hear a 1-second burst of answer tone. Following the answer tone will be the audible query: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD. Once the password has been entered, the system responds with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

(d) Call answered; the user will hear the password query and then the following: THE ADTS IS OFF-LINE. PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM. The ADTS must be put on-line by entering ONLIN to the function query on a terminal at the ADTS.

5.12 The user may shorten the password-function request formalities by inputting both the password and the desired function in one entry (no intervening *). If both the password and function are valid, ADTS begins executing the function immediately. To shorten the time required to set up a test, answers to familiar questions asked by DIVA may be given while the question is in progress.

5.13 Information is entered into ADTS by letters or numbers on the TOUCH-TONE dial. Numbers are entered into ADTS by depressing the desired digits on the TOUCH-TONE dial. Letters are entered into ADTS by using the following format:

(a) Depress #.

(b) Depress button with desired letter on it.

(c) Depress a number (1, 2, or 3) corresponding to the letter's position on the button [depressed in (b)].

5.14 In response to a YES or NO question, the following format is used:

(a) YES, enter one (1).

(b) NO, enter zero (0).

5.15 The user can again listen to the last spoken message, by entering #* (Table A).

Performing Tests

5.16 To start a test, the user enters the desired number code from Table B. The ADTS response is WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After the number has been entered, the ADTS response is YOU HAVE ENTERED (telephone or special service circuit number). IS THAT CORRECT?

TABLE A

TOUCH-TONE CODES FOR DIVA

FUNCTION	DEPRESS BUTTON(S)	DESCRIPTION
1, 2, 3, . . .etc.	Appropriate button(s)	Digits
#	#	Prefix character.
*	*	TOUCH-TONE star. Used at end of all entries as EOL character.
A,B,C, . . .etc.	Depress number sign, button on which character appears, and digit corresponding to the relative position of the letter (1,2, or 3). Example: For the letter A #21	Alphabetic characters.
Yes	1*	Answer yes to a question.
No	0*	Answer no to a question.
Repeat	#*	Repeats last message spoken by the system.
Telephone Number	Example: 3115552368*	Enter telephone number in sequence followed by EOL.
Data Set Code	Example: 202#23* Example: 202#235* Example: 401#515*	202C 202C5 401J5
Data Set Transmit Level	Example: 12*	-12 dBm. Eliminate sign and units designation. Enter numerical value.

The user enters 1 for YES or 0 for NO. If the response is incorrect, ADTS repeats the original query.

5.17 If the response is correct, ADTS will attempt to find a line card file (LCF). If an LCF is found, ADTS will use the data set code to find the test program. If there is a test program for the data set code and test function entered, ADTS will continue. If no test program is found, ADTS will abort the test with the following message: THE ADTS CANNOT RUN SELECTED TEST ON THIS DATA SET. (Since there are test programs available for data set 208B-type—78 and 37—this response indicates that the wrong test code was entered.)

5.18 If both an LCF and test program are found, the LCF information is given to the user. The user is then given a chance to make any necessary changes.

5.19 If no LCF is found, the ADTS response is THE DATA SET IS NOT ON FILE. ENTER THE DATA SET CODE. The user must then answer this question and others to create an LCF. In this case the entry would be 208#22*. After entry of the data set code, ADTS checks for the test program.

TABLE B

FUNCTIONS AVAILABLE VIA DIVA

FUNCTION	DESCRIPTION	NORMAL	FAST
Test List	Lists valid test functions.	8*	
Remote Test	Dynamic test of a data set.	78*	378*
Error Run Test	Tests a data set with data test set connected.	37*	337*
Results	Outputs results of most recent test of a data set.	7*	
Stop	Stops present function and requests new function.	#73*	
Off	Stops present function and disconnects.	#63*	

5.20 After the LCF information has been given or after new line card information has been entered ADTS instructs the user TO CORRECT ERRORS ENTER ONE. IF NO ERRORS, ENTER ZERO. If a 1 is entered, ADTS repeats the line card information query.

5.21 If no corrections are made to the LCF, ADTS asks ARE YOU CALLING FROM THE DATA SET? If the user is calling from a data set, the user must hang up. ADTS will then call the data set for testing. After the test has been completed, ADTS calls the data set again to give the user the results of the test. The test instructions direct the user on this procedure.

5.22 The ADTS asks the user DO YOU WANT INSTRUCTIONS? If requested, ADTS will supply test instructions. These instructions are to prompt the user, not to replace the data set BSP instructions.

5.23 After the instructions, ADTS gives the following message: WHEN READY, ENTER ONE. Upon receipt of a 1, ADTS responds with a THANK YOU. A pause will follow the thank you message as ADTS attempts to seize the hardware needed for the test. If the test hardware is busy performing another test or a self test, ADTS gives the following message: The ADTS TEST EQUIPMENT IS BUSY, PLEASE WAIT. When the test hardware becomes available, ADTS outputs THE TEST IS READY TO START.

5.24 At completion of the test, the user receives a short message describing the test results. When the data set fails, the system gives the reason(s) for failure. After giving the results of the data set test, the system returns to the function query.

Leaving ADTS

5.25 ***Manual Abort:*** Whenever the system is expecting user input, the user can abort the operation by entering #73 (the letter S) or #63 (the letter O). The letter S, for STOP, causes ADTS to abort the operation and return to the function query. The letter O, for OFF, causes ADTS to abort the operation and the DIVA port to hang up.

5.26 ***Automatic Abort:*** The ADTS automatically performs the equivalent of a user OFF if the user does not respond to a system request. Thirty seconds without a user entry after the original function query, ADTS will repeat the query. Thirty seconds after the second query without a user entry, ADTS will repeat the query for the third time. Thirty seconds after the third query without a user entry, ADTS will abort the task and hang up. If incorrect or illogical entries are made three successive times, ADTS will perform the equivalent of an OFF. After each invalid entry, an appropriate error message such as THE NUMBER IS INVALID, PLEASE REENTER will be spoken. After a third invalid entry, ADTS will abort the task and hang up.

B. Remote Test

5.27 Call the DIVA port number of the serving ADTS, using a TOUCH-TONE (TT) dial or pad. A 1-second answer tone will be heard in the

handset. After the answer tone will be the following: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD.

Note 1: If the above message is not heard, refer to paragraph 5.11.

Note 2: TOUCH-TONE stars are shown hereafter as required.

5.28 Enter the 4-character password, followed by a ✱, on the TT dial. ADTS will respond with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.29 Enter 78✱ on the TT dial. (The fast test, which omits line card review and test instructions, may be requested by entering 378✱.) ADTS will respond with WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER?

5.30 Enter the data set telephone number, followed by ✱, on the TT dial. ADTS will respond with YOU HAVE ENTERED (telephone number). IS THAT CORRECT?

5.31 If the number is correct, enter 1✱ on the TT dial. If the number is incorrect, enter 0✱ on the TT dial.

5.32 If 0✱ was entered, the query in paragraph 5.29 will be repeated. If 1✱ was entered, ADTS will respond with THE DATA SET CODE IS 208B. ARE YOU CALLING FROM THE DATA SET? To respond "yes" enter one; to respond "no", enter zero.

