

DATA SET 201C TRANSMITTER-RECEIVER DESCRIPTION AND OPERATION

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2400 bps over 2- or 4-wire private lines and the switched network.



Fig. 1—Data Set 201C—Front View

1. GENERAL

1.01 This section contains the physical and functional description and operation procedures for data set (DS) 201C. For more detailed information, refer to Section 592-029-150.

1.02 This section is reissued to include current information on DS 201C and to remove information that belongs in Section 592-029-150. Since this reissue is a general revision, arrows normally used to indicate changes have been omitted.

1.03 DS 201C (Fig. 1) is a synchronous, serial binary transmitter-receiver that operates at

1.04 DS 201C is line signal compatible with and can be interchanged for DS 201B in most applications. It is not compatible with DS 201A.

1.05 DS 201C provides the major features (except local copy) of DS 201B and also provides status indicators and self-test operation. A self-contained line control circuit is provided for switched network service.

Note: The line control circuit performs the functions previously performed by data auxiliary set (DAS) 804A-type. Therefore, DAS 804A-type is not required.

1.06 DS 201C may be used with the following auxiliary apparatus:

- DAS 829-type to provide a standard termination and switched network backup for 4-wire

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private lines with data only or alternate data/voice.

- DAS 828A-type to provide a standard termination for 4-wire private lines with data only or alternate data/voice.
- DAS 828C-type to provide switched network backup or to provide 4-wire transmission on two switched network lines.
- DAS 801-type to provide automatic calling on the switched network under control of the customer-provided equipment (CPE).

1.07 The following is a technical specification summary for DS 201C:

Operation: Synchronous, binary, serial

Modulation: Differential 4-phase shift keying (PSK)

Data Rate: 2400 bps

Interface Voltages: Per Electronic Industries Association (EIA) RS-232-C

Transmitter Timing: Internal or external

Line Requirements:

- 2-wire switched network
- 2- or 4-wire private line series 2000- or 3002-type (basic) channel.

Operating Modes:

- On 2-wire switched network or 2-wire private line, simplex (1-way) or half-duplex (2-way nonsimultaneous)
- On 4-wire private line, simplex, half-duplex, or duplex (2-way simultaneous)

Power Requirements: 105 to 129 volts, 27 watts, at 57 to 63 Hz

Ambient Temperature Range: +40 to +120°F

Relative Humidity Range: 20 to 95 percent

Dimensions: Width 10.5 inches, height 4.3 inches, depth 14 inches

Weight: 13 pounds

Customer-Provided Equipment: Must be supplied with an interface cord terminated in a Cinch or Cannon DB-19604-432 plug wired in accordance with Table A. This interface cord should not exceed 50 feet in length.

2. PHYSICAL DESCRIPTION

2.01 List code designations corresponding to the physical configurations of DS 201C are as follows:

- L1—Consists of the basic data set that is composed of two printed circuit boards (analog and digital, Fig. 2) interconnected by flexible cables.
- L2—Consists of the 100A power unit (Fig. 2) that provides +12, -12, and +5 volts.
- L3—Consists of the line control circuit board (Fig. 2) and the M13F telephone line interface cord.
- L4—Consists of the stand-alone enclosure and the P3BJ or KS-14532-L24 power cord. The enclosure (Fig. 3 and 4) is composed of front and rear molded black plastic covers mounted on an extruded aluminum housing. The housing has a brushed finish. The enclosure and the power cord are also orderable as a 50A1 data mounting.
- L5—Consists of the M8K telephone line interface cord.

2.02 The orderable list codes are as follows:

- 201C—L1/2/3 for multiple data set installations on the switched network.
- 201C—L1/2/5 for multiple data set installations on private lines.
- 201C—L1/2/3/4 for single data set installations on the switched network.

