PRIVATE LINE SERVICE TERMINATIONS
STATION ENGINEERING INFORMATION
STATION EQUIPMENT (DATA-VOICEBAND)

CONTENTS PAGE

1. GENERAL

1.01 This section provides engineering information for station arrangements used for private line data applications.

Comments concerning contents, usability, and adequacy of this practice will be welcome. Mail comments directly to the Bell System Practices Organization.

Mail to:
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Data Design Engineering Manager
2400 Reynolda Road
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1.02 This section is reissued to provide current reference information.

1.03 This section will serve as an aid to those who are engaged in the provision of voice bandwidth private line data arrangements. Information is provided for station arrangements using 4-wire voice bandwidth private line data channels with either Bell System data sets or customer-provided equipment (CPE).

1.04 General notes for all figures appear on a foldout on the last page of this section.

1.05 For general information for the entire Private Line Service Terminations series, refer to Section 812-002-200.

1.06 General rules for setting screw-type switches on terminating sets are provided in Section 851-300-101.

1.07 Section 812-002-201, Uniform Service Order Code (USOC) Index of Definitions and Applications, complements this section with additional information and references. It provides coordination for the entire Private Line Service Terminations series and will be maintained to reflect changes in the related sections.

1.08 The procedures in Section 590-000-100 should be followed when implementing data services. The provision of intercompany services should be in accordance with the Intercompany Service Plan in Section 010-520-XXX.

2. PRIVATE LINE SERVICE TERMINATIONS SERIES

2.01 The following sections constitute the Private Line Service Terminations series. All of these are related sections.

SECTION	TITLE
812-002-200	General Information
812-002-201	Uniform Service Order Code (USOC) Index of Definitions and Applications
812-002-210	PBX Terminations (Tie Trunk and SS-3)
812-002-211	PBX Terminations (Foreign Exchange and Wide Area Telecommunications Service)
812-002-215	Telephoto Station Arrangements
812-002-221	Station Equipment (Voice)
812-002-230	Station Equipment (Data Voiceband)
812-002-231	Station Equipment (Data Wideband)
812-002-250	Alternate Arrangements
812-002-270	Engineering Sketches and Signaling Devices
812-002-290	V4 Repeater Mountings and Components

3. DEFINITIONS (PRIVATE LINE DATA SERVICE)

3.01 The following are definitions frequently used with private line data services. Some are terms used in the tariffs, others are technical:

Amplitude Modulation (AM)—A method of transmission where the signal wave voltage is impressed upon a carrier wave of higher frequency. The amplitude of the carrier wave is varied proportionately with the amplitude of the signal wave.

Analog—A physical representation of information such that the representation bears an exact relationship to the original. The electrical signals generated by a telephone set are an analog representation of the original voice.

Asynchronous—A property of transmission where the performance of each operation starts as a result of a signal generated by the completion of the previous event or operation.

Baud—A unit of signaling speed equal to the number of discrete conditions or signal events per second.

Binary—Pertains to a characteristic or property involving a selection, choice or condition in which there are two possibilities. It pertains also to a number system with a base of two (rather than 10, as with the decimal system).

Bit—A contraction of binary digit. The bit is a unit of information content equal to one binary decision, or the designation of one of two possible and equally likely values (current, no current, voltage, no voltage, etc).

Baud Rate—The signaling speed in bauds which is equal to the reciprocal of the shortest element length in seconds to be transmitted.

Bit Rate—The number of units of information in a given time interval (commonly expressed in seconds).

Carrier—A transmission system where a signal wave is impressed upon a carrier wave by changing or "modulating" one of its characteristics.

Character—Composed of a certain number of bits. In the Baudot teletypewriter code, 5 information bits that equal 1 character and an additional 2.42 bits (1 start and 1.42 stop) are required to provide synchronization between the sending and receiving machines.

Data Service—Data transmission using Operating Company equipment or channels. Data service is a generic term and reflects an activity rather than an actual offering.

Data Transmission—The transmission of information in a form other than the human voice. The forms are either analog or digital. Digital can be either serial or parallel.

Data Mounting—Coded subassemblies intended primarily to provide mechanical facilities for mounting other apparatus in a cabinet or supporting structure. The mounting may include wiring and circuitry which contribute to or complete a function provided by the other apparatus.

Data Unit—Coded assemblies which provide circuits required to perform a function contributing to the operation of a data set or data auxiliary set. Data units are usually designed to be compatible with, and provide the same function for, several codes of data sets or data auxiliary sets.

Data Auxiliary Set (DAS)—The sets are coded apparatus which provide the circuits required to control the operation of a data set or data station. The DAS may also provide functions that are necessary or considered desirable for complete operation of a data set or data station.

Data Sets—Coded apparatus which at a minimum provide a modulator and/or demodulator to transform business machine signals to line signals and vice-versa. Data sets may also include control and supervisory circuits on either a fixed or optional basis.

Data Stations—Arrangements of coded apparatus which together perform all required communication functions for the associated business machine.

Data Communication System—System consisting of two or more data stations (or data sets) and the connecting transmission facilities.

Demodulator—Electronic equipment which converts the signal input from the line into a form acceptable to the business machine.

Digital—Signals made up of pulses of discrete duration, amplitude, etc.

Duplex—Two-way simultaneous circuit with separate transmission paths in both directions.

Frequency Modulation (FM)—A method of modulating a carrier frequency by causing the frequency to vary above and below the center or resting frequency in accordance with the modulating signal. The amount of deviation in frequency is at each instant proportional to the amplitude of the modulating signal.

Full Data (FD)—Circuit arranged for data only operation.

Full Data Alternate (FDA)—Circuit arranged for data transmission with alternate voice capability.

Half Duplex—Two-way nonsimultaneous circuit arranged for transmission in either direction, but not at the same time.

Interface—The point of connection between the customer-provided equipment (CPE) and the Operating Company equipment.

Modem—A contraction formed from the words ***modulator*** and ***demodulator***. It describes electronic equipment having both of these capabilities.

Modulator—Converts business machine output into a form suitable for transmission over line facilities.

Multiplex—The process which enables simultaneous transmission of several messages on the same circuit or facility.

Parallel Transmission—A method of transmission in which all bits of a character are sent simultaneously on the circuit or channel (rather than one after the other as in serial transmission).

Parity Bit—One or more binary digits appended to an array of bits for error detection and/or control.

Phase Modulation (PM)—Sending information by changing the phase characteristic of the carrier.

Serial Transmission—Method of transmission in which each bit of a character is sent sequentially on a single circuit or channel (rather than simultaneously as in parallel transmission).

Synchronous—A property of transmission in which the performance of any basic operation is compelled to start on, and usually to keep in step with, signals from a clock.

Synchronization—A means of insuring that both transmitting and receiving stations are operating together.

Word—The smallest unit of speech that has meaning when taken by itself. In Bell System data transmission terminology, the average word is defined as six characters of intelligence (5 letters, 1 space). Word length may be arbitrarily defined differently in other systems. The word rate is measured in words per minute (WPM).

4. INDEX OF TABLES

4.01 The following is an index of tables that provide additional information for the provision of private line data service.

5. PRIVATE LINE DATA SERVICE

5.01 Private line data service can be divided into the following areas:

- Channel
- Termination
- Loopback Circuit

- Data set or modem
- Interface.

5.02 The following information is based on Federal Communications Commission (FCC) Tariff 260. It may or may not be part of tariff offerings in associated Operating Companies. The areas described are necessary to provide private line data service.

Channel (Voice Bandwidth)

5.03 The Bell System offers a wide variety of channels for private line service. The transmission characteristics and types of services furnished are specified in FCC Tariff 260 and associated Operating Company tariffs. When used for data transmission, the channels are subject to the regulations set forth in the tariffs.

5.04 These channels are furnished for half-duplex or duplex operation on a two-point or multipoint basis. Varying degrees of conditioning are offered to meet transmission parameters as defined in the FCC Tariff 260.

5.05 Table A provides specifications for the voice bandwidth channel and C-type conditioning. Table B provides message circuit noise characteristics. These tables are provided for reference information. Complete information can be found in Sections 314-410-500, AB27.350, and Technical Reference, Transmission Specifications for Voice Grade Private Line Data Channels.

