

DATA AUXILIARY SET 828A

DESCRIPTION AND OPERATION

CONTENTS	PAGE
1. GENERAL	1
2. PHYSICAL DESCRIPTION	2
3. CIRCUIT OPERATION	8
A. Designations	8
B. Full Data (DAS 828A-L1 and -L1A)	9
C. Data With Alternate Voice (DAS 828A-L1/2 and -L1A/2)	13
D. DAS 828A Modified to Provide Station Bridging	16
4. TRANSMISSION DESIGN	16
5. POWER REQUIREMENTS	21
6. REFERENCES	26

1. GENERAL

1.01 This section provides the description and operation information on data auxiliary set (DAS) 828A. The DAS is intended to be used as the standard means to terminate 4-wire (4W) private line (PL) voiceband data channels. It is installed between the 4W line from the central office (CO) and the terminal equipment at the station, and provides functions normally required for both Telco- or customer-provided equipment. The connected terminal equipment usually consists of data modulators and demodulators that are typically called modems or data sets.

1.02 This section is reissued to add information on the following:

- (a) A modified DAS 828A which provides a method of bridging up to four data modems on a 4W voiceband PL channel at a customer's premises

(b) Options X and Y

(c) Hazardous voltage protection.

1.03 DAS 828A provides an interface point with both Bell System and customer-provided equipment (CPE) on the line side of the data set.

1.04 There are two types of DAS 828A. One type provides for data transmission only, for use where no alternate voice transmission as provided by Telco is required. The other arrangement includes a Telco-provided alternate voice capability with 20-Hz manual ringdown signaling. 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 inband signaling. These two arrangements are further identified by the following list codes:

828A List 1—Data only (relay rack version)

828A List 1A—Data only (cabinet version)

828A List 1/2—Data with alternate voice (relay rack version)

828A List 1A/2—Data with alternate voice (cabinet version).

Functions Provided

1.05 DAS 828A-L1 provides the following functions:

- (a) Means for terminating a 4W private line
- (b) Amplification or attenuation in the transmit and receive pairs
- (c) Slope (attenuation) equalization in the receive pair
- (d) 4W to 2-wire (2W) conversion to interface with 2W modems

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SECTION 598-080-100

- (e) Transmit level limiting if required
- (f) Equal level loop-back of the 4W line toward the central office for testing
- (g) Contact indication to modem when circuit is not-in-data mode
- (h) Hazardous voltage protection in series 4 and higher.

1.06 Terminals are also provided for access to a transfer circuit and for connecting other transmission equipment, such as delay equalizers or tone-operated loop-back circuits.

1.07 In addition to the functions listed in 1.05, DAS 828A-L1/2 provides the following functions:

- (a) Voice/data transfer control
- (b) Voice capability
- (c) 20-Hz manual ringdown signaling
- (d) Attenuation required for alternate voice/data operation.

1.08 DAS 828A-L1 consists of a 24V4B repeater mounting unit, relays, and pad sockets. List 2, consisting of a 37A1 data unit and a 568HAA-3 telephone set, is added to provide voice operation. No plug-ins, such as amplifiers, networks, equalizers, termination sets, or resistor pads, are supplied with either list code. The plug-ins must be selected and ordered separately, based on the modem interface and the 4W PL transmission requirements. Information required for selection of plug-ins is included in Part 4.

Hazardous Voltage Protection in Series 4 and Higher

1.09 Both list types of 828A may be modified to provide a 5-way split bridge that allows up to four data modems to be connected to a single 4W private line. The data modem with the voice termination (if alternate voice is provided) is considered to be the main station, while the other three are additional data stations.

1.10 When DAS 828A is to be equipped with alternate voice capability, only one voice termination will be provided for the data sets

associated with the bridge. The voice termination must be connected on the line side of the bridge, which is part of the modified DAS 828A.

2. PHYSICAL DESCRIPTION

DAS 828A-L1

2.01 The basic DAS is the 828A-L1, shown in Fig. 1. This unit consists of a 24V4B repeater mounting unit, relays, and pad sockets providing a single assembly that is prewired and tested for 4W PL data service.

2.02 Figure 2 shows the two 66-type connecting blocks, a 50-pin connector, and a 50-pin plug mounted to a plate on the rear of DAS 828A-L1.

2.03 Connections to Bell System data sets or customer-provided modems can be made on a plug-in or quick-connect basis at DAS 828A-L1, but plug-in connections are recommended.

2.04 The dimensions of DAS 828A-L1 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. DAS 828A-L1 is intended for mounting on relay racks, 16C or 31B apparatus mountings, and numerous equipment cabinets described in Section 463-140-100.

DAS 828A-L1A

2.05 DAS 828A-L1A, shown in Fig. 3, 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).

2.06 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.

DAS 828A-L1/2

2.07 DAS 828-L1/2, shown in Fig. 4, consists of a basic 828A-L1, a 37A1 data unit, and a 568HAA-3 key telephone set. The units are prewired and tested for 4W PL data/alternate voice service.

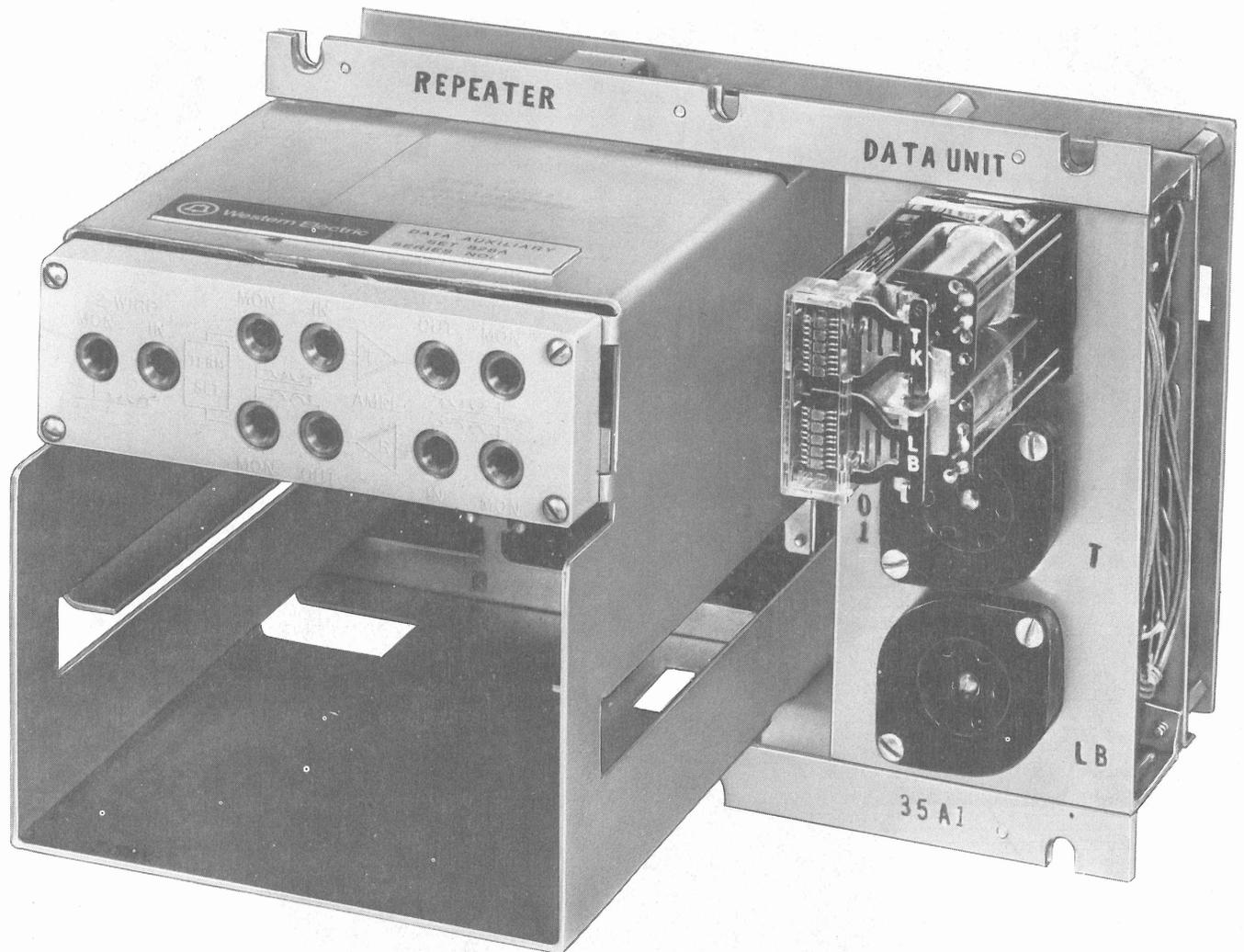


Fig. 1—Front View of DAS 828A-L1 (Series 1)

2.08 A 66-type connecting block, a 50-pin 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 that can be used for testing also appear at a 66-type connecting block.

2.09 DAS 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. DAS 828A-L1/2 (excluding the key telephone set) weighs approximately 17 pounds.

DAS 828A-L1A/2

2.10 DAS 828A-L1A/2, shown in Fig. 5, consists of a basic DAS 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).

2.11 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.