5.33 ADTS continues: TO CORRECT ERRORS ENTER ONE. IF NO ERRORS ENTER ZERO. Enter 1✱ to change the data set code. Follow this with an entry of 208#22✱ to select data set 208B.

5.34 This question follows: DO YOU WANT INSTRUCTIONS? A 1✱ reply requests instructions, which are as follows:

(1) When ADTS is called from a telephone other than the data set: RELEASE ALL SWITCHES ON THE DATA SET TO THE OUT POSITION. DEPRESS THE RT SWITCH AND THE 50 SWITCH ON THE DATA SET. THE ADTS WILL CALL THE DATA SET. LEAVE THIS TELEPHONE OFF-HOOK TO RECEIVE THE TEST RESULTS AT THE COMPLETION OF THE TEST.

(2) When ADTS is called from the data set telephone: RELEASE ALL SWITCHES ON THE DATA SET TO THE OUT POSITION. ON THE TONE DEPRESS THE RT SWITCH AND THE 50 SWITCH ON THE DATA SET AND THEN HANG UP. THE ADTS WILL CALL THE DATA SET. WHEN THE TEST IS COMPLETED, THE ADTS WILL CALL THE DATA SET AGAIN TO REPORT THE TEST RESULTS.

The ADTS then gives the message WHEN READY ENTER ONE.

5.35 When the user is satisfied that the instructions are understood, enter one, to which the ADTS responds THANK YOU. THE TEST IS READY TO START.

5.36 On conclusion of the test the ADTS gives the results as follows:

THE TEST RESULTS ARE:

THE RECEIVED LEVEL IS -24 DBM.
THE NUMBER OF BLOCKS RECEIVED WAS 30.
THE NUMBER OF TRANSMITTER ERRORS WAS 0.
THE NUMBER OF RECEIVER ERRORS WAS 0.
THE DATA SET TESTS OK.

5.37 If the data set failed the test, one or more of the following messages is given:

- THE DDD CONNECTION WAS LOST. TEST ABORTED.
- CARRIER WAS NOT RECEIVED.
- THE CARRIER SIGNAL DID NOT GO OFF.
- THE RECEIVED SIGNAL LEVEL IS OUT OF LIMITS.
- THE NUMBER OF TRANSMITTER ERRORS WAS TOO HIGH.

- THE NUMBER OF RECEIVER ERRORS WAS TOO HIGH.
- THE DATA SET DID NOT SEND THE RECEIVER ERROR SIGNAL.
- THERE HAS BEEN AN ADTS TEST EQUIPMENT MALFUNCTION. TRY AGAIN LATER.
- THE RECEIVED SIGNAL WENT OFF DURING MEASUREMENT.
- THE DATA SET DID NOT RELEASE FROM THE TEST MODE.
- THE ANSWER TONE DID NOT GO OFF.
- THE RECEIVED LEVEL IS (negative number) DBM.
- THE NUMBER OF BLOCKS RECEIVED WAS (positive number).
- THE NUMBER OF TRANSMITTER ERRORS WAS (positive number).
- THE NUMBER OF RECEIVER ERRORS WAS (positive number).

5.38 The ADTS repeats the function query.

C. End-to-ADTS Error Run Test Using 921A DTS

Initial Test Setup for 921A DTS

5.39 Perform the initial test setup for the 921A DTS when used to test DS 208B-type as follows:

STEP	ACTION	VERIFICATION
1	Connect data set to DTS using interface cable and Electronic Industries Association (EIA) adapter cord provided with DTS. ***Note:*** The interface cable is equipped with two 37-pin connectors. The 6-inch adapter cord is equipped with a 37-pin female connector and a 25-pin male connector. Connect interface cable from DATA SET (DCE) connector on DTS to 37-pin connector on adapter cord. Insert 25-pin connector on adapter cord into customer interface connector on data set.	
2	Connect DTS to a 105- to 129-Vac 60-Hz power source.	
3	Apply power to data set.	Data set ON lamp lights.
4	On front of DTS, set POWER switch to ON.	POWER lamp lights.
5	Press RST on keyboard. ***Note:*** If RST is pressed during a test, the test is ended and the DTS recycles to this step.	Display reads (briefly) version number of DTS. DTS then performs self tests. If DTS is defective, display reads— TEST FAILED If DTS is satisfactory, display reads— DATA SET:
6	Remove EIA RS-232-C interface module from storage and ensure that all 25 interface module switches are in TERM position.	

STEP	ACTION	VERIFICATION
7	On right side of DTS, ensure that locking lever is in OPEN position.	
8	Insert interface module into slot.	
9	Move locking lever to CLOSE position.	
10	On front of DTS, ensure that all 37 DCE interface lead switches are in NORM position.	
11	Enter 71. ***Note:*** To delete a wrong entry on keyboard during any test, press back arrow (←).	Display reads— DATA SET: 71
12	Press GO.	Display reads— BIT RATE:
13	Enter 48.	Display reads— BIT RATE: 48
14	Press GO. ***Note:*** If GO or TST is pressed at an unauthorized point in a test, the test is ended and the DTS recycles to this step.	Display reads— TEST SEQ:

5.40 Call the DIVA port number of the serving ADTS, using a TOUCH-TONE (TT) dial or pad. A 1-second answer tone will be heard in the handset. After the answer tone will be the following: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD.

Note: If the above message is not heard, refer to paragraph 5.11.

5.41 Enter the 4-character password, followed by a ✱, on the TT dial. ADTS will respond with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.42 Enter 37✱ on the TT dial. (The fast test, which omits line card review and test instructions, may be requested by entering 337✱.) ADTS will respond with WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER?

5.43 Enter the data set telephone number, followed by ✱, on the TT dial. ADTS will respond with YOU HAVE ENTERED (telephone number). IS THAT CORRECT?

5.44 If the number is correct, enter 1✱ on the TT dial. If the number is incorrect, enter 0✱ on the TT dial.

5.45 If 0✱ was entered, the query in paragraph 5.42 will be repeated. If 1✱ was entered, ADTS will respond with THE DATA SET CODE IS 208B. ACCESS TYPE LAST USED WAS DDD, ADTS ORIGINATED. TO CORRECT ERRORS ENTER ONE. IF NO ERRORS ENTER ZERO.

5.46 Enter 1✱ to change the data set code. Follow this with an entry of 208#22✱ to select data set 208B.

5.47 Enter 1✱ to change the data set access type. The ADTS responds with ENTER THE DATA SET ACCESS TYPE.

1. DDD, ADTS ORIGINATED
2. DDD, DATA SET ORIGINATED
3. RTAU
4. RTS.

5.48 If there are no more corrections, the ADTS asks the following question: DO YOU WANT THE ADTS TO TRANSMIT TO THE DATA SET?

5.49 A "yes" or "no" answer is followed by the following question: DO YOU WANT TO USE THE STANDARD TEST PARAMETERS? (Standard test parameters are: test time, 1 minute; word bit length, 511; bit error count). A "yes" answer is followed by PLEASE WAIT; a "no" answer by the following: ENTER THE TEST TIME IN MINUTES. ENTER THE WORD BIT LENGTH: 15, 63, 511, OR 2047 BITS.