5.06 Where alternate use of a channel for voice is requested, Type 2001 or Type 3000 channels are furnished as defined in the tariff.

5.07 With this type of service, the customer may switch from one type of operation to the other, ie, data to voice. Only one type of operation may be used at a time.

Termination

5.08 Termination of the data channel may be a repeat coil, transformer, repeater, or some combination of these, depending on the particular application.

5.09 Some of the apparatus mentioned above may be required for a particular channel. It will then be considered as part of the channel.

5.10 The channel terminal equipment is always furnished by the Operating Company.

Loopback Circuit

5.11 Where 4-wire arrangements are used in the channel design, loopback test arrangements should be provided. This will permit tying the transmit and receive loops together to permit remote testing by the Serving Test Center (STC). This should be done at equal transmission level points.

5.12 When the channel is being tested, the data set should be properly terminated and the necessary signals sent to indicate to the customer that the line is in the test mode.

5.13 The loopback test circuit may be remotely activated by a tone, dc voltage or a locally operated key. More detailed information is provided in Sections 314-410-500 and AB27.350.

Data Set or Modem

5.14 The data set or modem may be furnished by the Operating Company or by the customer.

5.15 Terminal equipment is required to condition signals generated by apparatus furnished by the customer to signals suitable for transmission on a channel. Terminal equipment is also required to condition signals received from such a channel to signals for delivery to apparatus furnished by the customer.

5.16 When the customer provides the modem, it must be in accordance with tariff regulations, and the circuit must be equipped with minimum circuit protection devices.

5.17 The Operating Company offers a wide range of data sets capable of operating on the various private line channels. Information on the parameters of a given data set is provided in the Technical Reference for that particular data set.

5.18 Table C provides a list of the data sets most commonly used on private lines. A more

complete list of data sets can be found in Section 590-000-102.

5.19 Technical Reference Manuals are provided for business machine companies and customers to assist them in the design, development, and application of compatible data terminal devices and equipment.

5.20 When the terminal equipment is provided by the Operating Company, and alternate voice data (FDA) is required, the Operating Company will furnish:

- The telephone instrument used for voice operation
- The key necessary to switch from voice to data. A means of signaling, if required, must be ordered separately.

5.21 A transfer arrangement must be provided when a customer requests a channel normally terminated in a PBX or station to be transferred to a data location. The data location will be considered a second location.

Interface

5.22 When providing channel only service, the interface is the point at which the Operating Company termination is connected to the customer-provided equipment.

5.23 This physical point may be the screw terminals of a protective device or similar transmission equipment. This serves as the demarcation point separating those parts of a service which are the responsibility of the Operating Company from those which are the responsibility of the customer.

5.24 With an Operating Company-provided data set, the interface is the point at which the data set is connected to the customer-provided equipment. This interface and the requirements are defined in the Bell System Technical Reference or section for the particular set used.

6. ENGINEERING CONSIDERATIONS

6.01 The following information includes some of the many variables which must be considered when providing private line data service.

Equipment

6.02 The data equipment is classified by description and characteristics as follows:

- Name of manufacturer
- Model designation
  - (a) Transmitter
  - (b) Receiver
  - (c) Transceiver
- Type of Information
  - (a) Digital or Analog
    - —Characters
    - —Words or blocks
    - —Continuous
  - (b) Start or Synchronizing bits or pulses used
  - (c) Means of error checking used.

Signal Characteristics

6.03 The following list of signal characteristics must be considered when implementing data service:

- Baseband or subcarrier
- If multiplexing is used
  - —Number of channels
  - —How derived (frequency division, time division, etc)
- Frequencies of all subcarriers
- Type of modulation (amplitude, frequency, etc)
  - —Amplitude—double or single side band
- Filters or equalizers used that might affect the signal

TABLE A

SPECIFICATIONS FOR THE BASIC

VOICE BANDWIDTH DATA CHANNEL AND FOR C-TYPE CONDITIONING

	3002 CHANNEL	C1 CONDITIONING	C2 CONDITIONING	C4 CONDITIONING
I. Circuit Designation Use (Note D + G) Interstate Tariff FCC No. 260	Alternate Voice/Data or Data only	Alternate Voice/Data or Data only	Alternate Voice/Data or Data only	Alternate Voice/Data or Data only
II. General Characteristics Type of Service Mode of Operation Method of Termination Imped.-Source & Load Maximum Signal Power (Note H)	2-Point or Multipoint Half-or Full-Duplex 2-Wire or 4-Wire 600-ohm-Resistive-Bal. 0 dBm for Composite Data Signal, OVU for Voice	2-Point or Multipoint Half-or Full-Duplex 2-Wire or 4-Wire 600-ohm-Resistive-Bal. 0 dBm for Composite Data Signal, OVU for Voice	2-Point or Multipoint Half-or Full-Duplex 2-Wire or 4-Wire 600-ohm-Resistive-Bal. 0 dBm for Composite Data Signal, OVU for Voice	2-Point or 3-Point (Note F) Half-or Full-Duplex 2-Wire or 4-Wire 600-ohm-Resistive-Bal. 0 dBm for Composite Data Signal, OVU for Voice
III. Attenuation Char. Meas. betw. 600-ohm Impedances at Lineup (Recommended) Expected Max. Var. of (L) (Note A) Frequency Response (Ref. 1000 Hz) (Note B) Frequency Error	16 dB±1 @ 1000 Hz Short-term ± 3 dB Long-term ± 4 dB Freq. Range Var.-dB 300-3000, -3 to + 12 500-2500, -2 to + 8 ± 5 Hz	16 dB±1 @ 1000 Hz Short-term ± 3 dB Long-term ± 4 dB Freq. Range Var.-dB * 300-2700, -2 to + 6 *1000-2400, -1 to + 3 2700-3000, -3 to + 12 ± 5 Hz	16 dB±1 dB @ 1000 Hz Short-term ± 3 dB Long-term ± 4 dB Freq. Range Var.-dB * 300-3000, -2 to + 6 * 500-2800, -1 to + 3 ± 5 Hz	16 dB±1 dB @ 1000 Hz Short-term ± 3 dB Long-term ± 4 dB Freq. Range Var.-dB * 300-3200, -2 to + 6 * 500-3000, -2 to + 3 ± 5 Hz
IV. Delay Characteristics Absolute delay (Note C) Envelope delay distortion	Not specified Less than 1750 Micro-seconds over band from 800 to 2600 Hz	Not Specified *Less than 1000 Micro-seconds over band from 1000 to 2400 Hz Less than 1750 Micro-seconds over band from 800 to 2600 Hz	Not Specified *Less than 500 Micro-seconds 1000 - 2600 Hz *Less than 1500 Micro-seconds 600 - 2600 Hz *Less than 3000 Micro-seconds 500 - 2800 Hz	Not Specified *Less than 300 Micro-seconds 1000 - 2600 Hz *Less than 500 Micro-seconds 800 - 2800 Hz *Less than 1500 Micro-seconds 600 - 3000 Hz *Less than 3000 Micro-seconds 500 - 3000 Hz
V. Noise Characteristics Message Circuit Noise Impulse Noise (Notes E & H)	See Table B 15 counts in 15 minutes @ 68dbrnVB 67dbrnC 70dbrnCO	See Table B 15 counts in 15 minutes @ 68dbrnVB 67dbrnC 70dbrnCO	See Table B 15 counts in 15 minutes @ 68dbrnVB 67dbrnC 70dbrnCO	See Table B 15 counts in 15 minutes @ 68dbrnVB 67dbrnC 70dbrnCO

TABLE A

Notes:

A. (L) is the net loss as measured at 1000 Hz. Short term variations are those likely to be observed during a measurement interval. They are caused by amplitude and phase hits, dropouts, and maintenance activities. Long-term variations include seasonal changes, tube aging, etc.

B. DC continuity is not provided on any of these offerings.

C. Absolute delay and propagation times are not specified. Where satellite channels are employed, the delay may be several tenths of a second and telemetry and retransmission schemes may be either unusable or limited.