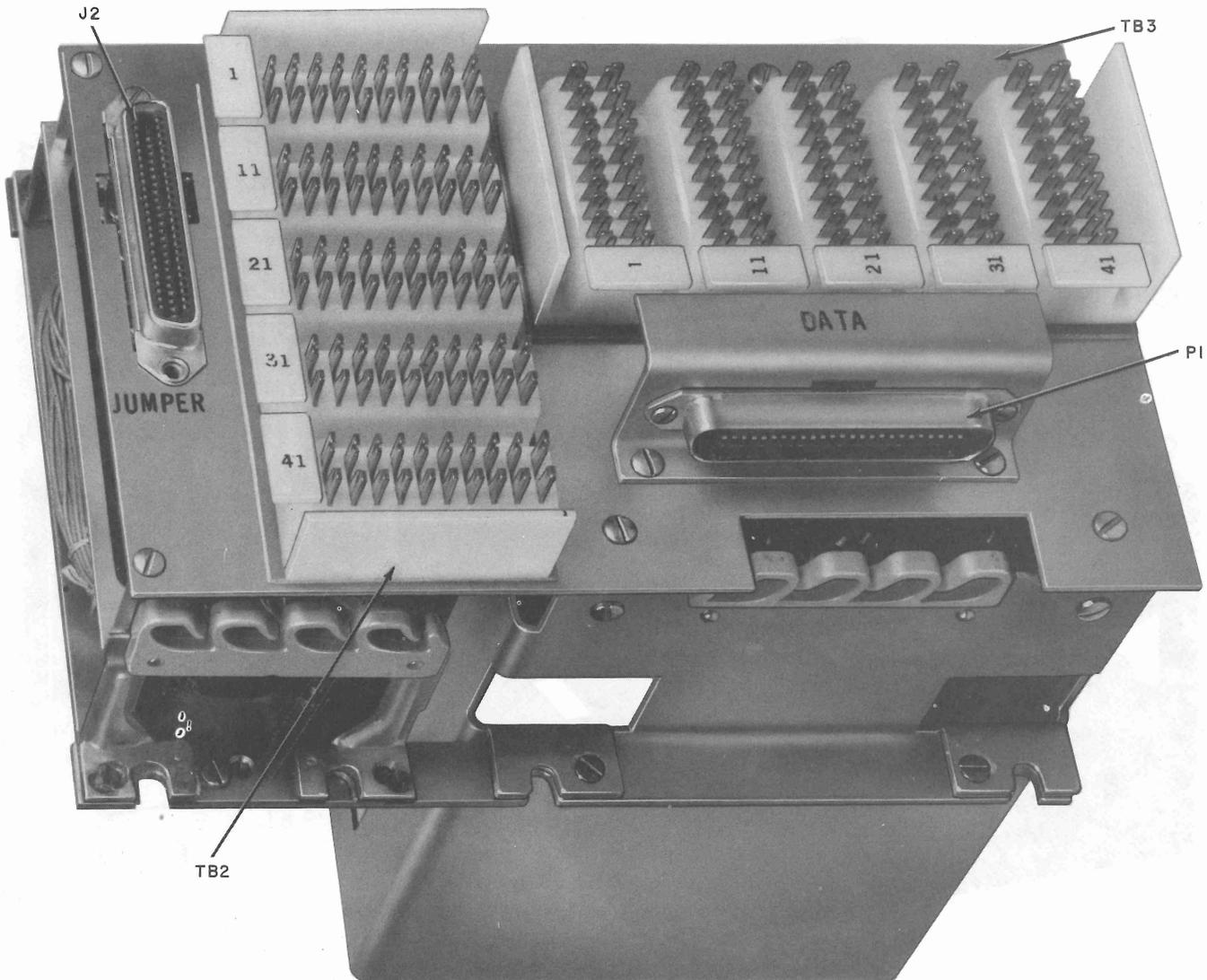


Fig. 2—Rear View of DAS 828A-L1 Showing Connectors and Terminal Blocks

► **DAS 828A Modified to Provide Station Bridging (Fig. 6)**

2.12 Physically, the station bridging modification affects each of the four DAS 828As as follows:

- **DAS 828A-L1 and 828-L1/2:** Provides an additional two mounting bars (P-12C824) to mount the 228A KTU and 49A-type data unit in a relay rack close to the DAS.
- **DAS 828A-L1A:** No additional mounting equipment is required, as sufficient room is provided on the lower half of the 31B

apparatus mounting to mount the 49A-type data unit. However, if the additional space on the 31B apparatus mounting is already being used, another 177A backboard and 31B apparatus mounting may be ordered separately in order to mount the 49A-type data unit and associated equipment. Alternately, two P-12C824 mounting bars may be ordered. The 228A KTU and 49A-type data unit would then mount in a relay rack.

- **DAS 828A-L1A/2:** Requires an additional 177A backboard and 31B apparatus mounting (ordered separately) in order to mount the 49A-type data unit and associated equipment.

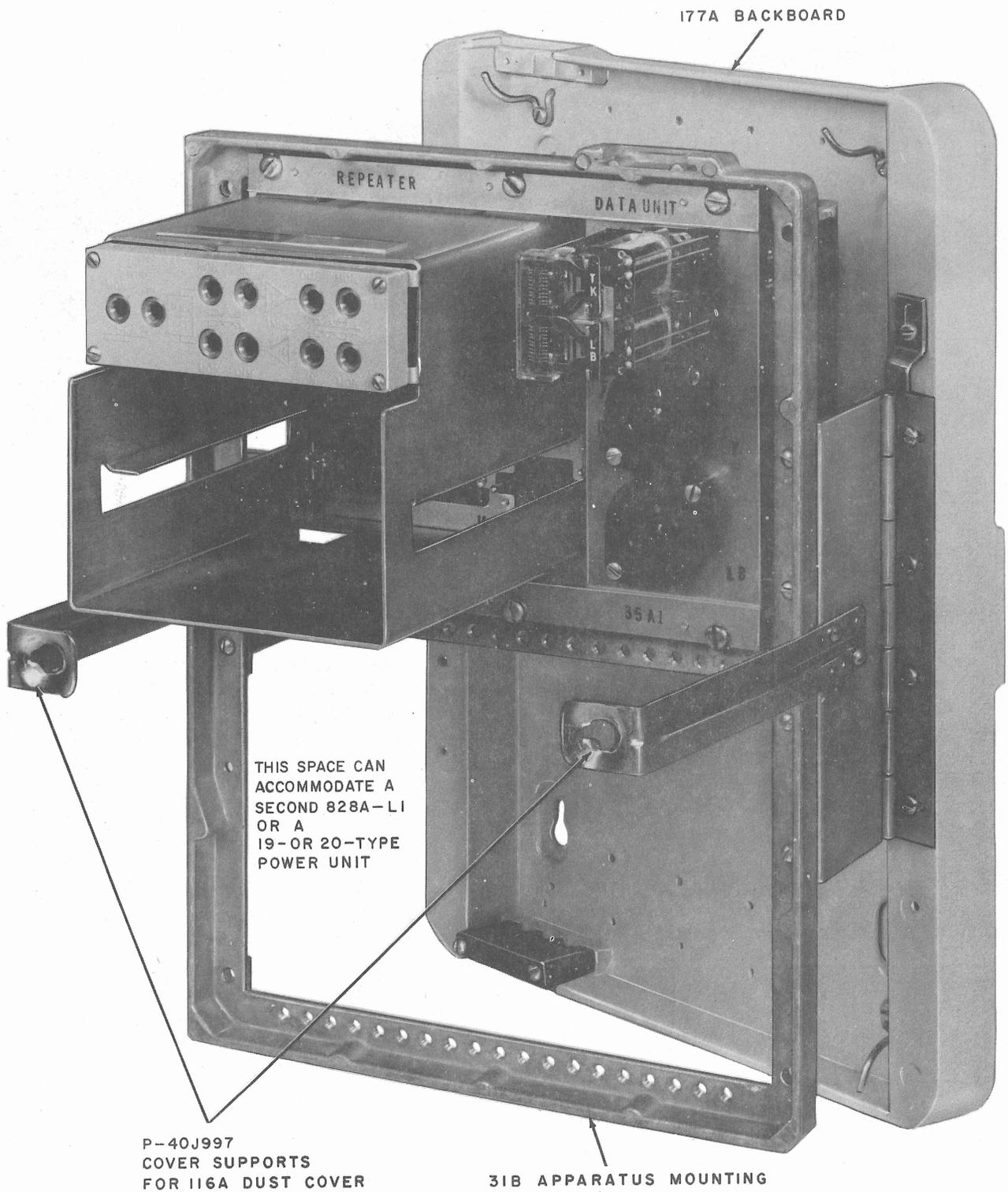


Fig. 3—Front View of DAS 828A-L1 (Series 1) Mounted on a 31B Apparatus Mounting—Shown Without Cover

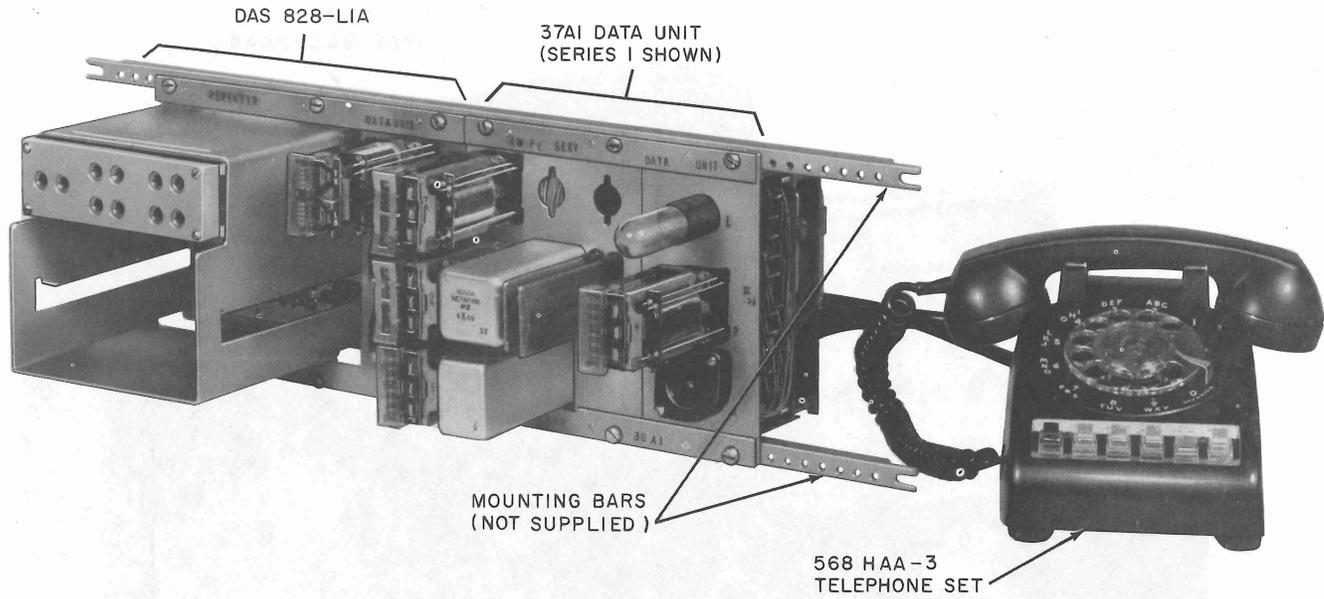


Fig. 4—Front View of DAS 828A-L1/2

Alternately, two P-12C824 mounting bars may be ordered. The 228A KTU and 49A-type data unit would then mount in a relay rack.