5.50 If the answer to the question in paragraph 5.49 was "no", the following message is given: DO YOU WANT TO DETECT BLOCK ERRORS? The response to a "yes" is ENTER THE BLOCK WORD LENGTH. An acceptable answer is 1, 2, 4, 8, or 16. If response is "no", a bit error count is made. With the proper answer, the ADTS responds PLEASE WAIT, then ARE YOU CALLING FROM THE DATA SET? A "yes" or "no" answer is acceptable.

5.51 A "yes" reply to the question DO YOU WANT INSTRUCTIONS? prompts the following message if the ADTS is originating the call and the call is not initiated from the data set: THE ADTS WILL CALL THE DATA SET AND START THE TEST AFTER THE DATA SET ANSWERS. LEAVE THIS TELPHONE OFF-HOOK TO RECEIVE THE TEST RESULTS. WHEN READY ENTER ONE.

5.52 When the call is from the data set the instructions are: ON THE TONE, HANG UP. THE ADTS WILL CALL AND TEST THE DATA SET. WHEN THE TEST IS COMPLETED, THE ADTS WILL CALL THE DATA SET TO REPORT THE TEST RESULTS OR YOU MAY CALL ADTS AND REQUEST THE TEST RESULTS.

ADTS Transmitting Data

5.53 If the ADTS is to transmit to the data set, this message follows: ADTS TEST DATA TRANSMISSION WILL BE PRECEDED BY 30 SECONDS OF GOOD DATA FOLLOWED BY THE INJECTION OF 10 BIT ERRORS.

5.54 During this initial period of data transmission, prepare the 921A data test set to receive the test data as indicated in the steps below. Receipt of bit errors is a positive indication that transmission is taking place. The time entered in Step 9 must be less than the time requested for the ADTS test, since erroneous errors will be produced if the 921A DTS looks for data when none is being transmitted.

STEP	ACTION	VERIFICATION
1	Ensure that 4-dB slope compromise equalizer option (S2B up; S2C up) is installed in data set.	
2	Ensure that initial test setup described in paragraph 5.39 has been performed.	Display reads— TEST SEQ:
3	Enter 54.	Display reads— TEST SEQ: 54
4	Press GO.	Display reads (briefly)— SELECT ERROR TEST Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63
5	Enter 5.	Display reads (briefly)— 511 BIT ERROR TEST Display then reads— 1=BIT ERRORS 2=BLOCK ERRORS

STEP	ACTION	VERIFICATION
6	Enter 2.	Display reads— ????? BITS IN A BLOCK
7	Enter 01024.	Display reads (briefly)— 01024 BITS IN A BLOCK Display then reads— ???? SECONDS
8	Place data set in data mode.	On DTS, DSR indicator lights (data set ready lead ***on***) Display continues to read— ???? SECONDS
9	Enter 0600.	Display reads (briefly)— 0600 SECONDS Display then reads— BLK RCVD=0000 ERR=0000 ***Note:*** From this point, display counts number of blocks received and number of blocks in error. If sync is lost during test, display flashes OSYN. If this occurs, test must be repeated by pressing A. At end of test, display reads TEST COMPLETE, total sync losses, total blocks received, and total blocks in error. ***Requirement:*** Total blocks in error are less than 30. Record block errors.

ADTS Receiving Data

5.55 If the ADTS is to receive data from the data set, perform the following steps at the transmitting station:

STEP	ACTION	VERIFICATION
1	Ensure that initial test setup described in paragraph 5.39 has been performed.	Display reads— TEST SEQ:
2	Enter 53.	Display reads— TEST SEQ: 53
3	Press GO.	Display reads (briefly)— SELECT ERROR TEST Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63

STEP	ACTION	VERIFICATION
4	Enter 5.	Display reads— 511 BIT ERROR TEST
5	Place data set in data mode.	On DTS, DSR indicator lights (data set ready lead ***on***) Display continues to read— 511 BIT ERROR TEST

5.56 After all instructions are performed and the test is complete, the ADTS gives this message: THE TEST RESULTS ARE (results). THE TEST TIME WAS (number of) MINUTES. DO YOU WANT TO RUN ANOTHER TEST?

5.57 The ADTS gives error message(s) as shown in paragraph 5.37 if the data set test was not performed successfully.

D. End-to-ADTS Error Run Test Using 914-Type DTS

Initial Test Setup for 914-Type DTS

5.58 Perform the initial test setup for the 914-type DTS when used to test DS 208B-type as shown in Fig. 3.

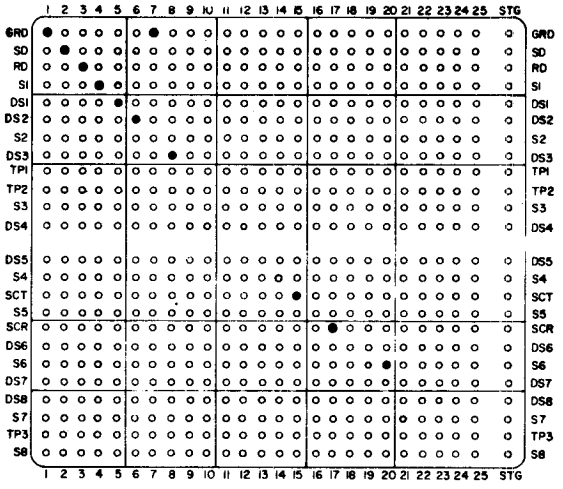
5.59 Repeat paragraphs 5.40 through 5.53 as for the error run test using the 921A DTS.

ADTS Transmitting Data

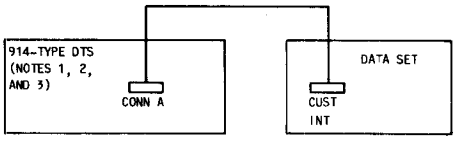
5.60 If the ADTS is to transmit to the data set, this message follows: ADTS TEST DATA TRANSMISSION WILL BE PRECEDED BY 30 SECONDS OF GOOD DATA FOLLOWED BY THE INJECTION OF 10 BIT ERRORS. Following this, the ADTS sends good data for the time specified.

5.61 During this initial period of data transmission, prepare the 914A data test set to receive the test data as indicated in the steps below. Receipt of bit errors is a positive indication that transmission is taking place. The time counter set in Step 8 must be shorter than the time requested for the ADTS test, since erroneous errors will be produced if the 914A DTS looks for data when none is being transmitted.

STEP	PROCEDURE
1	Remove programming pins from TP1-15 and TP2-2.
2	Insert programming pin at S3-20 and DS6-20.
3	Set COUNTER switch to BLOCK ERRORS 16 WL, (63-bit word) or 2 WL (511-bit word).
4	Apply power to the data set and then to the 914-type DTS.
5	Coordinate test procedure with transmitting end.
6	On the 914 DTS, move switch S3 (DTR) to ON.
7	Go to data mode.
8	Reset counter.