D. If alternate voice data operation is desired and the data modulation does not allow the use of compandors (such as many AM systems where instantaneous power varies rapidly), the voice mode may be degraded by excessive noise. If signaling is required, the data modulation must not interfere with 2600 Hz S.F. signaling units and response is not specified between 2450 and 2750 Hz.

E. These impulse noise limits are primarily Plant maintenance limits. In cases where they are exceeded, Engineering will evaluate the performance on impulse noise distribution, ie, how rapidly the counts (impulses) fall off as counting level (impulse noise peak voltage) is raised, and the effect on the data system performance.

F. Third-point operation describes the conditioning where point A (master) can transmit to B and C (slaves) simultaneously and both B and C can respond to A. Transmissions between B and C are possible, but the characteristics are not specified.

G. C3 conditioning, not included in this table, describes conditioning of access lines and trunks in central office switching applications. An end-to-end connection consisting of four trunks and two access lines with C3 will approximate C2 conditioning overall.

H. The "vb" in the objectives refers to the voiceband filter in the measuring set. This approximates the "C" message filter and the typical response of the voice grade channel.

*These specifications are tariff items.

TABLE B
MESSAGE CIRCUIT NOISE CHARACTERISTICS
PRIVATE LINE OPERATION

The basic objective for data operation is that the rms data level should be 24 dB above the message circuit noise reading with a "C message weighted filter" during the data signal on condition. Since the data level can be -16 dBm at the terminal, the following objective is given:

* rms data signal	—16	dBm	74	dBrnC
Signal-to-Noise requirement	24		24	
Allowable Noise	—40	dBm	50	dBrnC

If readings are made in the idle or "no signal" condition, as is most common, the following objectives are typically used. These readings are caused by a masking of noise, due to idle circuit loss in the expandor in compandored carrier systems, and other effects.

Circuit Length (Miles)		Expected Noise Reading C Message Weighting Not Exceeding
0-	50	28 dBrnC
50-	100	31 dBrnC
100-	400	34 dBrnC
400-	1000	38 dBrnC
1000-	1500	40 dBrnC
1500-	2500	42 dBrnC
2500-	4000	44 dBrnC
4000-	8000	** 47 dBrnC
8000-	16000	** 50 dBrnC

* Assume a random spectrum of the data signal.

** Voice operation may be degraded.

Note: All readings are expected values. While the noise characteristics are fairly stable, variations due to facility activity or troubles will be experienced.

TABLE C
DATA STATION ARRANGEMENTS
PRIVATE LINE DATA SETS
(NOTES A, B, C)

DATA SET	USOC	SPEED	TRANSMISSION MODE	FEATURES	SD AND CD	APPLICABLE SECTION
201 A3	DFS ( )	2000 BPS	PM Serial	Send and Receive with internal timing	1D186	592-011-101
201 A4	DNA ( )	2000 BPS	PM Serial	Send and Receive with external timing	1D186	592-011-101
201 B3	DGS ( )	2400 BPS	PM Serial	Send and Receive with internal timing	1D186	592-011-201
201 B4	DNS ( )	2400 BPS	PM Serial	Send and Receive with external timing	1D186	592-011-201
202 D3	DRE ( )	Up to 1800 BPS	FM Serial	Send and Receive	1D049	592-016-100
203 A ( )	DEN ( )	1.8, 3.6, 5.4 KBPS	Multi-Level AM VSB	Send and Receive	1D151	592-019-100
203 A ( )	DFE ( )	2.4, 4.8, 7.2 KBPS				
203 B ( )	DEH ( )	1.8, 3.6, 5.4 KBPS	Multi-Level AM VSB	Send Only, Includes Secondary channel Signaling	1D151	592-019-100
203 B ( )	DEW ( )	2.4, 4.8, 7.2 KBPS				
203 C ( )	DEL ( )	1.8, 3.6, 5.4 KBPS	Multi-Level AM VSB	Receive Only, Includes Secondary channel Signaling	1D151	592-019-100
203 C ( )	DEX ( )	2.4, 4.8, 7.2 KBPS				

Notes: A. This table provides a list of the most commonly used private line data sets. For a complete list see 590-002-102.
B. See Section 590-000-100 for determination of proper USOC suffix (Data Set Options).
C. See Division 590 for reference information.

- Duration of bit or shortest pulse (milliseconds or microseconds)
- Number of bits per character, word, or block
- Rate of transmission

  —Bits per second—Bauds

  —Character, words, or blocks per second
- Permissible error rate (in bits per minute, blocks per day, etc).

Terminations

6.04 The following should be considered when providing terminations for private line data service.

- Transmitting

  —Impedance

  —Balanced or unbalanced
- Receiving

  —Impedance

  —Balanced or unbalanced
- Range of transmitter output level(dBm)
- Range of acceptable signal level into receiver (dBm) (sensitivity)
- Special terminating equipment or arrangements to be provided by the Operating Company.

6.05 Information on Operating Company terminal equipment (Teletypewriter, DATASPEED®, etc) can be found in the applicable section (for example, Section 574-301-100 provides information for the Model 37 KSR Teletypewriter). Information on terminal equipment manufactured by outside suppliers can be found in publications furnished by the supplier.

Circuit Transmission Requirements

6.06 The following list contains those circuit transmission requirements that must be considered with private line data service. These are generally specified by transmission engineering.

- Frequency band (Hz).
- Maximum permissible variation of loss over the frequency band.
- Maximum permissible envelope delay distortion over the frequency band (μ seconds).
- Maximum permissible difference in absolute delay between channels, if multiplexing is used (μ seconds).
- Maximum permissible receiving level variation (dB)

  —Short term

  —Long term.
- Maximum permissible level of noise below unmodulated subcarrier or other reference

  —Background noise

  —Impulse noise.
- Maximum permissible frequency shift between terminals (Hz).
- Maximum permissible level of "talker" echo (signal transmitted returning to originating station) below direct signal from distant station (dB).
- Maximum permissible level of "listener" echo (signal arriving later than desired signal at the receiving station) below desired signal (dB).
- Line design may be either 2-wire or 4-wire but 4-wire is preferred for maintenance and return loss considerations. On multipoint services, 4-wire line design and termination are preferred and may be necessary to provide adequate stability. See Section 851-300-101.
- Where 4-wire circuits are used, equal level loop back arrangements should be specified to tie the transmit and receive loops together for testing.

Operational Requirements

6.07 The following are operational requirements to be considered when implementing private line data service.

- Two-point only or multipoint operation.
- Desired communication pattern between stations.
- Type of signaling, if required. ***When providing transfer arrangements, signaling must be compatible. If not, additional circuitry is required.***
- Need for a talking arrangement for coordination.
- Alternate use with another service.
- Requirements for full duplex operation (simultaneous two-way).
- Switching requirement.
- Availability of ac outlet for channel termination equipment and data set.
- Arrangements for mounting data sets.
- Available sufficient space for all units of equipment.

Interconnection

6.08 To protect Operating Company facilities and the services furnished to the general public from harmful effects, the signals applied to these facilities by customer-provided terminal equipment or communications systems must comply with the applicable minimum protection criteria. The physical protection implementation aspect is governed by the current effective dates filed in FCC Tariff 260 or in applicable State Tariffs.

6.09 The minimum protection required for voice grade circuits routed over local cable (metallic or VF repeatered) and short haul carrier systems (eg, N and T1) is:

- ***Hazardous Voltage Protection***
- ***Longitudinal Balance***

6.10 The minimum physical protection required for voice grade circuits routed over broadband long haul carrier systems is:

- ***Hazardous Voltage Protection***
- ***Longitudinal Balance***
- ***Signal Power Limiting.***

7. DATA STATION ARRANGEMENTS

7.01 The following provides information on standard arrangements for private line data service. All figures shown are for 4-wire private line voice channels.

7.02 Table D provides the USOC and description of the more common basic data service arrangements.

7.03 Table E describes the USOC combinations for data station arrangements using Operating Company-provided equipment (modem). It includes the USOC, channel use, interface information, and applicable section figure.

7.04 Table F provides information for private line arrangements for customer-provided equipment. It includes equipment information, applicable section references, and CD and SD references.

7.05 The data station arrangements using customer-provided equipment (modem) are described in Table G. It includes the USOC, channel use, interface information, and applicable section figure.

