44A1 DATA UNIT
TONE DETECTOR
DESCRIPTION

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1. GENERAL

1.01 This section covers the description of the 44A1 data unit. The data unit provides for tone-activated loop-back on a 4-wire private line (PL) voiceband data channel. The PL voiceband data channel may include carrier or other facilities not having dc continuity.

1.02 The 44A1 data unit, shown in Fig. 1, is intended for initial use with data auxiliary set (DAS) 828A. The 44A1 data unit plugs directly into the terminating set socket on the 24V4B repeater mounting unit of the DAS 828A. The 44A1 data unit can be mounted externally if the terminating set socket is being used. Descriptive information on DAS 828A is given in Section 598-080-100. Additional circuit applications are given in Part 4 of this section.

1.03 The data unit detects a tone transmitted over the 4-wire PL voiceband channel which is 2713 $\pm$7 Hz at the input to the 44A1 data unit. The signal level range at the data unit input for normal operation is +3 to −39 dBm. The data unit has a guard feature and a long integrate time to prevent false loop-back operation due to speech or data signals that may be present on the 4-wire channel.

1.04 The 44A1 data unit provides relay contact closures to an external relay circuit. The external circuit is arranged for connection to a loop-back relay that, when operated, provides for testing of the 4-wire voiceband channel. Additional contact closures of the data unit S relay are available and provide a means to indicate that tone is present. This is an auxiliary function intended for local applications as required.

Advantages

1.05 Tone-operated loop-back on the 4-wire PL voiceband channel provides the following advantages:

(a) The loop-back signal can be applied at any point on the PL channel. This permits testing both ends of a two-point channel from a single testing location.

(b) The use of the single frequency tone applied across the transmit pair at the test center (rather than, for example, requiring access to simplex leads) is consistent with present PL channel testing procedures using inband test signals.

(c) The 44A1 data unit permits remote loop-back with the alternate voice/data version of DAS 828A. Prior to this time, remote loop-back at the station using this apparatus was not possible. This was due to the dc simplex leads being used as the signaling pair for alternate voice operation.