2.13 A maximum of one main data station and three additional data stations can be provided per local 4W channel. The data stations must be located within 1500 cable feet of the modified DAS 828A.

2.14 The modified DAS 828A operates in an environment of 40 to 120°F ambient temperature and 20 to 95 percent relative humidity.⚡

568HAA-3 Telephone Key Set

2.15 The telephone set contains a 6-button key of the type used with key systems. It also contains a 4W relay that converts the set from its normal 2W circuit for talking on the 4W circuit.

Note: Current practices on some Bell System data sets specify a DAS 804A in some private line applications where alternate voice is required. The alternate voice arrangement provided by DAS 828A will in many cases be satisfactory and more economical.

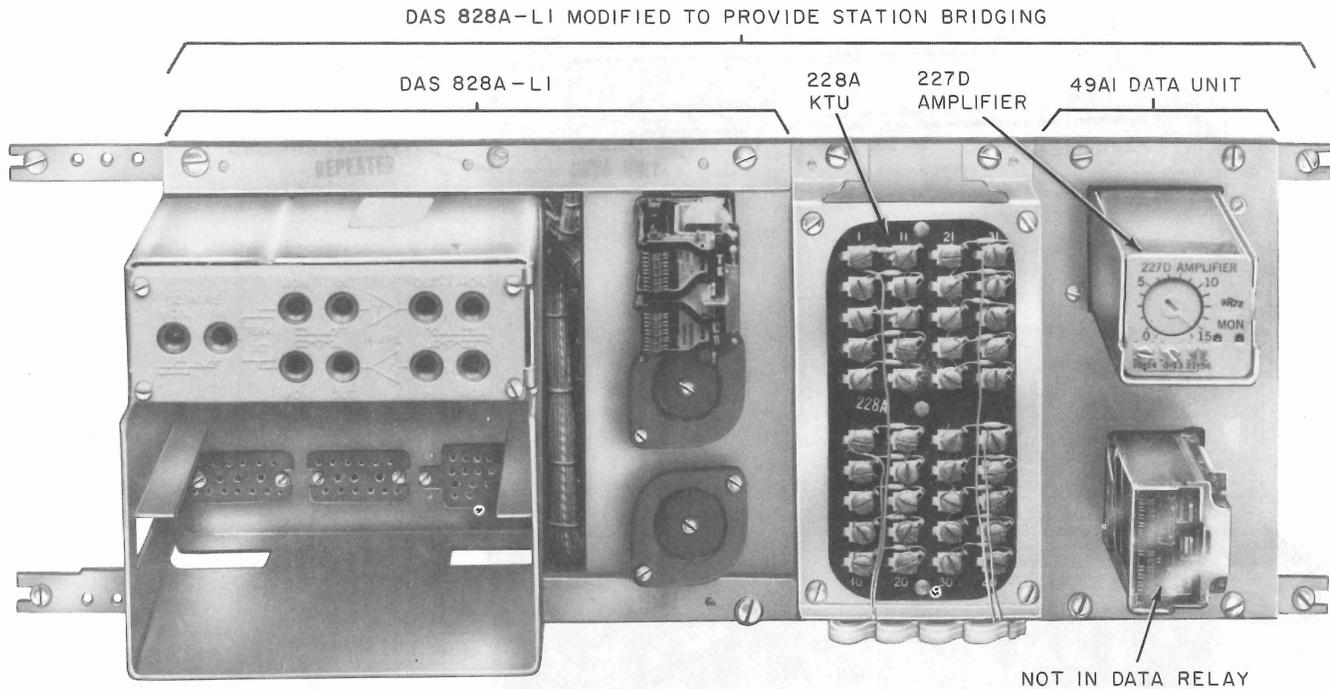


Fig. 6—DAS 828A-L1 Modified for Station Bridging

2.16 The six pushbuttons on the 568HAA-3 telephone key set must be marked as follows:

HOLD	-	-	LB	PL TALK	RING
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- HOLD—A nonlocking key used to clear the blocking keys.
- BLANK—Spare*.
- BLANK—Spare*.
- LB—A locking key used to operate the line loop-back relay.
- PL TALK—A locking key depressed in order to enter the talk mode on the 4W PL channel.

- RING—A nonlocking key used for manual ringdown.

*Refer to 3.34

2.17 The DAS 828A-L1/2 or -L1A/2 is equipped with a 568HAA-3 (rotary dial) telephone set. When a telephone set other than this is desired, refer to Section 598-080-180.

3. CIRCUIT OPERATION

3.01 This part describes the operation and functions of both DAS 828A-L1 and 828A-L1/2.

A. Designations

3.02 The circuit operation description includes functional drawings showing various relays, contacts, and switches. The designation and meaning of each of these items are as follows:

DESIGNATION	MEANING
CT	Cut Through
DP	Dial Pulse
FW	4-Wire
LB	Loop-Back
LS	Line Switch
PL TALK	Private Line Talk
R	Ring
TB	Talk Battery
TK	Talk

B. Full Data (DAS 828A-L1 and -L1A)

3.03 The circuit of DAS 828A-L1 is shown functionally in Fig. 7. The circuit consists of the following hardware items:

- 24V4B repeater mounting unit
- Loop-back relay
- Talk/data transfer relay
- Two attenuator pad sockets
- Plug P1 (DATA)
- Jack J2 (JUMPER)
- Two 66-type connecting blocks (TB2 and TB3).

4W Data Circuit

3.04 The 4W private line is connected to terminals shown on TB2. The signals received on the T and R leads pass through a 359-type equalizer mounted in the EQL socket. The equalizer provides slope equalization as required on the received line signal.

3.05 The signal then passes to the 227D amplifier or 849-type network mounted in the receiver amplifier (RAMPL) socket. From this point, the signal passes through a hazardous voltage protection network connected to terminals of TB2. TB2 connections also provide access to tone detectors, delay equalizers, SF signaling units, or other

transmission equipment which may be connected into the receive path.

3.06 From TB2, the received signal passes through the normally closed LB and TK contacts to terminals on TB2. If the modem is 4-wire, connections are made directly from TB2-25, 26, to TB3-9, 10, respectively. The received signal then passes on to the modem on the DT and DR leads of connector P1 (DATA).

3.07 The transmitted signal from the 4W modem is brought in on the DT1 and DR1 leads, and connected to TB3-7 and 8, which for a 4W modem are strapped respectively to TB2-27 and 28.

3.08 The transmitted signal passes through the T and LB pads, where the level at the LB pad output is matched to the receive signal level. This ensures the TAMPL input and RAMPL output are equal level points. This point of equal level is further discussed in 3.10. From access terminals on TB2, the signal passes through a hazardous voltage protection network to the TAMPL input, and through either the 227D amplifier, the 849-type network, or the F-58122 amplifier, depending on what is mounted in the TAMPL socket. This plug-in sets the transmitted level of the signal entering the connected metallic facilities.

2-Wire Modem Connections

3.09 For 2W modems, a 1B terminating set is mounted in the TERM SET socket. No option connections are made to TB2-25, 26, 27, and 28 on DASs prior to series 4, while the appropriate option (X or Y) must be strapped between TB2-25, 26, 27, 28, and TB2-45, 46, 47, and 48, respectively, on series 4 and higher. The 2W line from the term set appearing on TB2-29 and 30 is instead connected to either the DT, DR pair or the DT1, DR1 pair, depending upon the modem to be connected. The remaining term set leads are also brought out to TB2, providing for special engineering applications if needed. Information on 2W and 4W modem options is given in Section 598-080-200.

Loop-Back

3.10 The loop-back portion of the circuit shown in Fig. 7 is provided to allow the 4W line to be looped back toward the central office for

SECTION 598-080-100

testing. When the line is looped, the drop pairs are each terminated in 600 ohms. The loop-back feature does not provide for testing the term set, station bridging apparatus, the DATA connector, and the T or LB pads, since they are excluded from the line during loop-back. In addition, the voice circuitry described in 3.25 is not tested.

Remote Loop-Back—DC Operation

3.11 DAS 828A-L1 can be looped back remotely from a dc access point, such as a central office or testing center. Figure 8 shows the circuit and connections required. The LB relay is operated over the simplex pair by applying 48-volt dc central office battery. Since a minimum of 30 mA is required to operate the LB relay, a maximum circuit resistance of 800 ohms is specified. This corresponds to a loop resistance of 1600 ohms per loop. There is no requirement to build out the circuit on short loops.

Remote Loop-Back—AC (Tone) Operation

3.12 The DAS 828A loop-back circuit may also be operated remotely by using an inband tone when the DAS 828A is equipped with a 44A1 data unit (tone detector). When so equipped, a remote dc access point is no longer necessary. However, the remote location must be equipped with a tone generator such as the 406A tone generator. Figure 9 shows the circuit using tone operation.

3.13 For 4W data sets, the 44A1 data unit may be plugged into the TERM SET socket of the 24V4B repeater mounting unit. For 2W data sets, the TERM SET socket is used to mount a 1-type term set. The 44A1 data unit must then be mounted external to DAS 828A.

3.14 Information is provided in Section 598-080-200 on the wiring and mounting of the 44A1 data unit for both 4W and 2W data sets. Additional information on the 44A1 data unit is given in Section 590-100-131. The 406A tone generator is described in Section 314-821-100.

