DATA AUXILIARY SET 829-TYPE
CHANNEL INTERFACE UNITS
VOICEBAND PRIVATE LINE CHANNELS
DESCRIPTION

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1. GENERAL

1.01 This section contains the description of data auxiliary set (DAS) 829-type and the supplementary data units and data mountings. Data auxiliary set 829-type functions as a channel interface unit (CIU) to provide a prewired and tested standard termination for 4-wire private line voiceband data channels. Basic station arrangements use the DAS 829-type CIU to provide 4-wire data only service. Other station arrangements use the DAS 829-type CIU and the supplementary apparatus to provide 4-wire data with alternate voice, dial backup, and switched dial backup service. Two-wire data only and data with alternate voice service are also provided.

1.02 This section is reissued to add information on the 48ER1, 48FR1, and 48G1 data units and the 44A2, 46A2, 46C2, 59A1, and 62A1 data mountings. Since this reissue is a general revision, arrows normally used to indicate changes have been omitted.

1.03 A choice of six codes for the DAS 829-type CIU provides proper termination of channels having various loop facilities.

- DAS 829A-L1 or L1A for short loops.
- DAS 829B-L1 or L1A for longer nonloaded loops.
- DAS 829C-L1 or L1A for longer loaded loops.

1.04 A choice of seven data units combined with a DAS 829-type CIU provides the following features:

- 48A1 data unit for 4-wire or 2-wire alternate voice service.

- 48B1 data unit for 4-wire dial backup service with manual dialing.

- 48C1 data unit (switching matrix) for switching any one of four 4-wire modems to either one of two 4-wire dial backup channels.

- 48D1 data unit (interface adapter) for use with a 46C1 or 46C2 and/or 46B1 data mounting to concentrate control leads in an 18- or 30-button CALL DIRECTOR® key telephone set.

- 48ER1 data unit for 4-wire dial backup service with manual or automatic dialing. This data unit complies with all requirements of the FCC Registration Program. The registration number for the 48ER1 data unit is AS593M-67751-PC-E. The ringer equivalence number for each line is 0.5A.

- 48FR1 data unit for 4-wire dial backup service with automatic answering. This data unit complies with all requirements of the FCC Registration Program. The registration number for the 48FR1 data unit is AS593M-67757-PC-E. The ringer equivalence number for each line is 0.5A.

- 48G1 data unit for 2-wire to 4-wire conversion.

1.05 A choice of seven types of data mountings houses single or multiple arrangements of DAS 829-type CIUs and/or 48-type data units without any change in wiring.

- 44A1 or 44A2 data mounting houses one DAS 829-type CIU.

- 45A1 data mounting houses one DAS 829-type CIU or one DAS 829-type CIU with the following data units: one 48A1 or 48B1, or one 48A1 and one 48B1.

- 46A1 or 46A2 data mounting houses up to eight DAS 829-type CIUs.

- 46B1 data mounting houses up to eight 48A1 or 48G1 data units.

- 46C1 data mounting houses one or two 48B1 data units and up to six 48C1 data units.

- 46C2 data mounting houses one or two 48B1 or 48ER1 data units and up to six 48C1 data units.

- 59A1 data mounting houses one DAS 829-type CIU or one DAS 829-type CIU with the following data units: one 48A1, 48B1, 48ER1, 48FR1, or 48G1; or one 48A1 and one 48B1, 48ER1, or 48G1.

- 62A1 data mounting houses one DAS 829-type CIU or one DAS 829-type CIU and one 48G1 data unit.

DATA ONLY SERVICE

1.06 The DAS 829-type CIU when used with the proper data mounting but without the supplementary data units provides 4-wire data only service. The DAS 829-type CIU also provides a loopback mode of operation to permit testing of the transmission facilities from a remote test center. A 48G1 data unit can be used with the DAS 829-type CIU to provide 2-wire data only service.

1.07 The DAS 829-type CIU provides a prewired and tested standard termination for 4-wire private line voiceband data channels. The CIU is available in six codes for proper termination of channels having the following loop facilities:

- DAS 829A-L1 and L1A for short nonloaded or loaded loops when no gain is required in the transmit or receive paths.

- DAS 829B-L1 and L1A for longer nonloaded loops that require gain in the receive path.

- DAS 829C-L1 and L1A for longer loaded loops that require gain in the receive path and extensive amplitude equalization.

The three L1A codes provide all the functions of the corresponding L1 codes and also provide the following functions: (1) data only service on 8-dB channels, (2) operation from a -48 Vdc power source, (3) visual indication of loopback, and (4) provision for disabling loopback by use of special data mountings.

1.08 The DAS 829A-L1, 829B-L1, and 829C-L1 CIUs are for use on channels with an end-to-end loss of 16 dB and a modem transmit

power of 0 dBm. The DAS 829A-L1A, 829B-L1A, and 829C-L1A CIUs are for use on channels with an end-to-end loss of either 8 or 16 dB. The 8-dB channels are limited to data only service since the supplementary data units required for alternate voice and/or dial backup service are designed for use on standard 16-dB channels only. The functions provided by the six CIU codes are summarized in Table A.

1.09 The DAS 829-type CIU provides two line pairs for 4-wire transmission and an additional line pair for line status. The line status pair is controlled by a normally-closed contact in the CIU and supplies a signal at the interface that can be used by the associated modem to control an Electronic Industries Association (EIA) circuit. When the EIA RS-232-C standard 25-pin interface is used, the line status pair can be used by the associated modem to control the data set ready signal (EIA CC circuit). When the EIA RS-449 standard 37-pin interface is used, the line status pair can be used by the associated modem to control the data mode signal (EIA DM circuit). An open line status pair provides a not-in-data indication when the CIU is in the loopback mode (facility loopback).

1.10 Housing for a single DAS 829-type CIU is provided by the 44A1 and 44A2 data mountings. The 45A1, 59A1, and 62A1 data mountings can also provide housing for a single DAS 829-type CIU but are not normally used for this purpose in data only service. Multiple housing for up to eight DAS 829-type CIUs is provided by the 46A1 and 46A2 data mountings. Housing for a single DAS 829-type CIU with a single 48G1 data unit is provided by the 62A1 data mounting. The 59A1 data mounting can also provide housing for a single DAS 829-type CIU with a single 48G1 data unit but is not normally used for this purpose in 2-wire data only service. Multiple housing for up to eight 48G1 data units is provided by the 46B1 data mounting. The 44A2 data mounting provides all the functions of the 44A1 data mounting and also provides screw terminal access to the simplex pair of the 4-wire metallic facilities. The 46A2 data mounting provides all the functions of the 46A1 data mounting and also provides the following functions: (1) connector access to the simplex pair of the 4-wire metallic facilities and (2) operation from a -24 or -48 Vdc power source.

1.11 If the DAS 829-type CIU requires a 24 Vac power source, the 44A1, 44A2, 45A1, 46A1, 46A2, 59A1, and 62A1 data mountings can be used. If the CIU requires a -24 or -48 Vdc power source, the 44A1, 44A2, 46A2, and 62A1 data mountings can be used. If the 48G1 data unit requires a 24 Vac power source for data only service, the 46B1, 59A1, and 62A1 data mountings can be used. If the 48G1 data unit requires a -24 or -48 Vdc power source, only the 62A1 data mounting can be used. Special arrangements that require disabling of CIU loopback must provide their own data mounting.

1.12 A simplified functional diagram for 4-wire data only service is shown in Fig. 1.

(a) In the normal (data) mode, the modem is connected to the 4-wire metallic facilities through the normally-closed contacts of the LB1 relay in the DAS 829-type CIU. Data transmission can take place over the 4-wire metallic facilities as indicated by a line status signal to the modem.

(b) In the loopback mode, operation of the LB1 relay in the DAS 829-type CIU disconnects the modem from the 4-wire metallic facilities and loops back the receive pair to the transmit pair through a loopback amplifier in the CIU. The 4-wire metallic facilities are now reserved for test purposes and are not available for data transmission as indicated by a line status signal to the modem.

1.13 A simplified functional diagram for 2-wire data only service is shown in Fig. 2. The DAS 829-type CIU operates in the same manner as described in paragraph 1.12 for 4-wire data only service. The 48G1 data unit converts the 2-wire channel from the modem into a 4-wire channel.

1.14 The 48G1 data unit provides the following functions:

- Balanced hybrid circuit consisting of a modem transmit and receive port, a station transmit port, and a station receive port.
- Gain in the station transmit port to offset hybrid and insertion losses in the transmit path.

TABLE A

FUNCTIONS PROVIDED BY THE DAS 829-TYPE CIU

FUNCTION	829A-L1	829B-L1	829C-L1	829A-L1A	829B-L1A	829C-L1A
Level adjustment in the transmit and receive paths:						
Attenuation in the transmit path	X	X	X	X	X	X
Attenuation in the receive path	X	X	X	X	X	X
Gain in the receive path		X	X		X	X
Amplitude equalization in the transmit and receive paths: Slope equalization:						
150-ohm line impedance		X			X	
600-ohm line impedance	X	X	*	X	X	*
1200-ohm line impedance	X	X	*	X	X	*
359A or 359K equalizer equivalent*			X			X
Tone operated loopback at equal transmission levels:						
For 8-dB channels				X	X	X
For 16-dB channels	X	X	X	X	X	X
Visual indication of loopback				X	X	X
Improved loopback control logic				X	X	X
Provision for disabling loopback†				X	X	X
Not-in-data indication to modem	X	X	X	X	X	X
Sealing current option	X	X	X	X	X	X
Hazardous voltage protection	X	X	X			
Improved hazardous voltage protection				X	X	X
Test and monitor jacks in transmit and receive circuits	X	X	X	X	X	X
TRANS MON jack connected directly to DT1 and DR1 leads				X	X	X
Handle to facilitate removal of CIU				X	X	X
Provision for central office operation (−48 Vdc supply)				X	X	X
Power source						
24 Vac	X	X	X	X	X	X
−24 Vdc	X	X	X	X	X	X
−48 Vdc				X	X	X

* The 359A equalizer equivalent provides a 1200-ohm line impedance.
The 359K equalizer equivalent provides a 600-ohm line impedance.

† Not available through use of a standard data mounting.

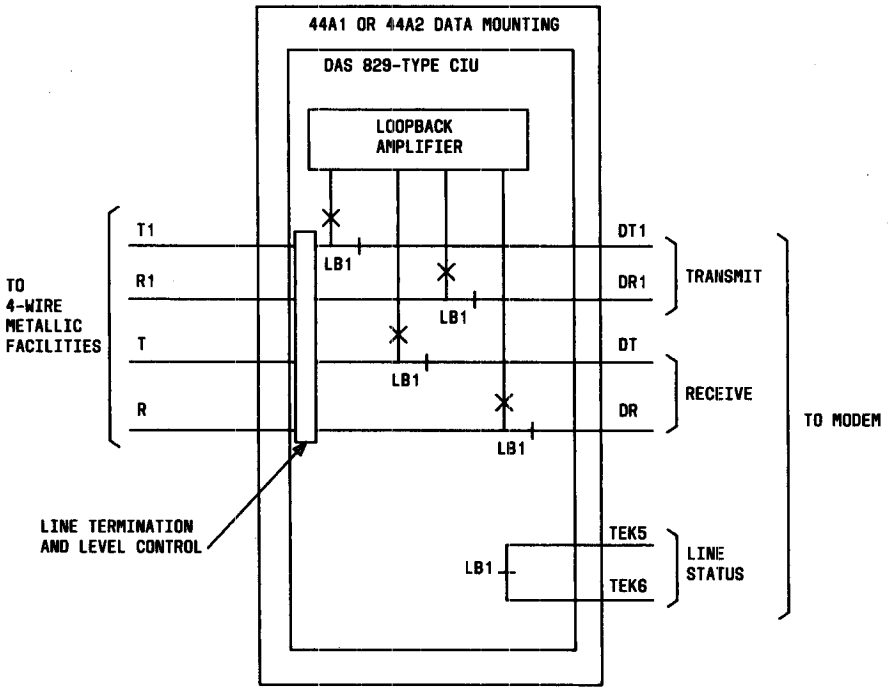


Fig. 1—4-Wire Data Only Service—Simplified Functional Diagram

- Gain in the station receive port to offset hybrid and insertion losses in the receive path.
- Test and monitor jacks in the modem port.
- Power supply option permitting operation from a 24 Vac, -24 Vdc, or -48 Vdc supply.

ALTERNATE VOICE AND DIAL BACKUP SERVICE

1.15 The 48A1, 48B1, 48ER1, 48FR1, and 48G1 data units, when used with the DAS 829-type CIU and the proper data mountings, provide the following arrangements:

- 4-wire data with alternate voice—This service is provided by a CIU with a 48A1 data unit.
- 2-wire data with alternate voice—This service is provided by a CIU with both a 48A1 and a 48G1 data unit.
- 4-wire data with dial backup (manual dialing)—This service is provided by a CIU with a 48B1 data unit.
- 4-wire data with dial backup (manual or automatic dialing)—This service is provided by a CIU with a 48ER1 data unit.
- 4-wire data with dial backup (automatic answering)—This service is provided by a CIU with a 48FR1 data unit.
- 4-wire data with alternate voice and dial backup—This service is provided by a CIU with both a 48A1 and a 48B1 or 48ER1 data unit.

1.16 The 48A1 data unit provides the switching, signaling, and transmission circuitry required to add alternate voice service to 4-wire or 2-wire private line data service. The 48B1 or 48ER1 data unit provides the switching, ring detection, and

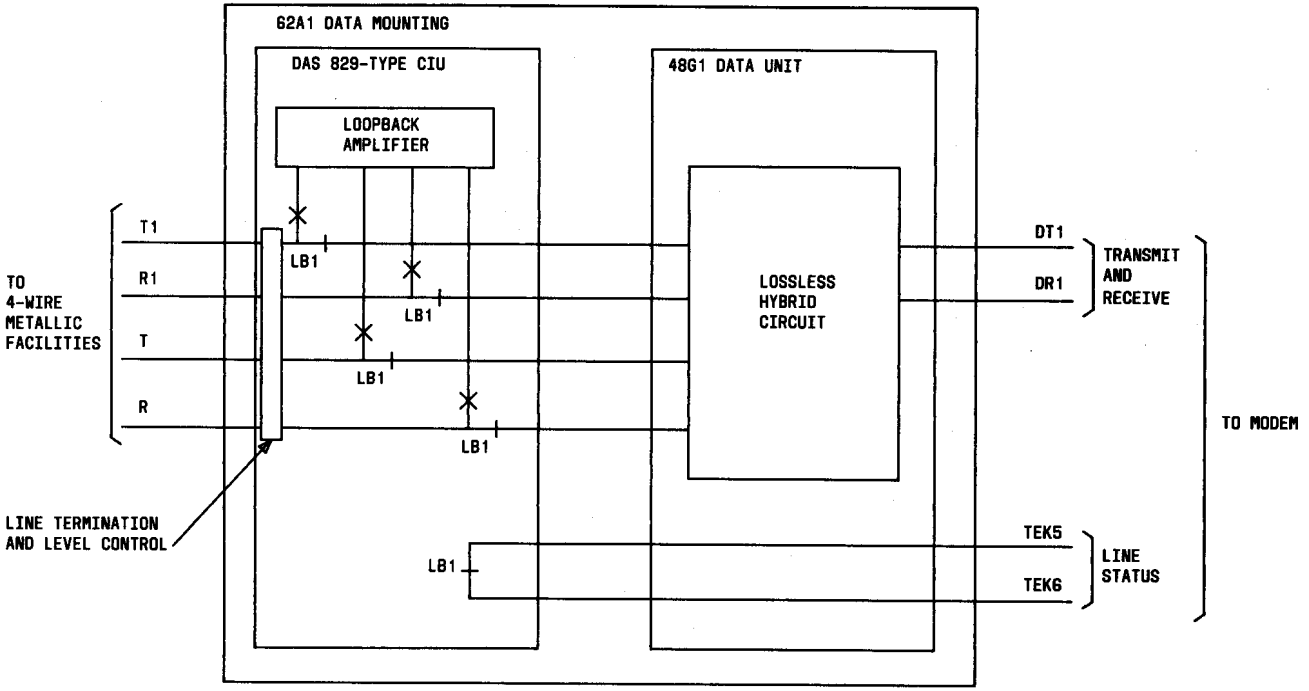


Fig. 2—2-Wire Data Only Service—Simplified Functional Diagram

transmission circuitry required to add 4-wire dial backup service to 4-wire private line data or data with alternate voice service. The 48ER1 data unit is a registered replacement for the 48B1 data unit and provides all the functions of the 48B1 data unit except 4-dB slope equalization. The 48ER1 data unit also permits automatic dialing at the originating station of a 4-wire dial backup channel and enables the originating station to operate with an unattended terminating station. The 48FR1 data unit is a registered data unit that provides the switching, ring detection, and transmission circuitry required for automatic answering at the unattended terminating station.

1.17 Housing for one CIU, one CIU with one 48A1 or one 48B1 data unit, or one CIU with one 48A1 and one 48B1 data unit is provided by the 45A1 data mounting. Housing for one CIU; one CIU with one 48A1, 48B1, 48ER1, 48FR1, or 48G1 data unit; or one CIU with one 48A1 and one 48B1, 48ER1, or 48G1 data unit is provided by the 59A1 data mounting. Multiple housing for up to eight CIUs is provided by the 46A1 or 46A2 data mounting. Multiple housing for up to eight 48A1 or 48G1 data units is provided by the 46B1 data mounting. The 59A1 data mounting is a replacement for the 45A1 data mounting and provides all the functions of the 45A1 data mounting. The 59A1 data mounting also provides the following functions: (1) housing for a 48ER1, 48FR1, or 48G1 data unit, (2) use of a customer- or modem-provided contact for control of the 48ER1 or 48FR1 data unit, and (3) screw terminal access to the simplex pair of the 4-wire metallic facilities.

1.18 A simplified functional diagram for 4-wire data with alternate voice and/or dial backup service is shown in Fig. 3.

(a) In the normal (data) mode, the modem is connected to the 4-wire metallic facilities (4-wire private line) through the normally-closed contacts of the LB1 relay in the DAS 829-type CIU, the TK relay in the 48A1 data unit (if alternate voice service is provided), and the A relay in the 48B1, 48ER1, or 48FR1 data unit (if dial backup service is provided). Data transmission can take place over the 4-wire private line as indicated by a line status signal to the modem.

(b) In the alternate voice mode, operation of the TK relay in the 48A1 data unit disconnects the modem and connects the key telephone set to the private line. The private line is now reserved for voice transmission and is not available for data transmission as indicated by a line status signal to the modem.

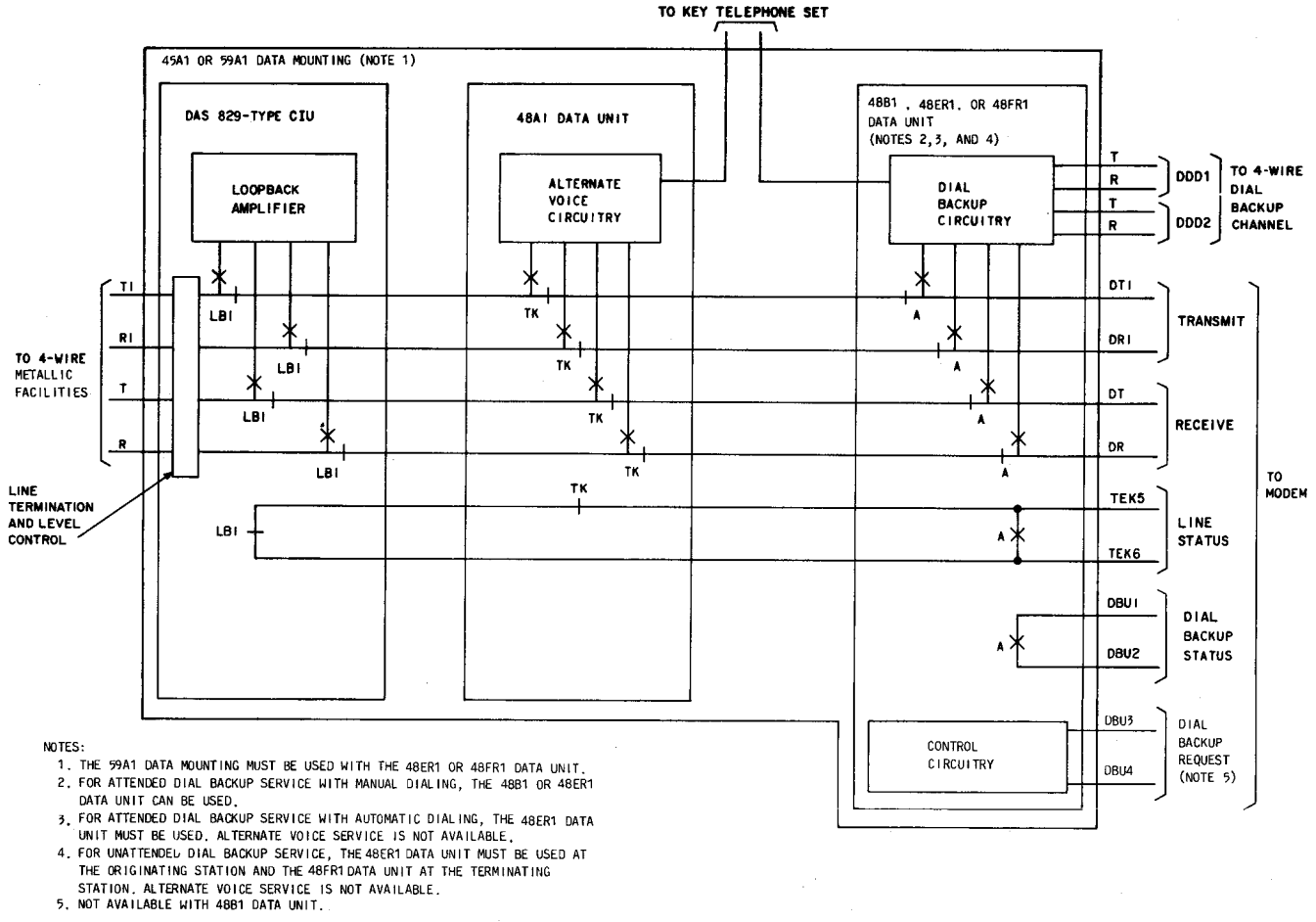
(c) In the dial backup mode, operation of the A relay in the 48B1, 48ER1, or 48FR1 data unit transfers the modem from the 4-wire private line to the 4-wire dial backup channel. Data transmission can now take place over the 4-wire dial backup channel as indicated by line status and dial backup status signals to the modem.

(d) When unattended dial backup is provided, the customer can control the operational mode of the 48ER1 or 48FR1 data unit through use of a dial backup request pair. A customer- or modem-provided contact is required for this remote control. A contact closure indicates a dial backup channel is requested. At present, Bell System modems do not provide for control of the dial backup request pair.

> ***Note:*** In the future, it is expected that Bell System modems will be available that provide for control of the dial backup request pair. These modems will have the EIA RS-449 standard 37-pin interface. The EIA select standby (SS) circuit can then be used for control of the dial backup request pair. The dial backup status pair can then be used for control of the EIA standby indicator (SB) circuit.

1.19 Four types of 4-wire single channel arrangements with dial backup service can be provided. The type of arrangement used is determined by the type of operation required at each station (attended or unattended). When attended operation is provided at the local and distant stations, alternate voice service over the private line channel can be provided. The four types of 4-wire single channel arrangements are as follows:

- Attended call origination and answer at Stations A and B.
- Attended call origination at Station A, unattended call answer at Station B.
- Attended call origination and answer at Station A, unattended call origination and answer at Station B.



NOTES:

1. THE 59A1 DATA MOUNTING MUST BE USED WITH THE 48ER1 OR 48FR1 DATA UNIT.
2. FOR ATTENDED DIAL BACKUP SERVICE WITH MANUAL DIALING, THE 48B1 OR 48ER1 DATA UNIT CAN BE USED.
3. FOR ATTENDED DIAL BACKUP SERVICE WITH AUTOMATIC DIALING, THE 48ER1 DATA UNIT MUST BE USED. ALTERNATE VOICE SERVICE IS NOT AVAILABLE.
4. FOR UNATTENDED DIAL BACKUP SERVICE, THE 48ER1 DATA UNIT MUST BE USED AT THE ORIGINATING STATION AND THE 48FR1 DATA UNIT AT THE TERMINATING STATION. ALTERNATE VOICE SERVICE IS NOT AVAILABLE.
5. NOT AVAILABLE WITH 48B1 DATA UNIT.

Fig. 3—4-Wire Data With Alternate Voice and/or Dial Backup Service—Simplified Functional Diagram

- Unattended call origination and answer at Stations A and B.

  (a) For attended call origination and answer at Stations A and B, the equipment required at the two stations is shown in Fig. 4. To set up a dial backup channel between the two stations in both transmit and receive directions, two calls must be established between lines DDD1 and DDD2 and the lines placed on hold. Both calls can be manually originated by either attended station or the first call can be manually originated by one station and the second call by the other station. However, line DDD1 at Station A must be connected to line DDD2 at Station B and line DDD2 at Station A to line DDD1 at Station B. If the stations are equipped with 48B1 dial backup units, the first call can be originated on line DDD1 or DDD2. If the stations are equipped with 48ER1 dial backup units, the first call must be originated on line DDD2.

  (b) For attended call origination at Station A, unattended call answer at Station B, the equipment required at the two stations is shown in Fig. 5. To set up a dial backup channel between the two stations in both transmit and receive directions, two calls must be established between lines DDD1 and DDD2 and the lines placed on hold. Both calls are manually originated by the attended station (Station A) and automatically answered by the unattended station (Station B). The second call must be completed within a timed interval after completion of the first call. Line DDD1 at Station A must be connected to Line DDD2 at Station B and line DDD2 at Station A to line DDD1 at Station B. The first call must be originated on line DDD2.

  (c) For attended call origination and answer at Station A, unattended call origination and answer at Station B, the equipment required at the two stations is shown in Fig. 6. To set up a dial backup channel between the two stations in both transmit and receive directions, two calls must be established between lines DDD1 and DDD2 and the lines placed on hold. The first call is manually originated by the attended station (Station A) on line DDD2 and automatically answered by the unattended station (Station B) on line DDD1. The second call is automatically originated by a single number dialer (station dial) at Station B on line DDD2 and manually answered by Station A on line DDD1.

  (d) For unattended call origination and answer at Stations A and B, the equipment required at the two stations is shown in Fig. 7. To set up a dial backup channel between the two stations in both transmit and receive directions, two calls must be established between lines DDD1 and DDD2 and the lines placed on hold. The first call is automatically originated by a single number dialer or an automatic calling unit (ACU) at unattended Station A on line DDD2 and automatically answered by unattended Station B on line DDD1. The second call is automatically originated by a single number dialer at Station B on line DDD2 and automatically answered at Station A on line DDD1.

1.20 A simplified functional diagram for 2-wire data with alternate voice service is shown in Fig. 8. The DAS 829-type CIU and the 48A1 data unit operate in the same manner as described in paragraph 1.18 for 4-wire data with alternate voice service. The 48G1 data unit converts the 2-wire channel from the modem into a 4-wire channel.

1.21 The 48A1 data unit provides the following functions:

- Alternate voice service for modems over a 4-wire or 2-wire private line through the interface of a DAS 829-type CIU.
- A 4-wire to 2-wire conversion to interface with a 2-wire key telephone set.
- 2600-Hz manual ringdown signaling.
- Control of station equipment through use of a key telephone set.
- Audible ringback signal.

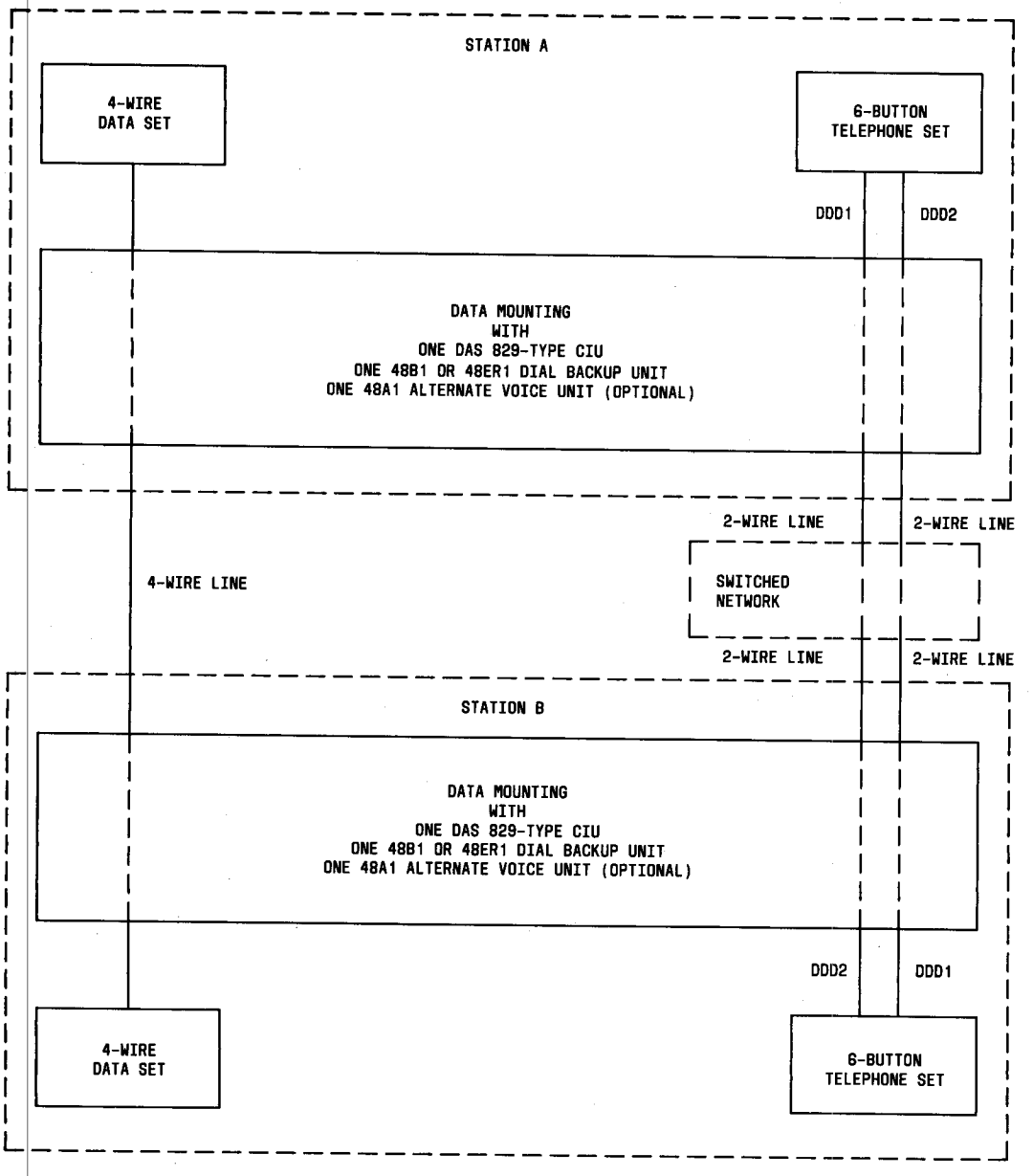


Fig. 4—4-Wire Single Channel Arrangement—Attended Call Origination and Answer at Stations A and B