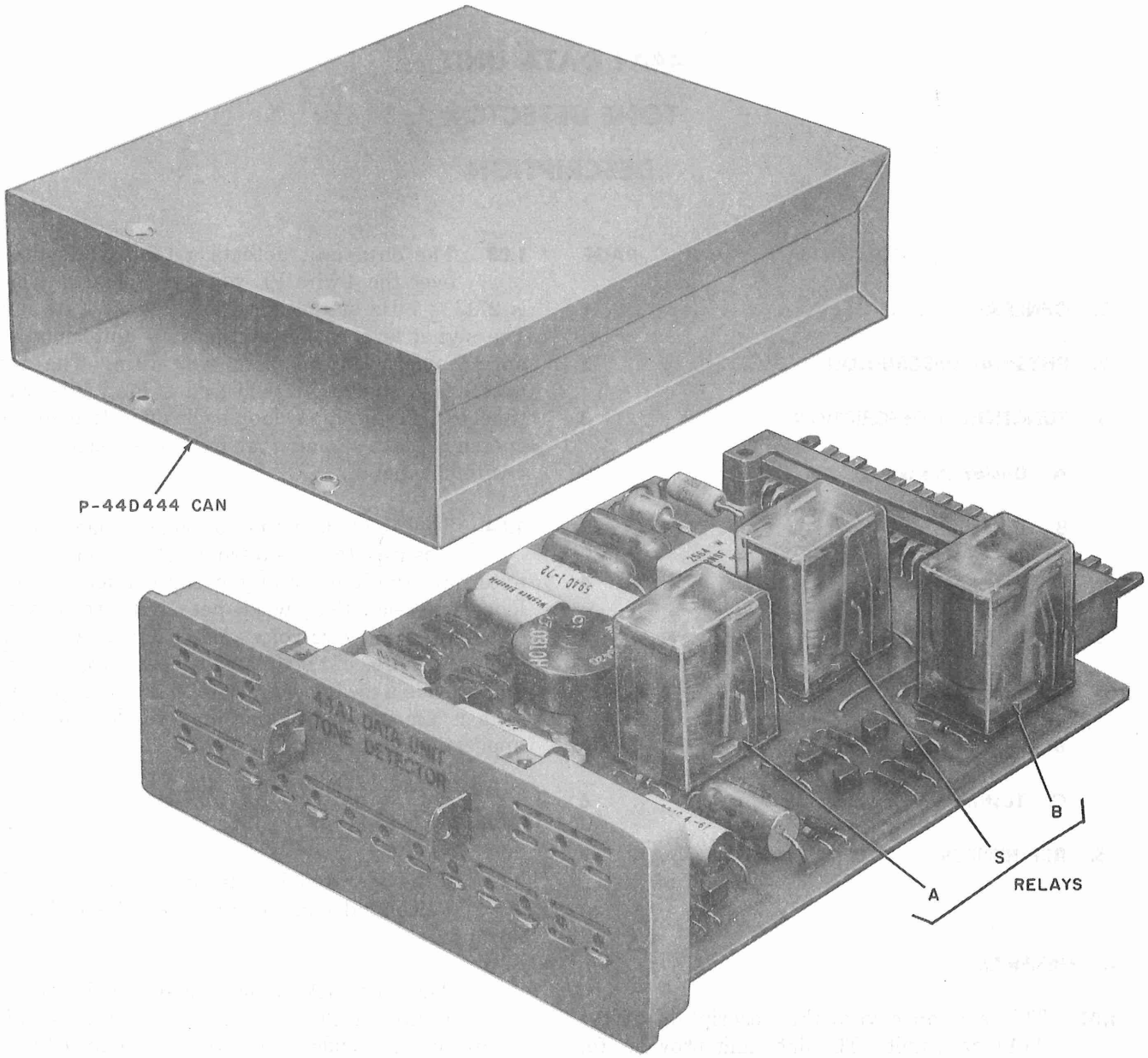

Fig. 1—44A1 Data Unit—Tone Detector

2. PHYSICAL DESCRIPTION

2.01 The 44A1 data unit contains component apparatus mounted on a single printed wiring board and is enclosed in a P-44D444 can. The data unit is arranged for plugging into the 1-type terminating set socket in the 24V4B repeater mounting unit.

2.02 Connection to the 24V4B repeater mounting unit of the associated DAS 828A is made on a plug-in basis. However, some wiring must be added at the quick connect terminals of DAS 828A.

2.03 The 44A1 data unit measures 1-3/4 inches high, 5-1/4 inches wide, and 7 inches deep. The data unit weighs approximately 1 pound.

2.04 The 44A1 data unit was designed to operate within the temperature range of 40°F to 120°F.

3. FUNCTIONAL DESCRIPTION

3.01 This part covers the designations and functional description of the 44A1 data unit.

A. Designations

3.02 The designation and function of the relays in the 44A1 data unit are as follows:

Relay Designation	Function
S	Operated when the 2713-Hz tone is present at detector input terminals.
A	Operated between the beginning of first and second applications of the 2713-Hz tone.
B	Operated between the removal of first and second applications of the 2713-Hz tone.

3.03 The functional block diagram of the 44A1 data unit is shown in Fig. 2. The circuit consists of five basic components as follows:

- Limiter
- Bandpass filter
- Threshold detector and timing
- The S relay
- The A and B relays.

3.04 The data unit is powered from an external −24 volt dc supply. This voltage supply can be the same supply as used for DAS 828A, provided that it has adequate current capacity. Connections and power supply requirements are given in Part 4 of this section.

B. Detection of Tone

3.05 The circuit of the data unit uses a limiter and bandpass filter to detect the 2713-Hz tone within a specific range of signal level and frequency. The operate and nonoperate regions of level and frequency are shown in Fig. 3. A tone received within this operate range will be detected and will operate the S relay.

3.06 In addition to the limiter function, the input portion of the limiter circuit provides a ripple filter. The ripple filter prevents 60- and 120-Hz voltage at the input from acting as guard energy. Guard energy is energy that is present outside the normal detector frequency band. The limiter circuit provides guard action that permits detector operation only when energy outside the detector frequency band is not present. This guard feature provides protection against talk-off by data signals. A long integrate time (1.4 seconds) provides protection against talk-off by speech signals.