Data Auxiliary Set (DAS) 828A

7.06 The Data Auxiliary Set (DAS) 828A is intended to be used as the standard means to terminate 4-wire private line voiceband data channels. It is installed between the 4-wire line from the central office and the terminal equipment at the station and provides functions normally required for both Operating Company or customer-provided equipment. The connected terminal equipment usually consists of data modulators and demodulators (modems or data sets). See Table C for a list of Bell System data sets commonly used for private line data service.

TABLE D
USOCS
BASIC DATA SERVICE ARRANGEMENT

USOC	DESCRIPTION
WUP (—)	Half-duplex service terminal
VPV (—)	Full-duplex service terminal
WX4 (—)	Additional half-duplex service terminal
VPW (—)	Additional full-duplex service terminal
1YX (—)	Miscellaneous transfer key
3AJ	Alternate use (Data Station)
L3M	Key signaling
SUFFIX	
SD	Data Set (Bell System)
SQ	Connecting Block
SM	Jack
SY	Special telephone

7.07 There are two types of DAS 828A. One type provides for data transmission only, for use where no alternate voice transmission as provided by the Operating Company is required. The other arrangement includes Operating Company-provided alternate voice capability with 20-Hz manual ringdown signaling.

7.08 The first type is referred to as the FULL DATA (FD) arrangement; the second type is referred to as the FULL DATA-ALTERNATE VOICE (FDA) arrangement. An alternate voice-data capability provided by the customer will use the FD arrangement and customer-provided in-band signaling. For complete description and operation of these two arrangements, see Section 598-080-100.

7.09 The FULL DATA (FD) arrangement of the DAS 828A provides the following functions:

- Means for terminating a 4-wire private line
- Amplification or attenuation in the transmit and receive pairs
- Slope (attenuation) equalization in the receive pair
- 4-wire to 2-wire conversion to interface with 2-wire modems
- Transmit level limiting when required for interconnection with customer-provided equipment and protection against foreign hazardous voltage. Consult the current tariff regulations for effective dates of implementation.
- Equal level loopback of the 4-wire line toward the central office for testing
- Contact indication to modem when circuit is not in data mode.

7.10 The FULL DATA-ALTERNATE VOICE (FDA) arrangement provides in addition to the functions listed in 7.09 the following.

- Voice-data transfer control
- Voice capability
- 20-Hz manual ringdown signaling
- Attenuation required for alternate voice-data operation.

TABLE E
USOCS
PRIVATE LINE DATA STATION ARRANGEMENTS
OPERATING COMPANY-PROVIDED EQUIPMENT

USOC COMBINATION	CHANNEL USE		MODEM INTERFACE		EQUIPPED WITH DIRECT DISTANCE DIALING BACK-UP	APPLICABLE SECTION FIGURE	NOTES
	DATA ONLY	ALT VOICE DATA	2-WIRE	4-WIRE			
WUPSD, DGS07	√		√			1	A, B, C
VPVSD, DGS31	√			√		2	A, B, E
WUPSD, 3AJ, DGS05, L3M		√	√			3	A, B, D
VPVSD, 3AJ DGS29, L3M		√		√		4	A, B, F
VPVSD, DGS05	√			√	√	5	A, B, D, G
VPVSD, 3AJ, DGS29, L3M		√		√	√	6	A, B, F, G

Notes: A. USOC suffix SD is assigned for data set termination. DGS is the USOC assigned for 201B3 Data Set and is used in this table as an example. The USOC for the particular Data Set used may be selected from Table C or Section 590-000-102. The USOC suffix may be selected from Section 590-000-100.

B. The USOC suffix decoding information in Notes C, D, E, and F was compiled using Sections 590-002-100 and 590-000-100.

C. USOC Suffix 07 Decoded is:

Decision	A1	E1A Interface
Decision	B4	Without Alternate Voice
Decision	C6	Without New Sync
Decision	D7	Half-duplex, 2-Wire
Decision	E	Not Applicable

D. USOC Suffix 05 Decoded is:

Decision	A1	E1A Interface
Decision	B3	With Alternate Voice
Decision	C6	Without New Sync
Decision	D7	Half-duplex, 2-Wire
Decision	E	Not Applicable

E. USOC Suffix 31 Decoded is:

Decision	A1	E1A Interface
Decision	B4	Without Alternate Voice
Decision	C6	Without New Sync
Decision	D8	Full-duplex, 4-Wire
Decision	E10	CXR Controlled by Req. to Send

TABLE E
NOTES (CONT)

F. USOC Suffix 29 Decoded is:

Decision	A1	E1A Interface
Decision	B3	With Alternate Voice
Decision	C6	Without New Sync
Decision	D8	Full-duplex, 4-Wire
Decision	E10	CXR Controlled by Req. to Send

G. In some operating companies there may be no distinction made in the tariff offering for variations, such as D.D.D. Backup for a private line data service. The information should be included in the remarks Section of the USSO.

TABLE F
USOCS
PRIVATE LINE DATA EQUIPMENT – STATION ARRANGEMENTS
CUSTOMER-PROVIDED EQUIPMENT (MODEM)

USOC	EQUIPMENT	SECTION (DIVISION)	SD AND CD	INTERFACE TO CUSTOMER	AUTOMATIC LEVEL CONTROL	NOTES
CGA	DAS 828A	598-	—1D225-01	2W/4W	No	A, B
	V4 Repeater	332-	—97047-01 —99739-01	2W/4W	No	A, B
	1000B	590-	—1D205-01	2W	Yes	A
CDT	1000A	590-	—1D205-01	2W	Yes	A

Notes: A. This table provides a list of the most common private line data station arrangements. The application of the limiting device is dependent on current effective tariff regulations.
B. Provides Automatic Level Control when equipped with F58122 amplifier.

7.11 The DAS 828A uses the 24V4 repeater as the basic unit. The plug-ins used such as term sets, amplifiers, networks, or equalizers are dependent on the facilities and the conditioning required. See Section 812-002-290 for reference information.

7.12 The basic unit is the 828A-L1. This unit consists of a 24V4B repeater mounting unit and a 35A1 data unit providing a single unit that is prewired and tested for 4-wire private line data service.

7.13 Connections to Bell System data sets or customer-provided modems can be made on a plug-in or quick-connect basis at the 828A-L1. Plug-in connection to the 828A-L1 is recommended.

7.14 The dimensions of the 828A-L1 unit are 6-15/16 inches high, 9-1/4 inches wide, and 9-7/16 inches deep. The unit weighs approximately 9-1/4 pounds. The 828A-L1 is intended for mounting on relay racks, 16C or 31B apparatus mountings, and numerous equipment cabinets described in Section 463-140-100.

7.15 The 828A-L1A unit consists of a basic 828A-L1 wired and assembled on a 31B apparatus mounting. The mounting frame is hinged to a 177A backboard, providing access to the rear of the units. The package arrangement is completed by a light olive gray dust cover (116A).

7.16 The dimensions of this unit with the cover in place are 16-5/8 inches high, 13-9/32 inches wide, and 10-1/16 inches deep. The complete assembly weighs approximately 17 pounds.

7.17 The 828A-L1/2 unit consists of a basic 828A-L1, a 37A1 data unit, and 568HAA-3

TABLE G
USOCS
PRIVATE LINE DATA STATION ARRANGEMENTS
CUSTOMER-PROVIDED EQUIPMENT (MODEM)

USOC	CHANNEL USE					MODEM INTERFACE		APPLICABLE SECTION FIGURE	NOTES
	DATA ONLY	ALT VOICE DATA		SIGNALING		2-WIRE	4-WIRE		
		CUSTOMER PROVIDED EQUIPMENT (TELEPHONE)	OPERATING COMPANY (TELEPHONE)	CUSTOMER PROVIDED EQUIPMENT	OPERATING COMPANY (20 Hz)				
WUPSQ, CGA03	√					√		1	A, B, D, E
VPVSQ, CGA04	√						√	2	A, B, D, G
WUPSQ, 3AJ, CGA03		√		√		√		1	A, B, C, D, E
VPVSQ, 3AJ, CGA04		√		√			√	2	A, B, C
WUPSQ, 3AJ CGA01, L3M			√		√	√		3	A, B, D, F
VPVSQ, 3AJ CGA02, L3M			√		√		√	4	A, B, D, H

Notes: A. All arrangements shown in this table use DAS 828A( ).