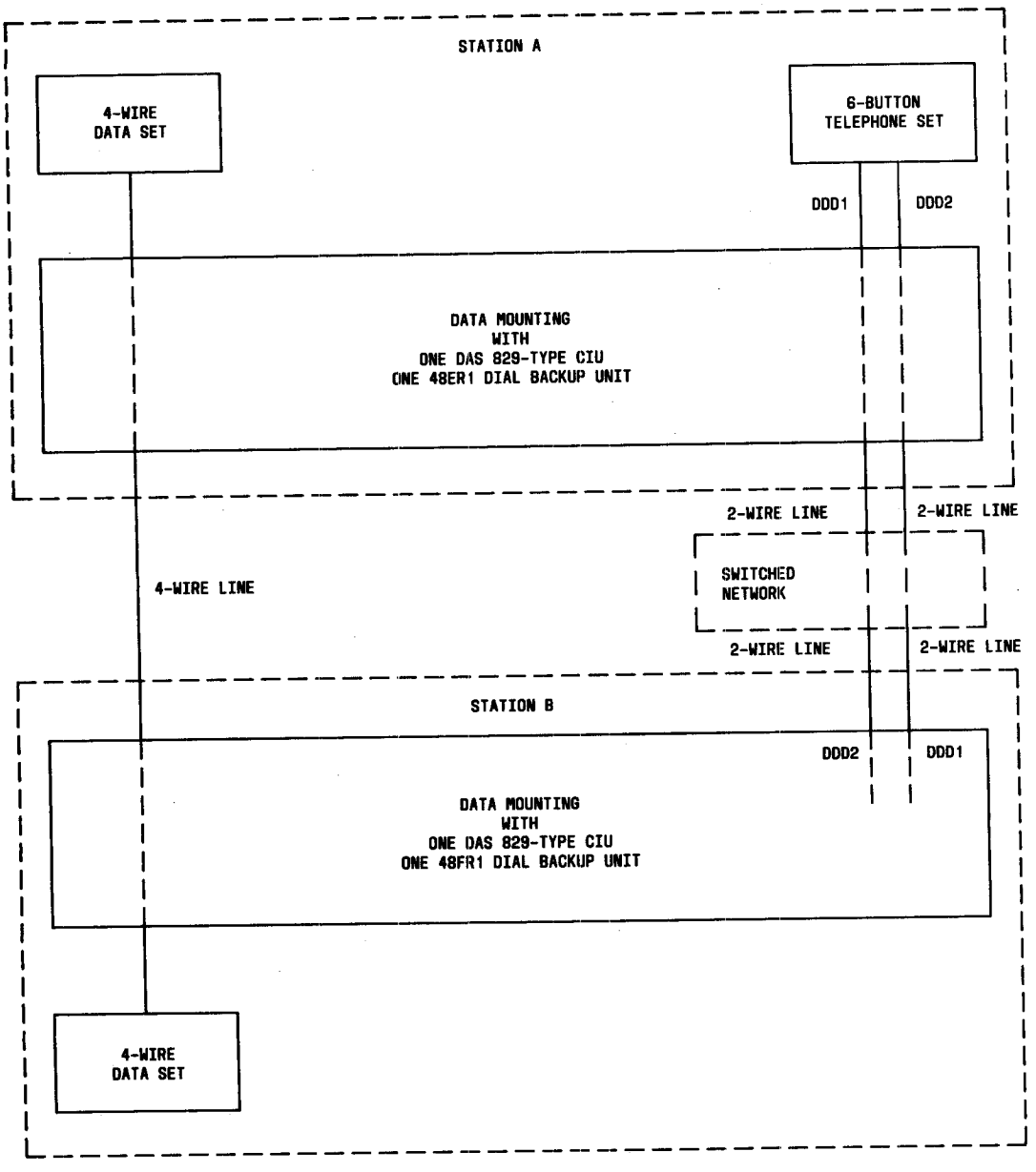


Fig. 5—4-Wire Single Channel Arrangement—Attended Call Origination at Station A, Unattended Call Answer at Station B

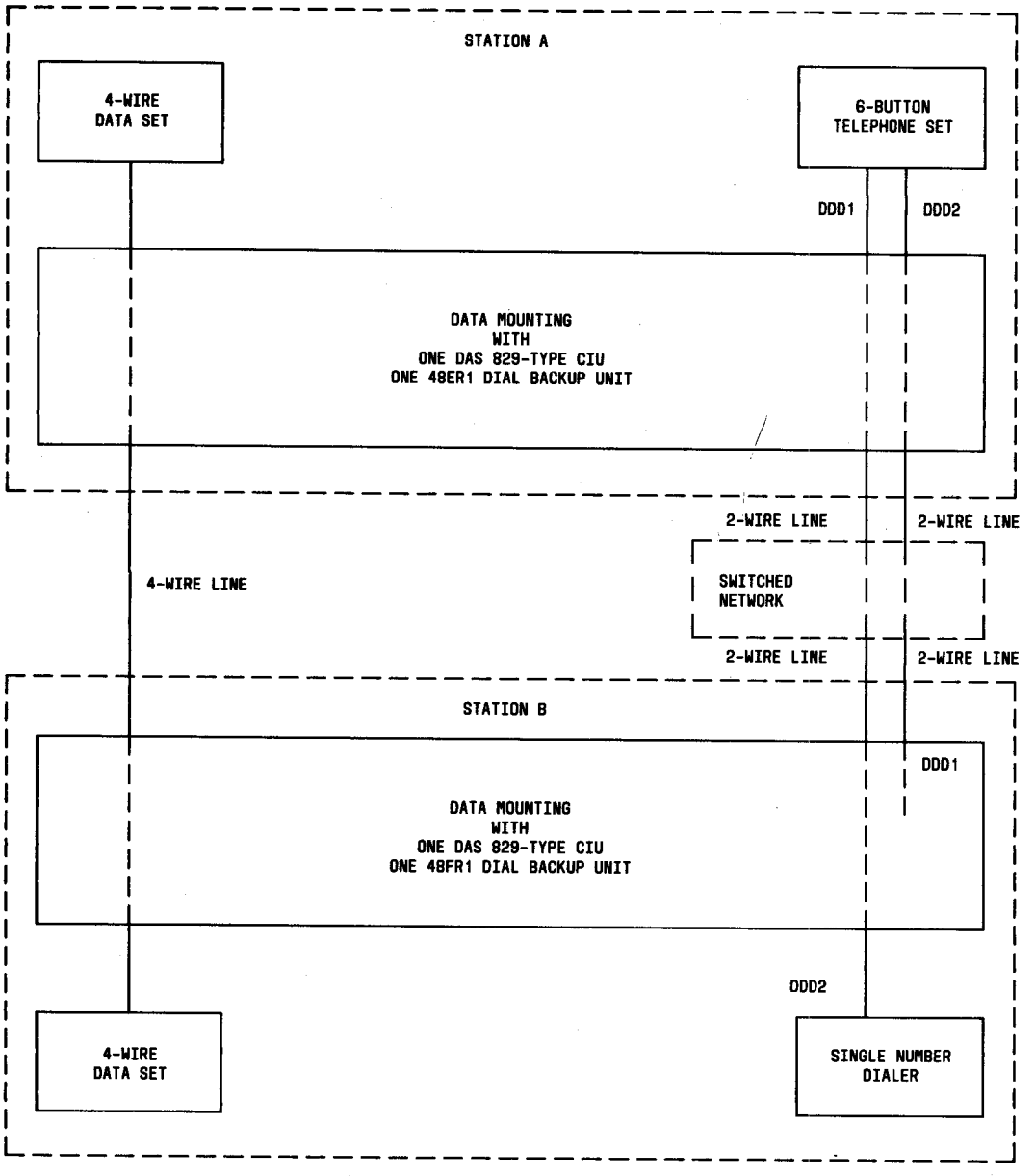


Fig. 6—4-Wire Single Channel Arrangement—Attended Call Origination and Answer at Station A, Unattended Call Origination and Answer at Station B

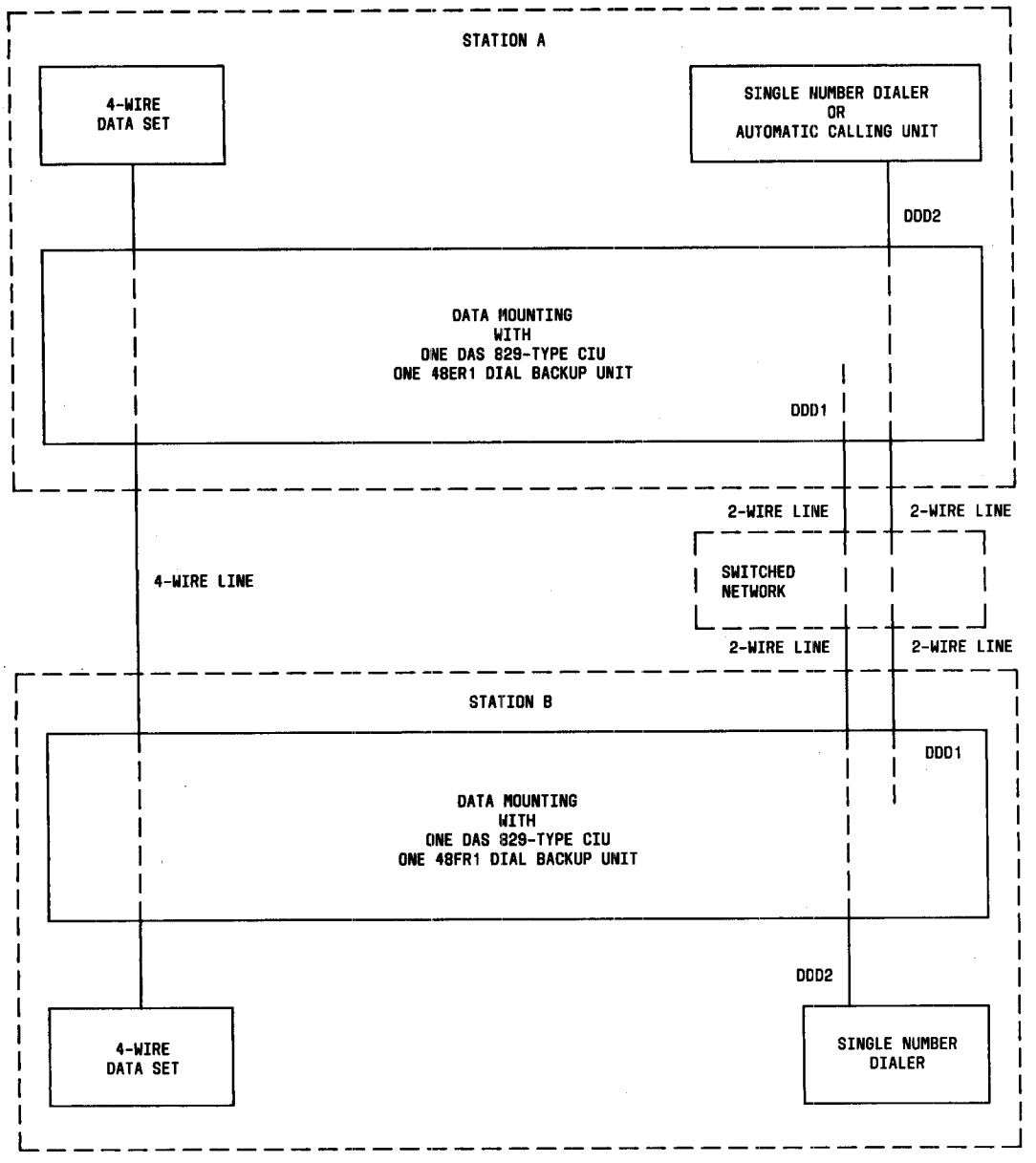


Fig. 7—4-Wire Single Channel Arrangement—Unattended Call Origination and Answer at Stations A and B

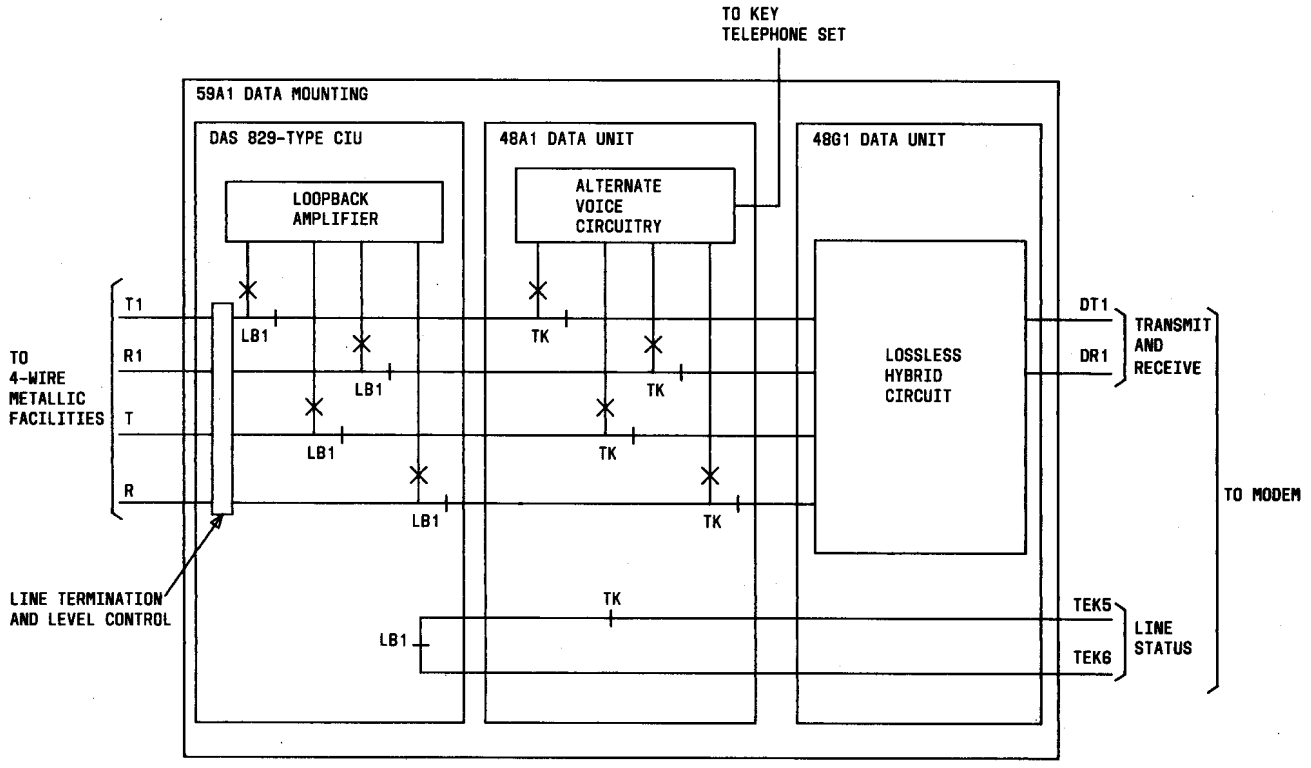


Fig. 8—2-Wire Data With Alternate Voice Service—Simplified Functional Diagram

- 2600-Hz ring detector controlling audible and lamp indications provided by the key telephone set.
- Locked-in ring detection.
- Control of a not-in-data signal to modem.

1.22 The 48B1 data unit provides the following functions:

- 4-wire dial backup service for Bell System modems interfacing with a DAS 829-type CIU.
- Termination for a 4-wire dial backup channel consisting of two 2-wire switched network (dial-up) lines.
- Transfer of modem interface to either a 4-wire private line or a 4-wire dial backup channel through use of a key telephone set.
- Variable gain on backup receive pair to control level of received signal.
- Optional 4-dB slope equalizer on backup receive pair.
- Variable attenuation on backup transmit pair to control level of transmitted signal.
- Control of a not-in-data signal to modem.
- Control of a dial backup signal to modem.
- Key telephone set lamp indication of dial backup mode.
- Ring detection and key telephone set lamp indication on each dial-up line.
- Line surge protection.
- Impedance matching (600-ohm modem to 900-ohm dial-up line).

1.23 The 48ER1 data unit provides the following functions:

- 4-wire dial backup service for modems interfacing with a DAS 829-type CIU.
- Protective circuit to enable connection of nonregistered modems to a 4-wire dial backup channel consisting of two 2-wire switched network (dial-up) lines.
- Variable gain on backup receive pair to control level of received signal.
- Signal power limiter on backup transmit pair to enable connection of nonregistered modems to a 4-wire dial backup channel.
- Variable gain on backup transmit pair to control level of transmitted signal.
- Control of a not-in-data signal to modem.
- Control of a dial backup signal to modem.
- Lamp indication of dial backup mode.
- Hazardous voltage protection.
- Impedance matching (600-ohm modem to 600-ohm dial-up line).
- Transmitter to send start and stop signals to a 48FR1 data unit. Transmitter and associated logic control an unattended dial backup terminating station.
- Manual dialing option providing the following:

  (a) Transfer of modem interface to either a 4-wire private line or a 4-wire dial backup channel through use of a key telephone set.

  (b) Ring detection and key telephone set lamp indication on each dial-up line.

  (c) Attendant origination of calls through use of a key telephone set.

- Automatic dialing option providing the following:

  (a) Origination of a 4-wire dial backup channel under control of a locking key provided as part of 48ER1 data unit or under control of a customer- or modem-provided contact closure.

(b) Control of a 43A or 53A station dial or partial control of a DAS 801CR-L1/2 automatic calling unit (ACU).

(c) Ring detection under control of internal logic.

(d) Transfer of modem interface to a 4-wire dial backup channel through use of internal logic.

(e) Release from dial backup mode under control of a locking key provided as part of 48ER1 data unit or under control of a customer- or modem-provided contact closure.

- Test jacks on modem side of 4-wire dial backup channel.

1.24 The 48FR1 data unit provides the following functions:

- Telco-provided unattended 4-wire dial backup service for modems interfacing with a DAS 829-type CIU.
- Protective circuit to enable connection of nonregistered modems to a 4-wire dial backup channel consisting of two 2-wire switched network (dial-up) lines.
- Variable gain on backup receive pair to control level of received signal.
- Signal power limiter on backup transmit pair to enable connection of nonregistered modems to a 4-wire dial backup channel.
- Variable gain on backup transmit pair to control level of transmitted signal.
- Control of a not-in-data signal to modem.
- Control of a dial backup signal to modem.
- Lamp indication of dial backup mode.
- Hazardous voltage protection.
- Impedance matching (600-ohm modem to 600-ohm dial-up line).
- Receiver to detect start and stop signals transmitted by a 48ER1 data unit. Receiver and associated logic enable control of an unattended dial backup terminating station.
- Loop-current monitor providing for release from dial backup mode when an interruption of loop current exceeding 5 ms is detected.
- Two-minute timer and associated logic providing for release from dial backup mode when terminating station is improperly accessed.
- Release key providing for manual release from dial backup mode when dial backup channel is lost due to a system malfunction; eg, loss of carrier facilities constitutes a system malfunction.
- Transfer of modem interface to a 4-wire private line when a stop signal is received on dial-up line 2.
- Dial-up lines placed on-hook when a stop signal is received on dial-up line 2.
- Automatic answering, 48FR1 data unit enabled option always permits unattended operation of a dial backup terminating station.
- Automatic answering, customer enabled option permits customer control of a dial backup terminating station. A customer- or modem-provided contact closure enables normal unattended operation of the station. When the contact is open, a dial backup channel cannot be established.
- Unattended operation (two calls answered within a timed interval option) providing the following:

(a) Ring detection under control of internal logic.

(b) Logic associated with dial-up line 1 assures that line 1 answers any incoming call, by tripping ringing with a line-holding coil.

(c) Logic associated with dial-up line 2 assures that line 2 answers any incoming

call, by tripping ringing with a line-holding coil, when dial-up line 1 is on hold.

(d) Transfer of modem interface to a 4-wire dial backup channel at end of a start signal received on dial-up line 2. Receipt of start signal completes calling sequence.

- Unattended operation (automatic call back option) providing the following:

(a) Ring detection under control of internal logic.

(b) Logic associated with dial-up line 1 assures that line 1 answers any incoming call, by tripping ringing with a line-holding coil.

(c) Logic associated with dial-up line 2 assures that line 2 goes off-hook, starting a 43A or 53A station dial, when dial-up line 1 is off-hook for at least 5 seconds. Line 2 is placed on hold when station dial completes dialing.

(d) Transfer of modem interface to a 4-wire dial backup channel at end of a start signal received on dial-up line 2. Receipt of start signal completes calling sequence.

- Test jacks on modem side of 4-wire dial backup channel.

1.25 The standard channel interface arrangements using the 48ER1 and 48FR1 data units have the following advantages over other currently available arrangements:

- The transmit channel of the 48ER1 and 48FR1 data units provides a signal power limiter. The signal power limiter ensures that the 48ER1 and 48FR1 data units satisfy the transmission requirements of the FCC Registration Program. Therefore, nonregistered modems can be connected to the switched network through use of the 48ER1 and 48FR1 data units.

- The 48ER1 and 48FR1 data units provide for a new service. The 48ER1 data unit provides the signaling and logic functions required for the originating station of a 4-wire dial backup channel having automatic dialing and/or automatic answering capabilities. The 48FR1 data unit provides the signaling and logic functions required for the terminating station of a 4-wire dial backup channel having automatic answering capabilities.

- Customer-provided modems can be connected to a 4-wire dial backup channel through use of the 48ER1 and 48FR1 data units.

SWITCHED DIAL BACKUP SERVICE

1.26 The 48B1 or 48ER1, 48C1, and 48D1 data units, when used with the DAS 829-type CIUs and the proper data mountings, provide 4-wire switched dial backup service. Alternate voice service can be added by use of the 48A1 data unit. These multiple channel arrangements use a CALL DIRECTOR key telephone set to control a maximum of 23 modems to provide 4-wire data, alternate voice, switched dial backup, or a combination of these services.

1.27 The 48C1 data unit provides a 2-by-4 switching matrix that can connect any one of four modems to either one of two 4-wire dial backup channels terminated by 48B1 or 48ER1 data units. The 48D1 data unit provides an interface adapter for use with a 46C1 data mounting to concentrate control of 48A1, 48B1 or 48ER1, and 48C1 data units in an 18- or 30-button CALL DIRECTOR key telephone set.

1.28 Housing for up to eight DAS 829-type CIUs is provided by the 46A1 or 46A2 data mounting. Housing for up to eight 48A1 data units is provided by the 46B1 data mounting. Housing for one or two 48B1 data units and up to six 48C1 data units is provided by the 46C1 or 46C2 data mounting. Housing for one or two 48ER1 data units and up to six 48C1 data units is provided by the 46C2 data mounting. The 48D1 data unit is rack mounted and does not require housing. The 46C2 data mounting is a replacement for the 46C1 data mounting and provides all the functions of the 46C1 data mounting.

1.29 A simplified functional diagram for 4-wire switched dial backup service is shown in Fig. 9.

(a) In the normal (data) mode, modem No. 1 is connected to 4-wire metallic facilities No. 1 (4-wire private line No. 1) through the normally-closed

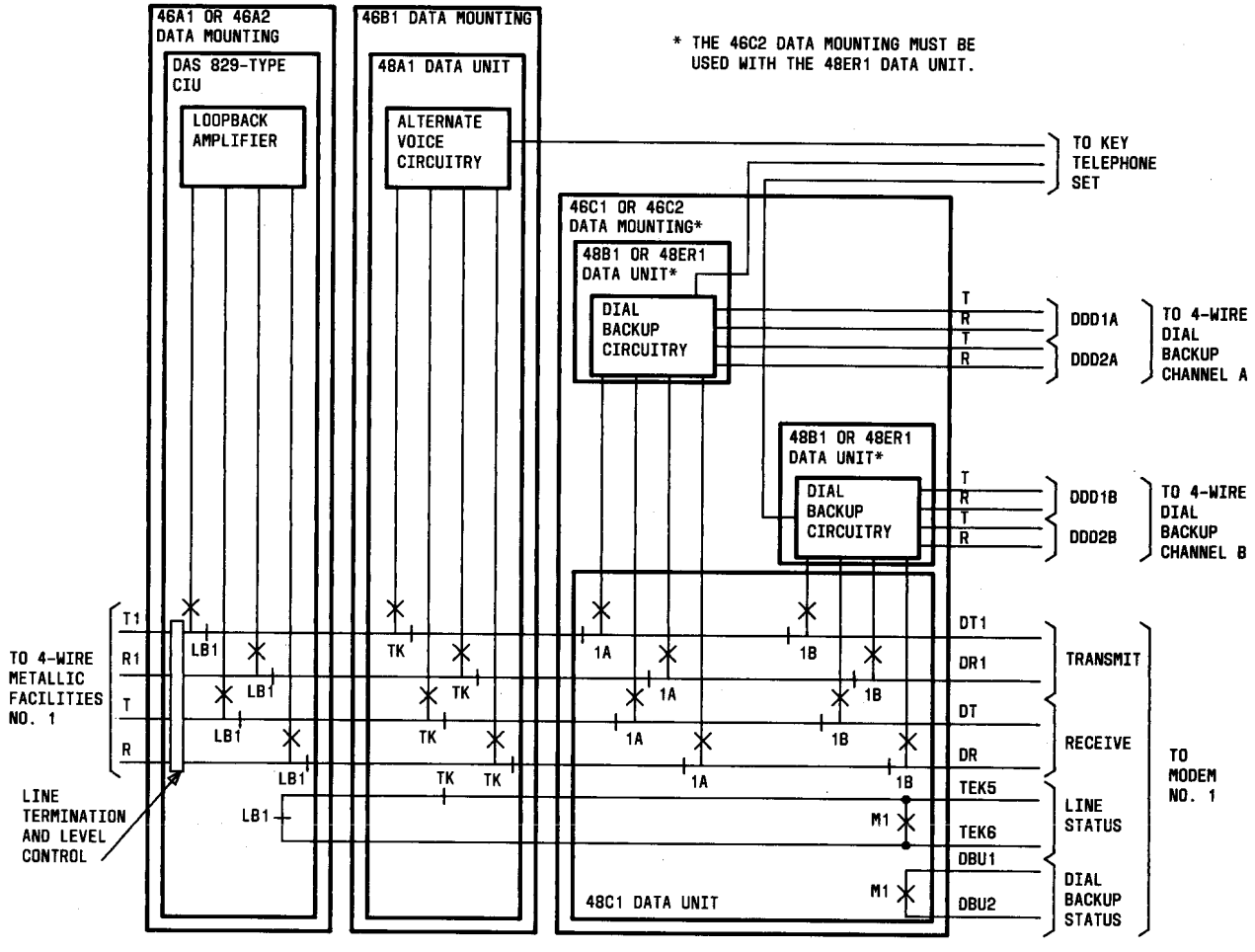


Fig. 9—4-Wire Switched Dial Backup Service—Simplified Functional Diagram for Modem No. 1

contacts of the LB1 relay in the DAS 829-type CIU, the TK relay in the 48A1 data unit (if alternate voice service is provided), and the 1A and 1B relays (the 1A, 1B, and M1 relays are provided for the first of four modems terminating in a 48C1 data unit) in the 48C1 data unit. Data transmission can take place over the 4-wire private line as indicated by a line status signal to the modem.

(b) In the alternate voice mode, operation of the TK relay in the 48A1 data unit disconnects the modem and connects the key telephone set to the 4-wire private line. The 4-wire private line is now reserved for voice transmission and is not available for data transmission as indicated by a line status signal to the modem.

(c) In the dial backup mode, operation of the 1A or 1B relay in the 48C1 data unit transfers modem No. 1 from 4-wire private line No. 1 to 4-wire dial backup channel A or B, respectively. Data transmission can now take place over the selected dial backup channel as indicated by line status and dial backup status signals (the M1 relay is operated when either the 1A or 1B relay is operated) to the modem.

1.30 The 48C1 data unit provides the following functions:

- 4-wire switched dial backup service for modems interfacing with a DAS 829-type CIU when used with a 48B1 data unit housed in a 46C1 or 46C2 data mounting or with a 48ER1 data unit housed in a 46C2 data mounting, and with a 48D1 data unit connected to an 18- or 30-button CALL DIRECTOR key telephone set.
- A 2-by-4 switching matrix to connect any one of four modems to either one of two 4-wire dial backup channels.
- Direct connection to a 48D1 data unit.
- Control of a not-in-data signal to modem.
- Control of a dial backup signal to modem.

1.31 The 48D1 data unit provides the following functions:

- Direct connection to up to three 46B1 data mountings containing a maximum of twenty-three 48A1 data units.
- Direct connection to up to six 48C1 data units housed in a 46C1 or 46C2 data mounting.
- Direct connection to a 46C1 or 46C2 data mounting when 4-wire dial backup service is required.
- Concentrated connection to a maximum of twenty-three modems to provide dial backup status signals to the modems if required.
- Direct connection to an 18- or 30-button CALL DIRECTOR key telephone set.

1.32 The multiple arrangements for 4-wire dial backup service described in this section have the following advantages over other currently available arrangements:

- One or two 4-wire dial backup channels can provide dial backup service for a maximum of twenty-three 4-wire private lines.
- Fewer key telephone sets are required for control of 4-wire dial backup and/or alternate voice service.
- Greater flexibility of station arrangements through use of plug-in circuit packs.

2. PHYSICAL DESCRIPTION

DATA MOUNTINGS

2.01 The data mountings provide single and multiple housing for the plug-in circuit packs (CIUs and data units) used with 4-wire private lines to provide data, alternate voice, dial backup, and switched dial backup service. Data and alternate voice service are provided for 2-wire private lines. The data mountings also provide the required connection facilities. The data mountings that provide a single housing (44A1, 44A2, 45A1, 59A1, and 62A1) can be mounted on a desk, shelf, or wall. The data mountings that provide a multiple housing (46A1, 46A2, 46B1, 46C1, and 46C2) require rack mounting or mounting in KS-20018-type cabinets.

A. 44A1 and 44A2 Data Mountings

2.02 The 44A1 and 44A2 data mountings (Fig. 10) are the same except the backplane. The 44A1 or 44A2 data mounting provides a housing for a single DAS 829-type CIU. The data mounting consists of a housing, a 6-foot power cord (840807028), and a 24-Vac wall-mounted transformer (KS-21239-L1 or L4). The data mounting can also operate from a -24 or -48 Vdc power source.

2.03 The backplane (Fig. 11) of the 44A1 data mounting contains a 50-pin connector and the screw terminals for connecting to 4-wire metallic facilities, a 24-Vac transformer, and a manual loopback key. Connector P1 connects to a single modem. The backplane (Fig. 12) of the 44A2 data mounting is the same as the backplane of the 44A1 data mounting except that two screw terminals have been added to provide access to the simplex pair of the 4-wire metallic facilities.

2.04 The 44A1 or 44A2 data mounting is 2-1/4 inches high, 5-3/4 inches wide, and 11 inches deep. The data mounting weighs 2-1/8 pounds.

2.05 The 44A1 or 44A2 data mounting can be used as a free standing unit on a desk or shelf or can be wall mounted using a separately ordered 193A backboard (Fig. 13).

B. 45A1 Data Mounting

2.06 The 45A1 data mounting provides a housing for a single DAS 829-type CIU or one of the following combinations:

- A CIU and a 48A1 data unit for 4-wire data with alternate voice service.
- A CIU and a 48B1 data unit for 4-wire data with dial backup service.
- A CIU plus a 48A1 data unit and a 48B1 data unit for 4-wire data with alternate voice and dial backup service (Fig. 14).

Note: The 48A1 data unit must be installed first in the 45A1 data mounting and removed last due to the physical location of circuit components on the data unit.

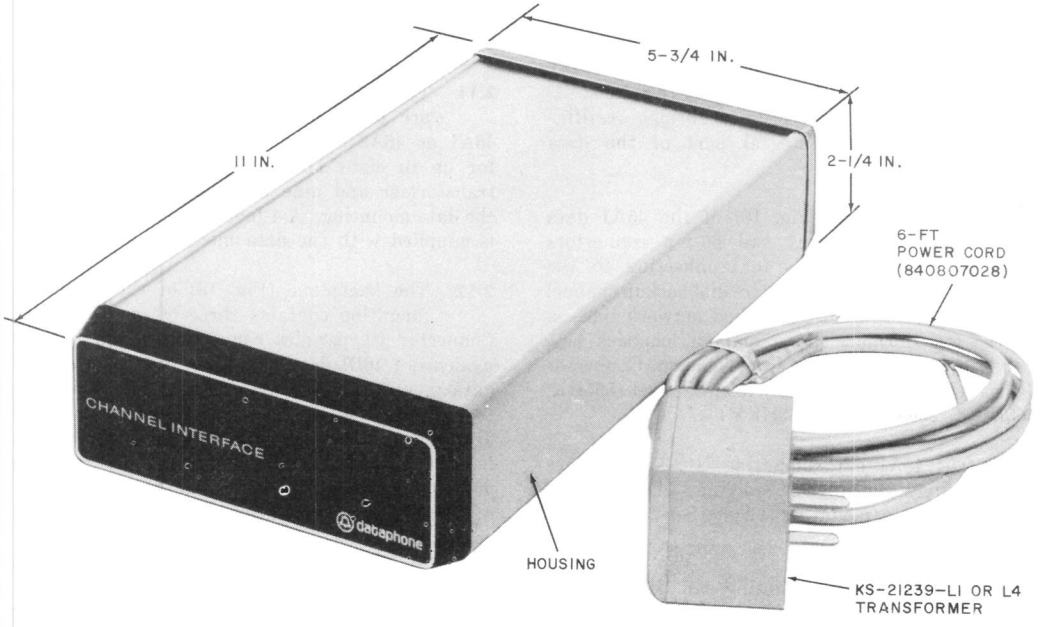


Fig. 10—44A1 or 44A2 Data Mounting—Front View

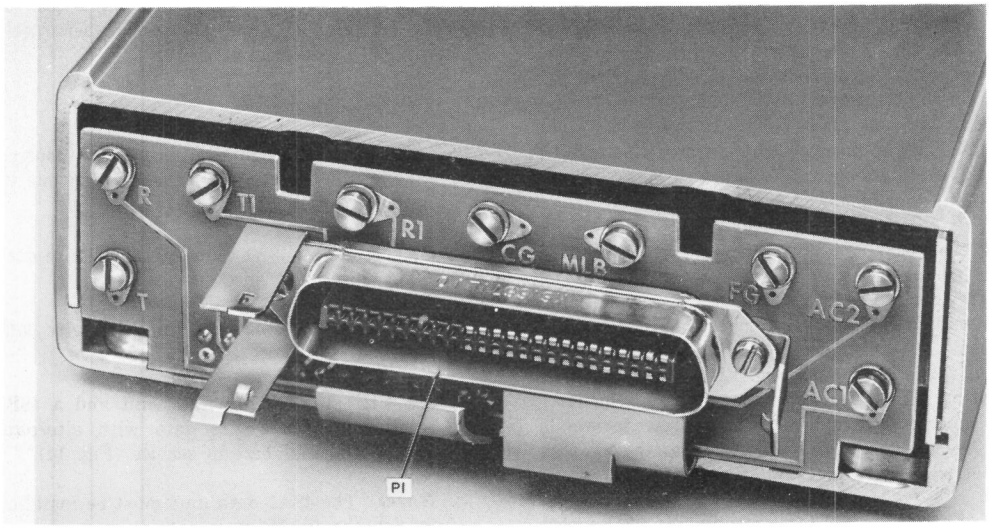


Fig. 11—44A1 Data Mounting—Rear View

2.07 The 45A1 data mounting (Fig. 15) consists of a housing, a 6-foot power cord (840807028), and a 24-Vac wall-mounted transformer (KS-21362-L1) with an 18-inch power cord. A bridge rectifier power supply is an integral part of the data mounting.