3.07 The bandpass filter is tuned to 2713 Hz and has a bandwidth of approximately 44 Hz. The signal output of the filter connects to the threshold detector and timing circuit where the tone signal is converted to a control voltage. If the time duration of the control voltage is 1.4

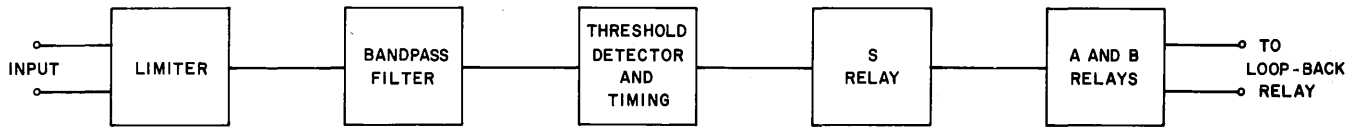

Fig. 2—Functional Arrangement of 44A1 Data Unit for Tone Detection

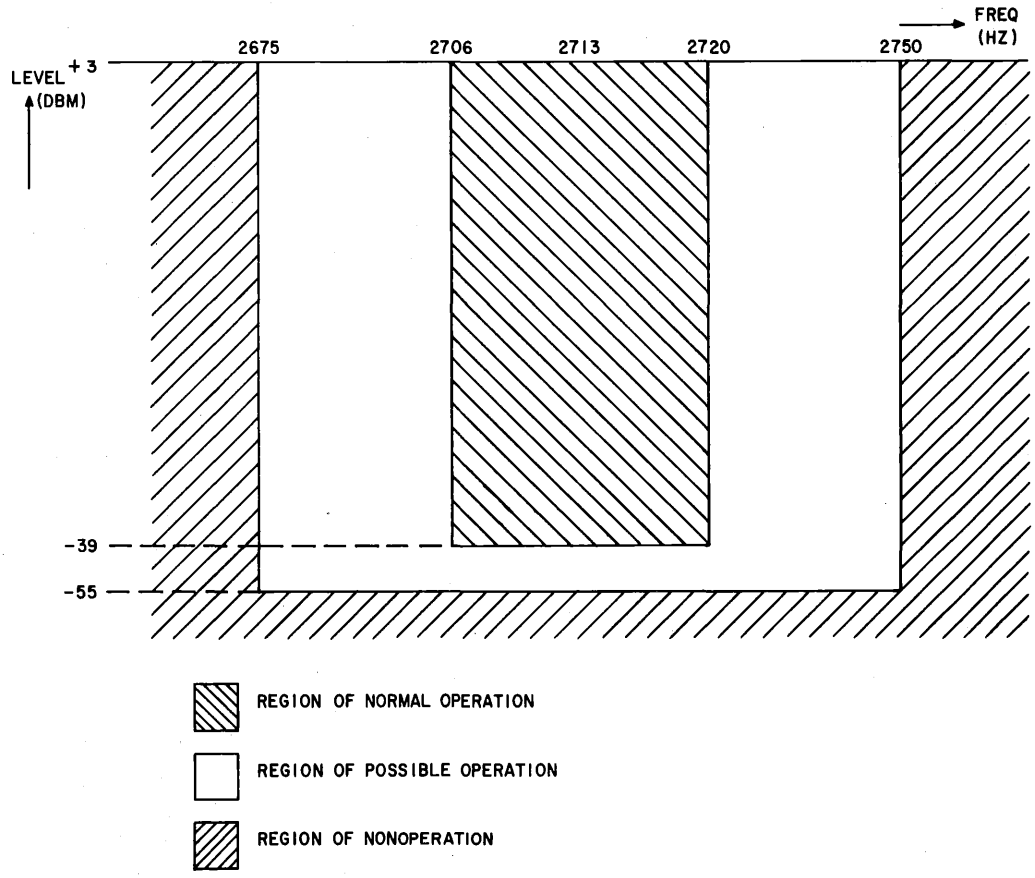

Fig. 3—Operate and Non-Operate Regions of Tone Detector

seconds or greater, the timing circuit operates the S relay.