TABLE A
CUSTOMER INTERFACE

PIN NO.	FUNCTION	DATA SET MNEMONIC	EIA DESIGNATION (RS-232-C)
1	Protective Ground	FG	AA
2	Transmitted Data	SD	BA
3	Received Data	RD	BB
4	Request to Send	RS	CA
5	Clear to Send	CS	CB
6	Data Set Ready	DSR	CC
7	Signal Ground	SG	AB
8	Received Line Signal Detector	CO	CF
9	Test Voltage	+12V	—
10	Test Voltage	-12V	—
14	New Sync	NS (Non-EIA)	—
15	Transmitter Signal Element Timing	SCT	DB
16	Dibit Clock Transmitter	DCT (Non-EIA)	—
17	Receiver Signal Element Timing	SCR	DD
18	Dibit Clock Receiver	DCR (Non-EIA)	—
19	Remote Release (+5V)	RR (Non-EIA)	—
20	Data Terminal Ready	DTR	CD
21	Ready	RDY (Non-EIA)	—
22	Ring Indicator	RI	CE
23	Ring Indicator 2	RG2 (Non-EIA)	—
24	Transmitter Signal Element Timing (External)	SCTE	DA

- 201C—L1/2/4/5 for single data set installations on private lines.
 - **TR (Terminal Ready):** Lighted when the data terminal ready (CD) lead is *on*.
 - **MR (Modem Ready):** Lighted when the data set ready (CC) lead is *on*.
 - **RS (Request to Send):** Lighted when the request-to-send (CA) lead is *on*.
 - **CS (Clear to Send):** Lighted when the clear-to-send (CB) lead is *on*.
 - **CO (Carrier On):** Lighted when the received line signal detector (CF) lead is *on*.
- 2.03** Eight status indicators are provided on the data set to monitor the power unit, certain interface leads, and the test switches. These status indicators consist of light emitting diodes (LEDs) that illuminate translucent designations on the data set front cover. These designations identify the functions being monitored. The indicators and their functions during normal operation are as follows:
- **ON:** Lighted when power is supplied to the data set.