2.08 The backplane (Fig. 16) of the 45A1 data mounting contains two 50-pin connectors and the screw terminals for connecting to the 4-wire metallic facilities, a 4-wire dial backup channel consisting of two 2-wire switched network lines, a 24-Vac transformer, and a manual loopback key. Connector P1 connects to a single modem. Connector J4 connects to a 6-button key telephone set (565HK, 565HKM, 2565HK, or 2565HKM).

2.09 The 45A1 data mounting is 2-11/16 inches high, 10-1/2 inches wide, and 12-1/4 inches deep. The data mounting weighs 5-1/2 pounds.

2.10 The 45A1 data mounting can be used as a free standing unit on a desk or shelf or can be wall mounted using a separately ordered 193A backboard (Fig. 13).

C. 46A1 and 46A2 Data Mountings

2.11 The 46A1 and 46A2 data mountings (Fig. 17) are the same except the backplane. The 46A1 or 46A2 data mounting provides a housing for up to eight DAS 829-type CIUs. A 24-Vac transformer and nine fuses are integral parts of the data mounting. A 4-foot power cord (840339907) is supplied with the data mounting.

2.12 The backplane (Fig. 18) of the 46A1 data mounting contains three 50-pin connectors. Connector P1 permits connection to up to eight modems, a 46B1 data mounting, or a 46C1 or 46C2 data mounting. Connector J9 permits connection to up to eight 4-wire metallic facilities. Connector J10 permits connection to up to eight manual loopback keys. The backplane (Fig. 19) of the 46A2 data mounting is the same as the backplane of the 46A1 data mounting except as follows: (1) connector J11 has been added to permit connection to the simplex pair of up to eight 4-wire metallic facilities, (2) two screw terminals have been added to permit connection to a -24 or -48 Vdc power source, and (3) two plug-in option straps have been added to permit operation from the internal 24-Vac

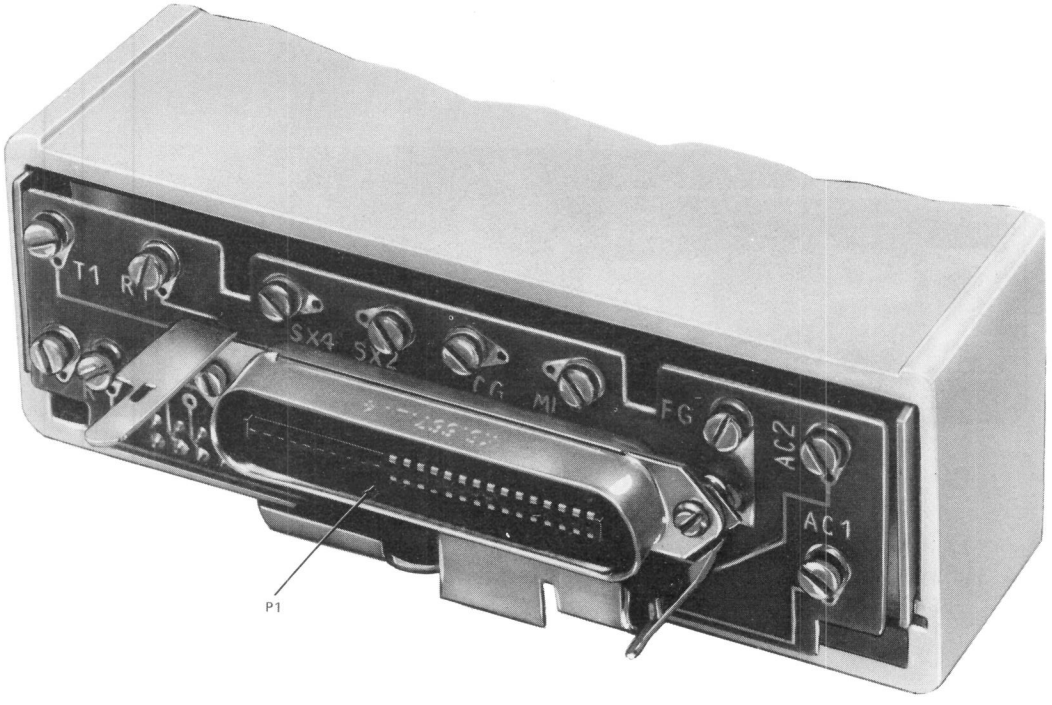


Fig. 12—44A2 Data Mounting—Rear View

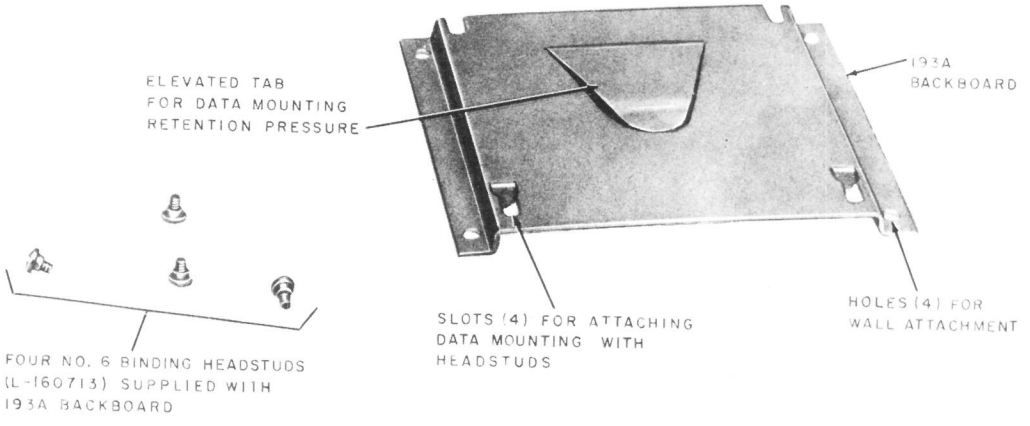


Fig. 13—193A Backboard

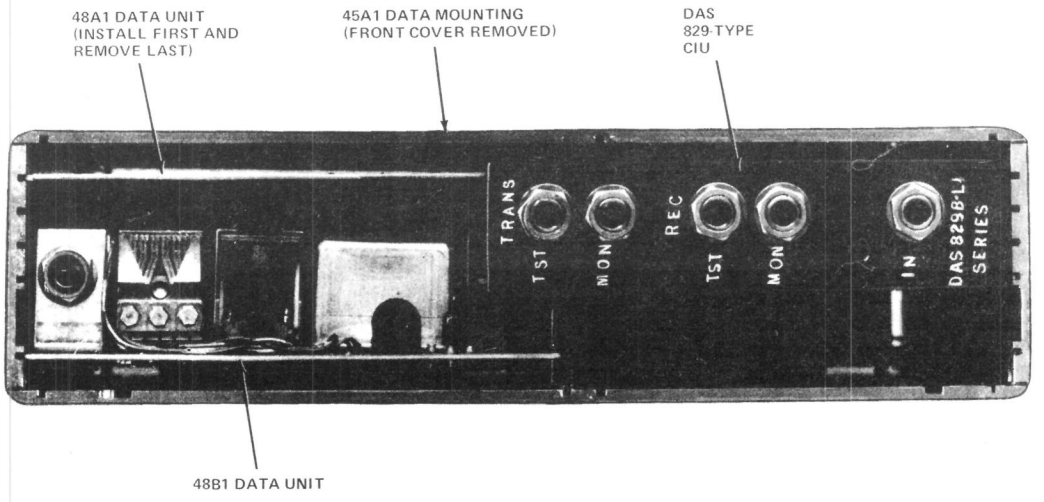


Fig. 14—45A1 Data Mounting Equipped With a DAS 829-Type CIU, a 48A1 Data Unit, and a 48B1 Data Unit

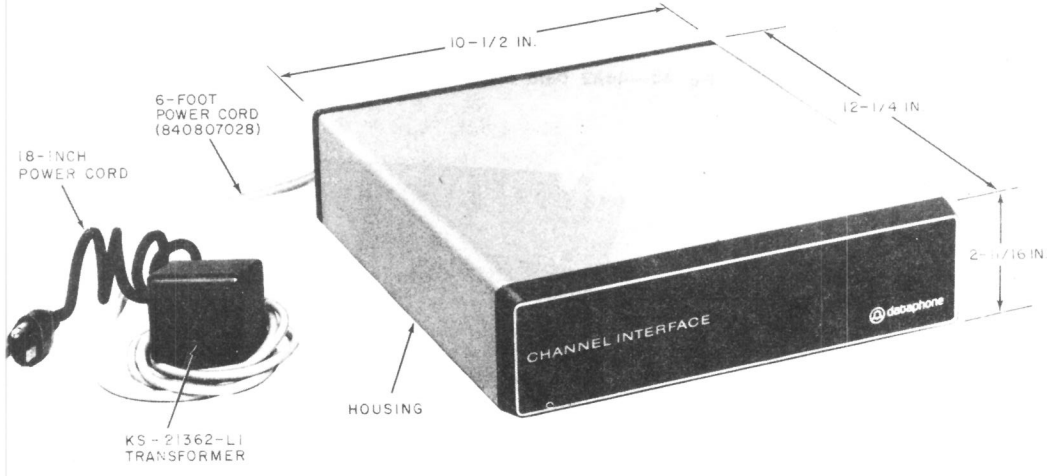


Fig. 15—45A1 Data Mounting—Front View

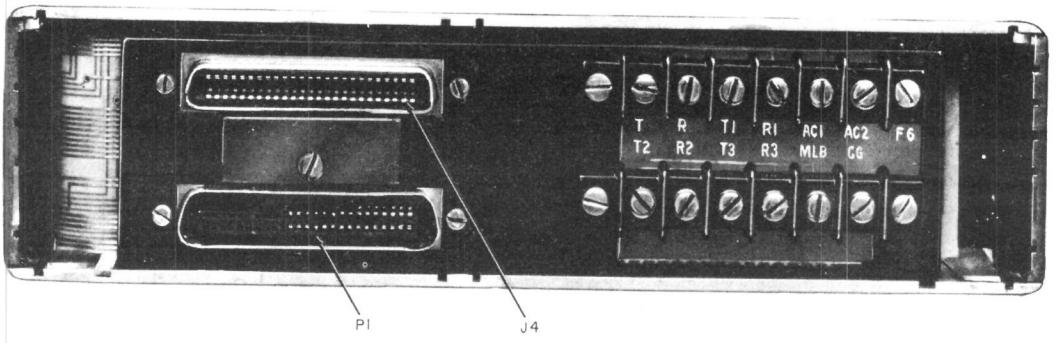


Fig. 16—45A1 Data Mounting—Rear View

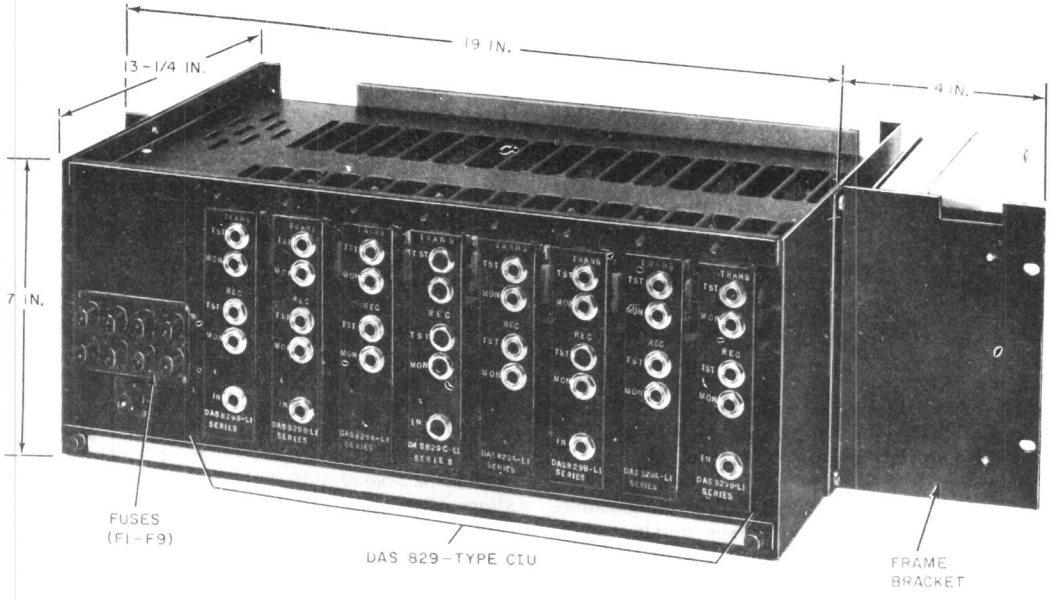


Fig. 17—46A1 or 46A2 Data Mounting—Front View

transformer or from the external dc power source. Power cord connector P2 and terminal strip TS1 are located on the rear of the 46A1 or 46A2 data mounting (Fig. 18 or 19) adjacent to the backplane. Terminal strip TS1 provides access to the operating voltages from the internal transformer to the CIUs.

2.13 Connector P1 permits direct connection to a multiple data mounting, such as the 40B data mounting for data set 202T. For connections from connector P1 to individual modems, a separately ordered KS-21253-L1 adapter can be used. This adapter concentrates up to eight modems into one

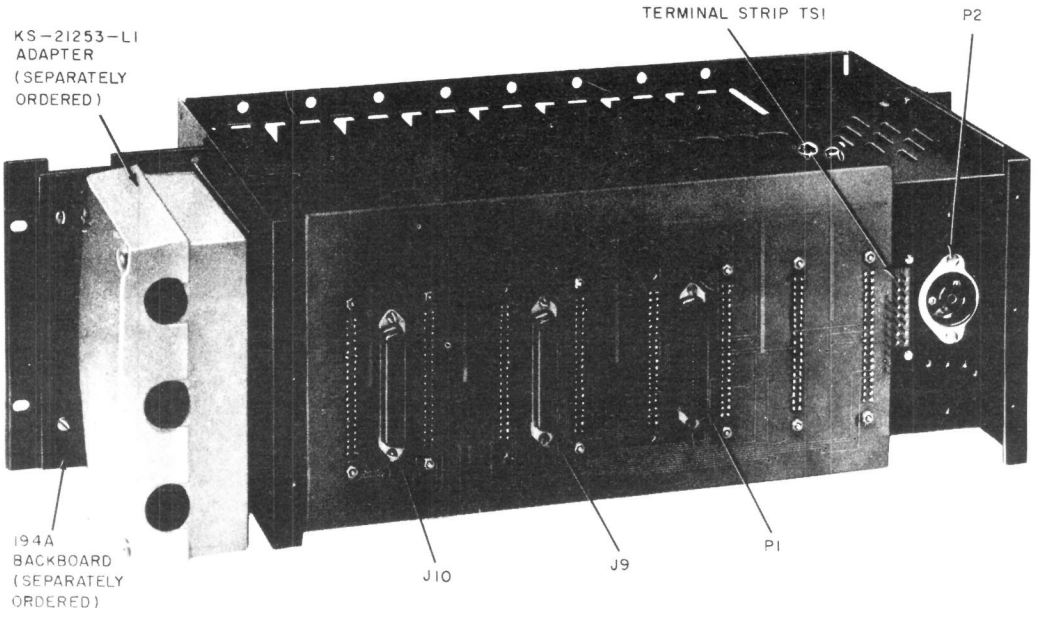


Fig. 18—46A1 Data Mounting—Rear View

50-pin connector. The adapter can be installed on the 46A1 or 46A2 data mounting by using a separately ordered 194A backboard as shown in Fig. 18 or 19.

2.14 The 46A1 or 46A2 data mounting is 7 inches high, 19 inches wide, and 13-1/4 inches deep. The data mounting weighs 20 pounds.

2.15 The 46A1 or 46A2 data mounting can be mounted on 19- or 23-inch relay racks. Mounting in KS-20018-type cabinets is recommended. Descriptive information on KS-20018-type cabinets is provided in Section 590-010-201.

D. 46B1 Data Mounting

2.16 The 46B1 data mounting (Fig. 20) provides a housing for up to eight 48A1 or 48G1 data units. A 24-Vac transformer, a bridge rectifier power supply, and nine fuses are integral parts of the data mounting. A 4-foot power cord (840339907) is supplied with the data mounting.

2.17 The backplane (Fig. 21) of the 46B1 data mounting contains three 50-pin connectors and a plug-in option strap. Connector P1 permits connection to up to eight modems. Direct connection can be made to a multiple data mounting, such as the 40B data mounting for data set 202T or the 46C1 or 46C2 data mounting for 4-wire switched dial backup service. Direct connection can also be made to a second 46B1 data mounting for 2-wire alternate voice service. For connections from connector P1 to individual modems, a separately ordered KS-21253-L1 adapter can be used. Connector J9 permits connection to a 46A1 or 46A2 data mounting. Connector J10 permits connection to a 10-button key telephone set (830- or 2830-type), a 48D1 data unit, or a locally engineered key system. Power cord connector P2 and terminal strip TS1 are located on the rear of the data mounting adjacent to the backplane. Terminal strip TS1 provides access to the operating voltages from the internal transformer to the 48A1 or 48G1 data units.

2.18 The ringing supply option (Fig. 21) uses a plug-in strap to select an internal ringing

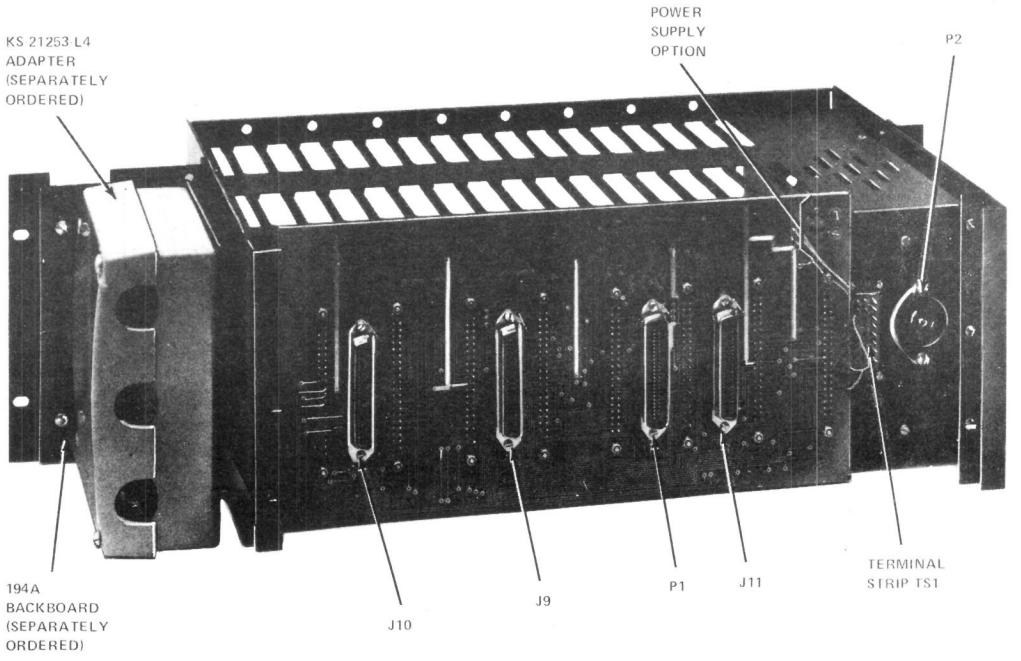


Fig. 19—46A2 Data Mounting—Rear View

supply (plug-in strap in INT position) or an external ringing supply (plug-in strap in EXT position). When the 46B1 data mounting is used with an 830- or 2830-type key telephone set, the plug-in strap must be in the INT position. When the 46B1 data mounting is used with a 48D1 data unit or a locally engineered key system, the plug-in strap must be in the EXT position.

2.19 The 46B1 data mounting is 7 inches high, 19 inches wide, and 13-1/4 inches deep. The data mounting weighs 20 pounds.

2.20 The 46B1 data mounting can be mounted on 19- or 23-inch relay racks. Mounting in KS-20018-type cabinets is recommended. Descriptive information on KS-20018-type cabinets is provided in Section 590-010-201.

E. 46C1 and 46C2 Data Mountings

2.21 The 46C1 (Fig. 22) and 46C2 (Fig. 23) data mountings are the same except a protective cover has been added at the front of the 46C2 data mounting. The 46C1 data mounting provides a housing for one or two 48B1 data units and up to six 48C1 data units. The 46C2 data mounting provides a housing for one or two 48B1 or 48ER1 data units and up to six 48C1 data units. Part of the control logic required for 4-wire switched dial backup service is an integral part of the 46C1 or 46C2 data mounting.

Note: The 46C1 or 46C2 data mounting must be used with the 48D1 data unit.

2.22 The backplane (Fig. 24) of the 46C1 or 46C2 data mounting contains eight 50-pin connectors, eight screw terminals, and two relays. Connector

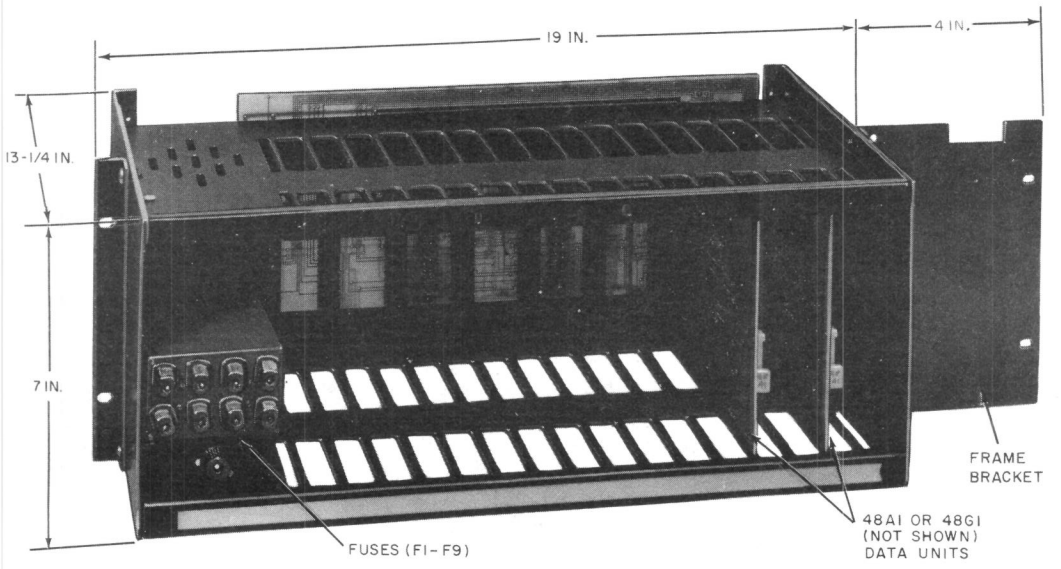


Fig. 20—46B1 Data Mounting—Front View

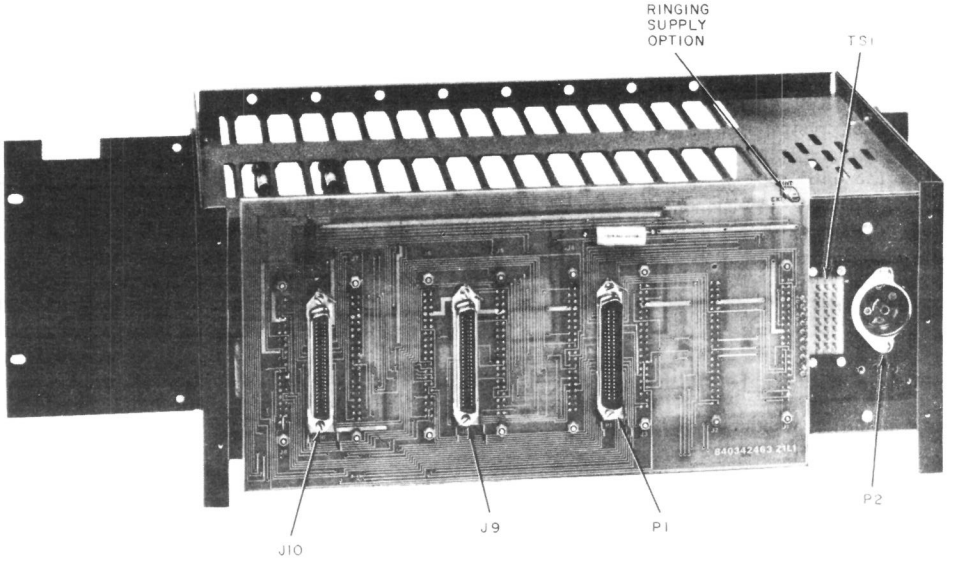


Fig. 21—46B1 Data Mounting—Rear View

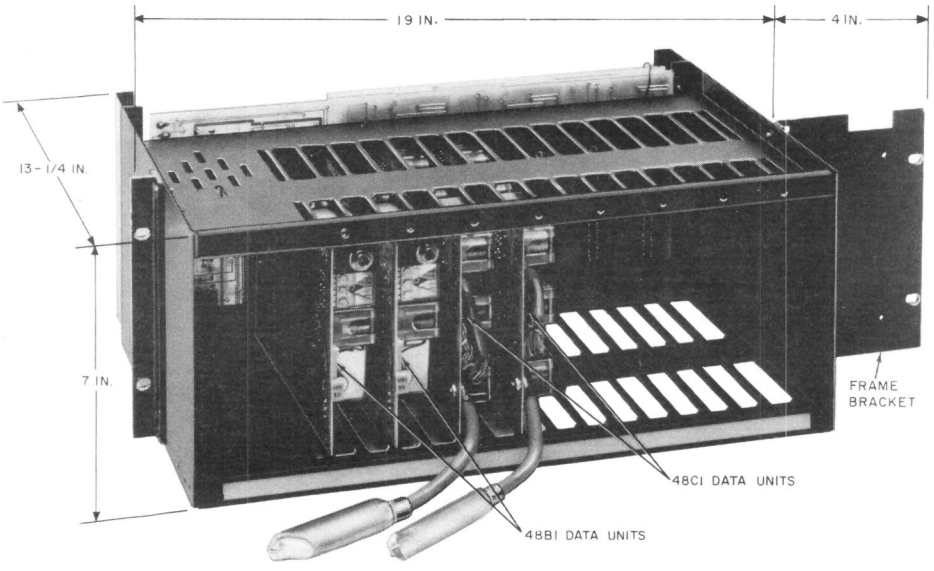


Fig. 22—46C1 Data Mounting—Front View

P1 permits connection to a 48D1 data unit. Connectors P2 through P4 permit connection to a maximum of twenty-three modems. Direct connection can be made from each connector to a multiple data mounting, such as the 40B data mounting for data set 202T. For connections from connectors P2 through P4 to individual modems, separately ordered KS-21253-L1 adapters can be used. To provide data with 4-wire switched dial backup service, connectors J10 through J12 permit connection to up to three 46A1 or 46A2 data mountings containing a maximum of twenty-three DAS 829-type CIUs. To provide data with alternate voice and 4-wire switched dial backup service, connectors J10 through J12 permit connection to up to three 46B1 data mountings containing a maximum of twenty-three 48A1 data units. Connector J1 or the eight screw terminals permit connection to one or two 4-wire dial backup channels consisting of two 2-wire switched network lines per channel. The two relays provide part of the control for the two backup channels.

Note: Use of connector J1 is not permitted in registered arrangements.

2.23 The 46C1 or 46C2 data mounting is 7 inches high, 19 inches wide, and 13-1/4 inches deep. The data mounting weighs 19 pounds.

2.24 The 46C1 or 46C2 data mounting can be mounted on 19- or 23-inch relay racks. Mounting in KS-20018-type cabinets is recommended. Descriptive information on KS-20018-type cabinets is provided in Section 590-010-201.

F. 59A1 Data Mounting

2.25 The 59A1 data mounting provides a housing for a single DAS 829-type CIU or one of the following combinations:

- A CIU and a 48G1 data unit for 2-wire data only service.
- A CIU and a 48A1 data unit for 4-wire data with alternate voice service.
- A CIU plus a 48A1 data unit and a 48G1 data unit for 2-wire data with alternate voice service (Fig. 25).

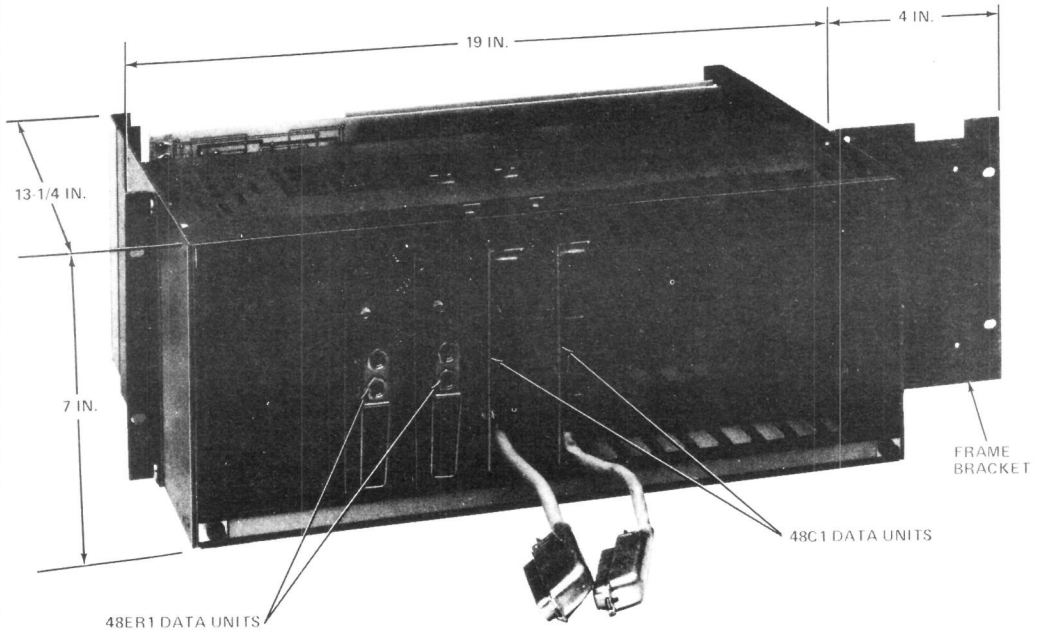


Fig. 23—46C2 Data Mounting—Front View

- A CIU and a 48B1 or 48ER1 data unit for 4-wire data with dial backup service with manual dialing.

- A CIU plus a 48A1 data unit and a 48B1 or 48ER1 data unit for 4-wire data with alternate voice and dial backup service with manual dialing (Fig. 26).

- A CIU and a 48ER1 data unit for 4-wire data with dial backup service with automatic dialing.