B. The USOC suffix SQ (connecting block) is used in this table as an example. Suffix SQ, SM or SY may be used when terminating in customer-provided equipment. It is recommended that appropriate supporting information be included in remarks section of USSO to describe customer-provided equipment.

TABLE G
NOTES (CONT)

C. With a customer-provided telephone (alternate voice data) the customer is expected to provide any channel signaling that is required, using inband signaling techniques.

D. The service description and options for private line data access arrangements are:

SERVICE DESCRIPTION	USOC
Data Access Arrangement for Connection of Customer-Provided Data Terminal Equipment or Data Communication Systems	
Send or Send and Receive	CGA (—)
Receive Only	CGB (—)

Suffix coding is as follows:

OPTION	CHOICE
A	1. Two-Wire Customer Interface 2. Four-Wire Customer Interface
B	3. With Telco-Provided Voice 4. Without Telco-Provided Voice
C	5. O DBM Transmit Power Level 6. -8 DBM Transmit Power Level

E. Using the above and Section 590-000-100:
CGA03 Decoded is:

Option A1 Two-Wire Customer Interface
Option B4 Without Operating Company-Provided Voice
Option C5 O DBM Transmit Power Level

F. CGA01 Decoded is:

Option A1 Two-Wire Customer Interface
Option B3 With Operating Company-Provided Voice
Option C5 O DBM Transmit Power Level

G. CGA04 Decoded is:

Option A2 Four-Wire Customer Interface
Option B4 Without Operating Company-Provided Voice
Option C5 O DBM Transmit Power Level

H. CGA02 Decoded is:

Option A2 Four-Wire Customer Interface
Option B3 With Operating Company-Provided Voice
Option C5 O DBM Transmit Power Level

key telephone set. The units are prewired and tested for 4-wire private line data alternate voice service. The 37A1 data unit consists of a 248B key telephone unit (KTU) and a 36A1 data unit.

7.18 A 66-type connecting block, a 50-pair connector, and an A25D connector cable are mounted on a plate at the rear of the 37A1 data unit. Connections to the 828A-L1 portion and the 568HAA-3 key telephone set are made on a plug-in basis. Wiring appearances for the telephone set also appear at a 66-type connecting block that can be used for testing.

7.19 The 828A-L1/2 is intended for mounting in the same manner as the 828A-L1. When the 828A-L1/2 is mounted side-by-side, the dimensions are 6-15/16 inches high, 17 inches wide, and 9-7/16 inches deep. The 828A-L1/2 (excluding the key telephone set) weighs approximately 17 pounds.

7.20 The 828A-L1A/2 unit consists of a basic 828A-L1 and 37A1 data unit prewired and assembled on a 31B apparatus mounting. The 568HAA-3 telephone set is also provided. The mounting frame is hinged to a 177A backboard, providing access to the rear of the units. The package arrangement is completed by a light olive gray dust cover (116A).

7.21 The dimensions of this unit with the cover in place are 16-5/8 inches high, 13-9/32 inches wide and 10-1/16 inches deep. The complete assembly, not including the key telephone set, weighs approximately 24-3/4 pounds.

7.22 The DAS 828A is not equipped with a power supply. It must be selected and ordered separately based on the various power requirements for each arrangement.

7.23 All arrangements in this section allow use of the DAS 828A. See Section 598-080-100 for more detailed information.

Data Auxiliary Set (DAS) 828C

7.24 The Data Auxiliary Set (DAS) 828C is for use on the Direct Distance Dialing (DDD) switched message network to transmit 4-wire voiceband data. The DAS 828C makes use of two DDD lines to provide one 4-wire voiceband data circuit when used with Operating Company-provided data sets. The primary function of the DAS 828C is as a backup for one 4-wire private line voiceband data circuit. It is used typically with the DAS 828A in this capacity.

7.25 The DAS 828C provides the necessary switching, control, and signaling functions associated with the transfer to the DDD network.

7.26 Plug-ins for the DAS 828C such as pads and equalizers are dependent on the facilities provided.

7.27 The 828C-L1 unit consists of two discrete packages which plug together and are suitable for mounting on relay racks or on a 31B or 16C apparatus mounting. One package consists of two 39A1 data units and a connecting block assembly mounted on hanger bars to form a single integral unit. The other package consists of a 227B KTU, 229B KTU, 36A1 data unit, and a connecting block assembly mounted on hanger bars as a single integral unit. Both packages are prewired and tested.

7.28 Three 66-type connecting blocks have been provided for testing, strapping options, and power terminations.

7.29 The smaller package of the 828C-L1 unit measures 6-15/16 inches high, 5-7/32 inches wide, and 8-7/32 inches deep. The package weighs approximately 8-1/2 pounds. The larger package measures 6-15/16 inches high, 9-1/8 inches wide, and 7-23/32 inches deep. The package weighs approximately 8-1/4 pounds.

7.30 The 828C-L1A unit consists of the two List 1 packages mounted in an enclosure made up from a 31B apparatus mounting, 177A backboard, 116A cover, and associated hardware. It is prewired and tested.

7.31 The 828C-L1A unit, with the cover in place, measures 16-5/8 inches high, 13-9/32 inches wide, and 10-1/16 inches deep. It weighs approximately 23 pounds.

7.32 The power supplies for the DAS 828C must be selected and ordered separately based on the various power requirements for each arrangement.

7.33 For complete description and operation of the DAS 828C, see Section 598-080-101.

Circuit Arrangements

7.34 Table H provides a figure index and description of service applications for data station arrangements. All arrangements, with the exception of Fig. 5 and 6, may use either Bell System data set or customer-provided equipment (modem).

7.35 The following is a brief description of each circuit arrangement.

Data Only—2-Wire and 4-Wire (Fig. 1 and 2)

7.36 Fig. 1 is the circuit arrangement for data only 2-wire service. The 2-wire condition is at the data set interface, the channel is 4-wire.

7.37 Fig. 2 shows the arrangement for data only 4-wire service. The data set and channel are both 4-wire.

7.38 In both arrangements, the loopback circuit consists of a relay which may be locally operated using a key (6017-type or equivalent) or remotely operated via the simplex leads. See Fig. 7 for the schematic of the key control of the loopback relay.

7.39 When using customer-provided equipment (modem), the customer may provide a talking instrument. Any channel signaling that is required must be accomplished using inband signaling provided by the customer.

7.40 If the customer provides the talking instrument, the single interface of the Full Data Service will be used. It is then the responsibility of the customer to provide pad switching between the modem and the talking instrument to obtain proper transmission levels.

TABLE H
DATA STATION ARRANGEMENTS
FIGURE INDEX
(SERVICE APPLICATIONS)
(NOTES A, B, C, D)

FIGURE	TYPE OF SERVICE	EQUIPMENT	CD AND SD	SECTION
1	2-Wire Full Data	DAS 828A( )	1D-225-01	598-080-100
2	4-Wire Full Data	DAS 828A( )	1D-225-01	598-080-100
3	2-Wire Full Data Alternate	DAS 828A( )	1D-225-01	598-080-100
4	4-Wire Full Data Alternate	DAS 828A( )	1D-225-01	598-080-100
5	4-Wire Full Data with DDD Backup	DAS 828A( ) and DAS 828C( )	1D-225-01 and 1D-233-01	598-080-100 and 598-080-101
6	4-Wire Full Data Alternate with DDD Backup	DAS 828A( ) and DAS 828C( )	1D-225-01 and 1D-233-01	598-080-100 and 598-080-101
7	Manual Key for Loopback	6017B	69160-01	512-210-101

Notes:

A. The components for the 24V4 repeater are dependent on the conditioning required and the facilities used and shall be provided as required. Component information is provided in Section 812-002-290.

B. See appropriate section for data set options and connection information.

C. When customer-provided equipment is specified, the proper interconnection unit must be selected and ordered as required.