914-TYPE DTS MATRIX



NOTES:

1. SET SWITCHES ON 914-TYPE DTS AS FOLLOWS:

SWITCH	SETTING
INTERFACE	
SELECTOR A	ALL DEPRESSED
INTERFACE MODE	VOLTAGE
TEST SET MODE	SER (914C) RCV SER (914B)
COUNTER	BLOCK ERRORS-2WL
FUNCTION	OFF
SAMPLE WIDTH	.5mS
RCV BIT RATE (914C)	EXT+
RCV WORD LENGTH (914C)	511
TRANSMIT BIT RATE (914C)	EXT+
TRANSMIT WORD LENGTH (914C)	511
SIG LEV (914C)	±4V
BIT RATE (914B)	EXT+
WORD LENGTH (914B)	511
SIGNAL LEVEL (914B)	±4V
S1	ON
S6	ON

2. INSERT RED PROGRAMMING PINS IN 914-TYPE DTS MATRIX IN POSITIONS INDICATED.
3. 914-TYPE SWITCHES CORRESPOND TO THE FOLLOWING INTERFACE LEADS:

SWITCH	LEAD	EIA
S1	REQUEST TO SEND (RS)	CA
S6	DATA TERMINAL READY (DTR)	CD

Fig. 3—End-to-ADTS Error Run Test Setup Using 914-Type DTS

STEP	PROCEDURE
9	Counter should count at least once and shortly thereafter the NO DATA lamp should illuminate.
10	Reset counter. The NO DATA lamp should extinguish.
11	Counter should record less than 30 counts (less than 30 block errors).
12	At end of 10-minute interval, go to talk mode and give results.
13	End of test. Return equipment to normal operating condition.

ADTS Receiving Data

5.62 If the ADTS is to receive data from the data set, perform the following steps at the transmitting station:

STEP	PROCEDURE
1	Remove programming pins from TP1-15, TP2-2, and RD-3.
2	Insert programming pin at SD-2, S3-20, and DS6-20.
3	Set TEST SET MODE to SER (914C) or TRMT SER (914B).
4	Apply power to the data set and then to the 914-type DTS.
5	Call the receiving end to coordinate test procedure.
6	On the 914 DTS, move switch S3 (DTR) to ON.
7	Go to data mode.
8	Set S1 (RS) to ON.
9	To verify equipment is operating properly, set switch S1 (RS) to OFF.
10	Set switch S1 (RS) to ON.
11	Conduct 10-minute error run.
12	At end of 10-minute interval, go to talk mode.
13	End of test. Return equipment to normal operating condition.

5.63 After all instructions are performed and the test is complete, the ADTS gives this message: THE TEST RESULTS ARE (results). THE TEST TIME WAS (number of) MINUTES. DO YOU WANT TO RUN ANOTHER TEST?

E. Repair Test

5.64 This test provides a method for isolating a data set trouble to a single circuit pack (CP). Table C lists the individual tests in the sequence in which they are to be performed, and also lists the associated CPs that might be defective if the test fails.

5.65 If the data set fails a test listed in Table C, proceed as follows:

(1) Refer to list of CPs associated with test that failed.

(2) Replace first CP in list and repeat test.

(3) If data set still fails test, restore original CP in data set.

(4) Continue replacing, testing, and restoring CPs in sequence in which they are listed until data set passes test. The last CP replaced is cause of trouble.

Note: If CP HG19, HG24, or HG25 is replaced, install correct options before proceeding.

TABLE C

REPAIR PROCEDURES

TEST	CP REPLACEMENT SEQUENCE		
	DS 208B-L1	DS 208B-L1A	DS 208B-L1B
Remote Test or End-to-ADTS Error Run Test	HG19 HG18 HG4 HG20 HG3 HG17 HG21 HG2 HG14 or HG14B HG22 HG15 or HG15B HG12 (No. 1) HG12 (No. 2) HG13 HG11 HG16 or HG16B HG5 HG6	HG24 HG18B HG4 HG20 HG3 HG17 HG21 HG2 HG14 or HG14B HG22 HG15 or HG15B HG12 (No. 1) HG12 (No. 2) HG13 HG11 HG16 or HG16B HG5 HG6	HG25 HG4 HG20 HG3 HG26 HG21 HG2 HG14B HG22 HG15B HG12 (No. 1) HG12 (No. 2) HG13 HG11 HG16B

(5) If all CPs have been replaced and cause of trouble has not been found, notify supervision.

6. REFERENCES

6.01 Additional information concerning the DS 208B-type and use of the ADTS is contained in the following publications:

SECTION	TITLE
107-101-100	914-Type Data Test Sets—Description and Operation
107-402-100	921A Data Test Set—Description and Operation
314-205-501	Data Systems—DATAPHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines
590-010-500	J1P005 Automatic Data Test System (ADTS)—Operation From Field Locations
592-030-100	Data Set 208B-Type Transmitter-Receiver—Description and Operation
592-030-150	Data Set 208B-Type Transmitter-Receiver—Supplementary Information
592-030-200	Data Set 208B-Type Transmitter-Receiver—Installation and Connections
592-030-500	Data Set 208B-Type Transmitter-Receiver—Test Procedures Using 914-Type Data Test Set
592-030-501	Data Set 208B-Type Transmitter-Receiver—Test Procedures Using 921A Data Test Set

DATA SET 212A

TESTING FROM FIELD LOCATIONS

USING J1P005 AUTOMATIC DATA TEST SYSTEM (ADTS)

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1. GENERAL

1.01 This section provides self-test and field-test information for data set (DS) 212A. Digital loopback and error run tests are provided using the J1P005 ADTS. These procedures are to be used when testing DS 212A on an initial installation or during a maintenance visit.

1.02 When this section is reissued, the reason for reissue will be presented in this paragraph.

1.03 The self tests require no external test equipment, and are included here for completeness.

1.04 This section contains information for testing DS 212A by means of DIVA (Digital Inquiry Voice Answer). The DIVA requires a TOUCH-TONE* dial telephone, or a rotary dial telephone used with a KS-21799-L1 (or equivalent) portable TOUCH-TONE pad.

1.05 In this section, the term "user" refers to telephone company (telco) personnel at the data set responsible for interfacing the data set with the ADTS.

1.06 Test circuitry built into DS 212A permits the following self tests to be performed: analog loopback, digital loopback, remote digital loopback, and end-to-end. Additional tests require the use of external test equipment such as a 921A data test set (DTS) and/or the ADTS.

1.07 Detailed self-test procedures are presented in paragraphs 4.02 through 4.09.

1.08 General ADTS test information is presented in paragraphs 5.01 through 5.25. Detailed ADTS test procedures are presented in paragraphs 5.26 through 5.45.

2. INSTALLATION TESTS

2.01 This part provides the sequence in which tests are to be performed following installation of

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the data set. This test sequence (Fig. 1) provides a method of verifying that the installation is satisfactory. Before proceeding with the tests, verify that the local loop meets the requirements specified in Section 314-205-501.

3. MAINTENANCE TESTS

3.01 This part provides the sequence in which tests are to be performed when clearing a trouble report and during a maintenance visit to the data station.

3.02 When a trouble report is received, a test center is responsible for isolating the trouble to the data station or the transmission facility. The procedure for doing this is shown in Fig. 2.

3.03 If the trouble seems to be in the data station equipment, a telco employee must be dispatched to conduct more extensive tests at the data station. The following equipment should be taken on a trouble visit:

- 921A DTS
- Spare DS 212A.