- A CIU and a 48FR1 data unit for 4-wire data with dial backup service with automatic answering.

2.26 The 59A1 data mounting (Fig. 27) consists of a housing, a 6-foot power cord (840807028), and a 24-Vac wall-mounted transformer (KS-21362-L1) with an 18-inch power cord. A bridge rectifier power supply is an integral part of the data mounting.

2.27 The backplane (Fig. 28) of the 59A1 data mounting contains two 50-pin connectors and the screw terminals for connecting to 4-wire metallic facilities, a 4-wire dial backup channel consisting of two 2-wire switched network lines, a 24-Vac transformer, a manual loopback key, the simplex pair of the 4-wire metallic facilities, and a customer- or modem-provided contact. Connector P1 connects to a single modem. Connector J4 connects to a 6-button key telephone set (565HKM or 2565HKM), a station dial (43A or 53A), or an automatic calling unit (DAS 801CR-L1/2).

2.28 The 59A1 data mounting is 3-2/3 inches high, 11-1/2 inches wide, and 12-2/3 inches deep. The data mounting weighs 6-7/8 pounds.

2.29 The 59A1 data mounting can be used as a free standing unit on a desk or shelf or can be wall mounted using a separately ordered 193A backboard (Fig. 13).

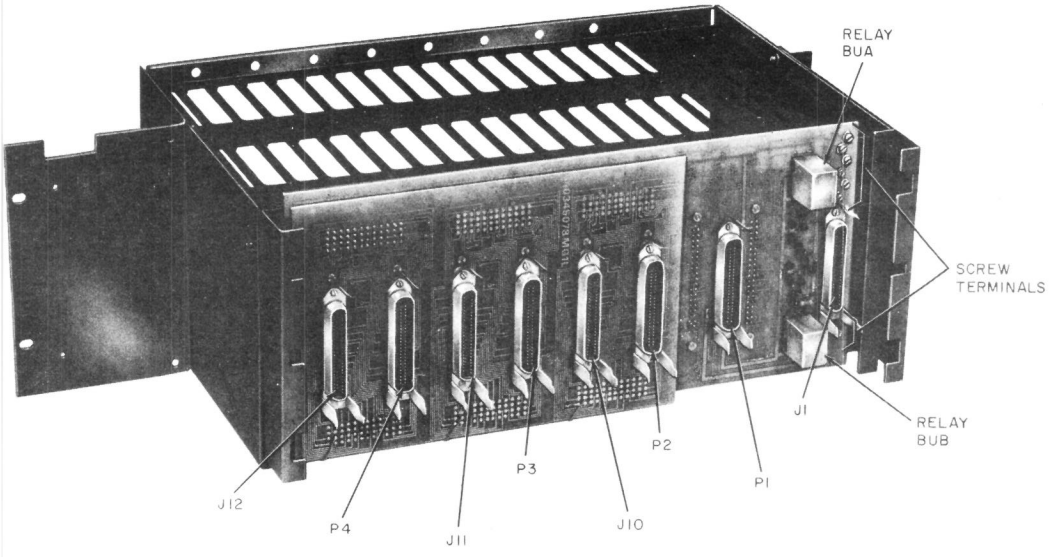


Fig. 24—46C1 or 46C2 Data Mounting—Rear View

G. 62A1 Data Mounting

2.30 The 62A1 data mounting provides a housing for a single DAS 829-type CIU or a CIU and a 48G1 data unit (Fig. 29). The data mounting (Fig. 30) consists of a housing, a 6-foot power cord (840807028), and a 24-Vac wall-mounted transformer (KS-21239-L4). A bridge rectifier power supply is an integral part of the data mounting. The data mounting can also operate from a -24 or -48 Vdc power source.

2.31 The backplane (Fig. 31) of the 62A1 data mounting contains a 50-pin connector and the screw terminals for connecting to 4-wire metallic facilities, the 24-Vac transformer, a manual loopback key, the simplex pair of the 4-wire metallic facilities, and a single modem. Connector P1 provides the preferred method for connecting to a single modem.

2.32 The 62A1 data mounting is 3-13/16 inches high, 5-7/8 inches wide, and 10-7/8 inches deep. The data mounting weighs 3-1/8 pounds.

2.33 The 62A1 data mounting can be used as a free standing unit on a desk or shelf or can be wall mounted using a separately ordered 193A backboard (Fig. 13).

CHANNEL INTERFACE UNITS (CIU)

2.34 The DAS 829-type CIU provides a prewired and tested standard termination for 4-wire private line voiceband data channels. The DAS 829-type CIU is available in six codes for proper termination of channels having various loop facilities. The three L1A codes provide all the functions of the corresponding L1 codes and also provide the following functions: (1) data only service on 8-dB channels, (2) operation from a -48 Vdc power source, (3) visual indication of loopback, and (4) provision for disabling loopback by use of special data mountings. All six codes are plug-in circuit packs that are housed in single or multiple data mountings.

A. DAS 829A-L1 CIU

2.35 The DAS 829A-L1 CIU (Fig. 32) contains the circuitry required to provide a standard termination for short 4-wire metallic facilities. The CIU consists of component apparatus mounted on

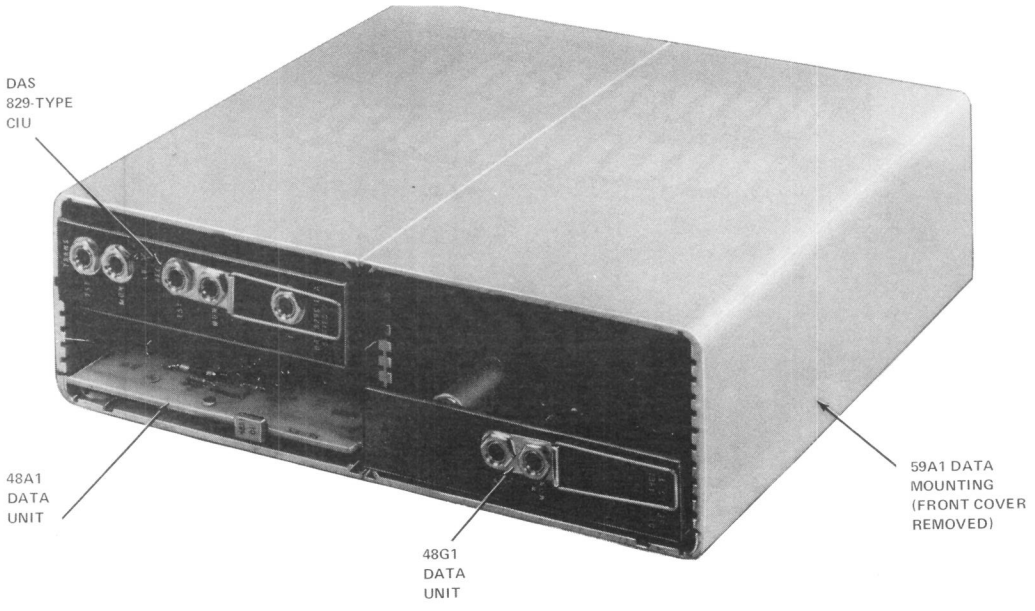


Fig. 25—59A1 Data Mounting Equipped With a DAS 829-Type CIU, a 48A1 Data Unit, and a 48G1 Data Unit

a plug-in printed wiring board. The CIU is housed in a 44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1 data mounting.

2.36 Two monitoring jacks and two test jacks are located on the CIU faceplate. These jacks will accept a standard 310 plug. Two variable attenuators and two installer options (line impedance and sealing current) are located on the printed wiring board.

2.37 The DAS 829A-L1 CIU is 1-1/3 inches high, 5-1/2 inches wide, and 9-2/3 inches long. The CIU weighs 15 ounces.

2.38 The DAS 829A-L1 CIU will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

B. DAS 829B-L1 CIU

2.39 The DAS 829B-L1 CIU (Fig. 33) contains the circuitry required to provide a standard termination for longer nonloaded 4-wire metallic facilities. The CIU consists of component apparatus mounted on a plug-in printed wiring board. The CIU is housed in a 44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1 data mounting.

2.40 Two monitoring jacks, two test jacks, and one input jack are located on the CIU faceplate. These jacks will accept a standard 310 plug. A receive fine gain control located on the printed wiring board is accessible through a hole in the faceplate. A variable attenuator and three installer options (receive coarse gain, line impedance, and sealing current) are also located on the printed wiring board.

2.41 The DAS 829B-L1 CIU is 1-1/3 inches high, 5-1/2 inches wide, and 9-2/3 inches long. The CIU weighs 1-5/8 pounds.

2.42 The DAS 829B-L1 CIU will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

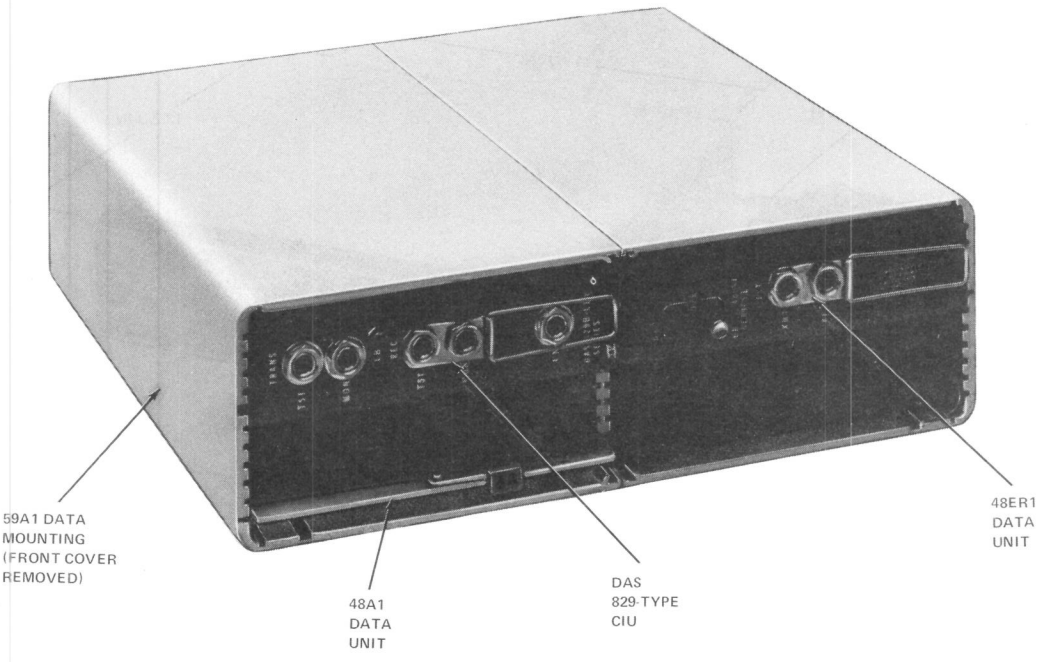


Fig. 26—59A1 Data Mounting Equipped With a DAS 829-Type CIU, a 48A1 Data Unit, and a 48ER1 Data Unit

C. DAS 829C-L1 CIU

2.43 The DAS 829C-L1 CIU (Fig. 34) contains the circuitry required to provide a standard termination for longer loaded 4-wire metallic facilities. The CIU consists of component apparatus mounted on a plug-in printed wiring board. The CIU is housed in a 44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1 data mounting.

2.44 Two monitoring jacks, two test jacks, and one input jack are located on the CIU faceplate. These jacks will accept a standard 310 plug. A receive fine gain control located on the printed wiring board is accessible through a hole in the faceplate. A variable attenuator and three installer options (receive coarse gain, 359A or 359K equalizer equivalent, and sealing current) are also located on the printed wiring board.

2.45 The DAS 829C-L1 CIU is 1-1/3 inches high, 5-1/2 inches wide, and 9-2/3 inches long. The CIU weighs 1-1/4 pounds.

2.46 The DAS 829C-L1 CIU will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

D. DAS 829A-L1A CIU

2.47 The DAS 829A-L1A CIU (Fig. 35) contains the circuitry required to provide a standard termination for short 4-wire metallic facilities. The CIU consists of component apparatus mounted on a plug-in printed wiring board. The CIU is housed in a 44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1 data mounting. A handle is provided on the CIU faceplate to facilitate removal of the CIU from the data mounting.

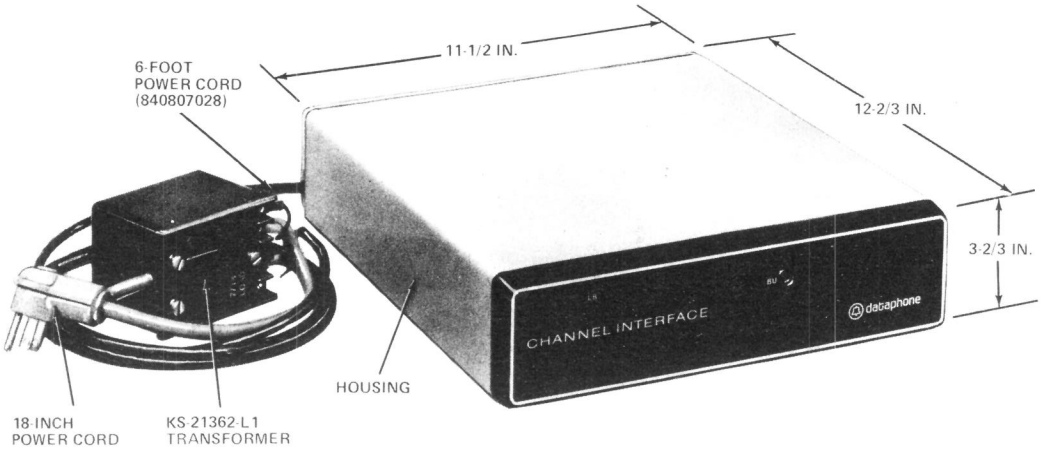


Fig. 27—59A1 Data Mounting—Front View

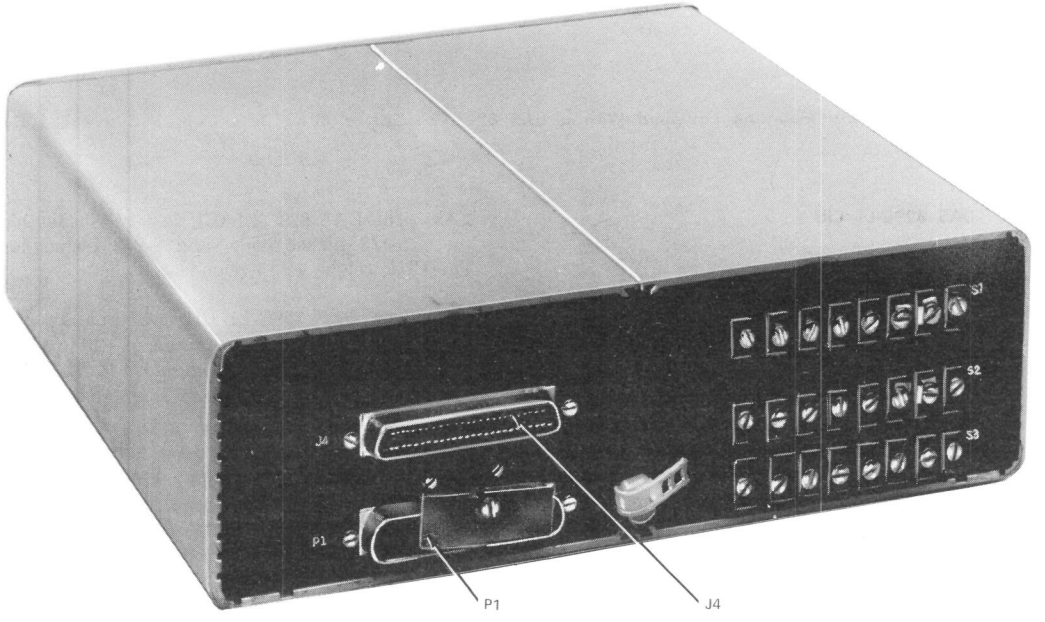


Fig. 28—59A1 Data Mounting—Rear View

Fig. 29—62A1 Data Mounting Equipped With a DAS 829-Type CIU and a 48G1 Data Unit

2.48 Two monitoring jacks and two test jacks are located on the CIU faceplate. These jacks will accept a standard 310 plug. A loopback indicator light is also located on the faceplate. Two variable attenuators and four installer options (line impedance, sealing current, loopback amplifier gain, and power supply) are located on the printed wiring board.

2.49 The DAS 829A-L1A CIU is 1-1/3 inches high, 5-1/2 inches wide, and 9-2/3 inches long. The CIU weighs 15 ounces.

2.50 The DAS 829A-L1A CIU will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

E. DAS 829B-L1A CIU

2.51 The DAS 829B-L1A CIU (Fig. 36) contains the circuitry required to provide a standard termination for longer nonloaded 4-wire metallic facilities. The CIU consists of component apparatus mounted on a plug-in printed wiring board. The CIU is housed in a 44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1 data mounting. A handle is provided on the CIU faceplate to facilitate removal of the CIU from the data mounting.

2.52 Two monitoring jacks, two test jacks, and one input jack are located on the CIU faceplate. These jacks will accept a standard 310 plug. A loopback indicator light is also located on the faceplate. A receive fine gain control located on the printed wiring board is accessible through a hole in the faceplate. A variable attenuator and five installer options (receive coarse gain, line impedance, sealing current, loopback amplifier gain, and power supply) are also located on the printed wiring board.

2.53 The DAS 829B-L1A CIU is 1-1/3 inches high, 5-1/2 inches wide, and 9-2/3 inches long. The CIU weighs 1-5/8 pounds.

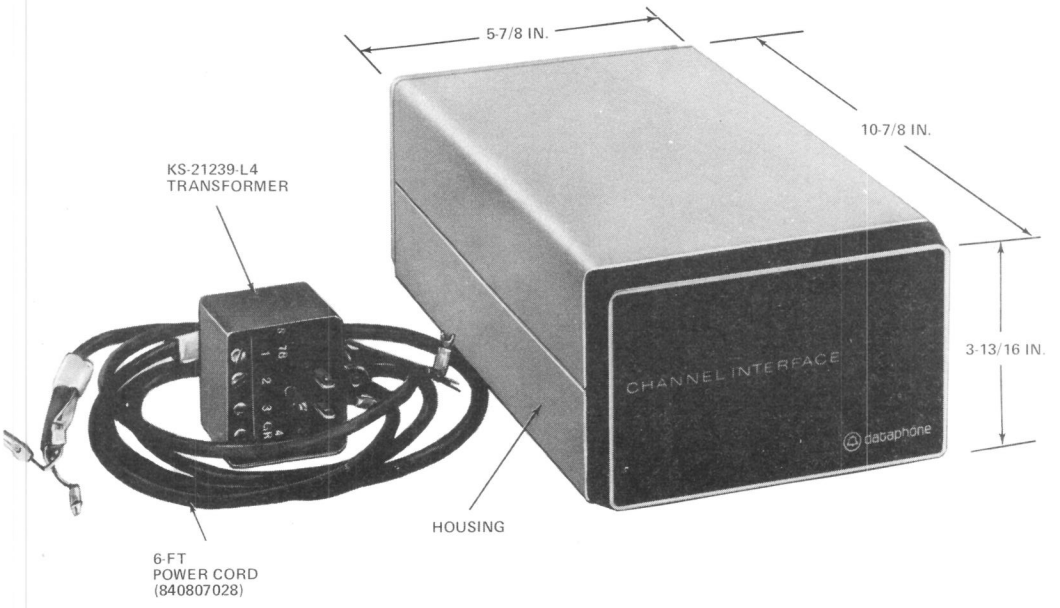


Fig. 30—62A1 Data Mounting—Front View

2.54 The DAS 829B-L1A CIU will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

F. DAS 829C-L1A CIU

2.55 The DAS 829C-L1A CIU (Fig. 37) contains the circuitry required to provide a standard termination for longer loaded 4-wire metallic facilities. The CIU consists of component apparatus mounted on a plug-in printed wiring board. The CIU is housed in a 44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1 data mounting. A handle is provided on the CIU faceplate to facilitate removal of the CIU from the data mounting.

2.56 Two monitoring jacks, two test jacks, and one input jack are located on the CIU faceplate. These jacks will accept a standard 310 plug. A loopback indicator light is also located on the faceplate. A receive fine gain control located on the printed wiring board is accessible through a hole in the faceplate. A variable attenuator and five installer options (receive coarse gain, 359A or 359K equalizer equivalent, sealing current, loopback amplifier gain, and power supply) are also located on the printed wiring board.

2.57 The DAS 829C-L1A CIU is 1-1/3 inches high, 5-1/2 inches wide, and 9-2/3 inches long. The CIU weighs 1-1/4 pounds.

2.58 The DAS 829C-L1A CIU will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

DATA UNITS

2.59 The 48-type data units provide the functions that are required to supplement the CIUs for 4-wire data with alternate voice, dial backup, and switched dial backup service. Two-wire data only and data with alternate voice service are also provided. The 48A1, 48B1, 48C1, 48ER1, 48FR1, and 48G1 data units are plug-in circuit packs that are housed in single or multiple data mountings. The 48D1 data unit is rack mounted and does not require housing.

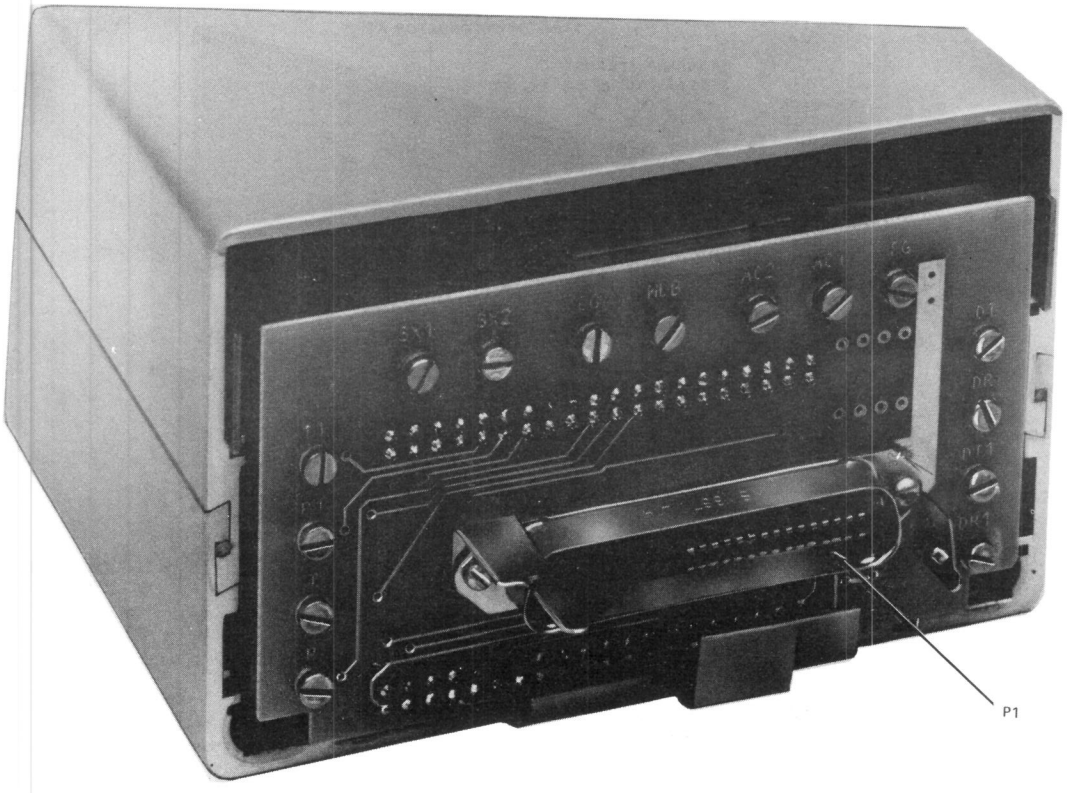


Fig. 31—62A1 Data Mounting—Rear View

A. 48A1 Data Unit

2.60 The 48A1 data unit (Fig. 38) contains the circuitry required to provide alternate voice service. The data unit consists of component apparatus mounted on a plug-in printed wiring board. The data unit is housed in a 45A1, 46B1, or 59A1 data mounting.

2.61 The alternate voice arrangement provided by the 48A1 data unit is not compatible with alternate voice arrangements of either the DAS 828A-type CIU or locally engineered systems requiring 20-Hz ringdown signaling unless signal conversion equipment is provided. When signal conversion equipment is required, the F-type SF unit is recommended. The E-type SF unit is not recommended. The 48A1 data unit uses an inband signal of 2600 Hz for ringdown signaling.

2.62 The 48A1 data unit is 1-1/4 inches high, 5-1/2 inches wide, and 9-11/16 inches deep. The data unit weighs 1-1/4 pounds.

2.63 The 48A1 data unit will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

B. 48B1 Data Unit

2.64 The 48B1 data unit (Fig. 39) contains the circuitry required to provide 4-wire dial backup service with manual dialing. The data unit consists of component apparatus mounted on a plug-in printed wiring board. The data unit is

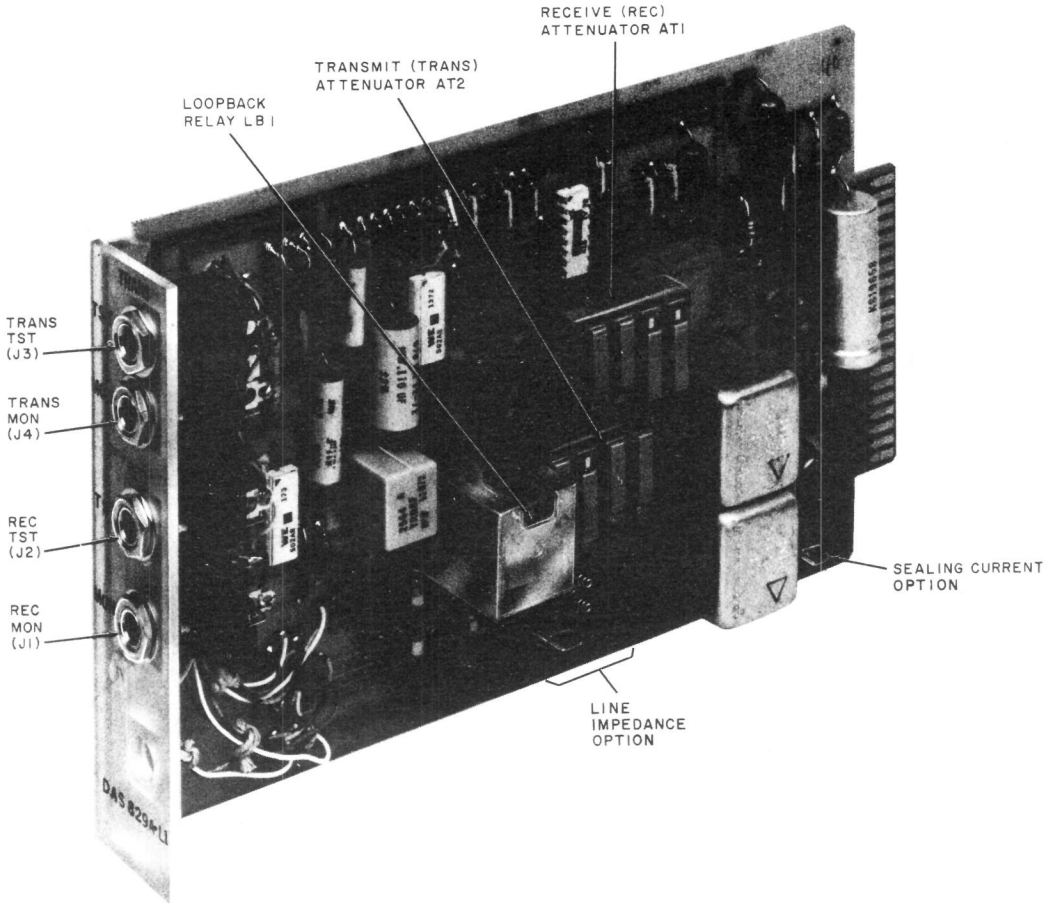


Fig. 32—DAS 829A-L1 CIU

housed in a 45A1, 46C1, 46C2, or 59A1 data mounting.

2.65 A test jack is located at the front of the data unit. This jack will accept a standard 310 plug. A variable attenuator, a variable gain control, and an installer option (slope equalizer) are located on the printed wiring board.

2.66 The dial backup arrangement provided by the 48B1 data unit is compatible with dial backup arrangements provided by either the DAS 828C-type CIU or by locally engineered systems that are equivalent to the DAS 828C-type CIU.

2.67 The 48B1 data unit is 1-1/4 inches high, 5-1/2 inches wide, and 9-11/16 inches deep. The data unit weighs 2 pounds.

2.68 The 48B1 data unit will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

C. 48C1 Data Unit

2.69 The 48C1 data unit (Fig. 40) contains the circuitry required to provide a 2-by-4 switching matrix that can connect any one of four 4-wire modems to either one of two 4-wire dial backup

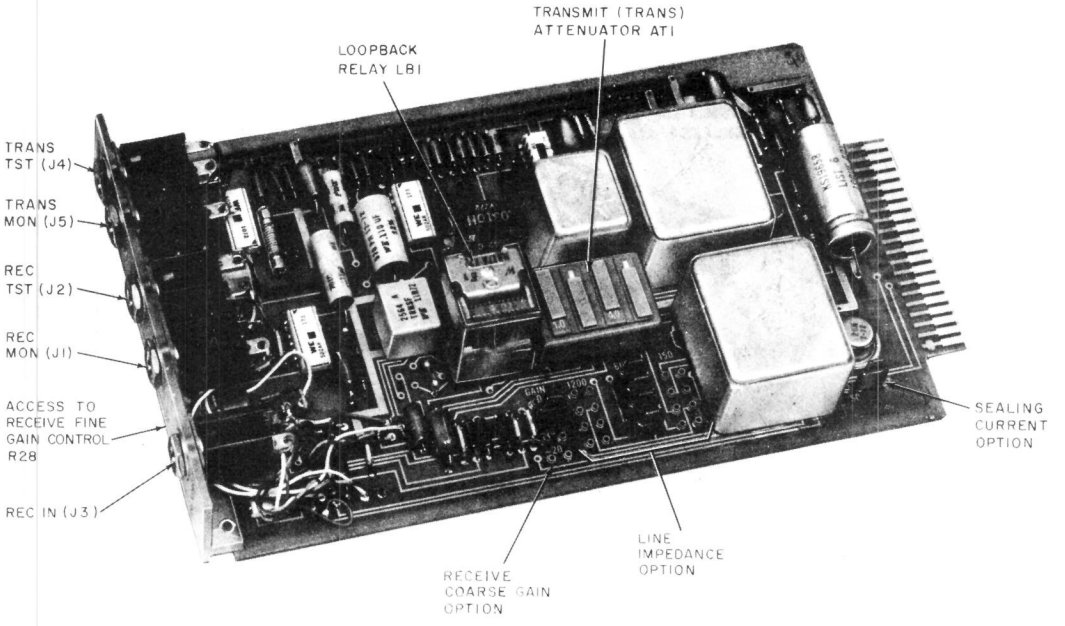


Fig. 33—DAS 829B-L1 CIU

channels. The data unit consists of component apparatus mounted on a plug-in printed wiring board. An attached cable and connector J1 permit direct connection to a 48D1 data unit. The 48C1 data unit is housed in a 46C1 or 46C2 data mounting.

2.70 The 48C1 data unit is 1-1/4 inches high, 5-1/2 inches wide, and 9-11/16 inches deep. The data unit weighs 1-3/4 pounds.

2.71 The 48C1 data unit will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

D. 48D1 Data Unit

2.72 The 48D1 data unit provides an interface adapter for use with a 46B1 and/or a 46C1 or 46C2 data mounting to concentrate control of 48A1, 48B1 or 48ER1, and 48C1 data units in an 18- or 30-button CALL DIRECTOR key telephone set.

2.73 The 48D1 data unit (Fig. 41) provides six 50-pin connectors, P4 through P9, for direct connection of up to six 48C1 data units mounted in a 46C1 or 46C2 data mounting. A 24-Vac transformer, a bridge rectifier power supply, a regulated power supply, and four fuses are integral parts of the 48D1 data unit. A 4-foot power cord (840339907) is supplied with the 48D1 data unit.

2.74 The backplane (Fig. 42) of the 48D1 data unit contains twelve 50-pin connectors. Connectors J1 through J5 permit connection to an 18- or 30-button CALL DIRECTOR key telephone set. Connector J6 permits connection to a 46C1 or 46C2 data mounting. Connectors P1 through P3 permit connection to up to three 46B1 data mountings containing a maximum of twenty-three 48A1 data units. Connectors P11 and P12 permit concentrated connection to a maximum of twenty-three modems to provide dial backup status to modems requiring this information. Connector P10 is provided for future use. Power cord connector P13 is located on the rear of the data unit adjacent to the backplane.