D. See Sections 590-010-201 or 463-140-100 for selection of cabinet and order as required.

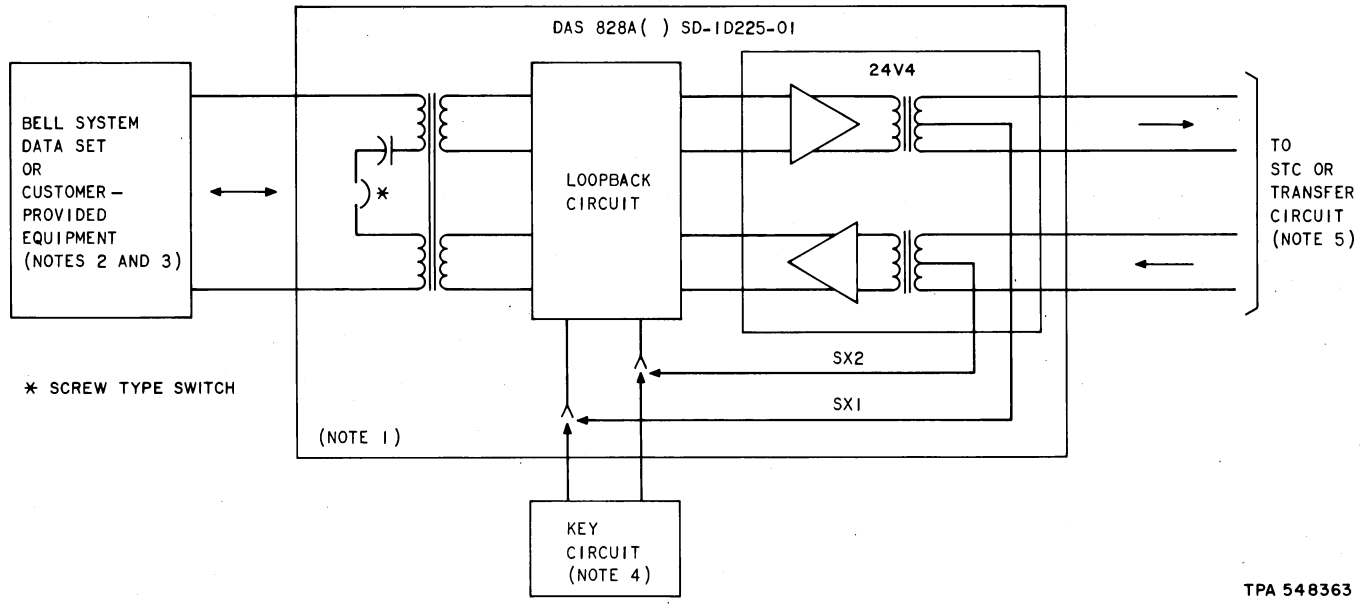

Fig. 1—2-Wire Data Only

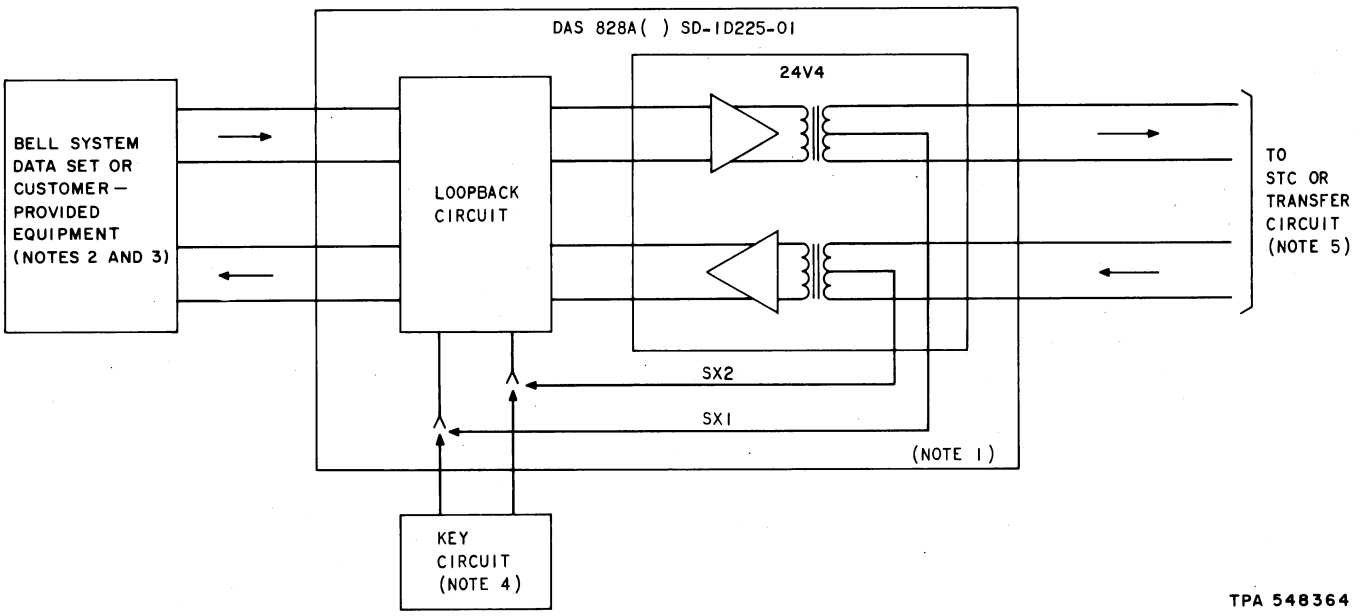

Fig. 2—4-Wire Data Only

Full Data/Alternate Voice—2-Wire and 4-Wire (Fig. 3 and 4)

7.41 Fig. 3 and 4 show Full Data Alternate arrangements for 2-wire and 4-wire respectively. For Fig. 3, the data set is 2-wire and the channel arrangement 4-wire.

7.42 The loopback circuit relay is operated by a key on the associated 568 telephone set in both arrangements.

7.43 A data/talk relay provides the ability to switch from data to voice. Pads are included

to ensure that proper transmission levels are maintained.

7.44 Ringdown signaling is provided using 20 Hz via a pushbutton on the 568 telephone set.

Full Data and Full Data Alternate—4-Wire E/W Direct Distance Dialing Backup (Fig. 5 and 6)

7.45 Fig. 5 and 6 show circuit arrangements for Full Data (FD) and Full Data Alternate (FDA), respectively. Both arrangements are 4-wire equipped with Direct Distance Dialing Backup.

7.46 These arrangements use the DAS 828C in conjunction with the DAS 828A. See 7.24.

7.47 A 568-type telephone set (Section 502-501-105) is used in both the Full Data and Full Data Alternate arrangements equipped with DDD backup.

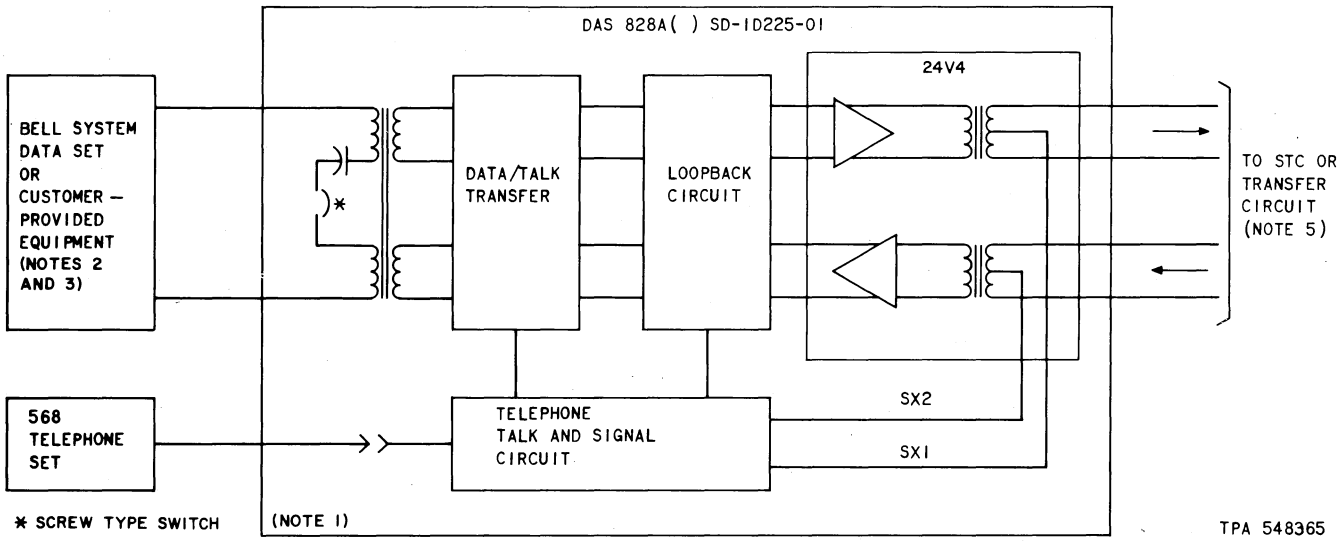

Fig. 3—2-Wire Full Data-Alternate Voice (20 Hz Manual Ringdown)