C. Relay Operation (Relay Logic)

3.08 The A and B relays are controlled by the tone (S) relay. Four possible states of relay operation exist as shown in Table A. Application and removal of tone provides two states of relay operation. Two applications and removal of tone are required to achieve all four states of relay operation. A closure between terminals 14 and 15 on connector P1 of the 44A1 data unit is the indication used for tone loop-back. A timing sequence of relay operation for tone-operated loop-back is shown in Fig. 4.

3.09 When tone is initially detected, the S relay operates and remains operated for approximately 1 second after tone is removed. The first time tone is detected, the S and A relays operate. When tone is removed, the S relay releases and the B relay operates. The A relay remains operated through its own make contact. A and B relays are now operated providing an operate path for the external loop-back (LB) relay. In addition, an indication of tone ON/OFF is provided at terminals 6, 8, and 9 on connector P1.

4. CIRCUIT APPLICATIONS

4.01 This part provides information on station arrangements and connections required for the various applications of the 44A1 data unit. Power supply requirements of the data unit are also given.

4.02 For 4-wire PL station applications, the data unit plugs directly into the terminating set socket on the 24V4B repeater mounting unit. When 2-wire data sets are used on the 4-wire data channel, the 44A1 data unit is mounted external to DAS 828A.

TABLE A

LOOP-BACK OPERATE SEQUENCE

STATE	TONE (2713 HZ)	RELAY OPERATION			LOOP-BACK
		S	A	B	
INITIAL	OFF	RELEASED	RELEASED	RELEASED	NO
1	ON	OPERATED	OPERATED	RELEASED	NO
2	OFF	RELEASED	OPERATED	OPERATED	YES
3	ON	OPERATED	RELEASED	OPERATED	NO
4	OFF	RELEASED	RELEASED	RELEASED	NO

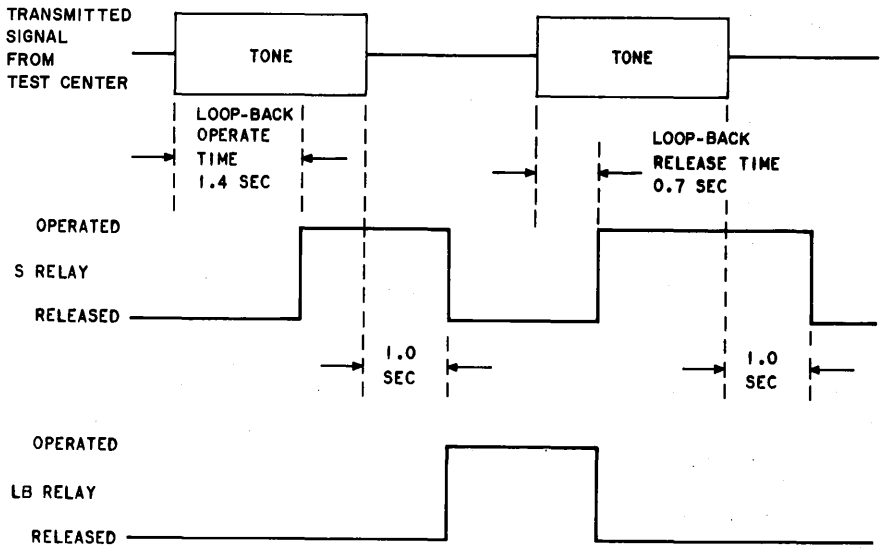

Fig. 4—Timing Sequence of Loop-Back Relay

4.03 A typical 4-wire station arrangement using tone-operated loop-back is shown in Fig. 5. The levels shown are typical values for receive and transmit pairs. When a 2713-Hz tone is detected and then removed, A and B relays operate and provide an operate path for the external LB relay.

A. Connections

4.04 The primary application for the 44A1 data unit is intended to be with DAS 828A where a 4-wire data set is used. In this case, the terminating set socket of the 24V4B repeater mounting unit is empty. The 44A1 data unit plugs directly into that socket. Some connections must be made on the quick connect terminals of DAS 828A in order to connect the 44A1 data unit to the receive pair and the loop-back relay, and to provide power. The wiring connections required are made at terminal strip TB2 of DAS 828A as shown in Fig. 6.

4.05 The DAS 828A can also be used with 2-wire data sets on the 4-wire channel. When a 2-wire data set is used, the 44A1 data unit must be mounted external to DAS 828A using standard terminating set mountings as shown in Fig. 7.