Locally Operated Loop-Back

3.15 Where remote loop-back operation (dc or ac) is not practicable or local operation of the loop-back is desired, the LB relay can be operated by a key circuit as shown in Fig. 10. In this

arrangement, a maximum key circuit resistance of 33 ohms is specified, based on a local supply of 22 volts dc minimum.

3.16 The particular LB operation to be used must be specified by the local telephone company.

Talk-Data Transfer

3.17 The TK relay is wired into the L1 unit as shown in Fig. 7. The TK relay contacts transfer the 4W line from the normal data path to terminals on TB2 and jack J2 (JUMPER) for voice operation. Further description of the voice operation is given in 3.25.

Not-in-Data Indication (Unmodified DAS)

3.18 The not-in-data condition exists whenever the LB or TK relays are operated. The circuit, also shown in Fig. 7, provides an off-normal indication to the modem through the TEK leads of TB3 and plug P1 (DATA). Most Bell System provided (Telco) modems will use this indication, the only current exception being data set 103F-type. This indication can be made available to CP modems, if required.

3.19 In Bell System data sets, the not-in-data indication is used to turn off the data set ready (DSR) lead to the customer-provided terminal equipment. This indicates to the terminal equipment that the data set is not ready to send or receive data. In the case of data set 103F-type, DSR stays on.

3.20 A total of six TEK leads (three pairs) are required to provide for all the Telco-provided data sets. None of the data sets uses all six leads.

Not-in-Data Indication Provided With DAS 828A

Modified for Station Bridging

3.21 A modified DAS 828A is equipped with a normally operated not-in-data (NID) relay which is used to turn off the data set ready (DSR) lead to the customer-provided terminal equipment. This indicates to the terminal equipment that the data set is not ready to send or receive data.

3.22 Contacts on the NID relay open and present a not-in-data indication to the terminal equipment whenever the LB or TK relays are

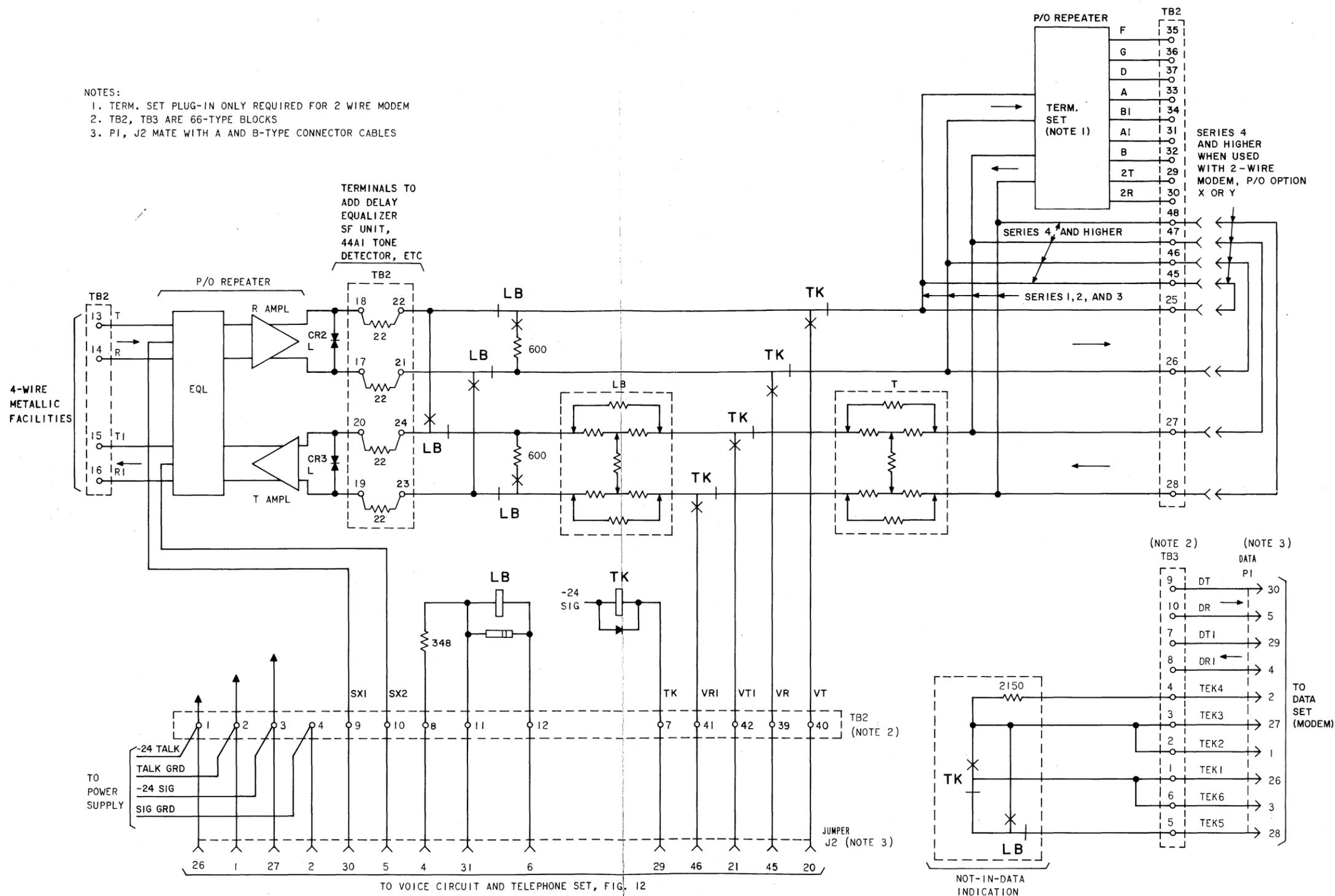


Fig. 7—Functional Arrangement of Data Circuit for DAS 828A-L1

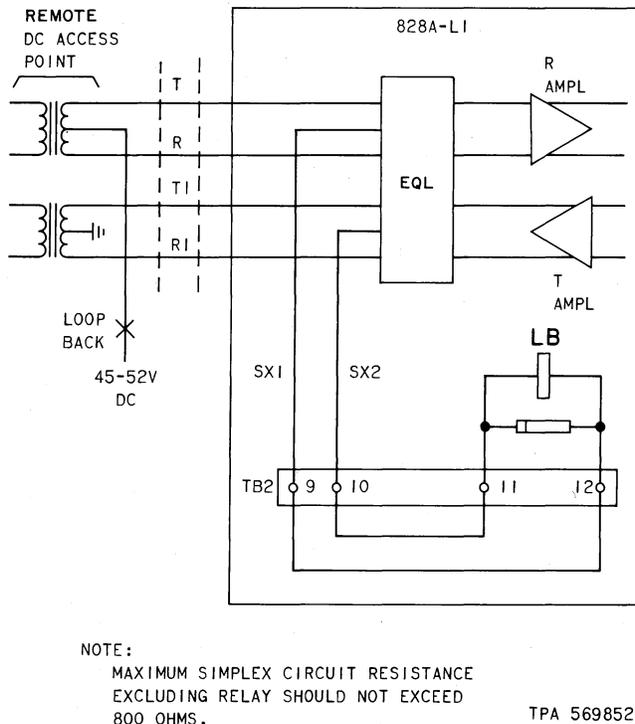


Fig. 8—Remote Loop-Back Circuit for DAS 828A-L1

operated or whenever the DAS loses power. The circuit, shown in Fig. 11, provides the not-in-data indication through TEK5 and TEK6 leads. All Bell System modems except data set 103F-type can use the not-in-data indication. This indication can be made available to CP modems, if required. ♣

C. Data With Alternate Voice (DAS 828A-L1/2 and L1A/2)

3.23 The voice circuit is shown functionally in Fig. 12 and consists of the 37A1 data unit and a 568HAA-3 telephone set. When combined with DAS 828A-L1, this circuit forms the station arrangement of data with alternate voice.

3.24 The alternate voice arrangement is made by plugging the 37A1 data unit P2 cable into the JUMPER (J2) connector on DAS 828A-L1 and connecting the telephone set. This makes the required loop-back and simplex connections. The loop-back operation in this configuration is controlled locally through the telephone key set, remotely by tone signaling, or by both. The simplex line pair (SX1 and SX2) is used only for 20-Hz ringdown signaling.

Voice Transmission

3.25 To place the DAS in the private line talk mode, remove the handset from the cradle and depress the PL TALK key. This operates the CT and TK relays and lights the PL TALK lamp through the ground path from TB4-21, through PL TALK, through the HOLD break contact, and through the LS make contact to TB4-4. At the same time, transmitter current in the telephone set causes the TB relay to operate.

Note: The TB relay is powered by voltage from TALK battery while the CT relay is powered by voltage from SIG battery.

3.26 After the CT and TB relays operate, the following sequence occurs:

- (1) Received signal on VT and VR leads of JUMPER cable is connected through the R pad to the telephone set.
- (2) Key set transmitter is connected through to the VT1 and VR1 leads of the JUMPER cable.
- (3) Sidetone network is connected to the transmitter circuit.
- (4) FW relay operates in the key set, switching it to a 4W mode.
- (5) R (ring) relay is enabled.

3.27 The DAS is now in the talk mode, and conversation may take place after the other end of the circuit has been alerted by ringdown signaling to go to the talk mode.

3.28 While in the talk mode, the R pad is used to reduce the received signal level to the normal telephone set receive level. Selection of the proper pad value is covered in Part 4.

3.29 To release the DAS from the talk mode, place the telephone receiver back on-hook or release the PL TALK key by momentarily depressing the HOLD key. Either action restores the DAS operation to the data mode.