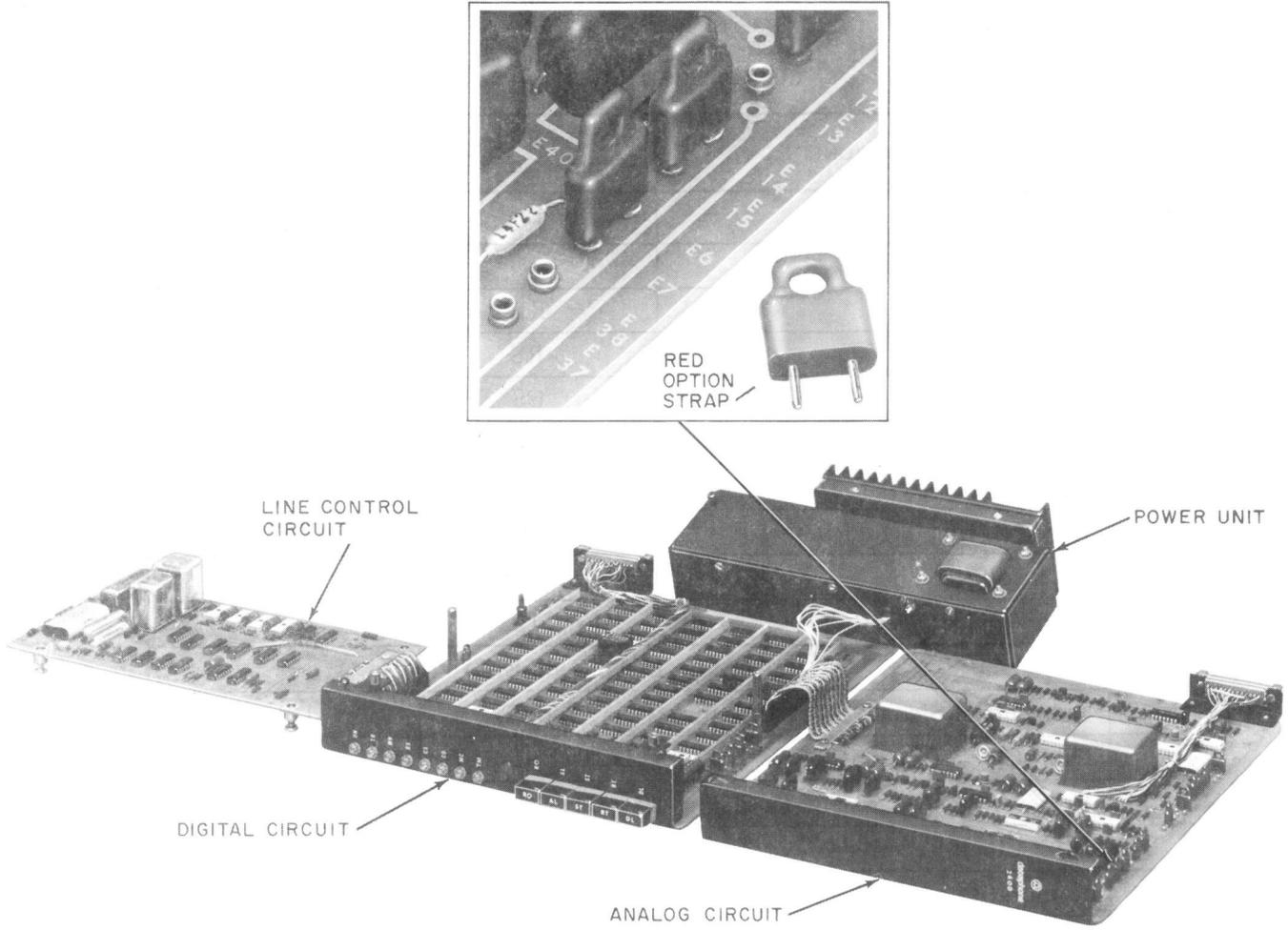


Fig. 2—Data Set 201C—Internal View

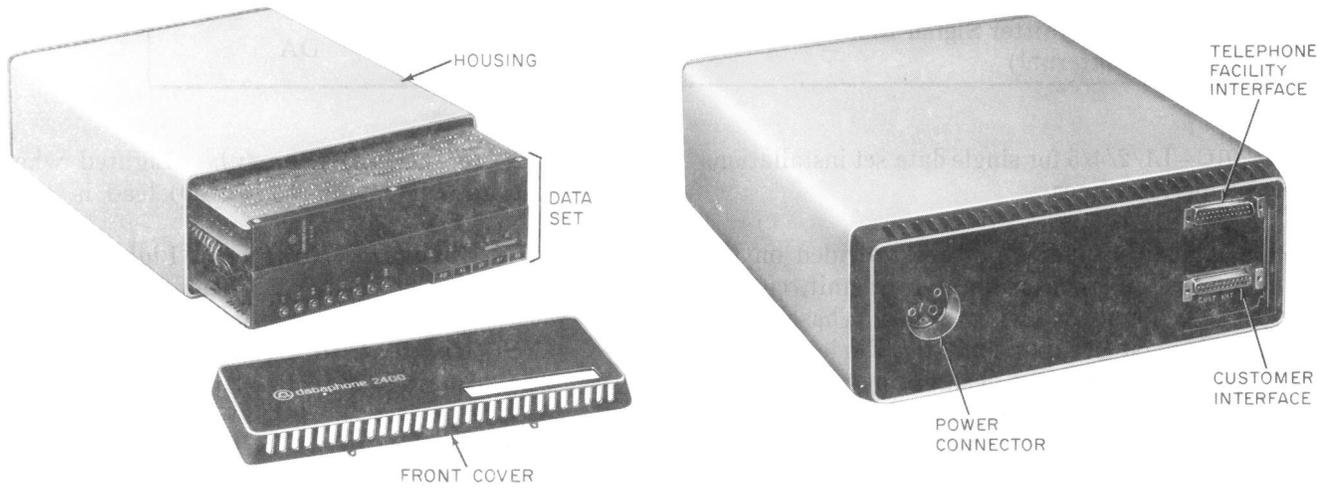


Fig. 3—Data Set 201C—Front Cover Removed

Fig. 4—Data Set 201C—Rear View

- **MC (Modem Check):** Lighted when the receiver signal element timing (DD) lead is *off*. During self-test operation, also lighted when errors occur in the received data.
- **TM (Test Mode):** Lighted when one or more of the AL, ST, RT, and DL test switches are depressed.

2.04 Five pushbutton switches, accessible through the front cover, provide self-test operation of the data set. These test switches are the depress-to-operate and depress-to-release type. The switches and their functions are as follows:

- **RO (Receive Only):** Conditions the data set to function as a receiver in an end-to-end self test on 2-wire facilities.
- **AL (Analog Loop-Back):** Loops back the data set transmitter output to the receiver input through an internal attenuator. On 2-wire switched network service, automatic answer and manual entry into the data mode are inhibited but the talk mode is not inhibited.
- **ST (Self Test):** Conditions the data set for self-test operation using an internal data generator and comparator.
- **RT (Remote Test):** Conditions the data set for remote testing from a data test center on 2-wire switched network service.
- **DL (Digital Loop-Back):** Loops back the data set receiver output to the transmitter input for testing on 4-wire facilities.