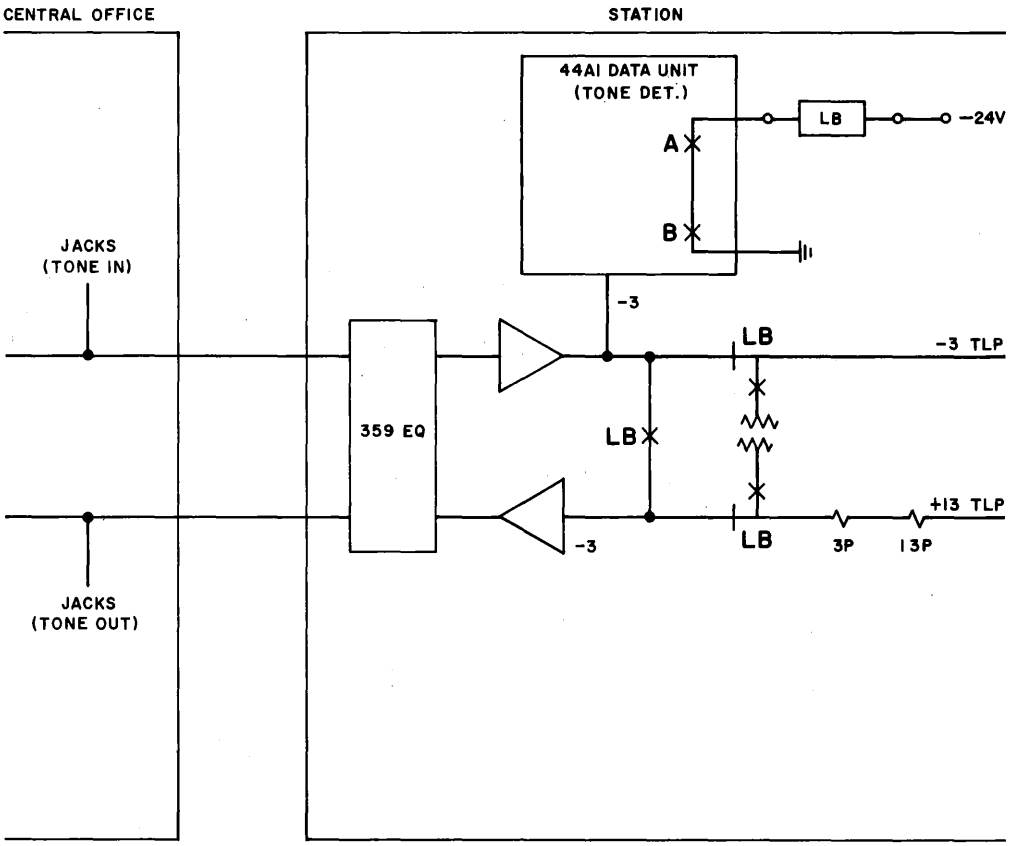

Fig. 5—Application of Tone Detector Using DAS 828A

4.06 The 44A1 data unit can be used at stations not equipped with DAS 828A. A 24V4B repeater mounting unit is commonly used in other locally designed arrangements. In some arrangements the pad required to provide equal level loop-back and the loop-back relay will be provided. In other arrangements only the 24V4B repeater will be provided. A suggested arrangement that adds the 44A1 data unit, a pad and relay to the 24V4B repeater is shown in Fig. 8. Station arrangements using fewer additional components can be made using the applicable parts of Fig. 8.

4.07 The 44A1 data unit can also be arranged in other configurations. The station must have lightning protection provided by other components. Also, no metallic dc current should be present on the receive pair where the 44A1 data unit is connected.

B. Power Requirements

4.08 The 44A1 data unit is powered from a −24 volt dc source. The maximum current drain occurs when tone is detected and is approximately 70 mA at −24 volts dc. The 44A1 data unit can be powered from the same supply used for DAS 828A.

C. Testing

4.09 After installation and connections are completed, the tone detector should be tested to verify satisfactory operation. This operational test is made by calling the nearest test center and requesting a 2713-Hz tone be transmitted to the station for approximately 5 seconds. Loop-back occurs when the tone is removed. The test center then verifies that loop-back at the station has been achieved by sending a 1000-Hz test tone to the station. Loop-back is verified if the test center receives the tone back on the receive pair of the 4-wire PL.