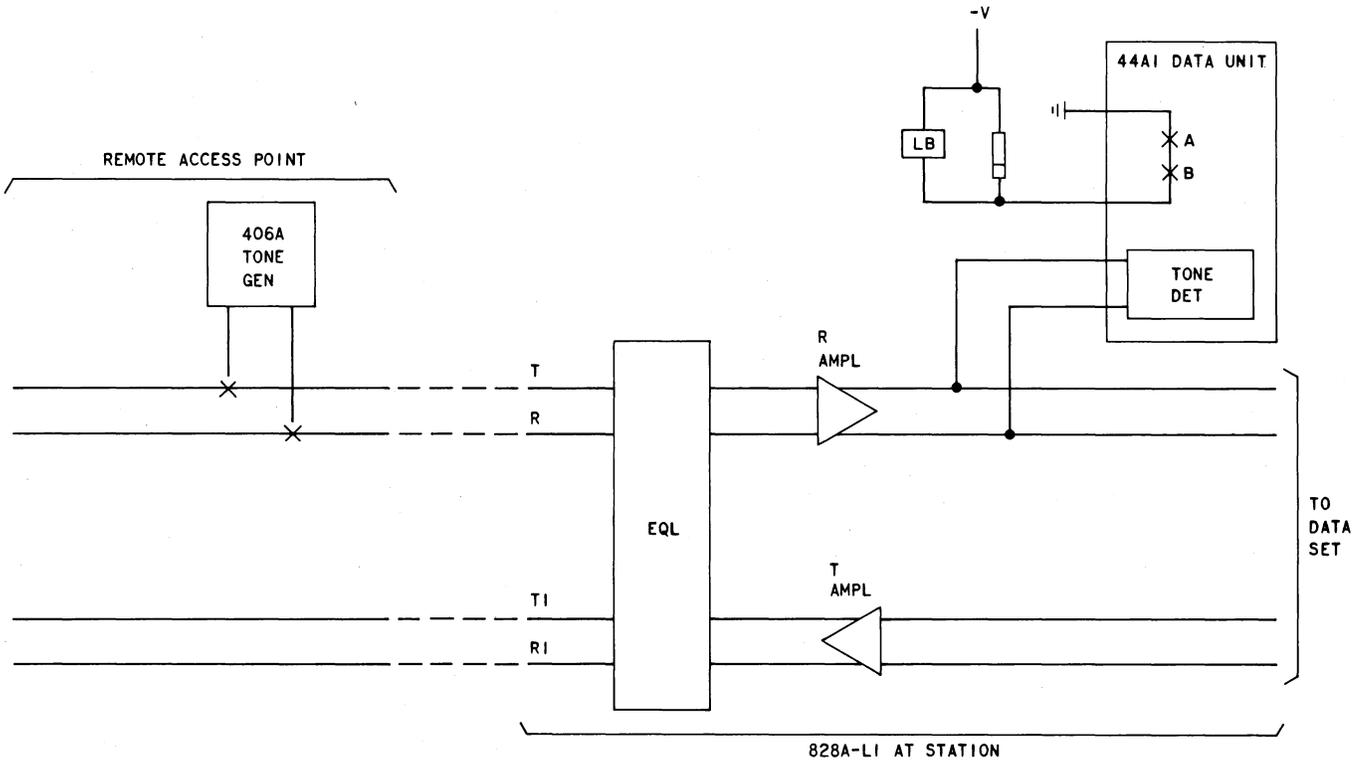
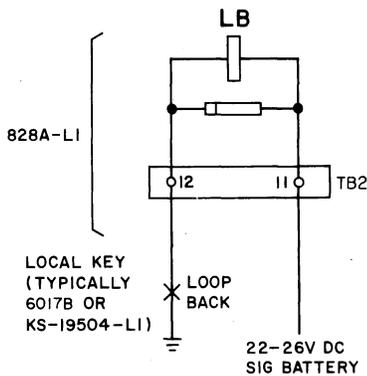


Fig. 9—Remote AC (Tone) Loop-Back Circuit for DAS 828A-L1



NOTE:
MAXIMUM KEY CIRCUIT RESISTANCE EXCLUDING
RELAY SHOULD NOT EXCEED 33 OHMS.

TPA 569853

Fig. 10—Local DC Loop-Back for DAS 828A-L1

Ringdown Signaling

3.30 While the DAS is in the talk mode, the RING key is enabled, and depressing this key causes 20-Hz signaling to be transmitted to

the distant end. At the distant end, the DAS can be in a data, talk, or loop-back condition, but still receives the 20-Hz signal.

3.31 The circuit diagram of Fig. 13 shows the ringing circuit up to the 20-Hz converter in the central office. As shown, the ringing signal is sent and received over the simplex line pairs. The circuit resistance of the simplex pair must not exceed 5000 ohms to ensure that the central office (CO) can activate the ringer in the telephone key set. Resistance values of less than 5000 ohms do not require any build-out resistance to be used. For long loops, the ringer in the telephone key set should be set to its low notch bias position. Ringdown signaling without CO 20-Hz converters is permissible when simplex circuit resistance, from station to station, is less than 5000 ohms. A direct metallic connection between stations is required, if no converters are used.

3.32 Power for ringdown signaling is obtained from an external ringing supply connected to TB4-31 and 32 on the 37A1 data unit. More information on power supplies is given in Part 5.

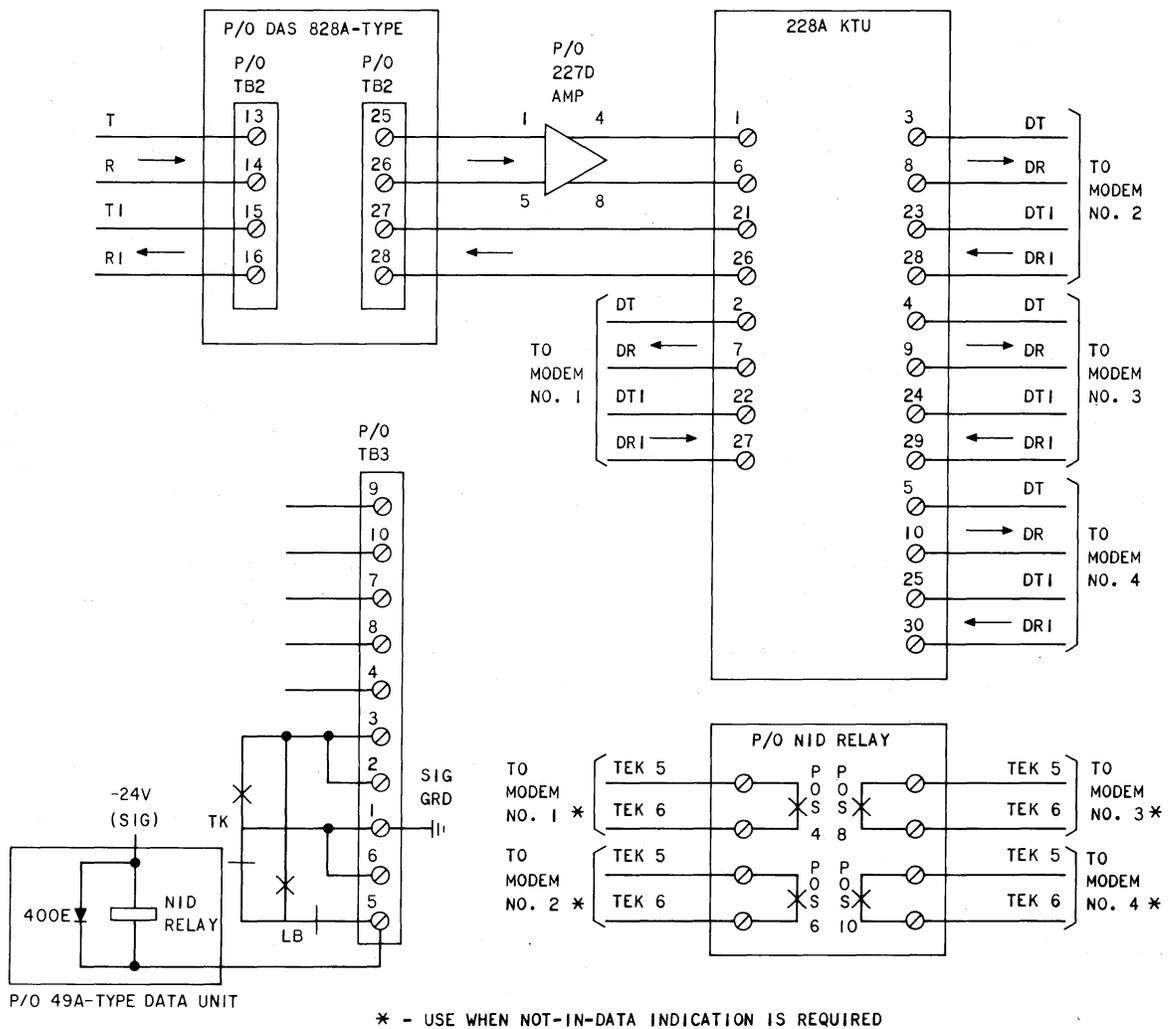


Fig. 11—Functional Arrangement of Data Circuit for DAS 828A-L1 Modified for Station Bridging

Loop-Back Key Control

3.33 The loop-back mode of operation is established by removing the telephone handset from the cradle and depressing the locking LB key on the telephone key set. This action operates the LB relay in the 828A-L1 unit and lights the LB lamp on the telephone key set. To restore to the data mode, place the handset back on-hook or release the LB key. The lamp also lights when tone-operated loop-back is used.

Extra Lines on Key Set

3.34 Two spare key positions are available for use as normal dial-up lines or as part of a

DDD backup circuit. DDD backup, using DAS 828C, is described in Section 598-080-101. When used as normal dial lines, these spare keys do not interfere with the operation, except they release the PL TALK or LB keys. A 251A KTU must be added to each DDD line on a locally engineered basis together with the 220A KTU to control the key set ringer.

Connection From Key Set to 37A1 Data Unit

3.35 The A- or B-type connector cables can be used to extend the distance from the telephone key set to the 37A1 data unit up to a maximum of 100 feet. This maximum distance is based on the maximum series resistance (10 ohms) that is

permitted in operating the CT and TK relays and PL TALK lamp, assuming a cable resistance of 0.1 ohm per foot. When necessary, this resistance can be measured at TB4 between terminals 21 and 4 with the handset off-hook and the PL TALK key depressed. Power must be removed for this measurement.

D. DAS 828A Modified to Provide Station Bridging

3.36 A modified DAS 828A provides all the circuitry necessary for simultaneous data transmission for up to four data receivers and for transmission from any one of four data transmitters.