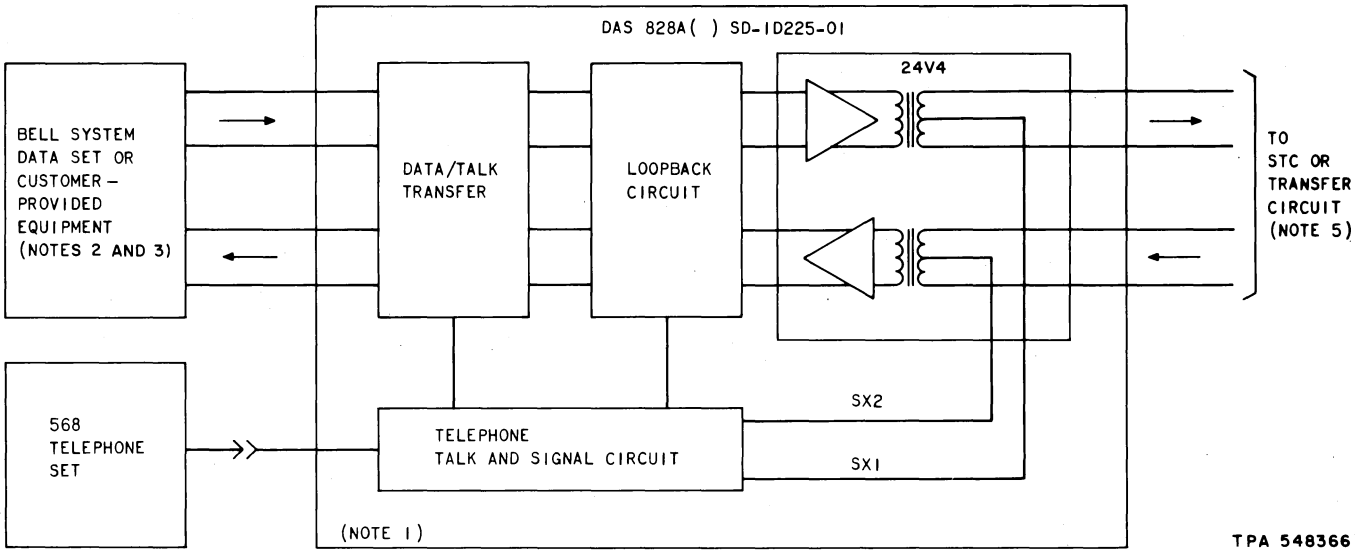

Fig. 4—4-Wire Full Data-Alternate Voice—(20 Hz Manual Ringdown)