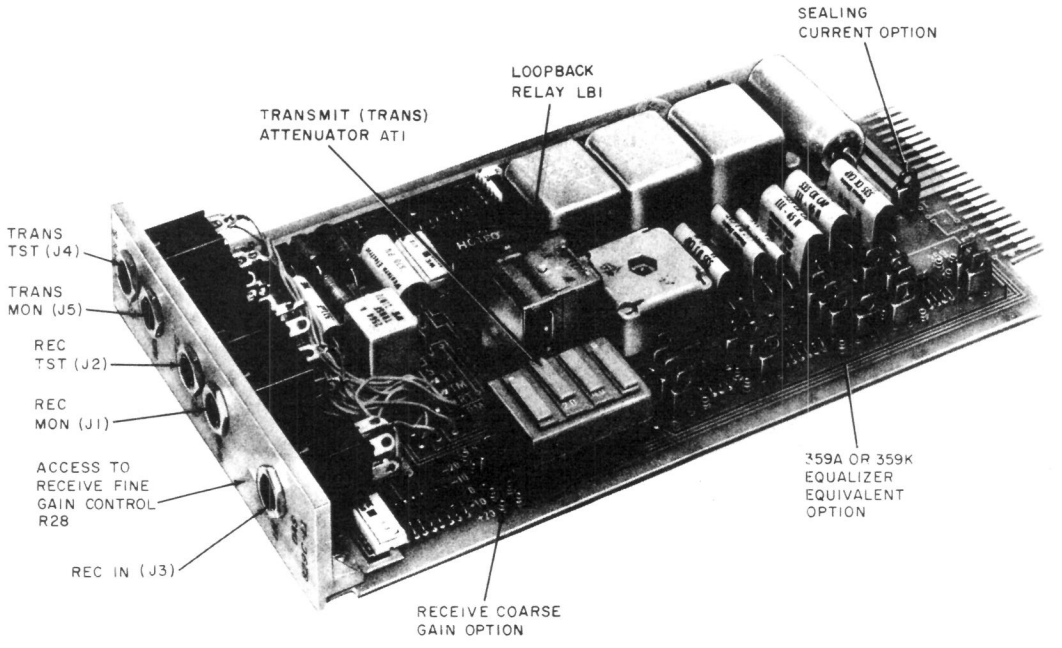


Fig. 34—DAS 829C-L1 CIU

2.75 The 48D1 data unit is 7 inches high, 19 inches wide, and 13-1/4 inches deep. The data unit weighs 24 pounds.

2.76 The 48D1 data unit can be mounted on 19- or 23-inch relay racks. Mounting in KS-20018-type cabinets is recommended. Descriptive information on KS-20018-type cabinets is provided in Section 590-010-201.

2.77 The 48D1 data unit will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

E. 48ER1 Data Unit

2.78 The 48ER1 data unit (Fig. 43) contains the circuitry required to provide 4-wire dial backup service with manual or automatic dialing. The data unit consists of component apparatus mounted on a plug-in printed wiring board. The data unit is housed in a 46C2 or 59A1 data mounting. A handle is provided on the data unit faceplate to facilitate removal of the data unit from the data mounting.

2.79 Two test jacks are located on the data unit faceplate. These jacks will accept a standard 310 plug. A locking switch and a dial backup indicator light are also located on the faceplate. Two gain control switches and three installer options (call control, unit control, and power supply) are located on the printed wiring board.

2.80 The dial backup arrangement provided by the 48ER1 data unit is compatible with dial backup arrangements provided by the 48B1 data unit, the DAS 828C-type CIU, or by locally engineered arrangements that are equivalent to the 48B1 data unit or the DAS 828C-type CIU.

2.81 The 48ER1 data unit is 1-1/4 inches high, 5-1/2 inches wide, and 10-1/16 inches deep. The data unit weighs 1-7/8 pounds.

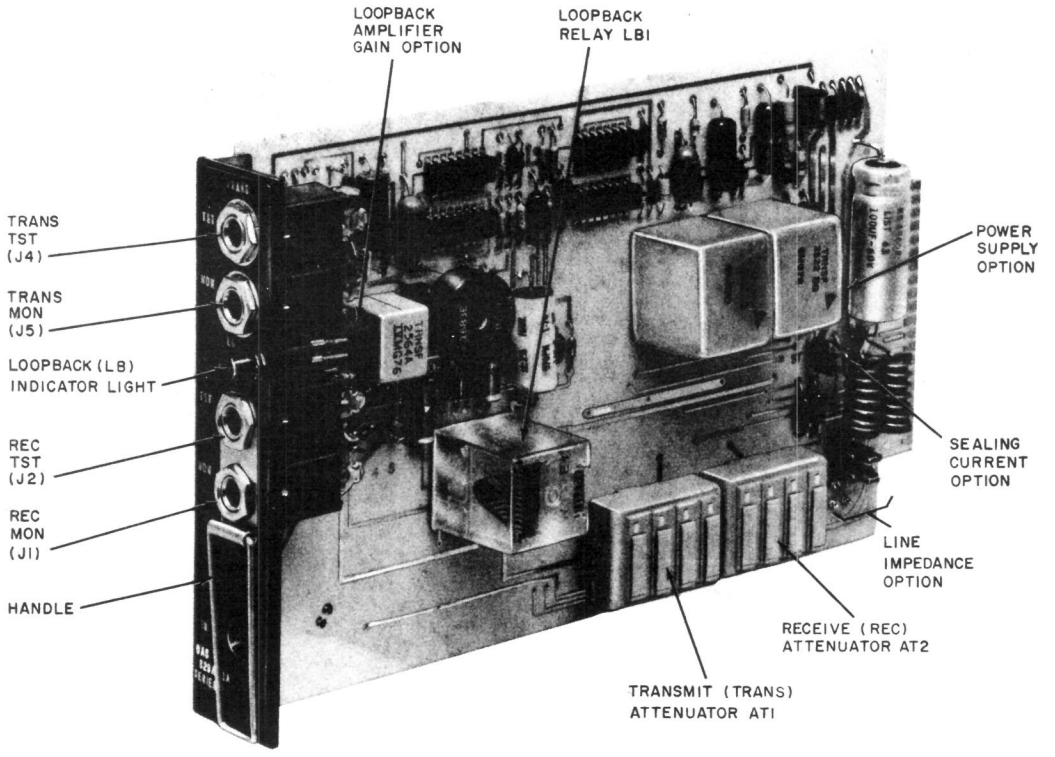


Fig. 35—DAS 829A-L1A CIU

2.82 The 48ER1 data unit will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

F. 48FR1 Data Unit

2.83 The 48FR1 data unit (Fig. 44) contains the circuitry required to provide 4-wire dial backup service with automatic answering. The data unit consists of component apparatus mounted on a plug-in printed wiring board. The data unit is housed in a 59A1 data mounting. A handle is provided on the data unit faceplate to facilitate removal of the data unit from the data mounting.

2.84 Two test jacks are located on the data unit faceplate. These jacks will accept a standard 310 plug. A nonlocking switch and a dial backup indicator light are also located on the faceplate. Two gain control switches and three installer options (call control, unit control, and power supply) are located on the printed wiring board.

2.85 The 48FR1 data unit is 1-1/4 inches high, 5-1/2 inches wide, and 10-1/16 inches deep. The data unit weighs 2 pounds.

2.86 The 48FR1 data unit will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

G. 48G1 Data Unit

2.87 The 48G1 data unit (Fig. 45) contains the circuitry required to provide conversion from a 2-wire to a 4-wire channel. The data unit consists of component apparatus mounted on a plug-in printed wiring board. The data unit is housed in

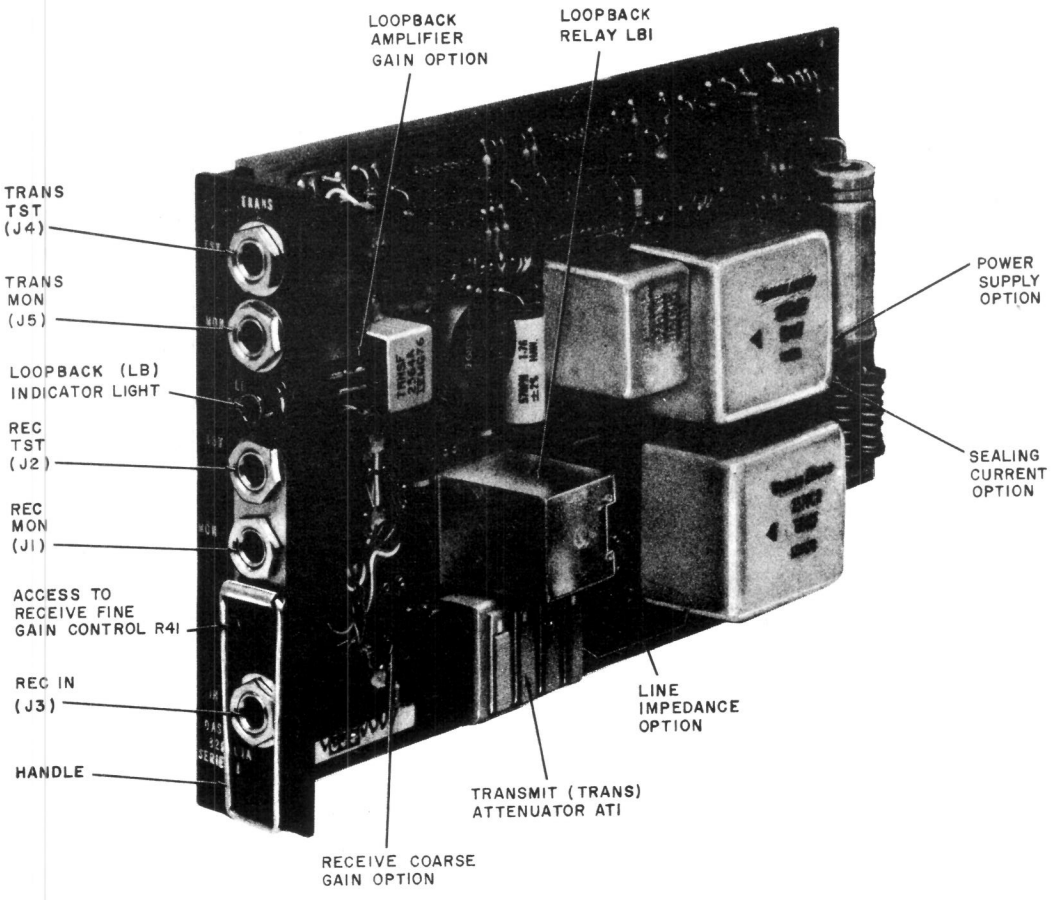


Fig. 36—DAS 829B-L1A CIU

a 46B1, 59A1, or 62A1 data mounting. A handle is provided on the data unit faceplate to facilitate removal of the data unit from the data mounting.

2.88 A monitoring jack and a test jack are located on the data unit faceplate. These jacks will accept a standard 310 plug. An installer option (power supply) is located on the printed wiring board.

2.89 The 48G1 data unit is 1-1/4 inches high, 5-1/2 inches wide, and 10-1/16 inches deep. The data unit weighs 2/3 pound.

2.90 The 48G1 data unit will operate in an ambient temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

3. FUNCTIONAL DESCRIPTION

CHANNEL INTERFACE UNITS (CIU)

3.01 The DAS 829-type CIU provides the transmission circuitry required for proper termination of 4-wire private line voiceband data channels. The DAS 829-type CIU is available in six codes for use with channels having various loop

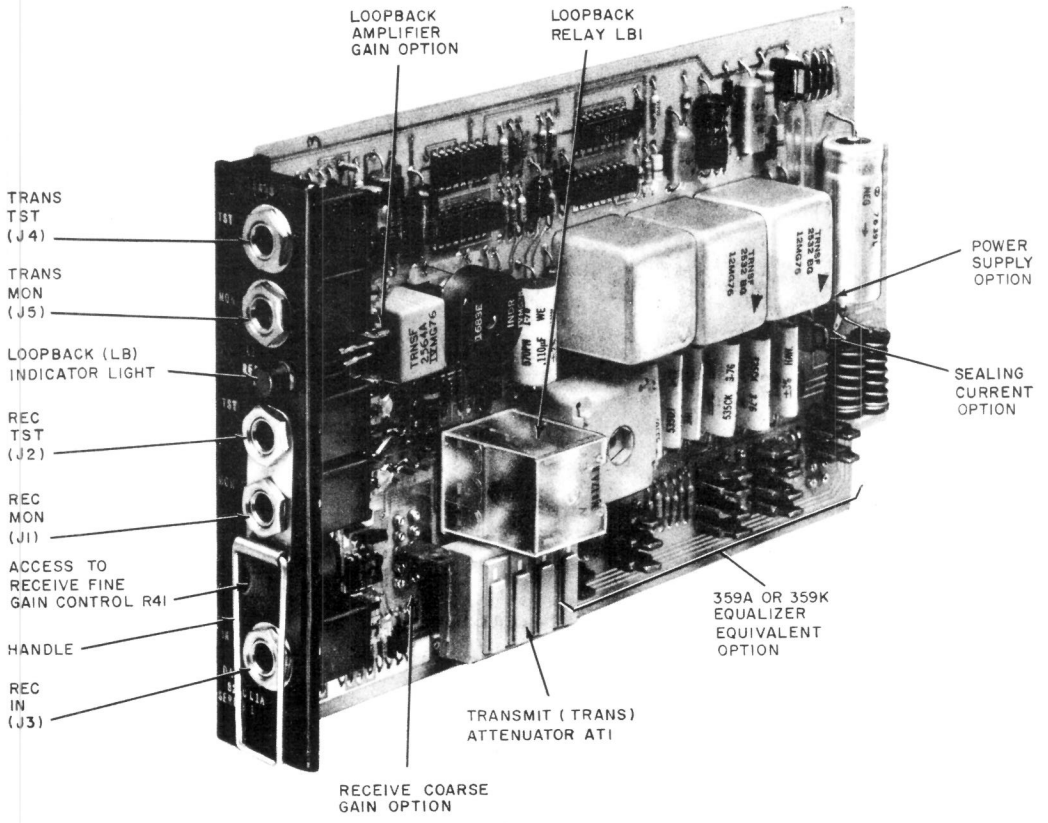


Fig. 37—DAS 829C-L1A CIU

facilities. The three L1A codes provide all the functions of the corresponding L1 codes and also provide the following functions: (1) data only service on 8-dB channels, (2) operation from a -48 Vdc power source, (3) visual indication of loopback, and (4) provision for disabling loopback by use of special data mountings.

3.02 For 4-wire data only service on a single 4-wire private line, the DAS 829-type CIU is housed in a 44A1 or 44A2 data mounting. For 4-wire data service on a single 4-wire private line, with alternate voice and/or dial backup service using manual dialing, the CIU and the required 48A1 and/or 48B1 data units are housed in a 45A1 or 59A1 data mounting. For 4-wire data service on a single 4-wire private line, with alternate voice and/or registered dial backup service using manual dialing, the CIU and the required 48A1 and/or 48ER1 data units are housed in a 59A1 data mounting. For 4-wire data service on a single 4-wire private line with registered dial backup service using automatic dialing or automatic answering, the CIU and the required 48ER1 or 48FR1 data unit are housed in a 59A1 data mounting. For 2-wire data only service on a single 4-wire line, the CIU and the required 48G1 data unit are housed in a 59A1 or 62A1 data mounting. For 2-wire data service on a single 4-wire line with alternate voice service, the CIU and the required 48A1 and 48G1 data units are housed in a 59A1 data mounting. Although the 45A1, 59A1, and 62A1 data mountings

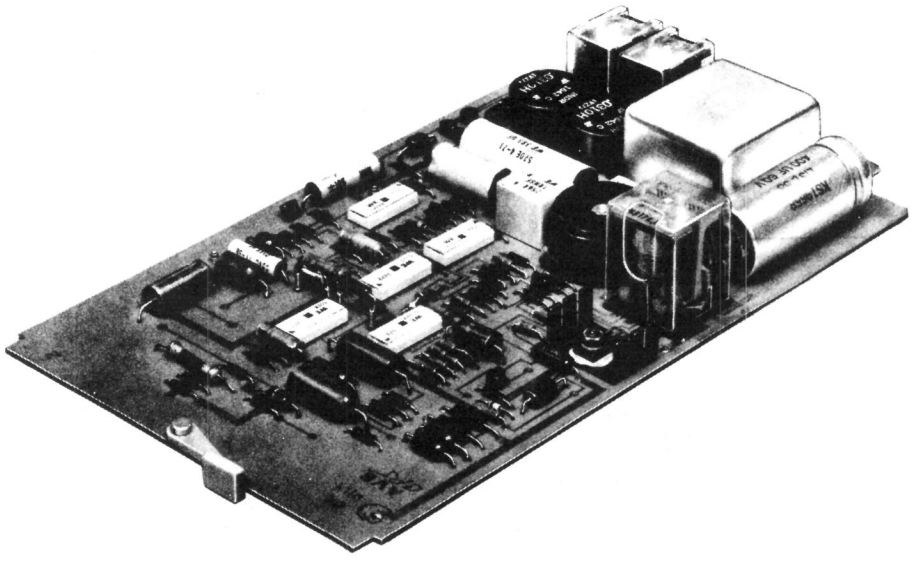


Fig. 38—48A1 Data Unit

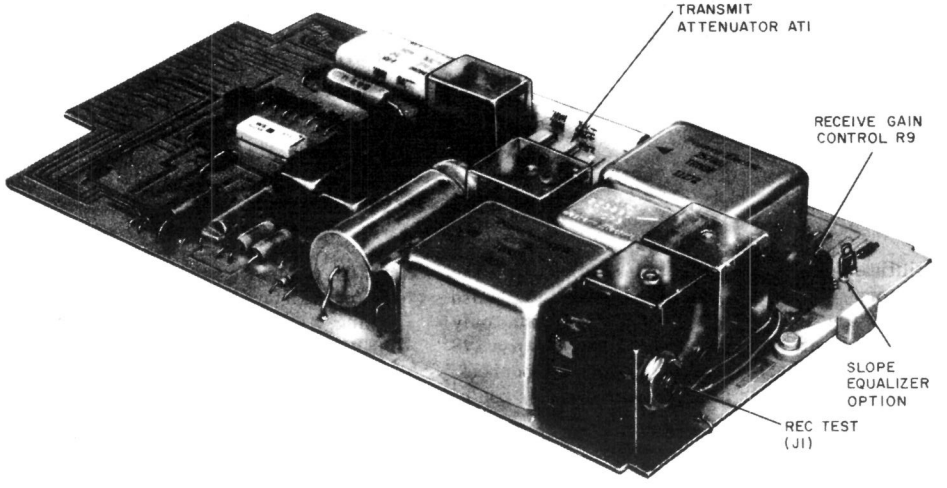


Fig. 39—48B1 Data Unit

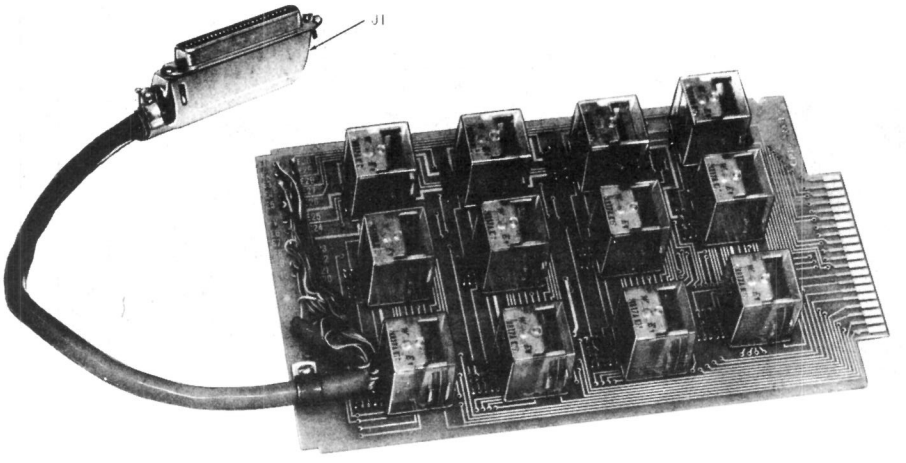


Fig. 40—48C1 Data Unit

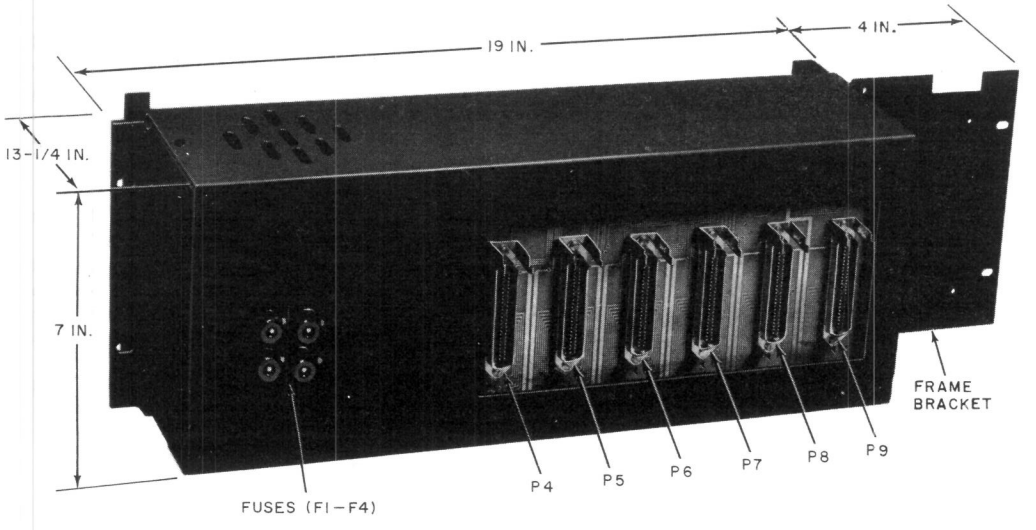


Fig. 41—48D1 Data Unit—Front View

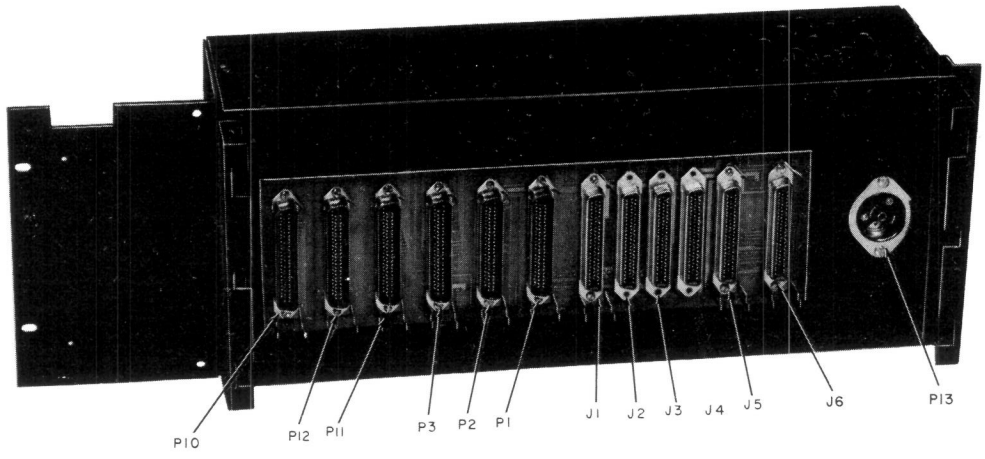


Fig. 42—48D1 Data Unit—Rear View

can house a CIU only, they are not normally used for this purpose. At present, 2-wire dial backup service is not available.

3.03 For 4-wire data only or data with additional services (alternate voice and/or switched dial backup) on multiple (up to eight) 4-wire private lines, the DAS 829-type CIU is housed in a 46A1 or 46A2 data mounting. For 2-wire data only or data with alternate voice service on multiple (up to eight) 4-wire lines, the CIU is also housed in a 46A1 or 46A2 data mounting. At present, 2-wire switched dial backup service is not available.

3.04 In the normal (data) mode (Fig. 1), the 4-wire modem can transmit and receive data over the 4-wire metallic facilities since the DAS 829-type CIU provides a through connection for the transmission leads of the standard 6-lead interface (DT, DR, DT1, DR1, TEK5, and TEK6) that connects the 4-wire modem to the CIU. The four transmission leads (DT, DR, DT1, and DR1) are complete through the normally-closed contacts of the LB1 relay in the CIU as long as the CIU remains in the data mode. This condition is indicated by an in-data line status signal to the modem.

3.05 In the normal (data) mode (Fig. 2), the 2-wire modem can transmit and receive data over the 4-wire metallic facilities since the DAS 829-type CIU provides a through connection for the 4-wire port of the 2-wire to 4-wire hybrid circuit in the 48G1 data unit that connects the 2-wire modem to the CIU. The four transmission leads (DT, DR, DT1, and DR1) are complete through the normally-closed contacts of the LB1 relay in the CIU as long as the CIU remains in the data mode. This condition is indicated by an in-data line status signal to the modem.

3.06 In the loopback mode (Fig. 1 or 2), operation of the LB1 relay in the DAS 829-type CIU disconnects the modem from the 4-wire metallic facilities and loops back the receive pair to the transmit pair through a loopback amplifier in the CIU. The 4-wire metallic facilities are now reserved for test purposes and are not available for data transmission. This condition is indicated by a not-in-data line status signal to the modem.

A. DAS 829A-L1 CIU

3.07 The DAS 829A-L1 CIU provides the transmission circuitry required for proper termination of short nonloaded or loaded 4-wire metallic facilities when no gain is required in the transmit or receive paths. A facility loopback circuit, a not-in-data indication, and a sealing current option are also provided. A dc power supply in the CIU obtains its required 24-Vac input from a transformer associated with the data mounting

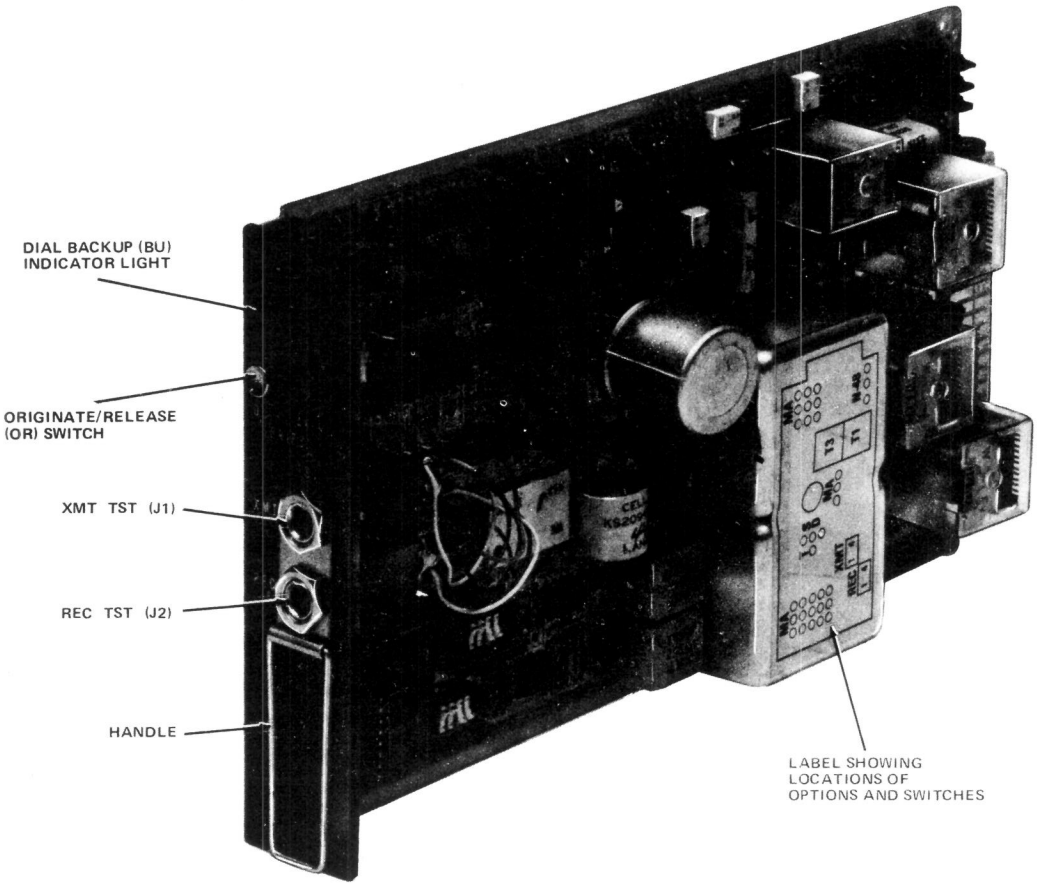


Fig. 43—48ER1 Data Unit

(44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1) that houses the CIU. All connections to the CIU are made through the data mounting.

Transmit Circuit

3.08 In the data mode (Fig. 46), transmitted signals on the modem transmit pair (DT1, DR1) are passed through the normally-closed contacts of test jack J3 (TRANS TST), the normally-closed contacts of relay LB1, the 0 to 15 dB attenuator AT2 (TRANS), and transformer T3 to the station transmit pair (T1, R1).

3.09 Resistor R38 functions as a fuse for the modem transmit pair (DT1, DR1). If excessive power is dissipated in resistor R38, the resistor opens to disconnect the hazardous voltage. Diode CR6 limits voltage surges in the circuit. The line impedance option provides a 600- or 1200-ohm line termination. Monitor jack J4 (TRANS MON) provides a monitoring point on the modem side of the CIU.

Receive Circuit

3.10 In the data mode (Fig. 46), received signals on the station receive pair (T, R) are passed

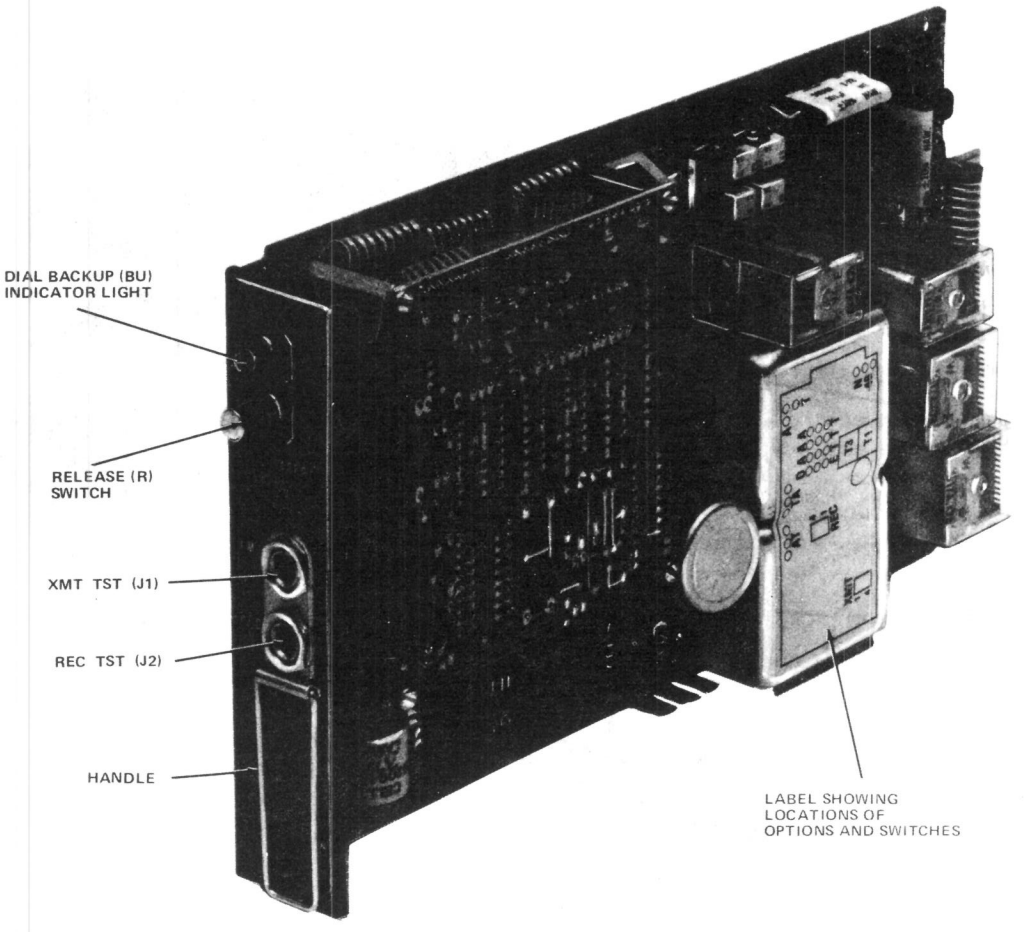


Fig. 44—48FR1 Data Unit

through transformer T2, the 0 to 15 dB attenuator AT1 (REC), the normally-closed contacts of test jack J2 (REC TST), and the normally-closed contacts of relay LB1 to the modem receive pair (DT, DR).