3.04 Troubleshooting is performed by the ADTS using the digital loopback test or error run test. If the trouble is isolated to the data set, replace the data set and repeat the test.

3.05 If the trouble persists after the tests have been completed, proceed as follows:

(a) Check that options installed in data set agree with those specified on service order.

(b) Verify that customer-provided equipment (CPE) has been tested and is operating properly.

(c) Check for physical damage to data station equipment.

(d) Verify that all cords and connectors are properly connected.

(e) Check for intermittent trouble in station wiring.

(f) Verify that data set and CPE are connected to a common ground.

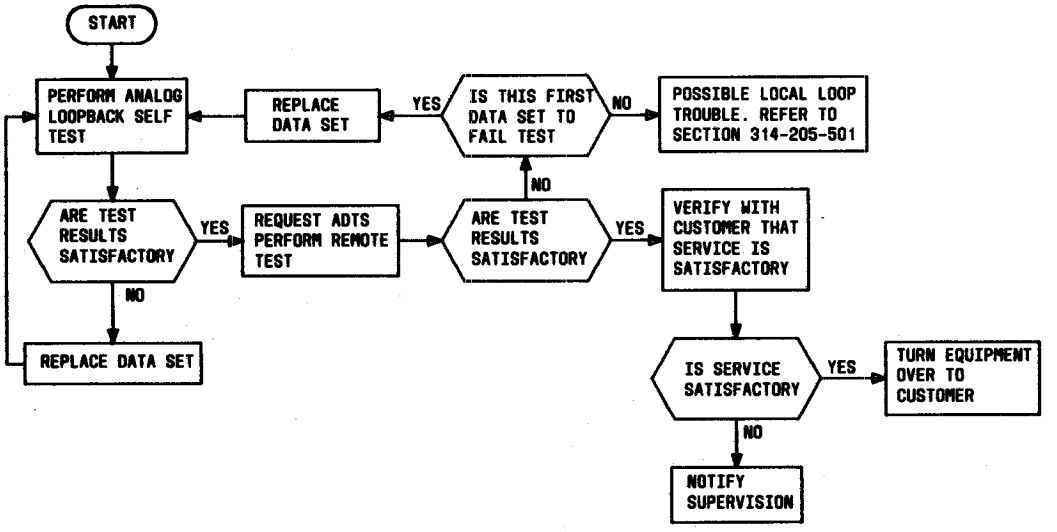


Fig. 1—Installation Test Sequence

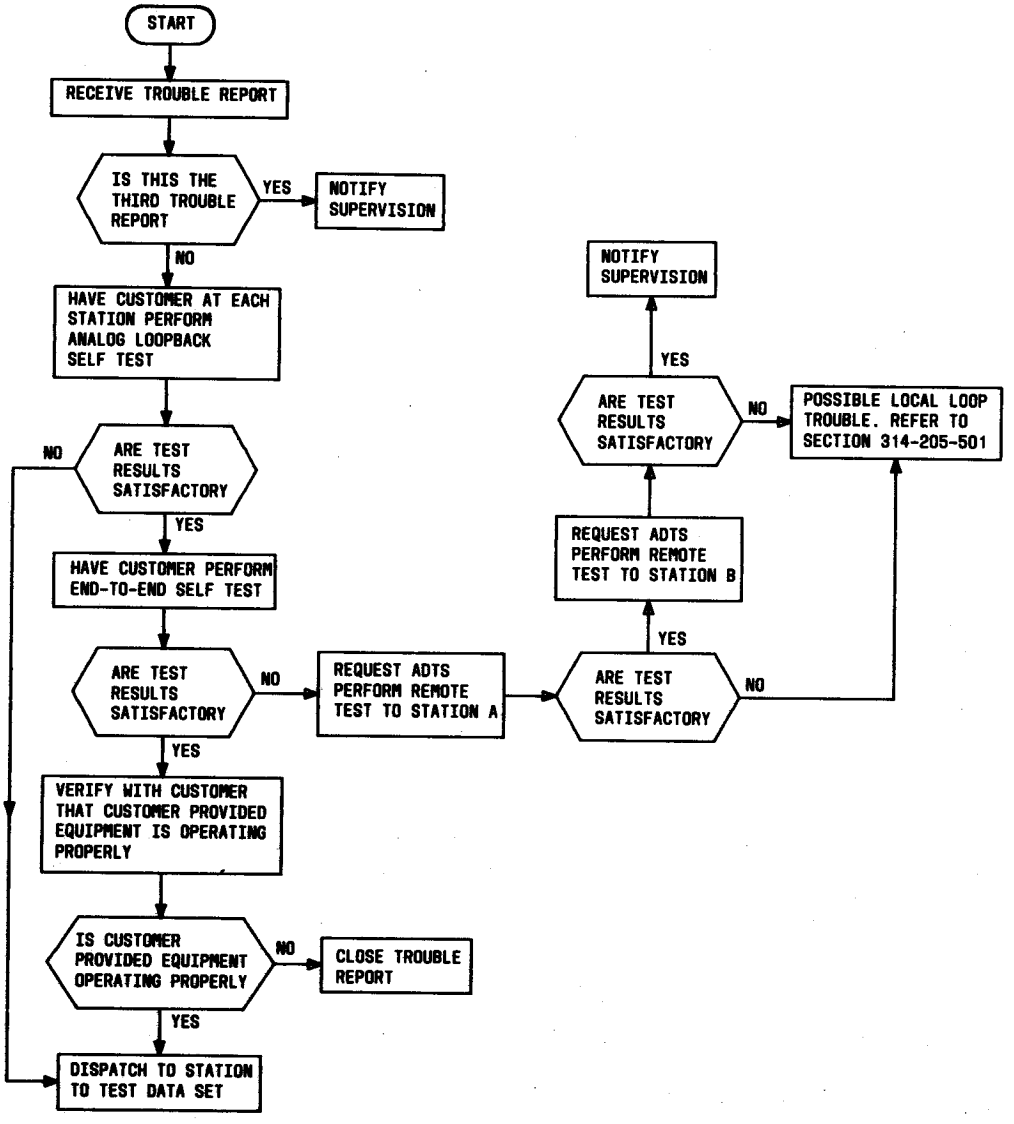


Fig. 2—Clearing Trouble Report

(g) If trouble persists, request help from immediate supervisor, who may then obtain technical support from DATEC (Data Technical Support) per Section 010-521-100.

4. SELF-TEST PROCEDURES

4.01 This part provides procedures for the installation and maintenance self tests.

A. Analog Loopback Self Test

4.02 The analog loopback self test checks the data set transmitter and receiver. The customer interface is not checked. Test data (dotting pattern) generated by the data set is looped internally from the transmitter output to the receiver input. The received data is compared to the transmitted data. This test can be performed in either the high-speed or low-speed mode. If the data set is operating in the low-speed mode, the MC lamp blinks if the distortion threshold (25 percent) is exceeded. If the data set is operating in the high-speed mode, the MC lamp blinks if a bit error is detected in the received data. Perform the test in the speed mode used by the customer provided equipment (CPE). The speed mode is selected by use of the HS switch on the data set (depressed for high-speed mode, released for low-speed mode).