3. FUNCTIONAL DESCRIPTION

3.01 This part contains information on data set test modes, interface leads, and options. For a functional description of the data set, refer to Section 592-029-150.

A. Test Modes

3.02 DS 201C provides three test modes for use by the customer or a telephone company (telco) employee: analog loop-back, digital loop-back, and end-to-end.

3.03 Analog Loop-Back: This test mode checks the data set transmitter and receiver. Test data is looped back from the transmitter output to the receiver input through an internal attenuator. The received data is compared to the original data and the data errors are counted. The test data can be generated and compared internally by the data set or externally by a data test set (DTS). When the internal or self-test method is used, the customer interface is not checked.

3.04 Digital Loop-Back: This test mode can be used only on 4-wire private line service. The test mode checks the transmitter and receiver of both data sets and the facilities connecting the data sets. Test data transmitted by the near-end data set is looped back from the receiver output to the transmitter input of the far-end data set and retransmitted. This data is received by the near-end data set, compared to the original data, and the data errors are counted. The test data can be generated and compared internally by the data set or externally by a DTS. When the internal or self-test method is used, the customer interface at the near-end data set is not checked. The test functions of the near-end data set can be performed by a test center.

3.05 End-to-End: This test mode checks the transmitter and receiver of both data sets and the facilities connecting the data sets. Test data generated at the near-end transmitter is compared at the far-end receiver and vice versa. On 2-wire lines, the test is performed half duplex. On 4-wire lines, the test can be performed duplex. The test data can be generated and compared internally by the data sets or externally by DTSs. When the internal or self-test method is used, the customer interfaces at both data sets are not checked. The test functions of either data set can be performed by a test center.

3.06 When DS 201C is used as an extension of a DS 209A-L1 multiplex system, refer to Section 592-032-100 for more information. Procedures used at the serving test center (STC) to maintain this system are contained in Section 666-511-504.

3.07 When DS 201C is used as a substrate off-net extension of the digital data system (DDS), refer to Section 314-919-100 for more information. Procedures used at the hub office STC to maintain the analog portion of this system are contained in Section 666-511-501.

3.08 When DS 201C is used as a remote extension of a DS 209A-L1 multiplex system or as a substrate off-net extension of the DDS, the following restrictions apply to the use of the self tests:

- (a) The analog loop-back self test cannot be performed at a remote extension with options as installed. If the internal timing option is temporarily installed or the M23B cord is temporarily removed at the remote extension, this test can be performed.
- (b) The digital loop-back self test cannot be performed from a remote extension (with options as installed) in toward DS 201C collocated with DS 209A-L1. If the internal timing option is temporarily installed or the M23B cord is temporarily removed at the remote extension, this test can be performed.
- (c) The digital loop-back self test cannot be performed from a remote extension (with options as installed) in toward a hub office of the DDS. If the internal timing option is temporarily installed or the M23B cord is temporarily removed at the remote extension, this test can be performed.

B. Customer Interface

3.09 The customer interface is accessible through the CUST INT connector at the rear of the data set. The connector pin numbers and the corresponding lead designations are shown in Table A. For a detailed description of the interface leads, refer to Section 592-029-150.

C. Telephone Line Interface

3.10 The telephone line interface is accessible through an unlabeled connector at the rear of the data set. The connector pin numbers and the corresponding lead designations are shown in Table B. For a detailed description of the interface leads, refer to Section 592-029-150.

D. Options

3.11 DS 201C has features or options that may be requested by the user. A detailed description of these options is contained in Sections 592-029-150 and 592-029-200. A summary of the options is contained in Table C.

4. OPERATION

A. 2-Wire Switched Network

4.01 DS 201C provides the capability for the following:

- Manual call handling
- Automatic answering and disconnect
- Use of telephone line for both voice and data transmission
- Compatibility with DAS 801-type

4.02 Answering: Answering may be done manually or automatically.

(a) In manual answering, the telephone receiver is lifted from the cradle and the data set enters the talk mode. This enables the customer to speak with the calling party. When ready, the customer depresses the DATA key on the telephone (Fig. 5), thereby initiating the answering sequence that puts the data set into the data mode. The manual answering sequence consists of a 53-ms (63-ms, for data sets with a JC1 line control board, series 5 or higher) quiet period, following which the data set enters the data mode. The data terminal ready lead (pin 20) must be **on** for the answering sequence to occur.