3.37 A modified DAS 828A-L1/2 or -L1A/2 retains its standard alternate voice capability, described in 3.23 through 3.35.

3.38 In addition to the hardware mentioned in 3.03, the modified DAS 828A contains a 227D amplifier and a 5-way split bridge.

4W Data Circuit

3.39 The 4W private line is connected to terminals shown on TB2 (Fig. 11). The signals received on the T and R leads pass through the DAS 828A-L1 as described in 3.04 through 3.06 until they reach TB2-25 and 26, respectively. From there they go through another 227D amplifier whose output is connected directly to the input of a resistive 5-way split bridge.

3.40 The signal received at the input of the bridge is simultaneously delivered to the four receive ports at the bridge output. Each output port has an output impedance of 600 ohms, therefore, all unused ports must be terminated in 600 ohms if the bridge is to provide proper transmission levels.

3.41 The 0-dBm transmitted signal from any one of the four data stations connected to one of the four input ports of the bridge (unused ports must be terminated in 600 ohms) is reduced 12 dBm at the bridge output.

3.42 The bridge output is connected to TB2-27 and 28. The transmitted signal passes through the DAS 828A in the same manner as described in 3.08.⚡

4. TRANSMISSION DESIGN

4.01 This part describes the basic ground rules for determining transmission design and provides typical circuit arrangements.

4.02 Transmission design using an unmodified DAS 828A involves selection of correct plug-in components and plug-in screw settings based on certain ground rules:

- (a) -13 dBm0 design.
- (b) The modem interface is either +13 TLP (0 dBm) transmit and -3 TLP (-16 dBm) receive, or +5 TLP (-8 dBm) transmit and -3 TLP receive. Telco modems typically use the +13 and -3 TLP levels. Customer-provided modems can use either set of TLP levels; however, the +13 TLP transmit and -3 TLP receive levels are recommended and should be used whenever possible.
- (c) Equal-level loop-back is provided whenever possible.
- (d) Customer-provided alternate voice/data use the modem interface levels as specified in (b).
- (e) Telco-provided voice is provided through a separate interface as follows:
 - (1) When the modem is 4-wire, the telephone set interface is 0 TLP transmit and -16 TLP receive.
 - (2) When the modem is 2-wire, the telephone set interface is +0.5 to 1.5 TLP transmit and -14.5 to -15 TLP receive. This is a minor deviation from station voice levels.

Transmission Design—DAS 828A Modified to Provide Station Bridging (Fig. 14)

4.03 The ground rules for transmission design using a modified DAS 828A are as follows:

- (a) -13 dBm0 design.
- (b) All modem interfaces must transmit at +13 TLP (0 dBm) and receive at -3 TLP (-16 dBm).

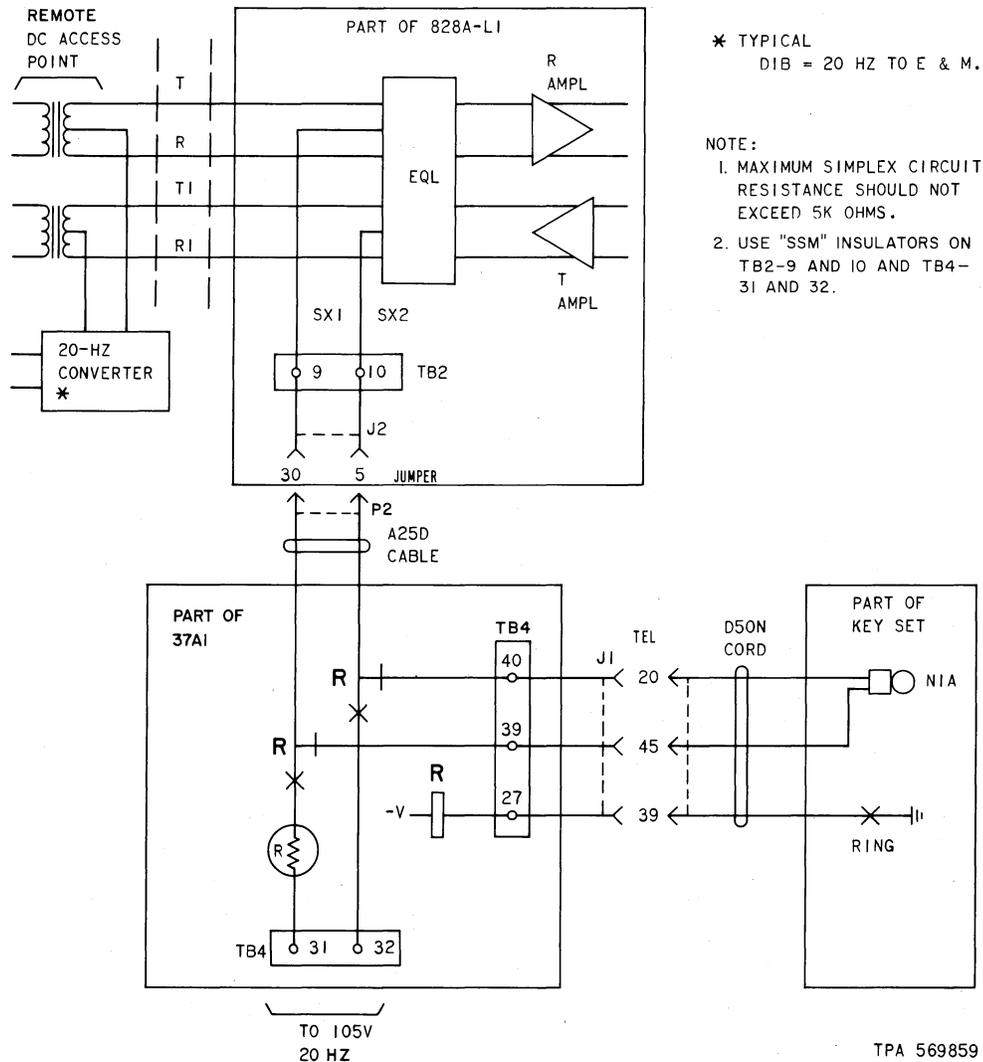


Fig. 13—20-Hz Ringdown Circuit for DAS 828A-L1/2

- (c) A maximum of one main data station and three additional data stations are provided per local 4W channel.
- (d) The data stations must be located within 1500 cable feet of the modified DAS 828A.
- (e) Data stations connected to the same modified DAS 828A cannot intracomunicate.
- (f) The bridging arrangement is restricted to data-only operation at the data station terminals. One voice termination can be provided at the line side of the bridge.
- (g) Dial backup is not provided for this arrangement.
- (h) Equal-level loop-back for testing is provided on the common local channel only. Line loop-back is not provided at the individual station termination.
- (i) Neither high performance data conditioning (HPDC), type D1, nor C5 conditioning can be provided.
- (j) Customer premises bridging is discouraged for customers with expensive or high-speed data terminals or where continuity of service to all stations is of prime consideration. Inherently,

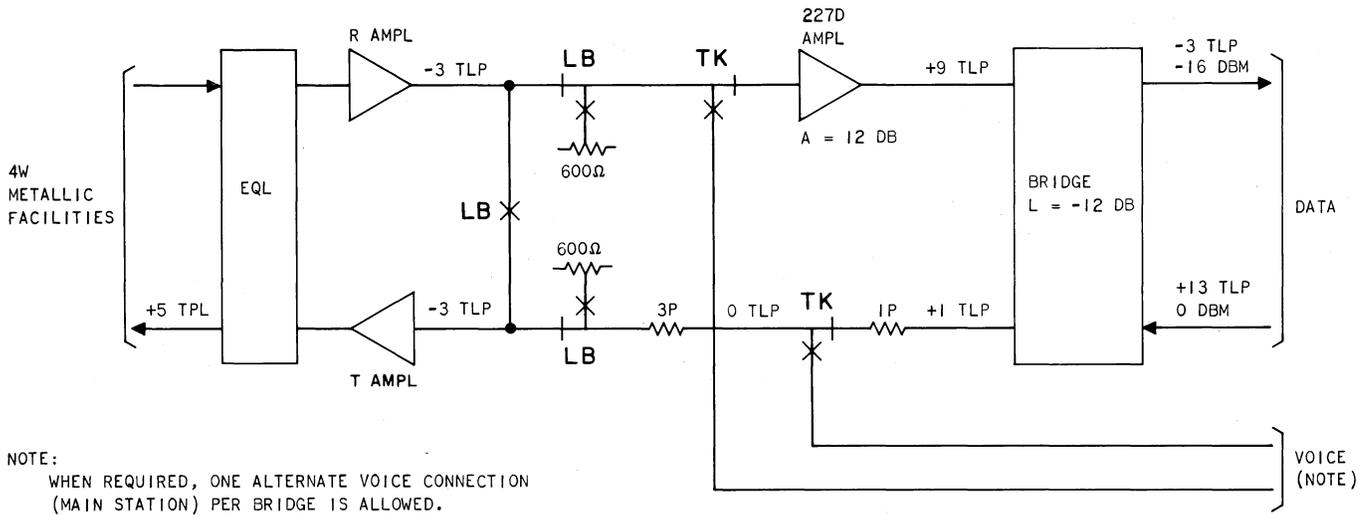


Fig. 14—Circuit Design for Station Bridging Arrangement

longer outages can be expected with customer premises bridging versus central office bridging. When a trouble occurs with one station, the other stations are not available for customer service while tests are being performed.

4.04 Determination of the station configuration and modem interface is made first, followed by selection of proper pad values to meet the requirement of equal-level loop-back. Once the equal-level loop-back value is known, the proper plug-ins for the repeater and correct screw settings can be found by referring to Sections AB24.100.01 and 332-104-503.

Typical Transmission Arrangements

4.05 Figures 15, 16, and 17 show three typical transmission arrangements. An additional 1.5-dB loss in both the transmit and receive directions results when the hazardous voltage protection network is provided in DAS 828A, series 4 and higher.