3.11 Resistor R37 functions as a fuse for the modem receive pair (DT, DR). If excessive power is dissipated in resistor R37, the resistor opens to disconnect the hazardous voltage. Diode CR5 limits voltage surges in the circuit. The line impedance option provides a 600- or 1200-ohm line termination. Monitor jack J1 (REC MON) provides a monitoring point on the modem side of the CIU.

Loopback Circuit

3.12 The loopback circuit (Fig. 46) provides a loopback mode of operation to permit testing of the transmitting and receiving facilities from a remote test center. The modem is disconnected and the station receive pair is looped back to the station transmit pair through a 16-dB loopback amplifier. The loopback amplifier provides a

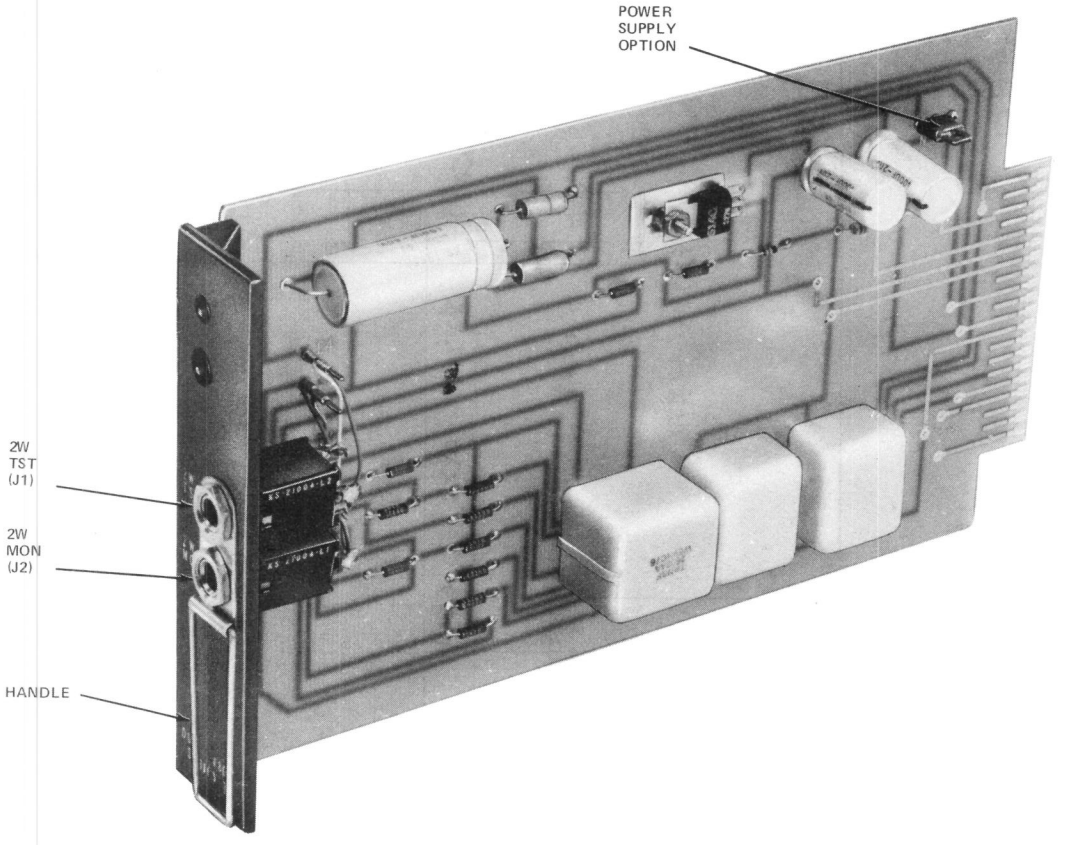


Fig. 45—48G1 Data Unit

loopback transmission path at equal (normal) levels. The loopback relay contacts, the TRANS TST jack contacts, and the interconnection between the modem and the CIU are not included in the loopback path.

3.13 Loopback is accomplished by operation of loopback relay LB1. Release of this relay restores the CIU to the normal (data) mode. Operation and release of the relay is usually initiated by a 2713-Hz tone from a remote test center. Operation and release of the relay may be initiated locally, if a manual loopback key is connected to the CIU.

3.14 The 2713-Hz tone from the test center is sent over the station receive pair (T, R) and activates the tone detector circuit in the CIU. To ensure activation, the transmitted tone should be 2713±5 Hz. Depending on the signal-to-noise ratio, the tone detector circuit may have a bandwidth as wide as 2685 Hz to 2741 Hz. When the 2713-Hz tone is sent for a minimum of 5 seconds and then removed, the tone detector circuit operates loopback relay LB1. The test center then sends a 1004-Hz test tone over the station receive pair (T, R). If the test tone is returned to the test center over the station transmit pair (T1, R1), loopback has been accomplished.

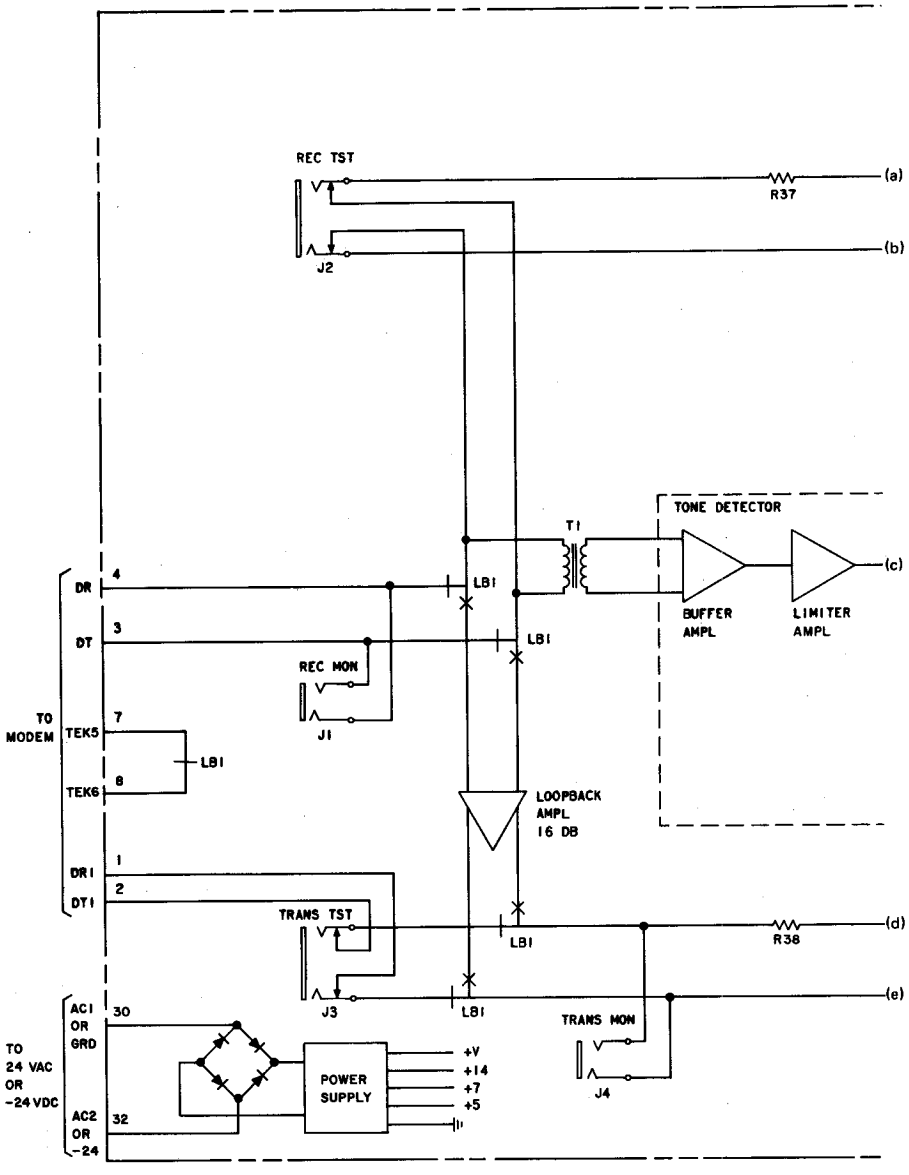


Fig. 46—DAS 829A-L1 CIU—Functional Diagram (Sheet 1 of 2)

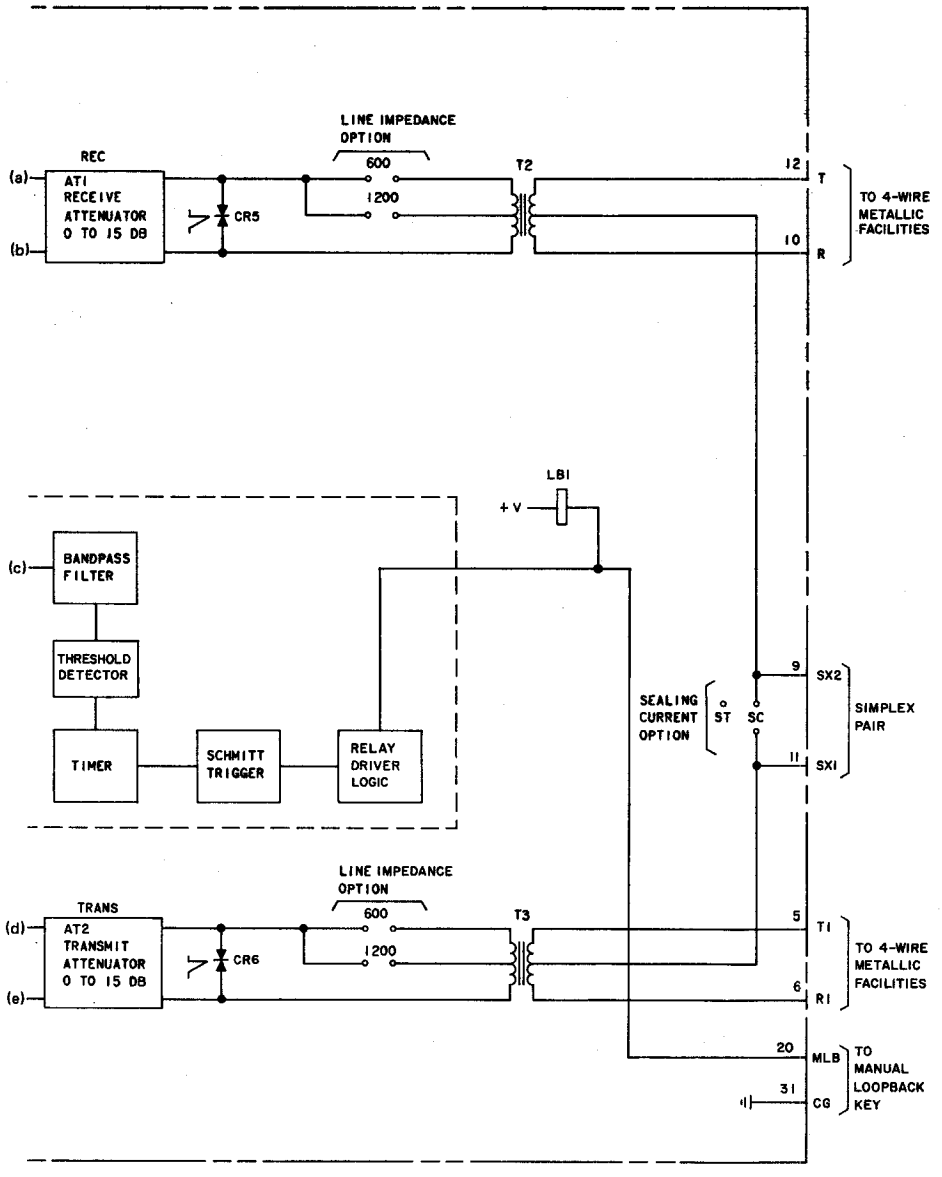


Fig. 46—DAS 829A-L1 CIU—Functional Diagram (Sheet 2 of 2)

Note: When a 2-wire private line is tested, the test center should open circuit the station transmit pair. This ensures that when the 2-wire port of the 2-wire to 4-wire hybrid circuit in a 48G1 data unit is improperly terminated, open or short circuit, the 2713-Hz tone will not be looped back via the hybrid circuit.

3.15 After the desired tests are completed, the 2713-Hz tone from the test center is again sent over the station receive pair (T, R) and activates the tone detector circuit in the CIU. About 1 second after activation, the tone detector circuit releases loopback relay LB1. The 2713-Hz tone is sent for a minimum of 5 seconds and then removed. The test center then sends the 1004-Hz test tone over the station receive pair (T, R). If the test tone is not returned to the test center over the station transmit pair (T1, R1), the CIU has been returned to the normal (data) mode.

Note: When a 2-wire private line is tested, an improperly terminated 2-wire port of a 48G1 data unit could cause the 1004-Hz tone to be returned to the test center. If the 2-wire port is open- or short-circuited, the improper loopback signal will be 16 dB below the valid loopback signal.

Not-in-Data Indication

3.16 When the CIU (Fig. 46) is in the loopback mode (relay LB1 operated), a normally-closed contact of the relay is opened to provide a not-in-data (line status) indication to the modem through the TEK5 and TEK6 leads.

3.17 The following two restrictions apply to the not-in-data indication if it is used with a customer-provided modem:

(1) The circuit in the modem must be noninductive or equipped with contact protection.

(2) Current to the CIU must not exceed 500 mA.

Sealing Current Option

3.18 Sealing current is a small dc current that is applied to the simplex pair of the 4-wire metallic facilities to eliminate impaired transmission. If sealing current is used, the sealing current option (Fig. 46) in the CIU provides dc continuity for the simplex pair. A typical sealing current arrangement is shown in Fig. 47.

B. DAS 829B-L1 CIU

3.19 The DAS 829B-L1 CIU provides the transmission circuitry required for proper termination of medium or long nonloaded 4-wire metallic facilities that require gain in the receive path. A facility loopback circuit, a not-in-data indication, and a sealing current option are also provided. A dc power supply in the CIU obtains its required 24-Vac input from a transformer associated with the data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1) that houses the CIU. All connections to the CIU are made through the data mounting.

Transmit Circuit

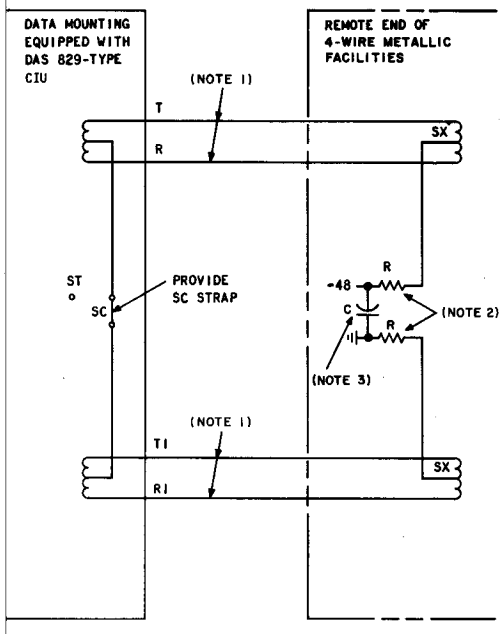
3.20 In the data mode (Fig. 48), transmitted signals on the modem transmit pair (DT1, DR1) are passed through the normally-closed contacts of test jack J4 (TRANS TST), the normally-closed contacts of relay LB1, the 0 to 15 dB attenuator AT1 (TRANS), and transformer T4 to the station transmit pair (T1, R1).

3.21 Resistor R42 functions as a fuse for the modem transmit pair (DT1, DR1). If excessive power is dissipated in resistor R42, the resistor opens to disconnect the hazardous voltage. Diode CR6 limits voltage surges in the circuit. The line impedance option provides a 150-, 600-, or 1200-ohm line termination. Monitor jack J5 (TRANS MON) provides a monitoring point on the modem side of the CIU.

Receive Circuit

3.22 In the data mode (Fig. 48), received signals on the station receive pair (T, R) are passed through transformer T3, the normally-closed contacts of input jack J3 (REC IN), the receive level circuit (coarse gain option), the 0 to 10 dB amplifier, transformer T2, the normally-closed contacts of test jack J2 (REC TST), and the normally-closed contacts of relay LB1 to the modem receive pair (DT, DR).

3.23 The coarse gain option provides coarse adjustment of the signal gain. The available coarse adjustments (GAIN) are +10, 0, -10, and



NOTES:

1. METALLIC CIRCUIT CURRENT (UNBALANCE) MUST BE LIMITED TO 0.5 MA TO ENSURE DATA WILL NOT BE AFFECTED BY SATURATION CHARACTERISTICS OF TRANSFORMERS IN DAS 829-TYPE CIU.
2. POWER SUPPLY FILTER AND CURRENT LIMITING RESISTORS (R) SHOULD BE PROVIDED AS REQUIRED.
3. POWER SUPPLY FILTER CAPACITOR (C) SHOULD BE 20 MFD.

Fig. 47—Typical Sealing Current Arrangement

-20 dB. Variable resistor R28 and the 0 to 10 dB amplifier provide fine adjustment of the signal gain. Diode CR5 limits voltage surges in the circuit. The line impedance option provides a 150-, 600-, or 1200-ohm line termination. Monitor jack J1 (REC MON) provides a monitoring point on the modem side of the CIU.

Loopback Circuit

3.24 The loopback circuit (Fig. 48) is the same as the loopback circuit described in paragraphs 3.12 through 3.15 for the DAS 829A-L1 CIU.

Not-in-Data Indication

3.25 The not-in-data indication (Fig. 48) is the same as the not-in-data indication described in paragraphs 3.16 and 3.17 for the DAS 829A-L1 CIU.

Sealing Current Option

3.26 The sealing current option (Fig. 48) is the same as the sealing current option described in paragraph 3.18 for the DAS 829A-L1 CIU.

C. DAS 829C-L1 CIU

3.27 The DAS 829C-L1 CIU provides the transmission circuitry required for proper termination of medium or long loaded 4-wire metallic facilities that require gain in the receive path and extensive amplitude equalization. A facility loopback circuit, a not-in-data indication, and a sealing current option are also provided. A dc power supply in the CIU obtains its required 24-Vac input from a transformer associated with the data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1) that houses the CIU. All connections to the CIU are made through the data mounting.

Transmit Circuit

3.28 In the data mode (Fig. 49), transmitted signals on the modem transmit pair (DT1, DR1) are passed through the normally-closed contacts of test jack J4 (TRANS TST), the normally-closed contacts of relay LB1, the 0 to 15 dB attenuator AT1 (TRANS), and transformer T4 to the station transmit pair (T1, R1).

3.29 Resistor R42 functions as a fuse for the modem transmit pair (DT1, DR1). If excessive power is dissipated in resistor R42, the resistor opens to disconnect the hazardous voltage. Diode CR6 limits voltage surges in the circuit. The 359A or 359K equalizer equivalent option provides a 1200- or a 600-ohm line termination, respectively. Monitor jack J5 (TRANS MON) provides a monitoring point on the modem side of the CIU.

Receive Circuit

3.30 In the data mode (Fig. 49), received signals on the station receive pair (T, R) are passed through transformer T3, the slope equalizer circuit, the normally-closed contacts of input jack J3 (REC IN), the receive level circuit (coarse gain option), the 0 to 10 dB amplifier, transformer T2, the normally-closed contacts of test jack J2 (REC TST),

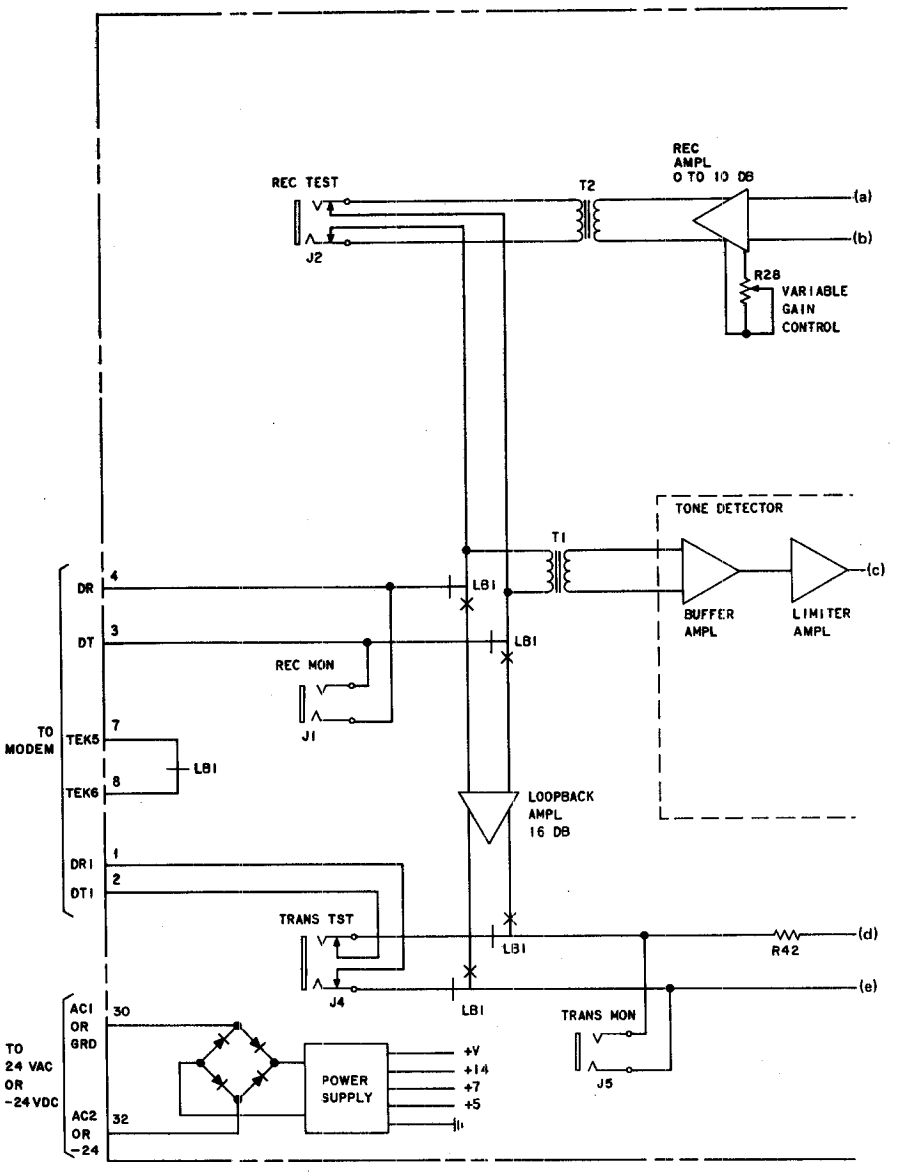


Fig. 48—DAS 829B-L1 CIU—Functional Diagram (Sheet 1 of 2)

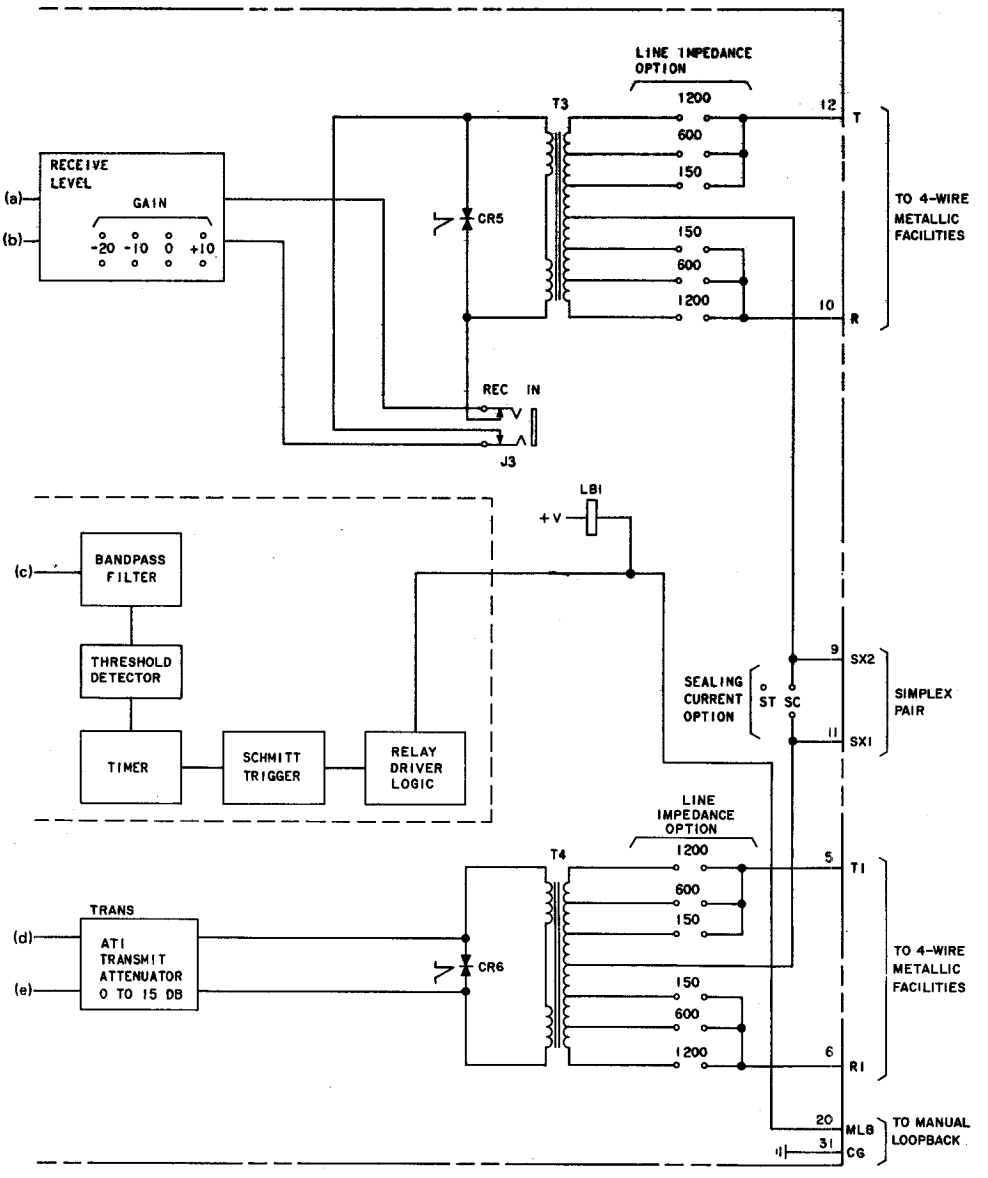


Fig. 48—DAS 829B-L1 CIU—Functional Diagram (Sheet 2 of 2)

and the normally-closed contacts of relay LB1 to the modem receive pair (DT, DR).

3.31 The coarse gain option provides coarse adjustment of the signal gain. The available coarse adjustments (GAIN) are +20, +10, 0, -10, and -20 dB. Variable resistor R28 and the 0 to 10 dB amplifier provide fine adjustment of the signal gain. Diode CR5 limits voltage surges in the circuit. The 359A or 359K equalizer equivalent option provides a 1200- or a 600-ohm line termination, respectively. Monitor jack J1 (REC MON) provides a monitoring point on the modem side of the CIU.

3.32 The slope equalizer circuit and the 1200- or 600-ohm line terminations (transmit and receive) form the equivalent of a 359A or 359K equalizer. The slope equalizer circuit and the line terminations for the receive circuit are shown in Fig. 50.

3.33 The slope equalizer circuit contains jacks arranged in a matrix. The matrix consists of four columns and four rows with a storage position to the left of each column. The required equalization is obtained by inserting plug-in straps into the appropriate matrix jacks.

3.34 All four columns (A, B, C, and D) are required to provide the equivalent of a 359A equalizer while only columns C and D are required for the equivalent of a 359K equalizer. Columns A and B comprise the high frequency section and are designed for equalization of H88-loaded high-capacitance cable. Columns C and D provide equalization for 4-wire or 2-wire private lines at frequencies up to 1000 Hz.

Loopback Circuit

3.35 The loopback circuit (Fig. 49) is the same as the loopback circuit described in paragraphs 3.12 through 3.15 for the DAS 829A-L1 CIU.

Not-in-Data Indication

3.36 The not-in-data indication (Fig. 49) is the same as the not-in-data indication described in paragraphs 3.16 and 3.17 for the DAS 829A-L1 CIU.

Sealing Current Option

3.37 The sealing current option (Fig. 49) is the same as the sealing current option described in paragraph 3.18 for the DAS 829A-L1 CIU.

D. DAS 829A-L1A CIU

3.38 The DAS 829A-L1A CIU provides the transmission circuitry required for proper termination of short nonloaded or loaded 4-wire metallic facilities when no gain is required in the transmit or receive paths. A facility loopback circuit, a not-in-data indication, a sealing current option, a loopback amplifier gain option, and a power supply option are also provided. The 2-position power supply option enables the associated dc power supply to operate on 24 Vac (N position), -24 Vdc (N position), or -48 Vdc (-48 position). The 24 Vac input is obtained from a transformer associated with the data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1) that houses the CIU. The -24 and -48 Vdc inputs are obtained from an external power source. All connections to the CIU are made through the data mounting.

Transmit Circuit

3.39 In the data mode (Fig. 51), transmitted signals on the modem transmit pair (DT1, DR1) are passed through the normally-closed contacts of test jack J4 (TRANS TST), the normally-closed contacts of relay LB1, the 0 to 15 dB attenuator AT1 (TRANS), and transformer T1 to the station transmit pair (T1, R1).

3.40 Resistors R7 and F1 function as fuses for the modem transmit pair (DT1, DR1) and the station transmit pair (T1, R1), respectively. If excessive power is dissipated in resistor R7 or F1, the resistor opens to disconnect the hazardous voltage. Diodes CR1 and CR2 limit voltage surges in the circuit. The line impedance option provides a 600- or 1200-ohm line termination. Monitor jack J5 (TRANS MON) provides a monitoring point on the modem side of the CIU.