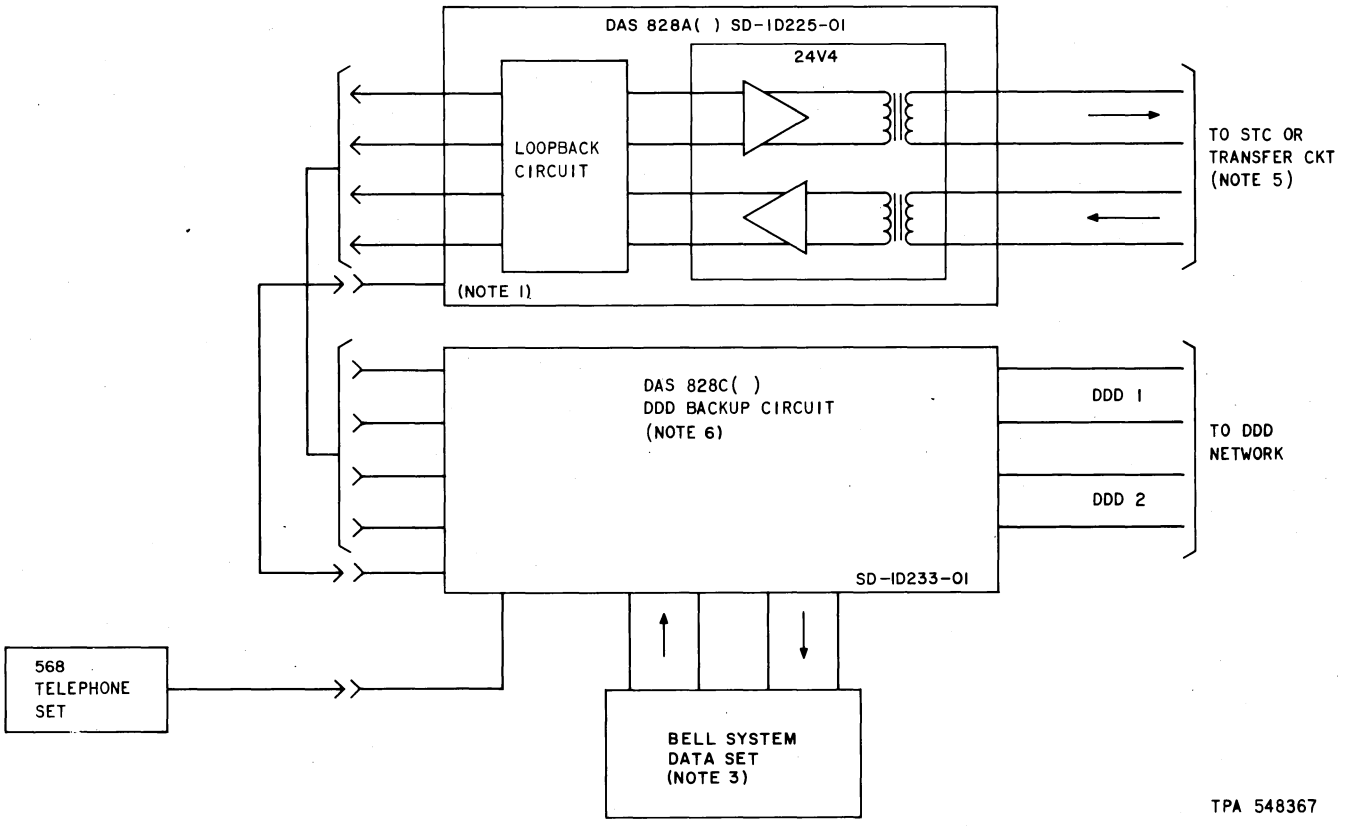

Fig. 5—4-Wire Full Data—Equipped With Direct Distance Dialing Backup Circuit

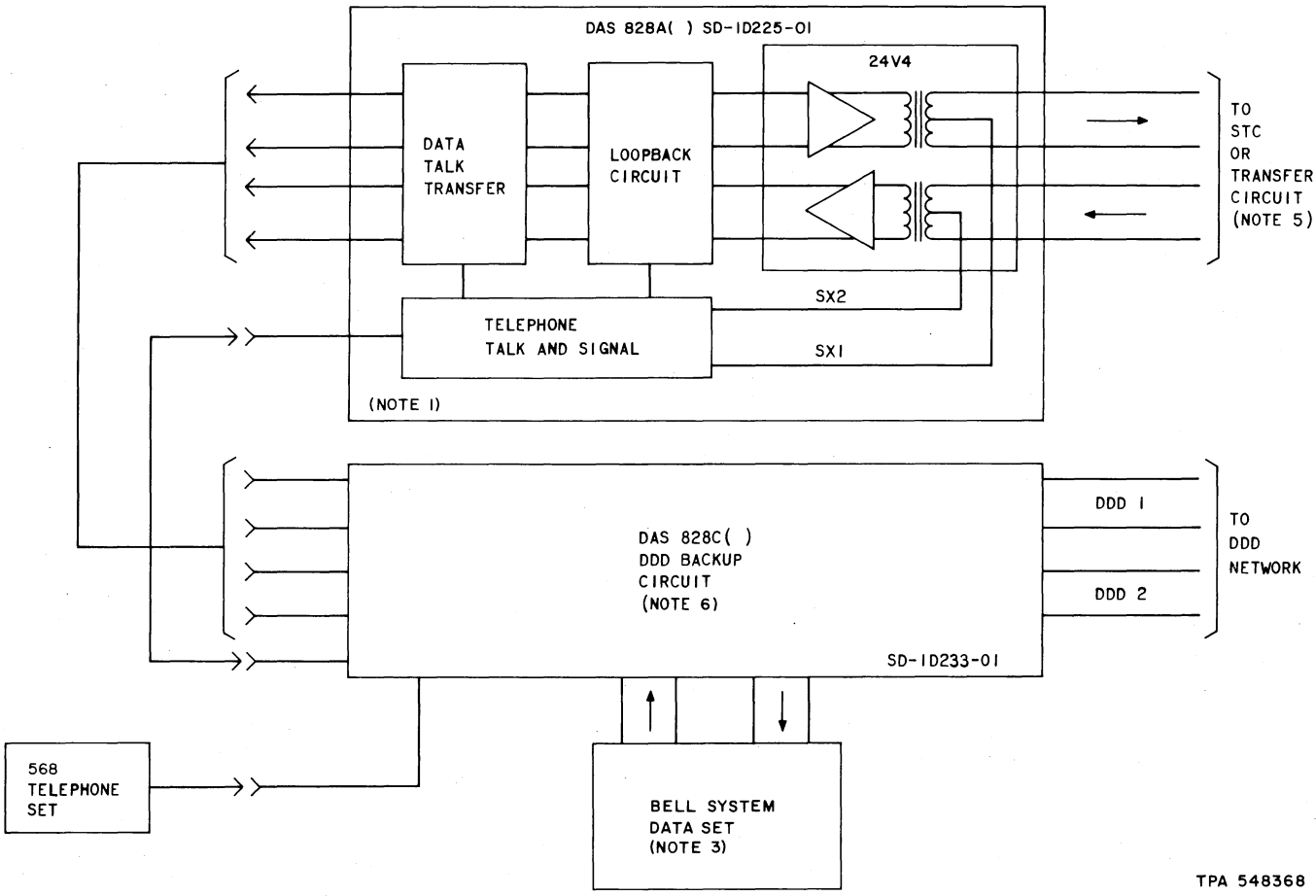

Fig. 6—4-Wire Full Data Alternate—Equipped With Direct Distance Dialing Backup Circuit

Loopback Relay Circuit (Fig. 7)

7.48 The loopback relay circuit shown in Fig. 7 is part of DAS 828A. This arrangement provides for a locally-operated loopback test circuit.

7.49 The key for the relay should be located in a suitable location, and tagged with proper information. The customer should be instructed in the use of the key.

8. REFERENCE INFORMATION

8.01 The following sections and schematic diagrams (SD) will serve as an aid to those who desire more detailed information on the general subjects covered in this section. Titles are condensed and rearranged for use as a ready reference.

Data Auxiliary Set 828A

SECTION	TITLE
590-010-200	General Installation and Connection Information
598-080-100	Description and Operation
598-080-200	Installation and Connections
598-080-500	Maintenance and Test Procedures
SD-1D225-01	DAS 828A
SD-1D227-01	35A-1 Data Unit
SD-1D228-01	36A-1 Data Unit
SD-1D225-01	37A-1 Data Unit

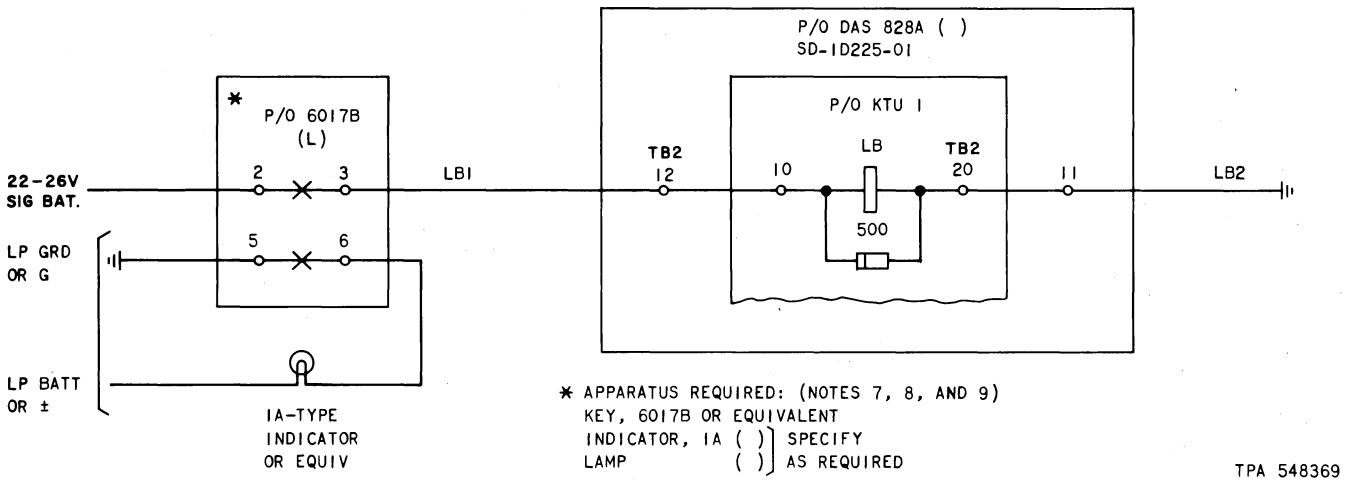

Fig. 7—Key Control (Manual Locking) of Loopback Relay

Data Auxiliary Set 828C

SECTION	TITLE
598-080-101	Description and Operation
590-100-130	39A-1 Data Unit, Identification
SD-1D233-01	DAS 828C

Data Sets

SECTION	TITLE
590 Division	Data Systems—General Information
591 Division	100 Series Data Sets
592 Division	200 Series Data Sets
593 Division	300 Series Data Sets
594 Division	400 Series Data Sets
596 Division	600 Series Data Sets
598 Division	800 Series Data Auxiliary Sets

Related Sections

SECTION	TITLE
103 Division	Transmission Test Equipment
107 Division	Data and Teletypewriter Test Equipment
179 Division	General Signaling and Compatibility Consideration
314 Division	Data Transmission Systems

Engineering Considerations

SECTION	TITLE
851-300-1XX	Switched Special Services—General Design Considerations
852-307-100	V4 Telephone Repeaters
AB27.025.( )	Envelope Delay Characteristics of Telephone Facilities, General Information
AB27.350.( )	Transmission Engineering and Data Channels for Miscellaneous Purposes, Transmission Required and Conditioning
AB27.400.( )	A1 Digital Data Circuits, Estimate of Impulse Noise on N and ON Carrier Channels
AB27.401.( )	Data Circuits, Delay Equalization
AB27.425.( )	DATA-PHONE® Service, General Engineering Considerations

GENERAL FIGURE NOTES

Notes:

1. Components for the 24V4 repeater are dependent on the conditioning needed and facilities used. Component information for the repeaters is found in Section 812-002-290. DAS 828 equipment specifications are provided in Table H.

2. When customer-provided equipment is used, the proper interconnecting arrangement must be selected and ordered depending on current tariff implementation regulations. (See Tables C, D, and E.)

3. When Operating Company-provided equipment is used, see Tables B and G.

4. When manual loopback is required, see Fig. 7.

5. When transfer is required, see Section 812-002-270.

6. See Table B for Direct Distance Dialing information.

7. The key and lamp should be mounted in a suitable location.

8. The key should be tagged explaining operation. The customer should be instructed.

9. See Section 512-210-101 and 463-210-100 for information on the 6017B key and lamp indicators, respectively.