4.03 Perform the test as follows:

(1) Depress AL and ST switches on data set.

Requirements: MB and TM indicators are lighted. MC indicator goes off after SD and RD indicators light. TR indicator is lighted when ST or DL switch is depressed. MR indicator is lighted if option ZF is installed in data set.

(2) Observe MC indicator for 1 minute.

Requirement: MC indicator does not blink.

(3) Release AL and ST switches.

B. Digital Loopback Self Test

4.04 This test uses the digital loopback capability of the data set at one end and the self-test (pattern generating and comparing) capability of the data set at the other end. The test is performed by putting one data set in the DL mode, placing the other data set in the ST mode, placing a call, and then going to the data mode. The MC indicator on the data set that is in the ST mode blinks if the distortion threshold (25 percent) is exceeded in the low-speed mode or if a bit error is detected in the received data in the high-speed mode. Perform the test in the speed mode used by the CPE. The speed mode is selected by use of the HS switch on the data set (depressed for high-speed mode, released for low-speed mode).

Note: In the low-speed mode, the distant data set may be 103J, 103JR, 113C, 113CR, 113D, or 113DR. In the high-speed mode, the distant data set must be a 212A-type.

4.05 Perform the test as follows:

(1) Place a call to distant station. If distant data set is already in DL mode, it will answer automatically.

(2) If distant data set does not answer automatically, instruct attendant at distant station to depress DL switch and go to data mode.

(3) On local data set, depress ST switch and go to data mode.

(4) Observe MC indicator on local data set for 2 minutes.

Requirements

- Low-Speed—If MC indicator stays off, both data sets and the line facilities are operating properly. If MC indicator blinks or remains lighted, the round-trip distortion is exceeding 25 percent. Since the distortion in the two directions may be additive, no conclusion about the proper operability of the data sets and the line facilities may be drawn.
- High-Speed—Maximum of six blinks.

(5) Release ST switch on local data set. Call distant station and have DL switch released.

C. Remote Digital Loopback Self Test

4.06 This test uses the remote digital loopback and self-test capabilities of the local data set and can be used to test both data sets and the line facilities in the high-speed mode only. The local data set

is placed in the self-test mode by depressing the ST switch. The distant data set is placed in the remote digital loopback mode by depressing the RDL switch on the local data set. The local data set pattern generator is used to send a signal to the distant data set, where it is looped back and retransmitted. The error-detecting circuitry causes the MC indicator on the local data set to blink when an error is detected in the received data.

Note: If the distant data set is equipped with option YL (receiver responds to digital loop—OUT) or option ZG (automatic answer—OUT), this test cannot be performed.

4.07 Perform the test as follows:

(1) Depress HS, RDL, and ST switches on local data set and verify that TM indicator lights.

(2) Dial a call to distant data set.

(3) When distant data set has answered, place local data set in data mode.

(4) Observe MC indicator on local data set for 2 minutes.

Requirement: Maximum of six blinks.

Note: If MC indicator is lighted continuously, this may indicate that distant data set is not in DL mode.

(5) Release RDL and ST switches on local data set. Return local data set to speed mode used by CPE.

D. End-to-End Self Test

4.08 This test can be used to check the local data set, the distant data set, and the line facilities. This test is performed by depressing the ST switch at each end, placing a call from one end to the other, and then going to the data mode. Each data set sends the test pattern to the other end. The speed mode of the test is selected at the originating station. The error-detecting circuitry at each end monitors the received data signal and causes the MC indicator to blink if the distortion threshold (25 percent) is exceeded (low-speed) or if a bit error is detected (high-speed). Perform the test in the speed mode used by the CPE.

Note: For low-speed testing, the distant end may be a DS 103J, 103JR, 113C, 113CR, 113D, or 113DR. In the high-speed mode, the distant data set must be a 212A-type.

4.09 Perform the test as follows:

(1) Call distant station and arrange to conduct an end-to-end self test. At originating station, speed mode is selected by use of HS switch on data set (depressed for high-speed mode, released for low-speed mode).

(2) Depress ST switch on each data set. Verify that TM indicator lights.

(3) Go to data mode at each station. Verify that MC indicator goes off after SD and RD indicators light. TR indicator is lighted when ST or DL switch is depressed. HS indicator is lighted or off, depending on speed mode of test.

(4) Observe MC indicator on data set for 2 minutes.

Requirements:

- Low-Speed—If MC indicator stays off, both data sets and the line facilities are operating properly. If MC indicator blinks or remains lighted, the distortion is exceeding 25 percent.

- High-Speed—Maximum of two blinks.

(5) At end of test, go to talk mode and then release ST switch on each data set.

5. ADTS TEST PROCEDURES

A. General

5.01 This part provides instructions necessary for the proper operation of ADTS from field data sets. Included are instructions for entering and leaving the system and for performing installation and maintenance tests.

5.02 Operations involving ADTS require man/machine interaction. With DIVA, the information is entered into ADTS by tones from a TOUCH-TONE dial. The system outputs a message by a voice response unit, and the user receives the message via the telephone handset.



Every entry from a TOUCH-TONE dial must be followed by a TOUCH-TONE star (*) except when calling the DIVA port number. To

avoid repetition, the star entry has not been included in the text but should be understood as included whenever an entry is mentioned.

5.03 The ADTS must be on-line and DIVA must be up to accept DIVA tests.

Functions Available via DIVA (Table B)

5.04 The test functions available via DIVA initiate a static or dynamic test of a data set. When 3 is used as a prefix with a test function, a fast test is performed on the data set without review of the line card information and without receiving test instructions.

5.05 ***Test Function List:*** With an entry of 8, DIVA will respond with a message of all test functions that can be performed on DS 212A.

5.06 ***Digital Loopback Test:*** This function provides a digital loopback test of DS 212A by the ADTS. The digital loopback test is initiated by entering 35; the fast digital loopback test by entering 335.

5.07 ***Results:*** This function provides results of the most recent test of the data set. The results function is initiated by entering 7. In response to the results function entry, the ADTS gives the audible query WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After receiving a number, the ADTS outputs the results in a format similar to the following:

THE TEST RESULTS ARE:

THE DATA SET CODE IS (data set code)

THE RECEIVED SIGNAL LEVEL IS OUT OF LIMITS

WHAT IS THE FUNCTION YOU WISH TO PERFORM?

5.08 ***Stop:*** This function stops the present function and requests a new function. The stop function is initiated by entering #73.

5.09 ***Off:*** This function stops the present function and disconnects the DIVA port. The off function is initiated by entering #63.

Accessing ADTS

5.10 Access to ADTS by DIVA is obtained by placing a call to a DIVA port number. Depending on the mode of ADTS and the mode of DIVA, one of four actions will occur:

(a) Busy signal; all DIVA ports are busy. Try again later.

(b) Call not answered; either ADTS is off-line or DIVA is in the down mode.

(c) Call answered; the user will hear a 1-second burst of answer tone. Following the answer tone will be the audible query: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD. Once the password has been entered, the system responds with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

(d) Call answered; the user will hear the password query and then the following: THE ADTS IS OFF-LINE. PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM. The ADTS must be put on-line by entering ONLIN to the function query on a terminal at the ADTS.