(b) In automatic answering, the data set will answer the incoming call automatically if the data terminal ready lead (pin 20) is **on** and the automatic answer option is installed or the ready lead (pin 21) is **on** or connected to the remote release lead (pin 19). The automatic answering sequence consists initially of a 1.7-second (1.0-second, for data sets with a JC1 line control board, series 5 or higher) quiet period during which no signal is transmitted from the data set. This is followed by a 1.7-second (2.0-second, for data sets with a JC1 line control board, series 5 or higher) period of 2025-Hz answer tone that is used to signal the distant automatic calling unit (ACU) to switch the distant data set into the data mode. A 53-ms (63-ms, for data sets with a JC1 line control board, series 5 or higher) quiet period then occurs, following which the data set enters the data mode.

TABLE B
TELEPHONE LINE INTERFACE

PIN NO.	DESIGNATION	FUNCTION
1	L	Line status lamp control from data set to telephone set
2	-12V	Test voltage
3	+5V	Test voltage
4	LG	Line status lamp control ground
5	TD	Talk/data control from telephone set to data set
7	T	Telephone line tip
8	R	Telephone line ring
9	DT	Telephone line tip
10	DR	Telephone line ring
11	TEK6	Data set ready control ground
12	RNG	Common ringer control for multiple data sets
13	TEK5	Data set ready control from CIU* to data set
14	C	Data mode status from data set to ACU
16	D1	Data mode control from ACU to data set
20	+12V	Test voltage
21	T1	Telephone set tip
22	R1	Telephone set ring
23	A	Telephone line status from data set to ACU
25	TDG	Talk/data control ground

* Channel interface unit (DAS 828-type, DAS 829-type, or equivalent)

4.03 Calling: Calling may be done manually or automatically by an ACU. The data terminal ready lead (pin 20) must be **on** before the data set enters the data mode.

(a) In manual calling, the data set starts in the talk mode and does not enter the data mode until the DATA key on the telephone is depressed. After the DATA key is depressed, the data set goes through the same sequence as described for manual answering.

Note: In manual calling, neither end transmits an answer tone. Both ends should depress the DATA key at about the same time.

(b) In automatic calling by an ACU, the ACU responds to the 2025-Hz answer tone from the distant end, bypasses the quiet and answer-tone periods of the manual answering sequence, and puts the data set directly into the data mode.

4.04 Hang Up: The call may be ended manually or automatically.

(a) In manual operation, the call is ended by lifting the handset, depressing the LINE key on the telephone, and then hanging up. Depressing the AL switch on the data set while in the data mode also ends the call.

TABLE C
DATA SET 201C OPTIONS

FEATURE	OPTION			PROVIDE
Transmit Line Signal Level	0 dBm	For Private Lines	ZA	One Per Set
	-1 dBm	For Switched Network	ZB	
	-2 dBm		ZC	
	-3 dBm		ZD	
	-4 dBm		ZE	
	-5 dBm		ZF	
	-6 dBm		ZG	
	-7 dBm		ZH	
	-8 dBm		ZI	
	-9 dBm		ZJ	
	-10 dBm		ZK	
	-11 dBm		ZL	
	-12 dBm		ZM	
	-13 dBm		ZN	
	-14 dBm		ZO	
-15 dBm	ZP			
Line Impedance	600 ohms		ZQ	One Per Set
	900 ohms		ZR	
Compromise Equalizer (See Note)	In		ZS	One Per Set
	Out		ZT	
Carrier On Sensitivity	-24 dBm for Private Line		ZU	One Per Set
	-44 dBm for Switched Network		ZV	
New Sync	Not Used		YA	One Per Set
	Under Customer Control		YB	

TABLE C (Cont)
DATA SET 201C OPTIONS

FEATURE	OPTION		PROVIDE	
Transmitter Timing	Internal	YC	One Per Set	
	External	YD		
Automatic Answer	Not Provided or Provided Under Control of Customer Interface Circuits RDY and DTR	YE	One Per Set	
	Provided Under Control of DTR Only	YF		
Ring Indication on Customer Interface	EIA Interface on Terminal 22	YG	One Per Set	
	Contact Interface Between Terminals 22 and 23	YH		
External Control of DSR	Yes	YI	One Per Set	
	No	YJ		
Grounding	Signal Ground Connected to Frame Ground	YK	One Per Set	
	Signal Ground Not Connected to Frame Ground	YL		
Type of Operation and Clear-to-Send Delay	4-Wire Private Line	Switched Carrier, 7-ms CS Delay	XA	One Per Set
		Continuous Carrier, 7-ms CS Delay	XB	
		Continuous Carrier, 0-ms CS Delay	XC	
	2-Wire Switched Network	Switched Carrier, 150-ms CS Delay	XD	
	2-Wire Private Line	Switched Carrier, 150-ms CS Delay	XE	

Note: Use option ZS for all installations.