4.10 After loop-back operation is verified, a second 2713-Hz tone is transmitted and loop-back is released at the beginning of the tone. The test

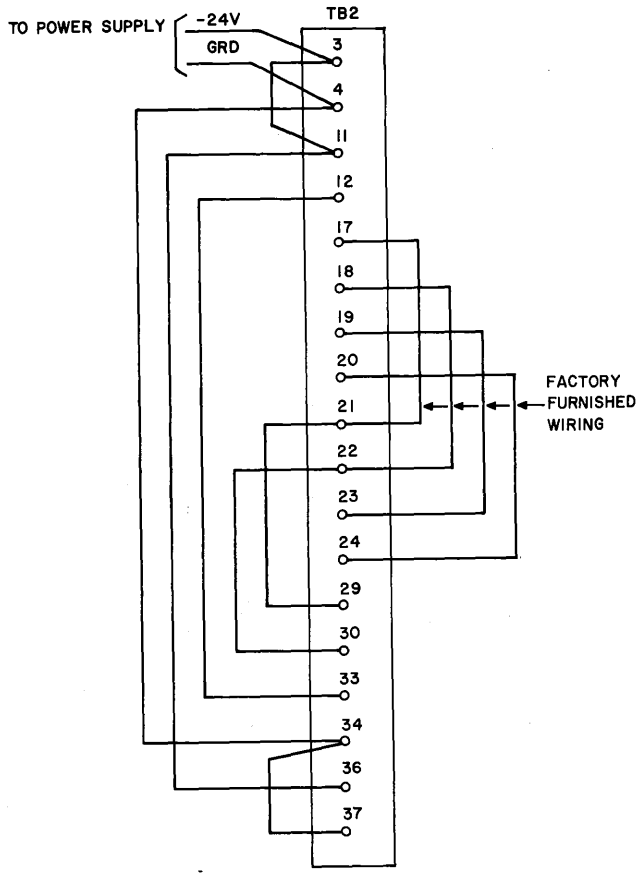

Fig. 6—DAS 828A Connections With 4-Wire Data Sets

tone at 1000-Hz is again transmitted to the station. The tone should not be returned to the test center indicating the station is no longer looped. This will ensure that loop-back has been released before turning the channel back to the customer.