Receive Circuit

3.41 In the data mode (Fig. 51), received signals on the station receive pair (T, R) are passed through transformer T3, the 0 to 15 dB attenuator AT2 (REC), the normally-closed contacts of test

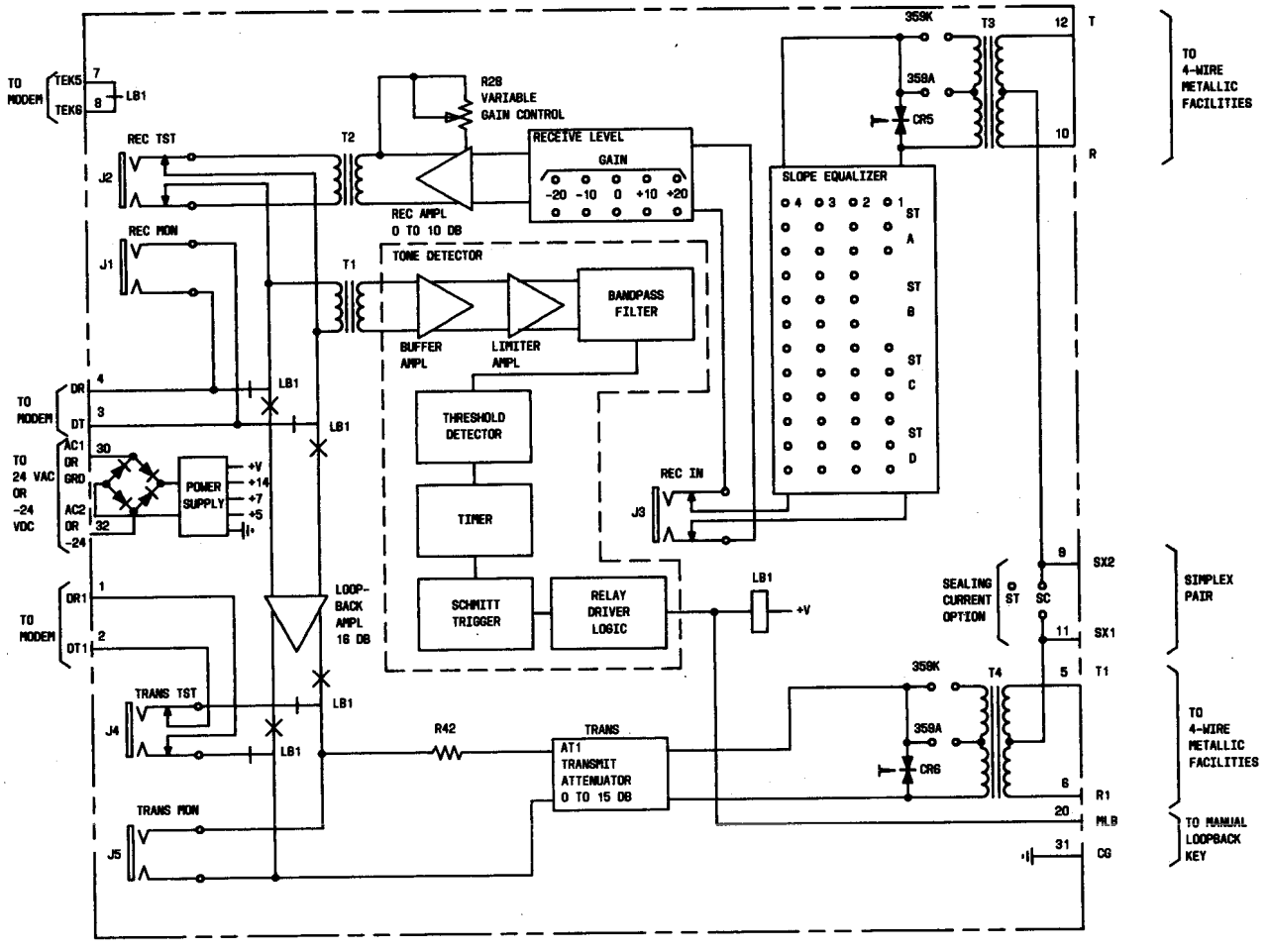


Fig. 49—DAS 829C-L1 CIU—Functional Diagram

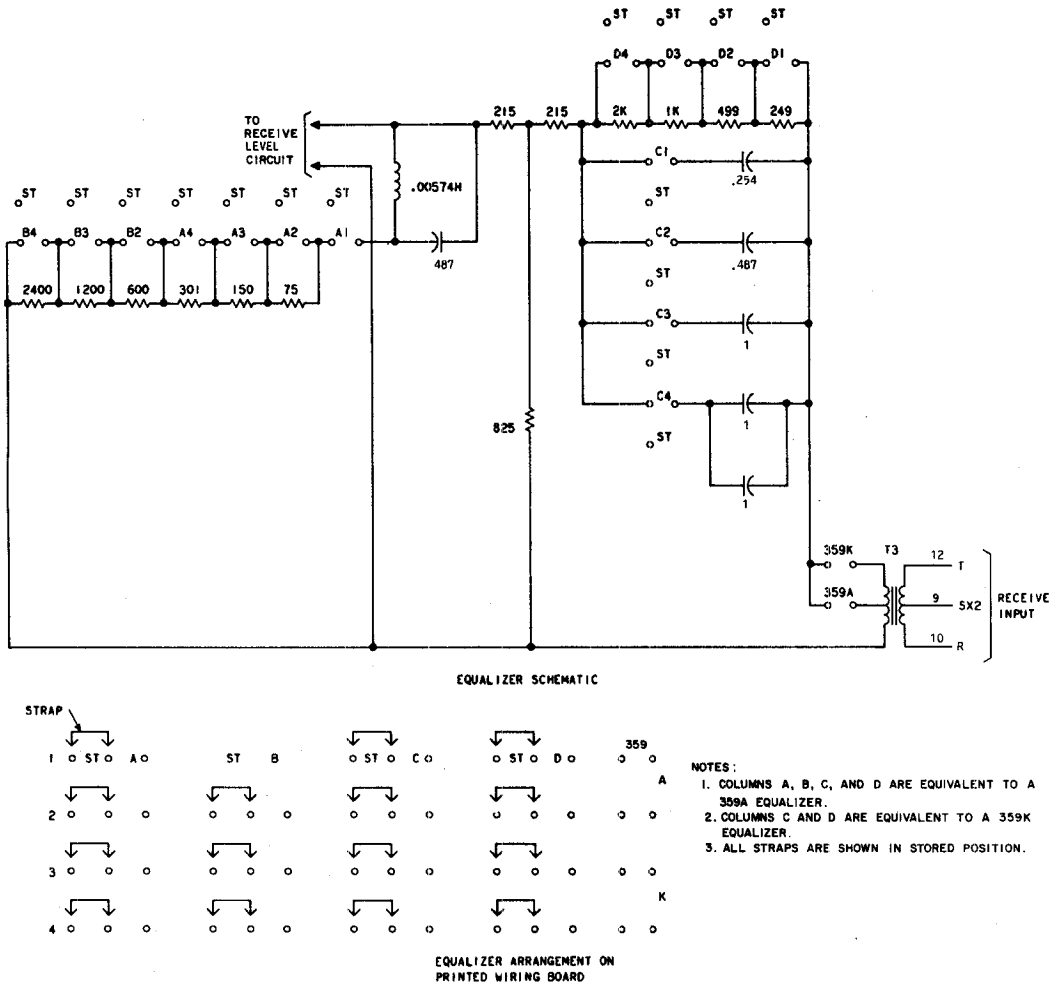


Fig. 50—Schematic and Physical Layout of Equalizer Circuit

jack J2 (REC TST), and the normally-closed contacts of relay LB1 to the modem receive pair (DT, DR).

3.42 Resistors R56 and F2 function as fuses for the modem receive pair (DT, DR) and the station receive pair (T, R), respectively. If excessive power is dissipated in resistor R56 or F2, the resistor opens to disconnect the hazardous voltage. Diodes CR15 and CR16 limit voltage surges in the circuit. The line impedance option provides a 600- or 1200-ohm line termination. Monitor jack J1 (REC MON) provides a monitoring point on the modem side of the CIU.

Loopback Circuit

3.43 The loopback circuit (Fig. 51) is the same as the loopback circuit described in paragraphs

3.12 through 3.15 for the DAS 829A-L1 CIU, with the following exceptions:

(a) A loopback amplifier gain option has been added to permit operation on either 8- or 16-dB channels.

(b) A light-emitting diode, DS1 (LB), has been added on the faceplate of the CIU to provide visual indication of the loopback mode. The diode is lighted when the CIU is in the loopback mode.

(c) The loopback control logic has been improved to ensure that the loopback logic will not respond to a 2713-Hz tone while the manual loopback key is operated, and to ensure that release of the manual loopback key will always return the CIU to the data mode.

(d) The loopback circuit can be disabled by means of an isolated (floating) low-impedance interface connection (such as a relay contact or an optically coupled transistor) between the DTD lead (pin 40) and the CG lead (pin 31). This feature is not available when the CIU is housed in a standard data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1), since these data mountings do not provide access to the DTD lead.

Not-in-Data Indication

3.44 The not-in data indication (Fig. 51) is the same as the not-in-data indication described in paragraphs 3.16 and 3.17 for the DAS 829A-L1 CIU.

Sealing Current Option

3.45 The sealing current option (Fig. 51) is the same as the sealing current option described in paragraph 3.18 for the DAS 829A-L1 CIU.

E. DAS 829B-L1A CIU

3.46 The DAS 829B-L1A CIU provides the transmission circuitry required for proper termination of medium or long nonloaded 4-wire metallic facilities that require gain in the receive path. A facility loopback circuit, a not-in-data indication, a sealing current option, a loopback amplifier gain option, and a power supply option are also provided. The 2-position power supply option enables the associated dc power supply to operate on 24 Vac (N position), -24 Vdc (N position), or -48 Vdc (-48 position). The 24 Vac input is obtained from a transformer associated with the data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1) that houses the CIU. The -24 and -48 Vdc inputs are obtained from an external power source. All connections to the CIU are made through the data mounting.

Transmit Circuit

3.47 In the data mode (Fig. 52), transmitted signals on the modem transmit pair (DT1, DR1) are passed through the normally-closed contacts of test jack J4 (TRANS TST), the normally-closed contacts of relay LB1, the 0 to 15 dB attenuator AT1 (TRANS), and transformer T1 to the station transmit pair (T1, R1).

3.48 Resistors R7 and F1 function as fuses for the modem transmit pair (DT1, DR1) and the station transmit pair (T1, R1), respectively. If excessive power is dissipated in resistor R7 or F1, the resistor opens to disconnect the hazardous voltage. Diodes CR1 and CR2 limit voltage surges in the circuit. The line impedance option provides a 150-, 600-, or 1200-ohm line termination. Monitor jack J5 (TRANS MON) provides a monitoring point on the modem side of the CIU.

Receive Circuit

3.49 In the data mode (Fig. 52), received signals on the station receive pair (T, R) are passed through transformer T3, the normally-closed contacts of input jack J3 (REC IN), the receive level circuit (coarse gain option), the 0 to 10 dB amplifier, transformer T4, the normally-closed contacts of test jack J2 (REC TST), and the normally-closed contacts of relay LB1 to the modem receive pair (DT, DR).

3.50 The coarse gain option provides coarse adjustment of the signal gain. The available coarse adjustments (GAIN) are +10, 0, -10, and -20 dB. Variable resistor R41 and the 0 to 10 dB amplifier provide fine adjustment of the signal gain. Resistors R56 and F2 function as fuses for the modem receive pair (DT, DR) and the station receive pair (T, R), respectively. If excessive power is dissipated in resistor R56 or F2, the resistor opens to disconnect the hazardous voltage. Diodes CR15 through CR17 limit voltage surges in

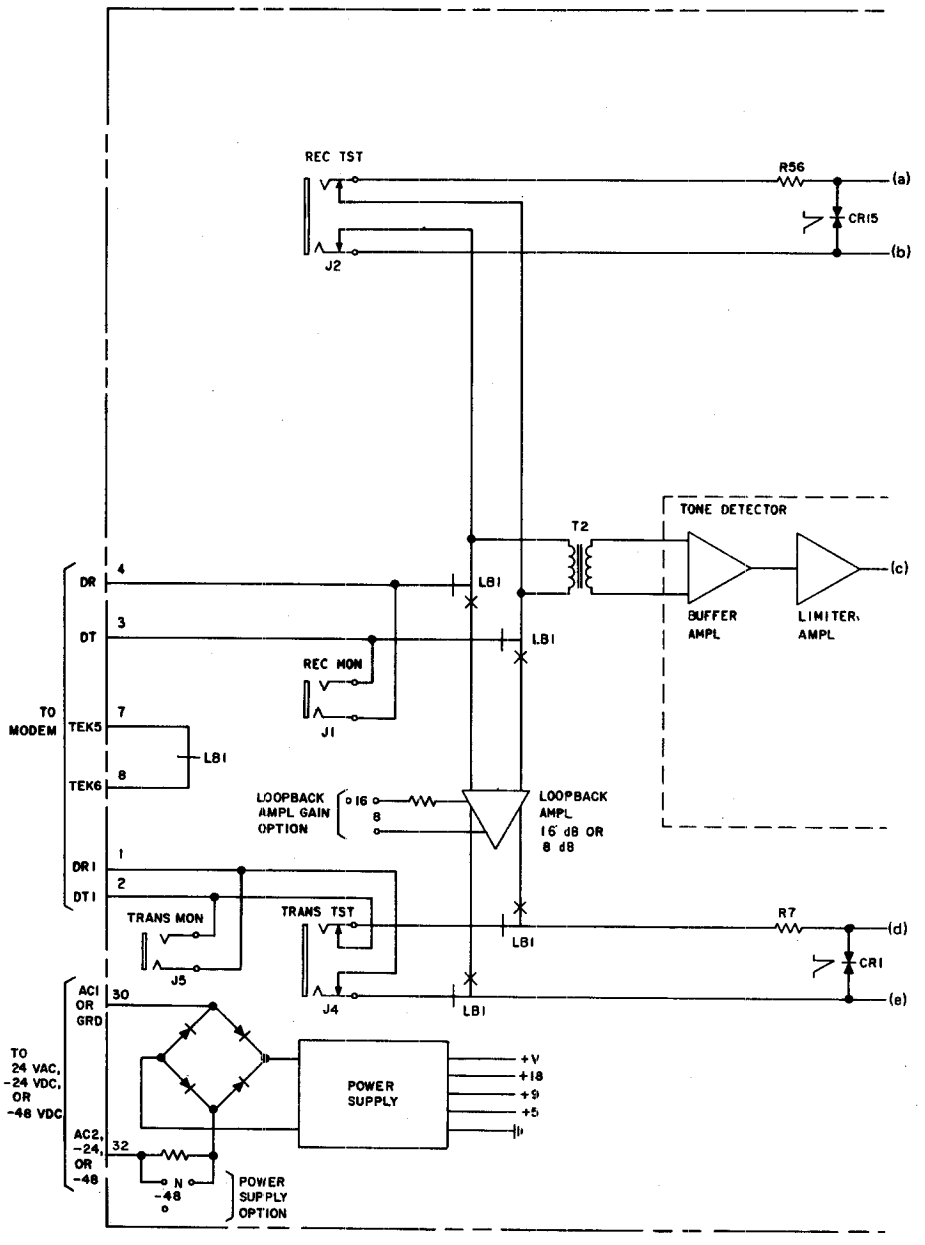


Fig. 51—DAS 829A-L1A CIU—Functional Diagram (Sheet 1 of 2)

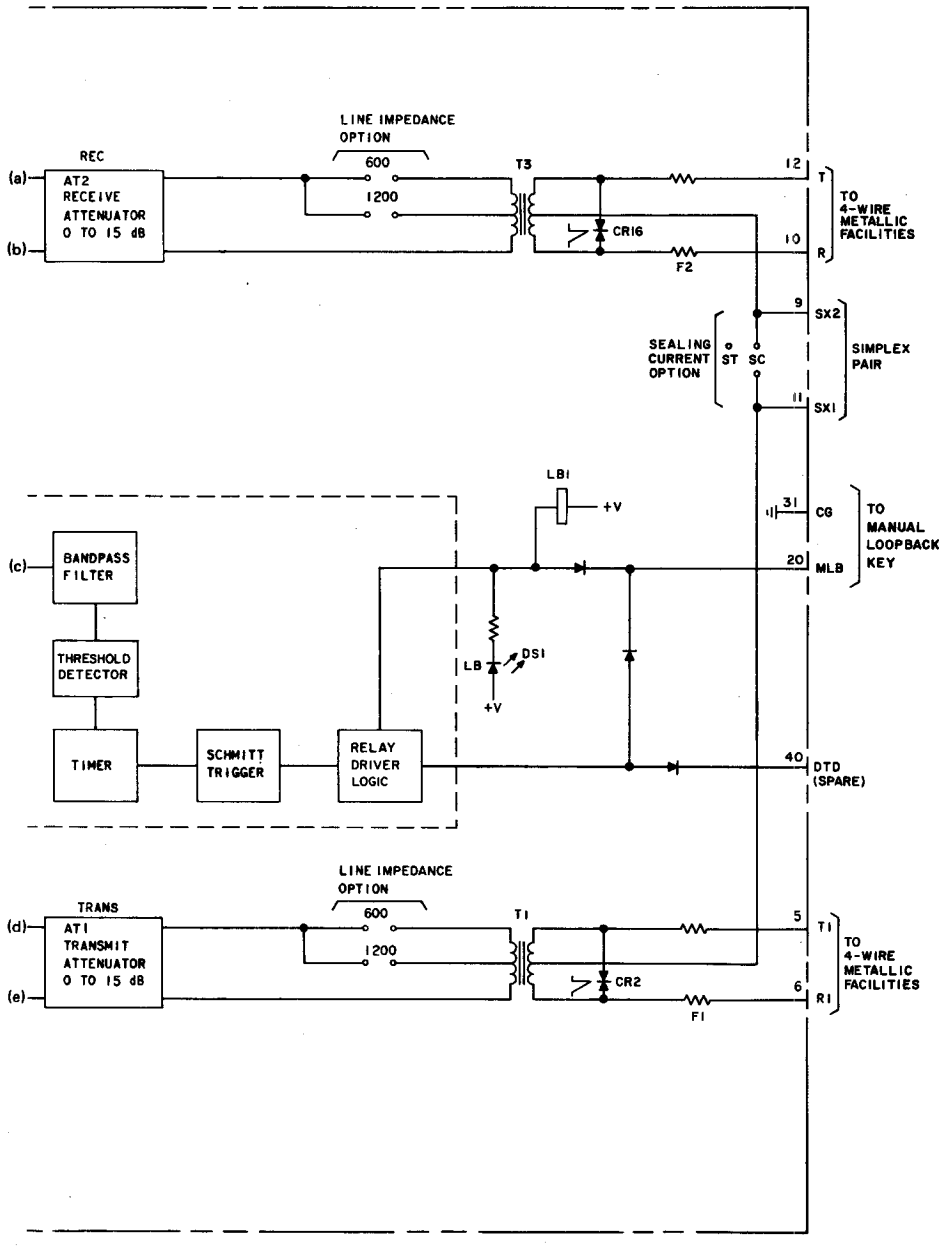


Fig. 51— DAS 829A-L1A CIU—Functional Diagram (Sheet 2 of 2)

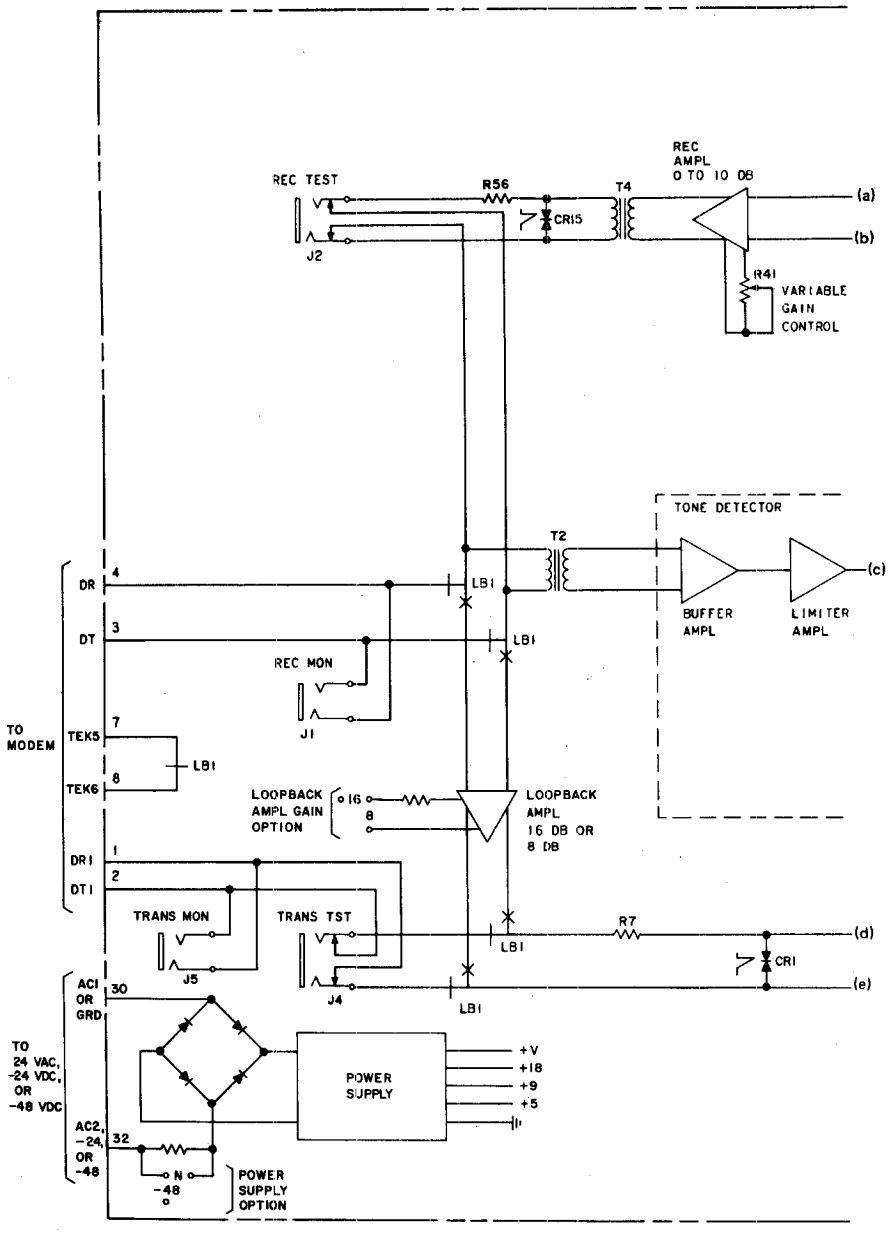


Fig. 52—DAS 829B-L1A CIU—Functional Diagram (Sheet 1 of 2)

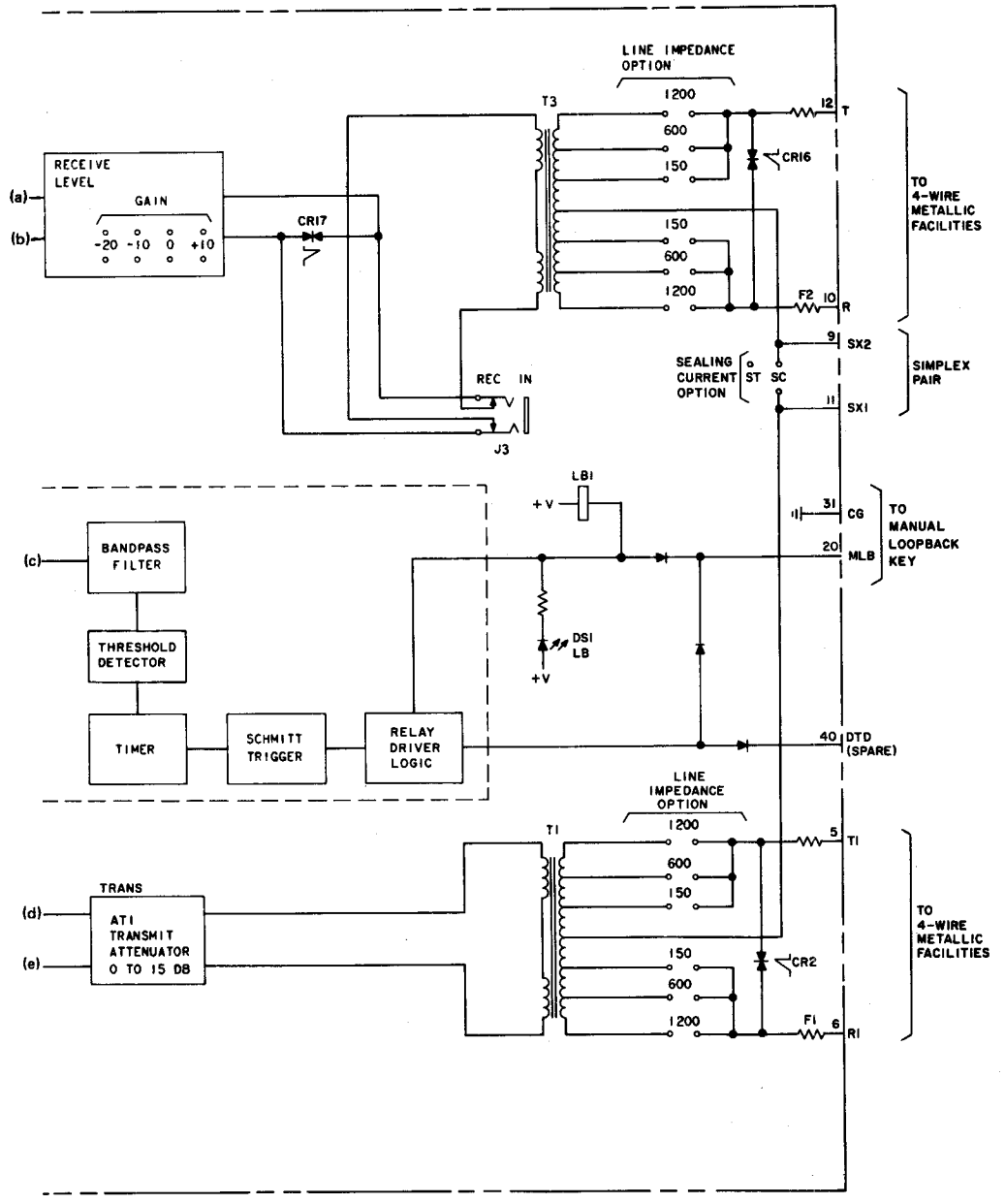


Fig. 52—DAS 829B-L1A CIU—Functional Diagram (Sheet 2 of 2)

the circuit. The line impedance option provides a 150-, 600-, or 1200-ohm line termination. Monitor jack J1 (REC MON) provides a monitoring point on the modem side of the CIU.

Loopback Circuit

3.51 The loopback circuit (Fig. 52) is the same as the loopback circuit described in paragraphs 3.12 through 3.15 for the DAS 829A-L1 CIU, with the following exceptions:

(a) A loopback amplifier gain option has been added to permit operation on either 8- or 16-dB channels.

(b) A light-emitting diode, DS1 (LB), has been added on the faceplate of the CIU to provide visual indication of the loopback mode. The diode is lighted when the CIU is in the loopback mode.

(c) The loopback control logic has been improved to ensure that the loopback logic will not respond to a 2713-Hz tone while the manual loopback key is operated, and to ensure that release of the manual loopback key will always return the CIU to the data mode.

(d) The loopback circuit can be disabled by means of an isolated (floating) low-impedance interface connection (such as a relay contact or an optically coupled transistor) between the DTD lead (pin 40) and the CG lead (pin 31). This feature is not available when the CIU is housed in a standard data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1), since these data mountings do not provide access to the DTD lead.

Not-in-Data Indication

3.52 The not-in-data indication (Fig. 52) is the same as the not-in-data indication described in paragraphs 3.16 and 3.17 for the DAS 829A-L1 CIU.

Sealing Current Option

3.53 The sealing current option (Fig. 52) is the same as the sealing current option described in paragraph 3.18 for the DAS 829A-L1 CIU.

F. DAS 829C-L1A CIU

3.54 The DAS 829C-L1A CIU provides the transmission circuitry required for proper termination of medium or long loaded 4-wire metallic facilities that require gain in the receive path and extensive amplitude equalization. A facility loopback circuit, a not-in-data indication, a sealing current option, a loopback amplifier gain option, and a power supply option are also provided. The 2-position power supply option enables the associated dc power supply to operate on 24 Vac (N position), -24 Vdc (N position), or -48 Vdc (-48 position). The 24 Vac input is obtained from a transformer associated with the data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1) that houses the CIU. The -24 and -48 Vdc inputs are obtained from an external power source. All connections to the CIU are made through the data mounting.

Transmit Circuit

3.55 In the data mode (Fig. 53), transmitted signals on the modem transmit pair (DT1, DR1) are passed through the normally-closed contacts of test jack J4 (TRANS TST), the normally-closed contacts of relay LB1, the 0 to 15 dB attenuator AT1 (TRANS), and transformer T1 to the station transmit pair (T1, R1).

3.56 Resistors R7 and F1 function as fuses for the modem transmit pair (DT1, DR1) and the station transmit pair (T1, R1), respectively. If excessive power is dissipated in resistor R7 or F1, the resistor opens to disconnect the hazardous voltage. Diodes CR1 and CR2 limit voltage surges in the circuit. The 359A or 359K equalizer equivalent option provides a 1200- or a 600-ohm line termination, respectively. Monitor jack J5 (TRANS MON) provides a monitoring point on the modem side of the CIU.

Receive Circuit

3.57 In the data mode (Fig. 53), received signals on the station receive pair (T, R) are passed through transformer T3, the slope equalizer circuit, the normally-closed contacts of input jack J3 (REC IN), the receive level circuit (coarse gain option), the 0 to 10 dB amplifier, transformer T4, the normally-closed contacts of test jack J2 (REC TST), and the normally-closed contacts of relay LB1 to the modem receive pair (DT, DR).

3.58 The coarse gain option provides coarse adjustment of the signal gain. The available coarse adjustments (GAIN) are +20, +10, 0, -10, and -20 dB. Variable resistor R41 and the 0 to 10 dB amplifier provide fine adjustment of the signal gain. Resistors R56 and F2 function as fuses for the modem receive pair (DT, DR) and the station receive pair (T, R), respectively. If excessive power is dissipated in resistor R56 or F2, the resistor opens to disconnect the hazardous voltage. Diodes CR15 and CR16 limit voltage surges in the circuit. The 359A or 359K equalizer equivalent option provides a 1200- or a 600-ohm line termination, respectively. Monitor jack J1 (REC MON) provides a monitoring point on the modem side of the CIU. The slope equalizer circuit is the same as the slope equalizer circuit described in paragraphs 3.32 through 3.34 for the DAS 829C-L1 CIU.

Loopback Circuit

3.59 The loopback circuit (Fig. 53) is the same as the loopback circuit described in paragraphs 3.12 through 3.15 for the DAS 829A-L1 CIU, with the following exceptions:

(a) A loopback amplifier gain option has been added to permit operation on either 8- or 16-dB channels.

(b) A light-emitting diode, DS1 (LB), has been added on the faceplate of the CIU to provide visual indication of the loopback mode. The diode is lighted when the CIU is in the loopback mode.

(c) The loopback control logic has been improved to ensure that the loopback logic will not respond to a 2713-Hz tone while the manual loopback key is operated, and to ensure that release of the manual loopback key will always return the CIU to the data mode.

(d) The loopback circuit can be disabled by means of an isolated (floating) low-impedance interface connection (such as a relay contact or an optically coupled transistor) between the DTD lead (pin 40) and the CG lead (pin 31). This feature is not available when the CIU is housed in a standard data mounting (44A1, 44A2, 45A1, 46A1, 46A2, 59A1, or 62A1), since these data mountings do not provide access to the DTD lead.

Not-in-Data Indication

3.60 The not-in-data indication (Fig. 53) is the same as the not-in-data indication described in paragraphs 3.16 and 3.17 for the DAS 829A-L1 CIU.

Sealing Current Option

3.61 The sealing current option (Fig. 53) is the same as the sealing current option described in paragraph 3.18 for the DAS 829A-L1 CIU.

48A1 DATA UNIT

3.62 The 48A1 data unit provides the switching, signaling, and transmission circuitry required to add alternate voice service to 4-wire or 2-wire private line data service. A dc power supply in the data unit obtains its unregulated input from a bridge rectifier power supply in the data mounting (45A1, 46B1, or 59A1) that houses the data unit. All connections to the data unit are made through the data mounting.