5.11 The user may shorten the password-function request formalities by inputting both the password and the desired function in one entry (no intervening *). If both the password and function are valid, ADTS begins executing the function immediately. To shorten the time required to set up a test, answers to familiar questions asked by DIVA may be given while the question is being spoken.

5.12 Information is entered into ADTS by letters or numbers on the TOUCH-TONE dial. Numbers are entered into ADTS by depressing the desired digits on the TOUCH-TONE dial. Letters are entered into ADTS by using the following format:

(a) Depress #.

(b) Depress button with desired letter.

(c) Depress a number (1, 2, or 3) corresponding to the letter's position on the button [depressed in (b)].

5.13 In response to a YES or NO question, the following format is used:

(a) YES, enter one (1).

(b) NO, enter zero (0).

5.14 The user can repeat to the last spoken message, by entering #* (Table A).

Performing Tests

5.15 To start a test, the user enters the desired number code from Table B. The ADTS response is WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER? After the number has been entered, the ADTS response is YOU HAVE ENTERED (telephone or special service circuit number). IS THAT CORRECT? The user enters 1 for YES or 0 for NO. If the response is incorrect, ADTS repeats the original query.

5.16 If the response is correct, ADTS will attempt to find a line card file (LCF). If an LCF is found, ADTS will use the data set code to find the test program. If there is a test program for the data set code and test function entered, ADTS will continue. If no test program is found, ADTS will abort the test with the following message: THE ADTS CANNOT RUN SELECTED TEST ON THIS DATA SET. [Since there is a test program available for DS 212A (35)

TABLE A

TOUCH-TONE CODES FOR DIVA

FUNCTION	DEPRESS BUTTON(S)	DESCRIPTION
1, 2, 3, . . .etc.	Appropriate button(s)	Digits
#	#	Prefix character.
*	*	TOUCH-TONE star. Used at end of all entries as EOL character.
A,B,C, . . .etc.	Depress number sign, button on which character appears, and digit corresponding to the relative position of the letter (1,2, or 3). Example: For the letter A #21	Alphabetic characters.
Yes	1*	Answer yes to a question.
No	0*	Answer no to a question.
Repeat	#*	Repeats last message spoken by the system.
Telephone Number	Example: 3115552368*	Enter telephone number in sequence followed by EOL.
Data Set Code	Example: 202#23* Example: 202#235* Example: 401#515*	202C 202C5 401J5
Data Set Transmit Level	Example: 12*	-12 dBm. Eliminate sign and units designation. Enter numerical value.

TABLE B

FUNCTIONS AVAILABLE VIA DIVA

FUNCTION	DESCRIPTION	NORMAL	FAST
Test List	Lists valid test functions.	8*	
Digital Loopback Test	Tests data set in digital loopback mode.	35*	335*
Error Run Test	Tests a data set with data test set connected.	37*	337*
Results	Outputs results of most recent test of a data set.	7*	
Stop	Stops present function and requests new function.	#73*	
Off	Stops present function and disconnects.	#63*	

this response indicates that the wrong test code was entered.]

5.17 If both an LCF and test program are found, the LCF information is given to the user. The user is then given a chance to make any necessary changes.

5.18 If no LCF is found, the ADTS response is THE DATA SET IS NOT ON FILE. ENTER THE DATA SET CODE. The user must then answer this question and others to create an LCF. In this case the entry would be 212#21*. After entry of the data set code, ADTS checks for the test program.

5.19 After the LCF information has been given or after new line card information has been entered, ADTS instructs the user TO CORRECT ERRORS ENTER ONE. IF NO ERRORS, ENTER ZERO. If a 1 is entered, ADTS repeats the line card information query.

5.20 If no corrections are made to the LCF, ADTS asks ARE YOU CALLING FROM THE DATA SET? If the user is calling from a data set, the user must hang up. The ADTS will then call the data set for testing. After the test has been completed, ADTS calls the data set again to give the user the results of the test. The test instructions direct the user on this procedure.

5.21 The ADTS asks the user DO YOU WANT INSTRUCTIONS? If requested, ADTS will supply test instructions. These instructions are to prompt the user, not to replace the data set BSP instructions.

5.22 After the instructions, ADTS gives the following message: WHEN READY, ENTER ONE. Upon receipt of a 1, ADTS responds THANK YOU. A pause will follow the thank you message as ADTS attempts to seize the hardware needed for the test. If the test hardware is busy performing another test or a self test, ADTS gives the following message: THE ADTS TEST EQUIPMENT IS BUSY, PLEASE WAIT. When the test hardware becomes available, ADTS outputs THE TEST IS READY TO START.

5.23 At completion of the test, the user receives a short message describing the test results. When the data set fails, the system gives the reason(s) for failure. After giving the results of the data set test, the system returns to the function query.

Leaving ADTS

5.24 ***Manual Abort:*** Whenever the system is expecting user input, the user can abort the operation by entering #73 (the letter S) or #63 (the letter O). The letter S, for STOP, causes ADTS to abort the operation and return to the function query. The letter O, for OFF, causes ADTS to abort the operation and the DIVA port to hang up.

5.25 ***Automatic Abort:*** The ADTS automatically performs the equivalent of a user OFF if the user does not respond to a system request. Thirty seconds without a user entry after the original function query, ADTS will repeat the query. Thirty seconds after the second query without a user entry, ADTS will repeat the query for the third time. Thirty seconds after the third query without a user entry, ADTS will abort the task and hang up. If incorrect or illogical entries are made three successive times, ADTS will perform the equivalent of an OFF. After

each invalid entry, an appropriate error message such as THE NUMBER IS INVALID, PLEASE RE-ENTER will be spoken. After a third invalid entry, ADTS will abort the task and hang up.

B. Digital Loopback Test

5.26 Call the DIVA port number of the serving ADTS, using a TOUCH-TONE (TT) dial or pad. A 1-second answer tone will be heard in the handset. After the answer tone will be the following: THIS IS THE AUTOMATIC DATA TEST SYSTEM. PLEASE ENTER THE PASSWORD.

Note 1: If the above message is not heard, refer to paragraph 5.10.

Note 2: TOUCH-TONE stars are shown hereafter as required.

5.27 Enter the 4-character password, followed by a *, on the TT dial. ADTS will respond with PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM.

5.28 Enter 35* on the TT dial. (The fast test, which omits line card review and test instructions, may be requested by entering 335*.) ADTS will respond with DIGITAL LOOPBACK TEST. WHAT IS THE TELEPHONE OR SPECIAL SERVICE CIRCUIT NUMBER?

5.29 Enter the data set telephone number, followed by *, on the TT dial. ADTS will respond with YOU HAVE ENTERED (telephone number). IS THAT CORRECT?