5. REFERENCES

5.01 The schematic drawing and circuit description covering the 44A1 data unit are SD- and CD-1D246-01.

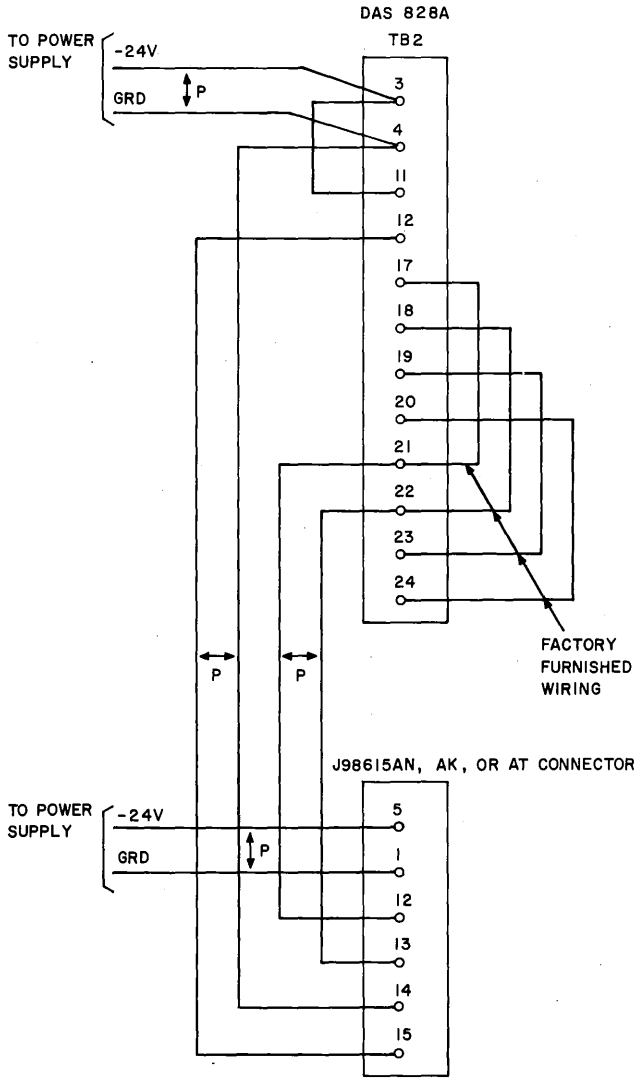

Fig. 7—DAS 828A Connections With 2-Wire Data Sets

5.02 More descriptive information on equipment associated with the 44A1 data unit is covered in the Bell System Practice entitled Data Auxiliary Set 828A—Description and Operation (598-080-100).

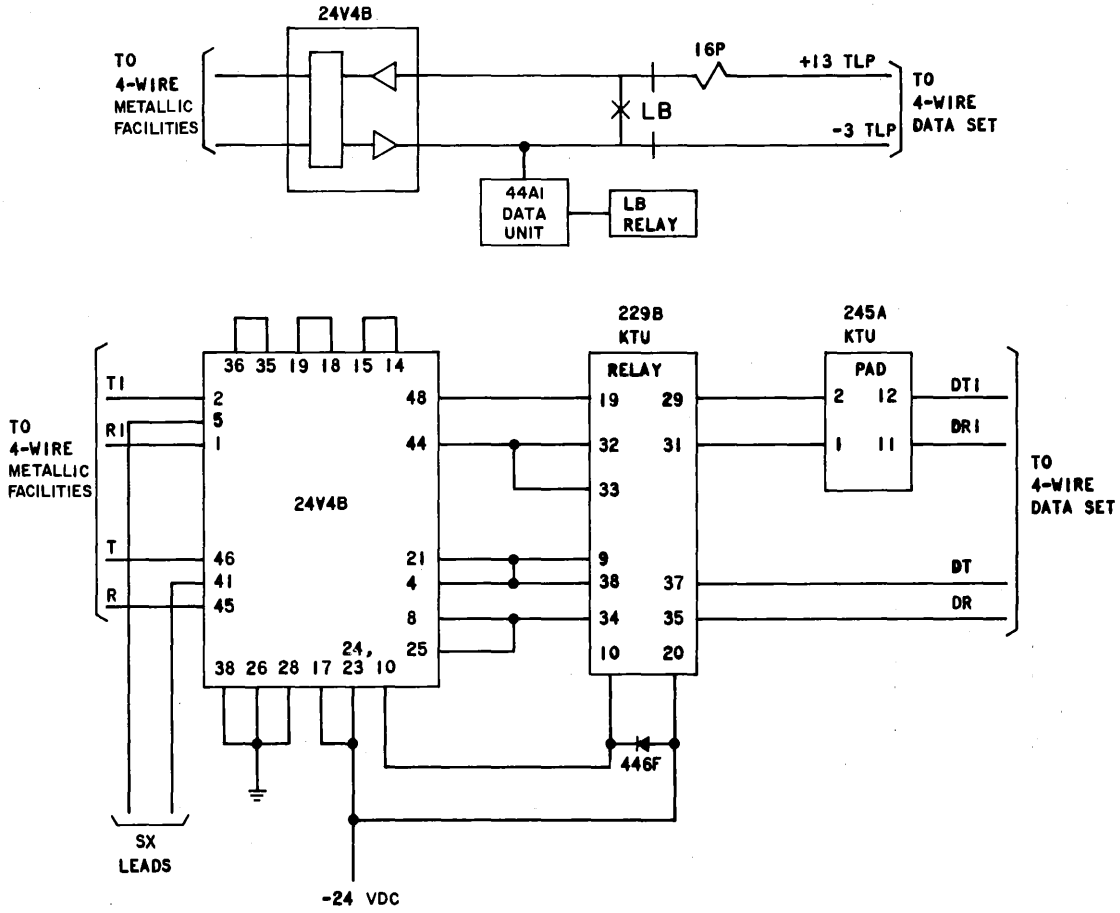

Fig. 8—Station Arrangement Using 24V4B Repeater