(b) In automatic operation, the call is ended by switching the data terminal ready lead (pin 20) to **off**. For data sets with a JC1 line control board, series 4 or lower, the data set ready lead (pin 6) goes **off** about 6 ms after the data terminal ready lead goes **off** but the data terminal ready lead may need to be **off** up to

15 ms to end the call. For data sets with these older JC1 boards, it is recommended that the data terminal ready lead be **off** at least 15 ms. For data sets with a JC1 line control board, series 5 or higher, the data set ready lead goes **off** about 25 ms after the data terminal ready lead goes **off** and the call is ended about 12

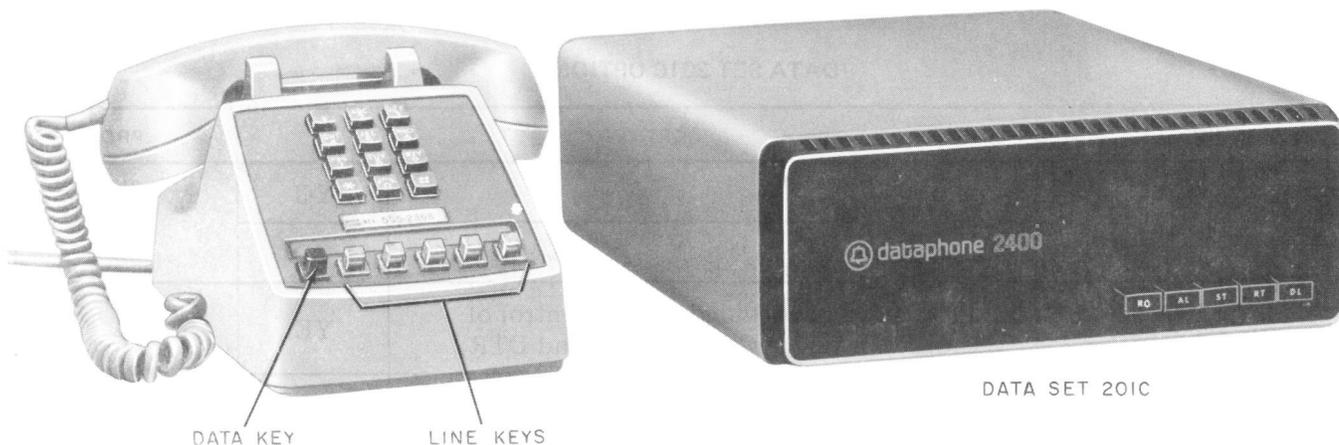


Fig. 5—Data Set 201C With Associated Telephone Set

ms after the data terminal ready lead goes *off*. For data sets with these newer JC1 boards, it is recommended that the data terminal ready lead be *off* at least until the data set ready lead goes *off*.

(c) Some central offices end a call by interrupting loop current to the local data set after the distant end goes on-hook. The duration of loop current interrupt required to end the call is about 10 to 20 ms. Since loop current interrupt cannot be guaranteed, this method of ending a call is not recommended.

B. 4-Wire Private Line

4.05 DS 201C is compatible with DAS 828-type and DAS 829-type channel interface units (CIUs). These CIUs provide a prewired and tested standard termination for a 4-wire private line voiceband channel with data only or data with alternate voice and/or switched network backup. For more information on the CIUs, refer to the references listed in Part 5.

C. 2-Wire Private Line

4.06 Arrangements using DS 201C on a 2-wire private line must be locally engineered. The data set should be optioned to transmit at 0 dBm. The receive level should be a nominal -16 dBm. The DAS 828-type CIU can be used to terminate a 2-wire data set operating over a 4-wire line.