4.06 Figure 18 shows a special case where the standard voice design rules cannot be met with the DAS as it is wired. For this case the voice levels are redefined. This causes a slight degradation in the signal-to-noise ratio through the

circuit when in the talk mode. Since voice operation is considered a secondary use, a 0.5- to 1.5-dB degradation is accepted rather than requiring a separate code or rewiring in the field.

4.07 In Fig. 16 and 18, term set losses of 4.5 dB are assumed in each direction of transmission. Because of this loss it is not possible to provide equal-level loop-back when the modem transmit level is -8 dBm. For this case, a looped back signal is raised 1 dB.

Plug-in Codes

4.08 The various plug-in codes are listed in Table A. The table lists a total of seven sockets. Each socket, with the exception of TERM SET, must contain a plug-in. The TERM SET socket only contains a plug-in for 2W modem operation or when used to mount the 44A1 data unit as described in 3.13.

4.09 When selecting plug-ins for the RAMPL and TAMPL sockets, only the 227D code of the 227-type amplifier should be used. If transmit power limiting is required, the F-58122 amplifier or equivalent must be used in the TAMPL socket. Descriptive information on the F-58122 amplifier is given in Section 332-104-103.

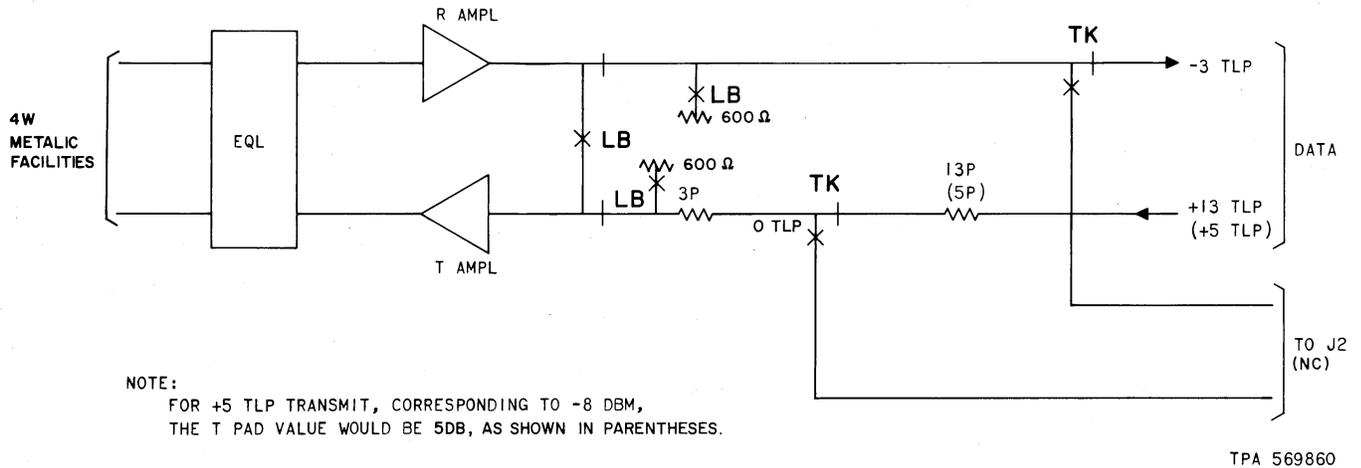


Fig. 15—Circuit Design for Data Only, 4-Wire Modem

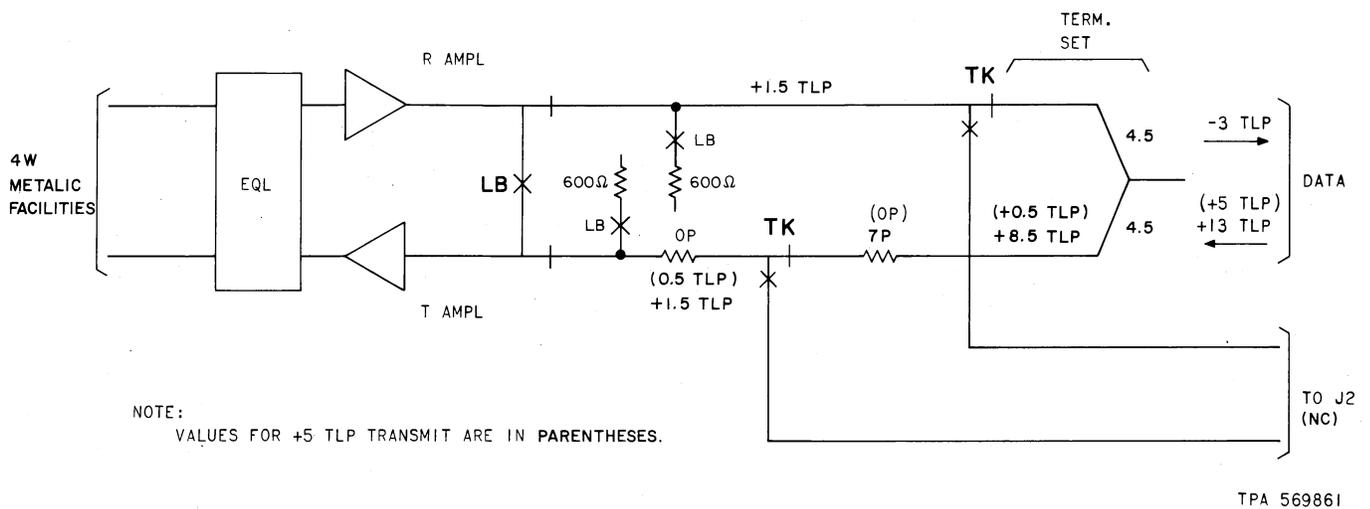


Fig. 16—Circuit Design for Data Only, 2-Wire Modem

4.10 In some cases where the F-58122 amplifier is not available or where the data format precludes its use, the 1000B data coupler may be used for level limiting. The data coupler is mounted externally, and a 227D amplifier or an 849-type network is used in the transmitting amplifier socket. Pad values different from those specified in this section are required to allow for the loss through the coupler.

Longitudinal Balance and DC Isolation

4.11 In order to guarantee longitudinal balance and dc isolation, it is necessary to use

combinations of equalizers and amplifier plug-ins that ensure that there is a transformer in both the transmit and receive pairs. The only usable combinations that do not provide a transformer all involve the 849C network. Therefore, whenever the 849C is selected, the 359B, F, M, or N equalizer must be used in order to provide the transformers.

5. POWER REQUIREMENTS

5.01 The DASs are not equipped with power supplies. These must be selected and ordered separately based on the various power requirements for each arrangement. A typical example of a

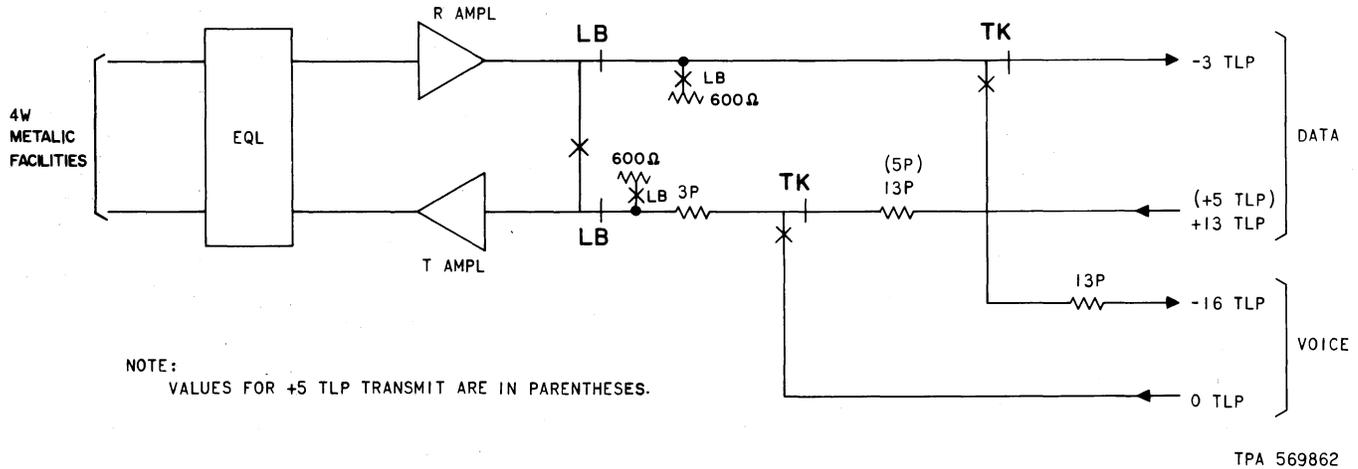


Fig. 17—Circuit Design for Data/Voice, 4-Wire Modem

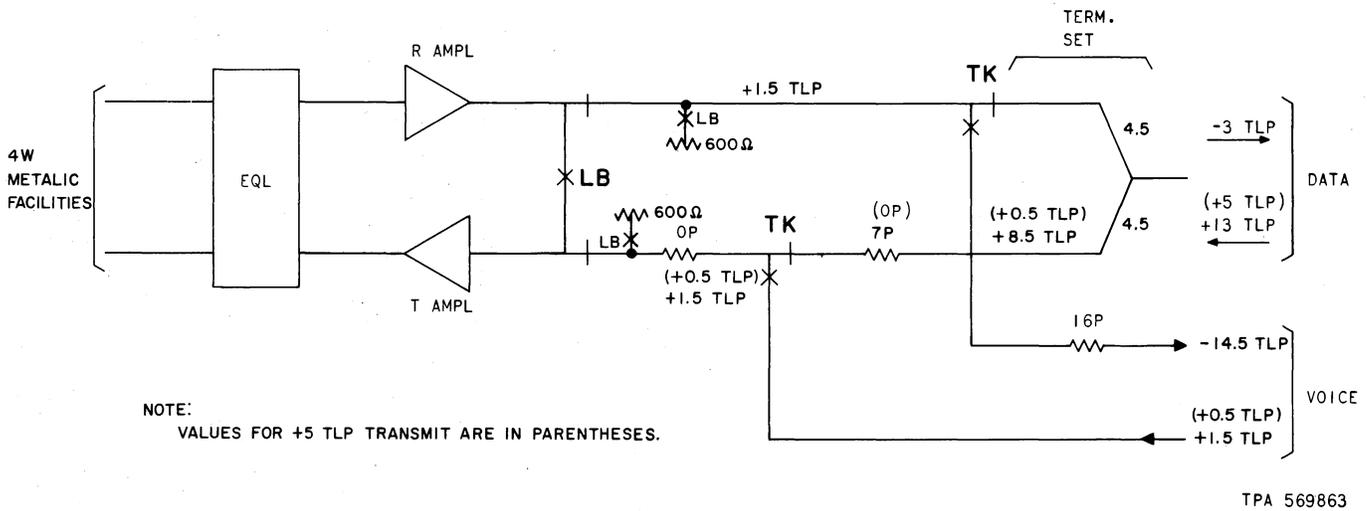


Fig. 18—Circuit Design for Data/Voice With 600-Ohm 2-wire Modem

DAS 828A-L1A with power unit is shown in Fig. 19. Section 598-080-200 provides a list of supplies that can be used.