5.30 If the number is correct, enter 1* on the TT dial. If the number is incorrect, enter 0* on the TT dial.

5.31 If 0* was entered, the query in paragraph 5.28 will be repeated. If 1* was entered, ADTS will respond with THE DATA SET CODE IS 212A. THE DATA SET HAS THE HIGH-SPEED OPTION. TO CORRECT ERRORS, ENTER ONE. IF NO ERRORS ENTER ZERO. Enter 0* to change the data set code. The ADTS will respond ENTER THE DATA SET CODE. Follow this with an entry of 212#21* to select DS 212A. The ADTS will respond YOU HAVE ENTERED 212A. IS THAT CORRECT? To respond "yes" enter 1*; to respond "no" enter 0*. The ADTS continues: DOES THE DATA SET HAVE THE HIGH-SPEED OPTION? To respond "yes" enter 1*; to respond "no" enter 0*.

5.32 The ADTS continues: ARE YOU CALLING FROM THE DATA SET? To respond "yes" enter 1*; to respond "no" enter 0*. The ADTS then asks DO YOU WANT TO ORIGINATE THE TEST FROM THE DATA SET? Enter 1* if the data set will call the ADTS; enter 0* if the ADTS will call the data set.

Note: The automatic hardware-controlled handshaking sequence for DS 212A differs slightly for the two cases.

5.33 Next the ADTS asks the following question for all cases except where the user is not calling from the data set and the test is to originate from the ADTS: DO YOU WANT TO RUN THE TEST IN THE LOW-SPEED MODE? In reply to this question, enter 1* for "yes"; enter 0* for "no." If, where the data set is to call the ADTS as specified in paragraph 5.32, the choice of test speed conflicts with the in-service option for that data set, the ADTS will respond THE DATA SET IS NOT OPTIONED FOR THE REQUESTED SPEED and repeat the question in this paragraph.

5.34 This question follows: DO YOU WANT INSTRUCTIONS? To respond "yes" enter 1*; to respond "no" enter 0*. If the reply was 1* (and for an example of a test where the user is calling from the data set, the test is originated by ADTS, and the test is run in low-speed mode) the ADTS will respond as follows: DEPRESS THE DL BUTTON TO PLACE THE DATA SET IN DIGITAL LOOPBACK MODE. ON THE TONE, HANG UP. THE ADTS WILL CALL AND TEST THE DATA SET. WHEN THE TEST IS COMPLETED, THE ADTS WILL CALL THE DATA SET TO REPORT THE TEST RESULTS, OR YOU MAY CALL THE ADTS AND REQUEST THE TEST RESULTS.

5.35 The ADTS then asks DO YOU WANT THESE INSTRUCTIONS REPEATED? To respond "yes" enter 1*; to respond "no" enter 0*. A 1* causes the instructions to be repeated.

Note: The instructions given differ significantly depending on the type of test specified. The instructions for the test described in paragraph 5.34 are continued throughout this practice as a representative example.

5.36 The ADTS next gives the message WHEN READY ENTER ONE. When the user is satis-

fied that the instructions are understood, enter 1*, to which the ADTS responds THANK YOU.

> ***Note:*** When the call is initiated from the data set, the ADTS will send 2 seconds of 1-kHz tone. This is followed by the message HANG UP. The ADTS will then call the data set within 1 minute to perform the test.

5.37 To speed up the test procedure, enter 335* in response to PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM. (This omits test instructions and the opportunity to make corrections.) Enter only the telephone number of the data set and the choice of test type in response to questions asked by DIVA (ARE YOU CALLING FROM THE DATA SET?, DO YOU WANT TO ORIGINATE THE TEST FROM THE DATA SET?, and DO YOU WANT TO RUN THE TEST IN THE LOW-SPEED MODE?) and the test will begin immediately.

5.38 The fast loopback test begins by measuring the level of the answer tone (ADTS originated only) from the remote data set. Then the signal looped back from the remote data set is checked for correct speed and format. This is followed by a 60-second bit error run. If during the test a malfunction is detected, the test will be aborted and appropriate error messages given. For a test where the user is not calling from the data set and the test originates from the ADTS, a high-speed run follows the low-speed run immediately without announcing results if the detected errors for the low-speed run are acceptable. This is the only DIVA test in which both a low-speed and a high-speed run are executed.

5.39 At the completion of the test, the ADTS reports test results to the calling telephone line. Test results announced for a successful or failed test include the measured level(s) of the received signal (ADTS originated only), the number of bit errors detected, and appropriate test status and/or error messages. At the completion of the test in the given example, ADTS will call the data set. The user answers in talk mode. The ADTS continues: TO RECEIVE THE TEST RESULTS ENTER ONE. The user replies by entering 1*. ADTS responds to 1* by reporting the results.

5.40 On satisfactory conclusion of the test, the ADTS gives the results as follows:

THE TEST RESULTS ARE:

THE RECEIVED LEVEL IS (−11 to −38) DBM.

THE DATA SET TESTS OK.

5.41 If the data set failed the test, one or more of the following messages is given:

- RINGING WAS NOT DETECTED.
- DIAL TONE WAS DETECTED.
- THE CARRIER SIGNAL DID NOT GO OFF.
- THE RECEIVED SIGNAL LEVEL IS OUT OF LIMITS.
- THE NUMBER OF BIT ERRORS DETECTED WAS TOO HIGH.
- THE NUMBER OF RECEIVER ERRORS WAS TOO HIGH.
- THE DATA SET IS UNABLE TO ADAPT TO THE ORIGINATOR.
- THERE HAS BEEN AN ADTS TEST EQUIPMENT MALFUNCTION. TRY AGAIN LATER.
- THE TEST COULD NOT BE COMPLETED DUE TO BAD RECEIVED SIGNAL.
- THE DATA SET DID NOT ANSWER.
- THE ADTS RECEIVER LOST SYNCHRONIZATION.
- AN ERROR COUNTER OVERFLOW OCCURRED.
- THE TEST CALL COULD NOT BE COMPLETED.

5.42 The ADTS continues: PLEASE ENTER THE FUNCTION YOU WISH TO PERFORM. If another test is to be run, enter the function code from Table B. If no other test is to be performed at this time, enter #63* to disconnect from the DIVA port.

5.43 For those tests in which the user called from the data set (as in this example), the ADTS calls the data set with the results at the completion of the test. The user should expect to receive this call approximately 2 minutes after entering 1* in response to WHEN READY ENTER ONE (paragraph 5.36).

5.44 When the user did not call from the data set, the ADTS gives test results via the (separate) telephone that made initial contact with ADTS. This telephone must remain off-hook throughout the test, and the user should expect to receive the results within 2 to 4 minutes after entering 1* in response to WHEN READY ENTER ONE (paragraph 5.36).

5.45 After test results are announced they are automatically stored in the ADTS Testlog File, and Recent Results File.

6. REFERENCES

6.01 Additional information concerning the DS 212A and use of the ADTS is contained in the following publications:

SECTION	TITLE
107-402-100	921A Data Test Set—Description and Operation
314-205-501	Data Systems—DATAPHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines
590-010-500	J1P005 Automatic Data Test System (ADTS)—Operation From Field Locations
592-034-100	Data Set 212A-L1A/2A Transmitter-Receiver—Description and Operation
592-034-200	Data Set 212A-L1A/2A Transmitter-Receiver—Installation and Connections
592-034-500	Data Set 212A-L1A/2A Transmitter-Receiver—Test Procedures Using 914-Type Data Test Set