5. REFERENCES

5.01 Additional information concerning DS 201C and auxiliary apparatus is contained in the following publications:

SECTION	TITLE
314-205-501	Data Systems—DATA-PHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines
314-410-500	Voice Bandwidth Private Line Data Circuits—Tests and Requirements
314-919-100	Digital Data System—Subrate Off-Net Extension Arrangements—Description
502-500-120	Telephone Sets—540, 560, 1560, and 2560 Series—Common Installation and Maintenance Information
590-002-100	Data Services—2000 and 2400 BPS Provided by Data Set 201-Type—Reference Guide

SECTION	TITLE	SECTION	TITLE
590-008-100	Data Auxiliary Set 801A-Type—Reference Guide	598-010-201	Data Auxiliary Sets 801A5 and 801A6 for Automatic Calling—Installation and Connections
590-008-101	Data Auxiliary Set 801C-Type—Reference Guide	598-010-301	Data Auxiliary Sets 801A5 and 801A6 for Automatic Calling—Maintenance
590-010-200	Data Sets and Data Access Arrangements—General Installation and Connection Information	598-010-501	Data Auxiliary Sets 801A5 and 801A6 for Automatic Calling—Test Procedures
590-010-201	Data Sets—Multiple Installation Information	598-012-101	Data Auxiliary Sets 801C3 and 801C4—Description and Operation
590-102-133	42A-Type Data Mounting—Identification	598-012-102	Data Auxiliary Set 801C-L1/2—Description and Operation
590-102-141	50A1 Data Mounting—Identification	598-012-151	Data Auxiliary Sets 801C3 and 801C4 for Automatic Calling—Theory of Operation and Supplementary Information
592-029-150	Data Set 201C—Transmitter-Receiver—Supplementary Information	598-012-201	Data Auxiliary Sets 801C3 and 801C4—Installation and Connections
592-029-200	Data Set 201C—Transmitter-Receiver—Installation and Connections	598-012-202	Data Auxiliary Set 801C-L1/2—Installation and Connections
592-029-300	Data Set 201C—Transmitter-Receiver—Maintenance	598-012-301	Data Auxiliary Sets 801C3 and 801C4—Maintenance
592-029-500	Data Set 201C—Transmitter-Receiver—Test Procedures Using 914-Type Data Test Set	598-012-501	Data Auxiliary Sets 801C3 and 801C4—Test Procedures
592-032-100	Data Set 209A-L1—Transmitter-Receiver—Description and Operation	598-012-502	Data Auxiliary Set 801C-L1/2—Test Procedures
592-862-100	Data Station 201C—Description and Operation	598-080-100	Data Auxiliary Set 828A—Description and Operation
592-862-200	Data Station 201C—Installation and Connections	598-080-101	Data Auxiliary Set 828C—Description and Operation
598-010-101	Data Auxiliary Sets 801A5 and 801A6 for Automatic Calling—Description and Operation	598-080-200	Data Auxiliary Set 828A—Installation and Connections
598-010-151	Data Auxiliary Sets 801A5 and 801A6 for Automatic Calling—Theory of Operation and Supplementary Information	598-080-201	Data Auxiliary Set 828C—Installation and Connections
		598-080-500	Data Auxiliary Set 828A—Maintenance and Test Procedures

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SECTION	TITLE	SECTION	TITLE
598-080-501	Data Auxiliary Set 828C—Maintenance and Test Procedures		(Switched Dial Backup)—Installation and Connections
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
598-082-101	Data Auxiliary Set 829-Type—Supplementary Functions for Voiceband Private Line Channels—(Alternate Voice and Dial Backup)—Description	598-082-501	Data Auxiliary Set 829-Type—Supplementary Functions for Voiceband Private Line Channels—(Alternate Voice and Dial Backup)—Test Procedures
598-082-102	Data Auxiliary Set 829-Type—Multiple Channel Arrangements—(Switched Dial Backup)—Description	598-082-502	Data Auxiliary Set 829-Type—Multiple Channel Arrangements—(Switched Dial Backup)—Test Procedures
598-082-200	Data Auxiliary Set 829-Type—Channel Interface Units—Voiceband Private Line Channels—Installation and Connections	666-511-501	Test of Data Services Provided by Data Set 201C From a Private Line Test Room
598-082-201	Data Auxiliary Set 829-Type—Supplementary Functions for Voiceband Private Line Channels—(Alternate Voice and Dial Backup)—Installation and Connections	666-511-504	Test of Data Services Provided by Data Set 209A-L1 From a Private Line Test Room
598-082-202	Data Auxiliary Set 829-Type—Multiple Channel Arrangements—	999-100-138	Data Set 201C—How to Operate Manual
		5.02	Detailed information concerning DS 201C is contained in CD- and SD-1D239-01.