Current Drains

5.02 Table B gives the current drains for both the 828A-L1 and 828A-L1/2 on a single line basis. A 25-percent margin should be added to the values given to allow for component variation.

TABLE A
PLUG-IN CODES

DAS	CODE	SOCKET	PLUG-IN CODE	NOTES
828A-L1/2 (Data/Voice)	828A-L1 (Data Only)	EQL	359-type equalizer	1
		RAMPL	227D amplifier or 849-type network with 89-type resistor	1
		TAMPL	227D amplifier or 849-type network with 89-type resistor or F-58112 amplifier	1, 2
		TERM SET	1-type terminating set or 44A1 data unit	1, 3
		T	89-type resistor	4
		LB	89-type resistor	4
	R	89-type resistor	4	

Notes:

1. 24V4B plug-ins are selected on the basis of transmission requirements and Section AB24.100.01.
2. F-58122 amplifier is for use if transmit level power limiting is required.
3. Term set only required for 2W modems. For 4W modems, the 44A1 data unit can occupy the socket to provide tone-operated loop-back.
4. T, LB, and R pad values are selected on the basis of modem and telephone set levels and on the requirement for equal-level loop-back.

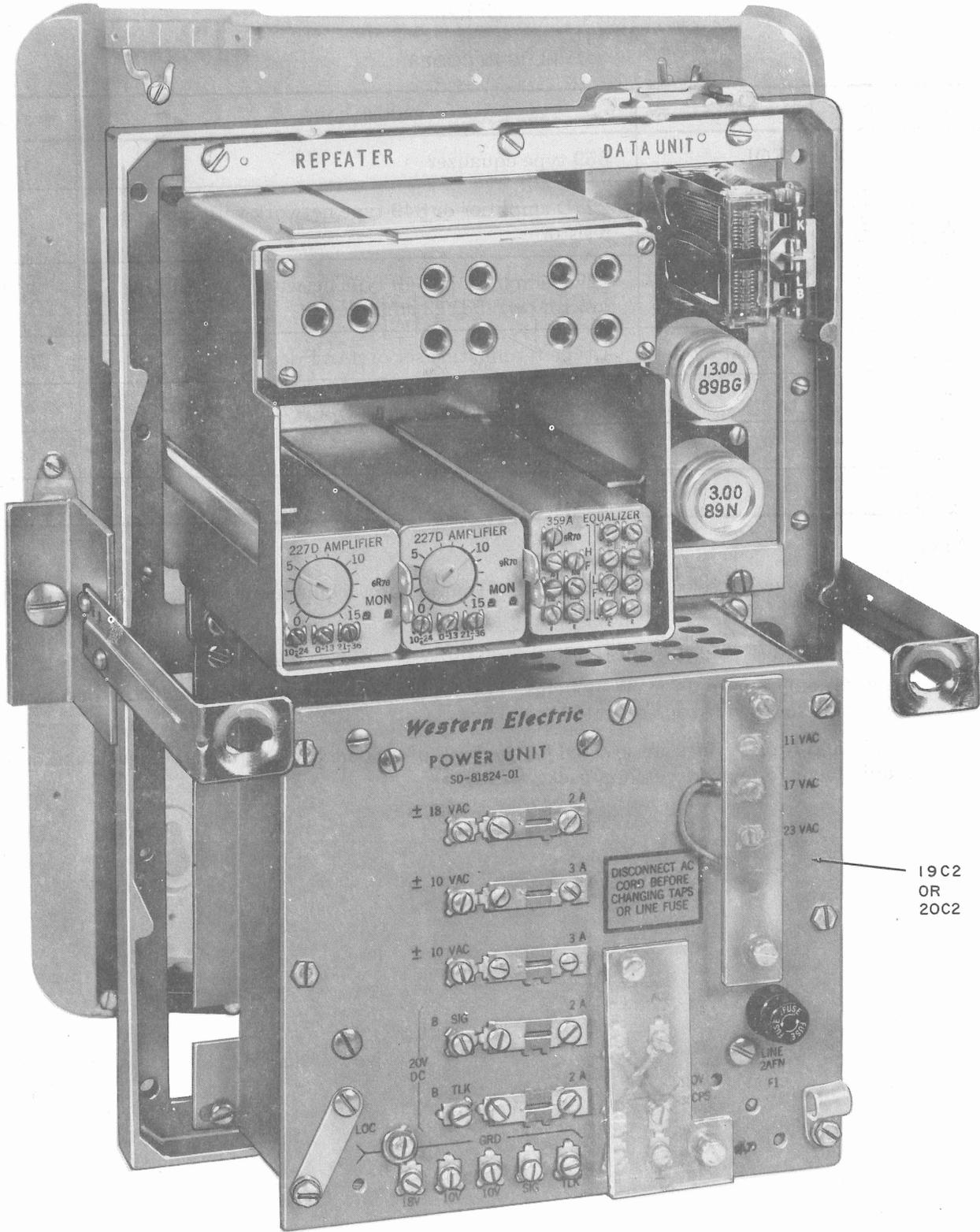


Fig. 19—Front View of DAS 828A-L1A Equipped With Locally Supplied DC Power Unit and Plug-Ins

TABLE B
SINGLE LINE CURRENT DRAINS

ARRANGEMENT	CURRENT DRAIN (NOTE 1)	
	-24V TALK BATTERY	-24V SIG BATTERY (NOTE 2)
DAS 828A-L1 (Data Only)	20 mA per amplifier plug-in (Note 3)	40 mA for locally operated loop-back circuit; no drain for remote dc oper- ation (Note 4) No drain in data mode
DAS 828A-L1/2 (Data/Voice) (Note 5)	20 mA per amplifier plug-in plus 70 mA while in talk or ringdown mode (Note 3)	80 mA in loop-back mode 120 mA in talk mode 165 mA in ringdown mode (Note 4)

Notes:

1. Current drains are nominal. Allow 25% extra to total supply drain to cover component variation.
2. Use of remote ac (tone) loop-back adds a constant signaling battery drain of 30 mA for each line in the normal mode and 55 mA for each line in the loop-back mode.
3. If the DAS 828A has been modified to provide station bridging, there is an additional 20-mA current drain.
4. If the DAS 828A has been modified to provide station bridging, there is an additional 10-mA current drain.
5. For DAS 828A-L1/2, the modes are as follows:
 - (a) Data—Handset on-hook or all buttons released
 - (b) Loop-Back—Handset off-hook and LB button pressed
 - (c) Talk—Handset off-hook and PL TALK button pressed
 - (d) Ringdown—Handset off-hook and PL TALK and RING buttons pressed.

SECTION 598-080-100

6. REFERENCES

6.01 The following documents provide additional information on facilities and equipment that may be associated with DAS 828A.

SECTION	TITLE	SECTION	TITLE
		314-821-500	Data Systems—Central Office—406A Tone Generator—Test Procedure
		332-104-102	V4 Type Repeaters—24V4B Telephone Repeater
CD&SD-1D225-01	Data Systems—Station Data Auxiliary Set 828-Type Data Service Units	332-104-103	V4 Telephone Repeater—F-58122 AGC Amplifier—Description
AB24.100.01	V4 Telephone Repeaters—Engineering Message Circuits	332-104-500	V4 Type Repeaters—Initial Line-up
AB27.350	Private Line Data Circuits—Voice Bandwidth—General Design Information	332-104-501	V4 Type Repeaters—227 Type Amplifiers—Tests and Adjustments
AB27.025.90	Equalizer Selection Programs Deldis and Delman for the GE-235 Time Sharing Computer System	332-104-503	V4 Telephone Repeater—F58122 AGC Amplifier—Tests and Adjustments
167-400-200	Power Plants and Power Units Located on Customer Premises—General Installation Requirements	332-115-10Z	V4 Type Repeaters—849A to G Network—Description
167-416-201	101-Type Power Plants—101G (J86731)—Identification, Installation, and Connections	332-116-10Z	V4 Type Repeaters—359A to N Equalizer—Description
167-440-201	Power Units Coded 19B2, 19C2, 20B1(MD), 20B2, and 20G2—Identification, Installation, Connections and Maintenance	590-100-131	44A1 Data Unit—Tone Detector—Description
179-100-303	V4 Telephone Repeater—Signaling Compatibility	598-080-180	Data Auxiliary Set 828A—Summarizing Specification—4-Wire Private Line Data Station
314-410-500	Voice Bandwidth Private Line Data Circuits—Tests and Requirements	598-080-200	Data Auxiliary Set 828A—Installation and Connections
314-821-100	Data Systems—Central Office—406A Tone Generator—Description and Operation	598-080-500	Data Auxiliary Set 828A—Maintenance and Test Procedures
314-821-200	Data Systems—Central Office 406 Tone Generator—Installations and Connections	598-080-101	Data Auxiliary Set 828C—Description and Operation
		598-080-201	Data Auxiliary Set 828C—Installation and Connections
		598-080-501	Data Auxiliary Set 828C—Maintenance and Test Procedures