3.63 For alternate voice service on a single 4-wire private line, the 48A1 data unit is housed in a 45A1 or 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU. If dial backup service is provided, a 48B1 data unit is also housed in the 45A1 or 59A1 data mounting or a 48ER1 data unit is also housed in the 59A1 data mounting. For alternate voice service on a single 2-wire private line, the 48A1 data unit is housed in a 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU and 48G1 data unit. A 6-button key telephone set (565HK, 565HKM, 2565HK, or 2565HKM) is used with the 48A1 data unit. The fourth pickup key (RING) on the telephone set must be converted to nonlocking operation and the six pushbuttons labeled as follows:

HOLD	—	—	PL TALK	RING	—

3.64 For alternate voice service on multiple (up to eight) 4-wire or 2-wire private lines, the 48A1 data units are housed in a 46B1 data mounting and the required DAS 829-type CIUs are housed

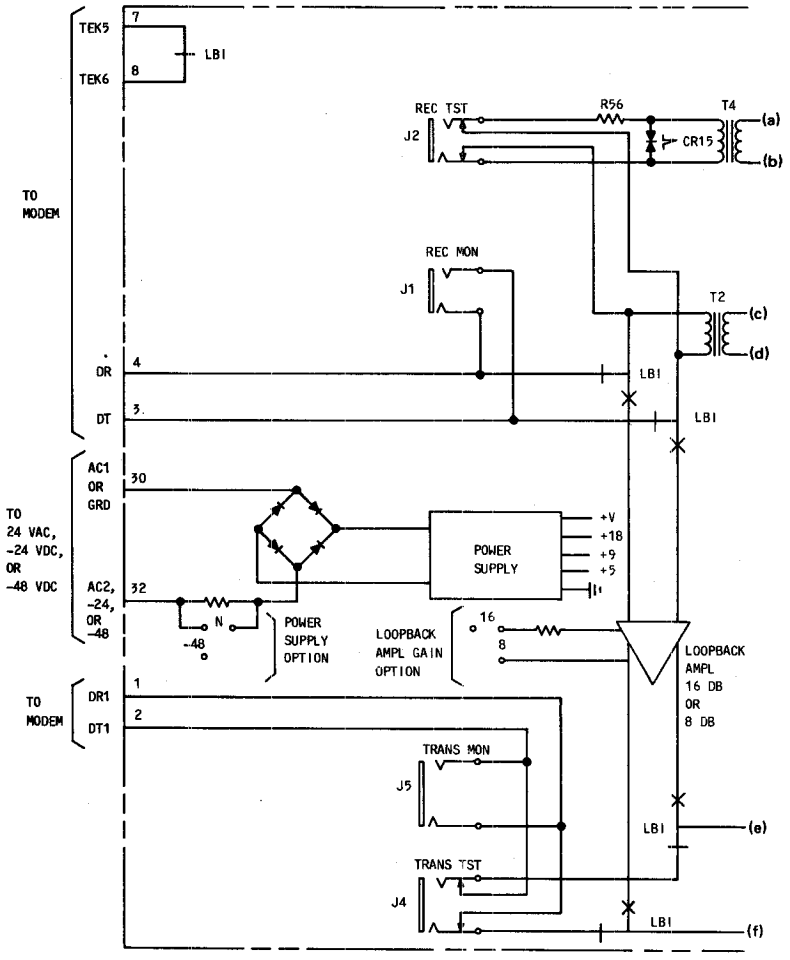


Fig. 53—DAS 829C-L1A CIU—Functional Diagram (Sheet 1 of 2)

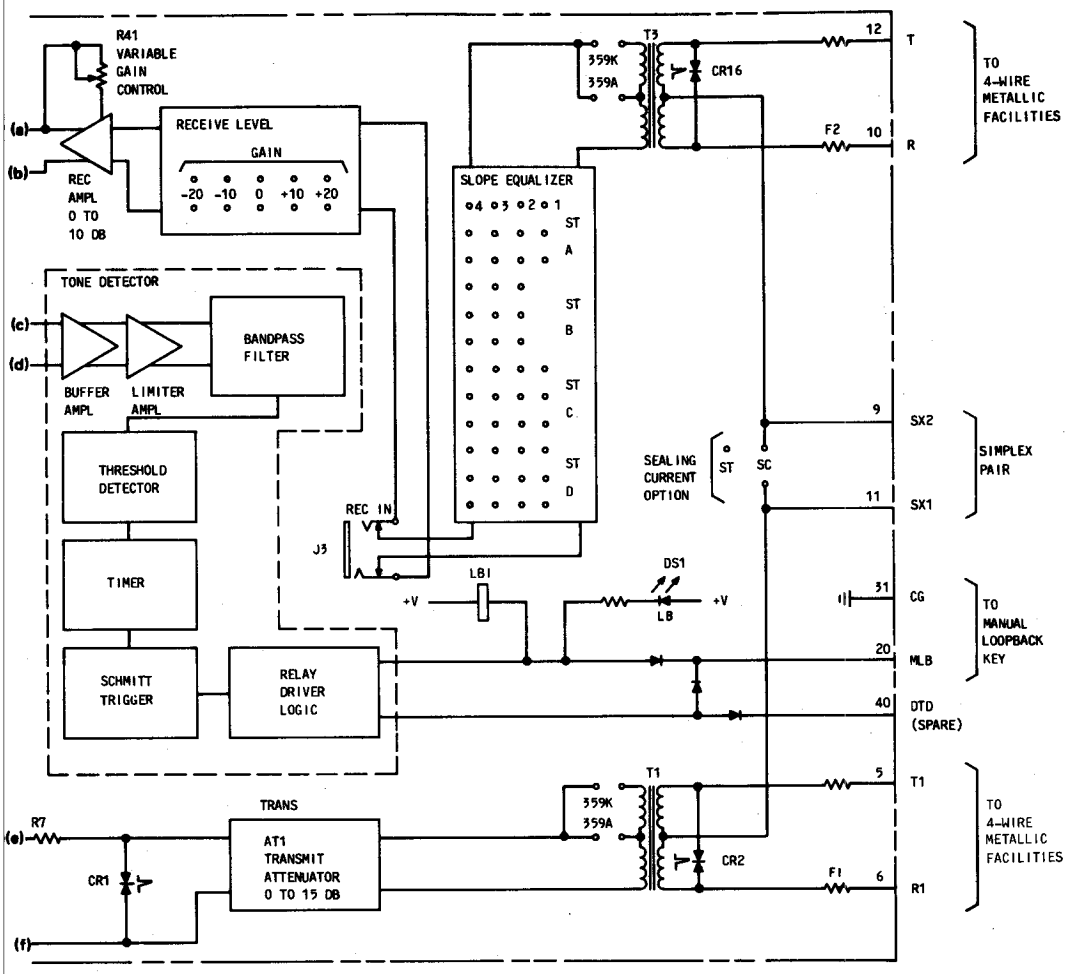


Fig. 53—DAS 829C-L1A CIU—Functional Diagram (Sheet 2 of 2)

in a 46A1 or 46A2 data mounting. The additional 48G1 data units required on 2-wire private lines are housed in a separate 46B1 data mounting. A 10-button key telephone set (830-type or 2830-type) is used with the 48A1 data units. The ninth pickup key (RING) on the telephone set must be converted to nonlocking operation and the ten pushbuttons labeled as follows:

HOLD	PL TALK1	PL TALK2	PL TALK3	PL TALK4

PL TALK5	PL TALK6	PL TALK7	PL TALK8	RING

A. Data Service

3.65 In the data mode (Fig. 3), the 4-wire modem can transmit and receive data over the 4-wire private line since the 48A1 data unit provides a through connection for the standard 6-lead interface (DT, DR, DT1, DR1, TEK5, TEK6) that connects the 4-wire modem to the DAS 829-type CIU. This 6-lead interface is complete through the normally-closed contacts of the TK relay in the 48A1 data unit as long as the 48A1 data unit remains in the data mode. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6, if the DAS 829-type CIU is also in the data mode.

3.66 In the data mode (Fig. 8), the 2-wire modem can transmit and receive data over the 2-wire private line since the 48A1 data unit provides a through connection for the 4-wire port of the 2-wire to 4-wire hybrid network in the 48G1 data unit that connects the 2-wire modem to the DAS 829-type CIU. The 4-wire transmission path and the 2-wire line status path are complete through the normally-closed contacts of the TK relay in the 48A1 data unit as long as the 48A1 data unit remains in the data mode. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6, if the DAS 829-type CIU is also in the data mode.

3.67 When data units are not installed in all positions of the 45A1, 46B1, or 59A1 data mounting, the data unit connectors at the vacant positions of the data mounting provide a through connection for the 6-lead interface.

B. Alternate Voice Service

3.68 In the alternate voice mode (Fig. 3 or 8), operation of the TK relay in the 48A1 data unit disconnects the modem and connects the key telephone set to the private line. A not-in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6.

3.69 The description in the following paragraphs assumes that the 48A1 data unit (Fig. 54) is installed in the 45A1 or 59A1 data mounting (Fig. 55 or 58), the required DAS 829-type CIU is installed in the data mounting, the required key telephone set is provided, and all necessary connections are made. The following description also applies to the 48A1 data unit when it is installed in the 46B1 data mounting. Operation of the 48A1 data unit is the same for 4-wire or 2-wire private lines.

Alternate Voice Mode

3.70 To put the 48A1 data unit in the alternate voice mode, the TK relay must be operated by taking the telephone handset off-hook and depressing the PL TALK key. This initiates the following actions:

(a) The PL TALK lamp on the telephone set lights.

(b) The modem is disconnected from the transmit and receive pairs and a not-in-data indication is supplied to the modem on interface leads TEK5 and TEK6.

(c) The transmit pair (DT1, DR1) is connected to the telephone set through an amplifier and a balanced hybrid circuit.

(d) The receive pair (DT, DR) is connected to the telephone set through a fixed attenuator and the balanced hybrid circuit.

(e) The 2600-Hz tone (inband ring) detector is disabled.

(f) The relay driver logic for ringdown signaling is partially enabled.

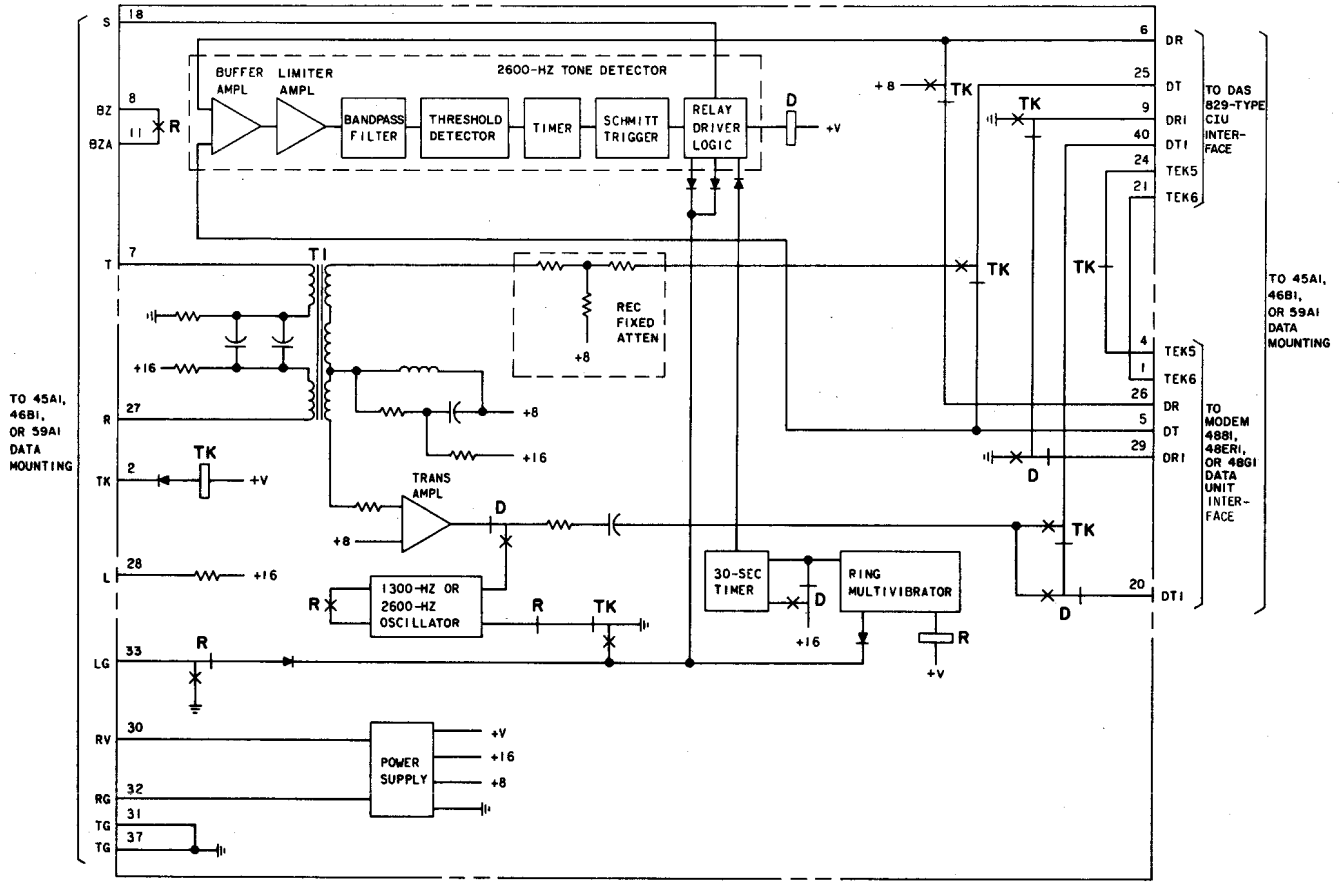
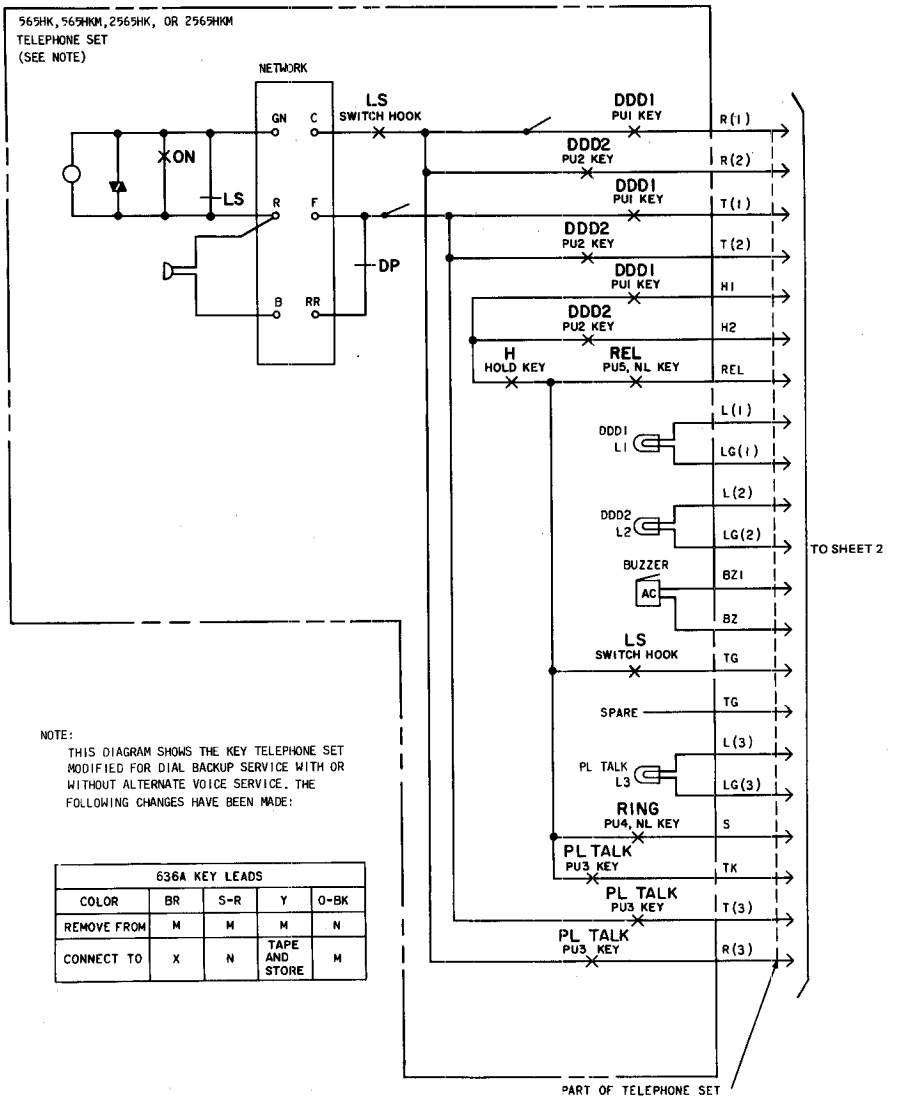


Fig. 54—48A1 Data Unit—Functional Diagram



NOTE:
THIS DIAGRAM SHOWS THE KEY TELEPHONE SET MODIFIED FOR DIAL BACKUP SERVICE WITH OR WITHOUT ALTERNATE VOICE SERVICE. THE FOLLOWING CHANGES HAVE BEEN MADE:

636A KEY LEADS				
COLOR	BR	S-R	Y	O-BK
REMOVE FROM	M	M	M	N
CONNECT TO	X	N	TAPE AND STORE	M

Fig. 55—45A1 Data Mounting—Interface Diagram (Sheet 1 of 4)

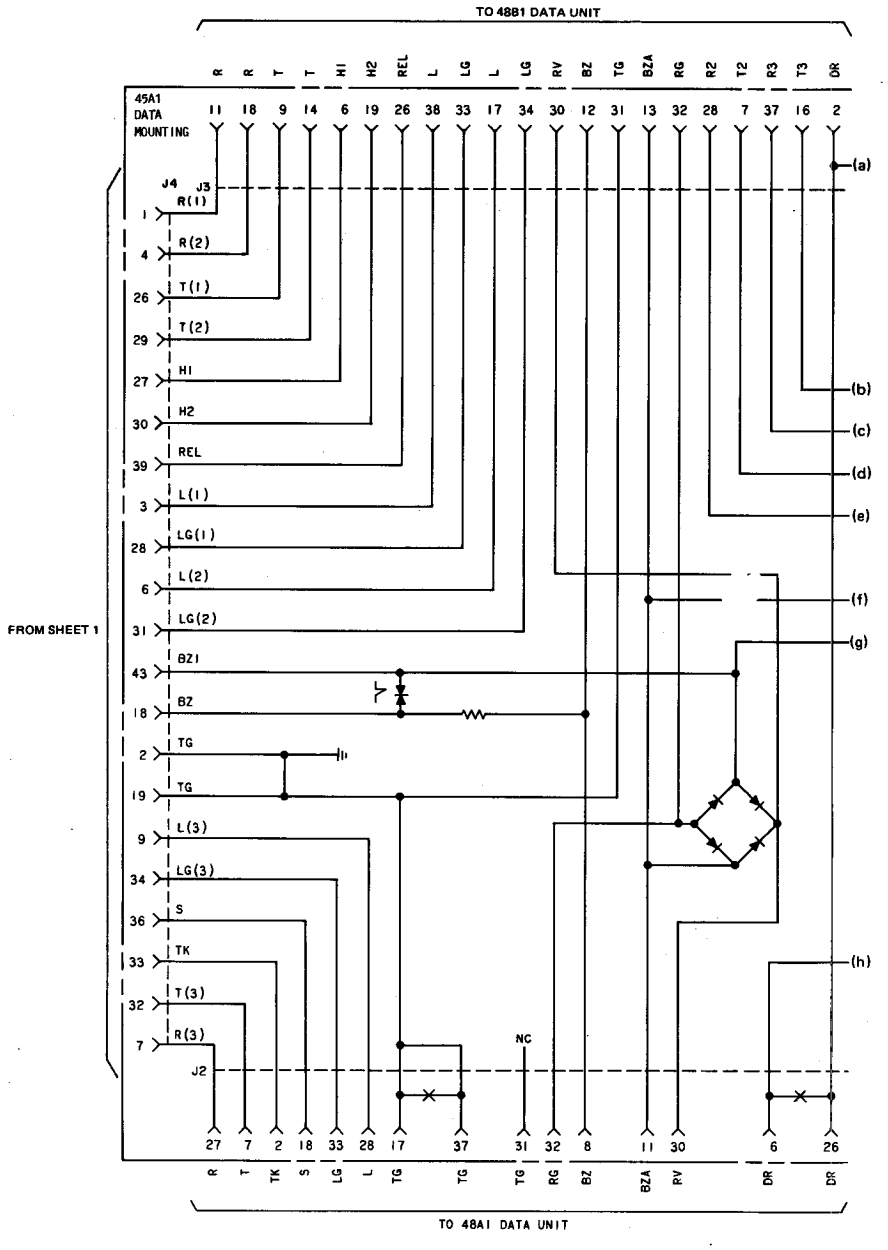


Fig. 55— 45A1 Data Mounting—Interface Diagram (Sheet 2 of 4)

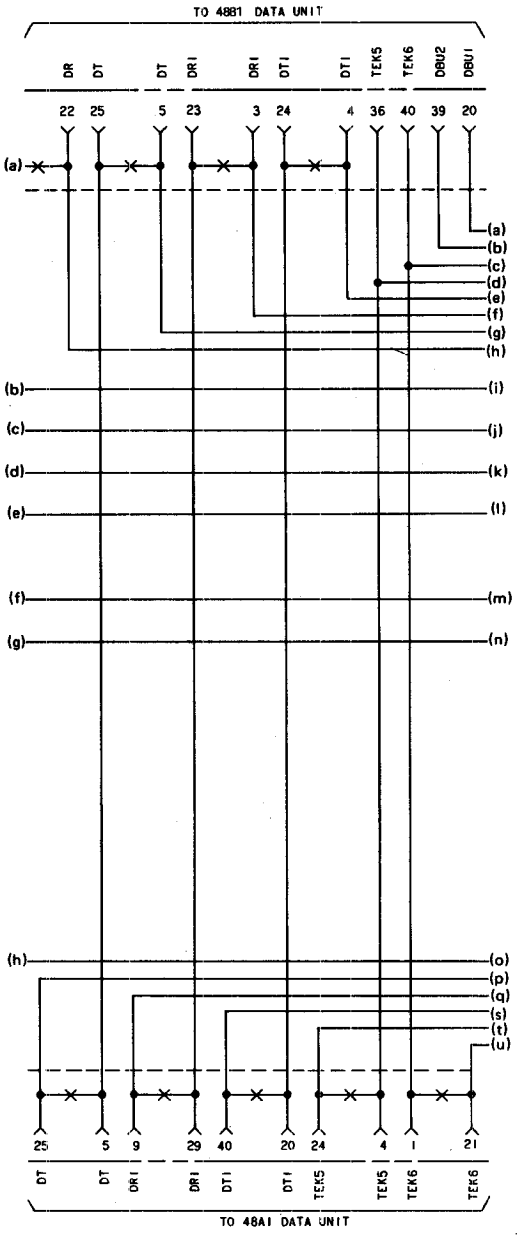


Fig. 55—45A1 Data Mounting—Interface Diagram (Sheet 3 of 4)

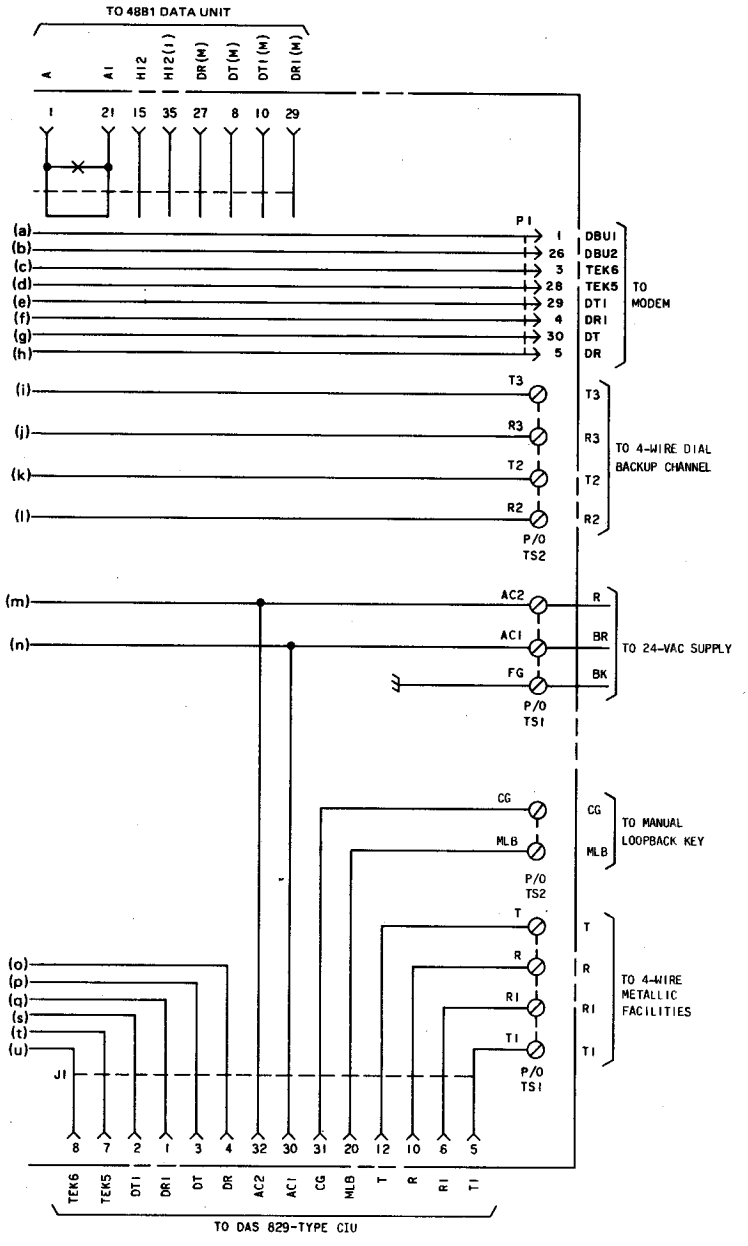


Fig. 55— 45A1 Data Mounting—Interface Diagram (Sheet 4 of 4)

3.71 The 48A1 data unit is now in the alternate voice mode (TK relay operated) and conversation can take place over the private line if the far end is also in the alternate voice mode.

3.72 The amplifier in the transmit pair and the fixed attenuator in the receive pair of the 48A1 data unit provide the required transmission level at the interface with the DAS 829-type CIU. The required level at this interface is +13 TLP (0 dBm) transmit and -3 TLP (-16 dBm) receive. The level at the 2-wire telephone set interface is 0 TLP transmit and -10 TLP receive.

Ringdown Signaling in Alternate Voice Mode

3.73 When the 48A1 data unit is in the alternate voice mode (TK relay operated), ringdown signaling is initiated by depressing the nonlocking RING key on the telephone set. This causes the relay driver logic in the data unit to operate the D relay. Since both TK and D relays are now operated, the transmit amplifier is disconnected from the transmit pair, a 2600-Hz oscillator is connected to the transmit pair, and a 2600-Hz ringdown signal is sent to the far end. At that end, the DAS 829-type CIU and the 48A1 data unit must be in the data mode to receive the 2600-Hz signal. If the CIU is in the loopback mode or the data unit is in the alternate voice mode, the 2600-Hz tone detector in the data unit cannot be activated.

3.74 The RING key should remain depressed until an audible ringback signal (bursts of 1300 Hz) is heard in the handset. This signal should be heard within 10 seconds after the RING key is depressed. When the signal is heard, the RING key should be released. The far end, if unanswered, will ring for about 30 seconds. If the RING key remains depressed for more than 30 seconds, the far end will ring until the RING key is released.

Ringdown Signaling in Data Mode

3.75 When the 48A1 data unit is in the data mode (TK relay released) and a 2600-Hz ringdown signal is detected by the 2600-Hz tone detector in the data unit, the relay driver logic causes the D relay to operate and put the data unit in the ring mode. Operation of the D relay initiates the following actions:

(a) A 30-second timer is activated. The timer ensures that the data unit will remain in the ring mode for about 30 seconds. If the 2600-Hz signal is still being detected when the timed interval elapses, the data unit will remain in the ring mode until the 2600-Hz signal is removed.

(b) The modem and the transmit amplifier are disconnected from the transmit pair and a 1300-Hz oscillator is connected to the transmit pair.

(c) A ring multivibrator is activated that periodically operates and releases the R relay. This cycling of the R relay causes the PL TALK lamp in the telephone set to flash and the buzzer to sound. The cycling also causes the 1300-Hz oscillator in the data unit to send an audible ringback signal (bursts of 1300 Hz) to the far end.

3.76 The ring mode is ended when the 48A1 data unit is placed in the alternate voice mode (TK relay operated).

C. Alternate Voice Call Sequence

3.77 To originate a voice call using the 48A1 data unit, perform the following steps:

(a) Depress the desired PL TALK key.

(b) Take the telephone handset off-hook.

(c) The PL TALK lamp is lighted while the 48A1 data unit is in the voice mode.

(d) Depress the RING key until the audible ringback signal is heard in the handset. When the audible ringback signal ceases, the RING key can be depressed again to initiate a new ring cycle.

Note: When the far end is equipped with a DAS 828A-type CIU there is no audible ringback signal. In this case, depress the RING key until the far end responds.

3.78 To answer a voice call, perform the following steps:

(a) Depress the PL TALK key associated with a flashing lamp.

(b) Take the telephone handset off-hook and talk.

3.79 To end a voice call and return to the data mode, perform the following steps:

(a) Depress and release the HOLD key to return the PL TALK key to its normal (released) position.

(b) The PL TALK lamp goes off.

(c) Place the telephone handset on-hook.

48B1 DATA UNIT

3.80 The 48B1 data unit provides the switching, ring detection, and transmission circuitry required to add 4-wire dial backup service with manual dialing to 4-wire private line data or data with alternate voice service. A dc power supply in the data unit obtains its unregulated input from a bridge rectifier power supply associated with the data mounting (45A1, 46C1, 46C2, or 59A1) that houses the data unit. All connections to the data unit are made through the data mounting.

A. Arrangements

3.81 The 48B1 data unit can be used to provide 4-wire dial backup service in the following equipment arrangements: single installation (manual dialing), and multiple installation (manual dialing).

Single Installation (Manual Dialing)

3.82 For 4-wire dial backup service with manual dialing on a single 4-wire private line, the 48B1 data unit is housed in a 45A1 or 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU and a 48A1 data unit (if alternate voice service is provided). A 6-button key telephone set (565HK, 565HKM, 2565HK, or 2565HKM) provides control of the 48B1 data unit.

(a) When used for dial backup service only, the key telephone set must be modified as shown in Fig. 55 or 58, the fifth pickup key (REL) converted to nonlocking operation, and the six pushbuttons labeled as follows:

HOLD	DDD1	DDD2	—	—	REL

(b) When used for dial backup and alternate voice service, the key telephone set must be modified as shown in Fig. 55 or 58, the fourth pickup key (RING) and the fifth pickup key (REL) converted to nonlocking operation, and the six pushbuttons labeled as follows:

HOLD	DDD1	DDD2	PL TALK	RING	REL

3.83 For a detailed description of the single installation (manual dialing) arrangement, refer to paragraphs 3.86 through 3.111.

Multiple Installation (Manual Dialing)

3.84 For 4-wire dial backup service with manual dialing on multiple 4-wire private lines, the 48B1 data unit is housed in a 46C1 or 46C2 data mounting and switched dial backup is used. An 18- or 30-button CALL DIRECTOR key telephone set provides control of the 48B1 data unit.

3.85 For a detailed description of the multiple installation (manual dialing) arrangement, refer to paragraphs 3.112 through 3.133.

B. Data Service

3.86 In the data mode (Fig. 3), the 4-wire modem can transmit and receive data over the 4-wire private line since the 48B1 data unit provides a through connection for the transmission leads of the standard 6-lead interface (DT, DR, DT1, DR1, TEK5, TEK6) that connects the modem to the DAS 829-type CIU. The four transmission leads (DT, DR, DT1, DR1) are complete through the normally-closed contacts of the A relay in the 48B1 data unit as long as the 48B1 data unit remains in the data mode. An in-data line status signal is

supplied to the modem on interface leads TEK5 and TEK6, if the 48A1 data unit and the DAS 829-type CIU are also in the data mode. Two additional interface leads, DBU1 and DBU2, supply a dial backup status signal to the modem.

3.87 When data units are not installed in all positions of the 45A1 or 59A1 data mounting, the data unit connectors at the vacant positions of the data mounting provide a through connection for the 6-lead interface.

3.88 The following are the transmission leads from the DAS 829-type CIU (or a 48A1 data unit, if alternate voice service is provided) and the corresponding 48B1 terminal numbers (Fig. 56):

Designation	48B1 Terminal Number
DT	25
DR	2
DT1	24
DR1	23

3.89 For 4-wire dial backup service on a single 4-wire private line, the following are the transmission leads from the modem and the corresponding 48B1 terminal numbers (Fig. 56):

Designation	48B1 Terminal Number
DT	5
DR	22
DT1	4
DR1	3

C. Dial Backup Service

3.90 In the dial backup mode (Fig. 3), operation of the A relay in the 48B1 data unit transfers the 4-wire modem from the 4-wire private line to the 4-wire dial backup channel. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

Transmit Circuit

3.91 In the dial backup mode (A relay operated, Fig. 56), the modem transmit pair (DT1, DR1) is connected through the normally-open contacts of relay A, the 0 to 15 dB attenuator AT1, line-holding transformer T1, and the normally-open contacts of relay H1 to the 2-wire dial-up line terminating on T2 and R2.

3.92 The 48B1 data unit provides a 900-ohm termination for the dial-up line and a 600-ohm termination for the modem. Diode CR1 limits voltage surges in the circuit.

Receive Circuit

3.93 In the dial backup mode (A relay operated, Fig. 56), the modem receiver pair (DT, DR) is connected through the normally-open contacts of relay A, the normally-closed contacts of test jack J1 (REC), isolation transformer T3, the slope equalizer option, the -6 to +14 dB amplifier, line-holding transformer T2, and the normally-open contacts of relay H2 to the 2-wire dial-up line terminating on T3 and R3.

3.94 The 48B1 data unit provides a 900-ohm termination for the dial-up line and a 600-ohm termination for the modem. Diode CR2 limits voltage surges in the circuit. Variable resistor R9 and the -6 to +14 dB amplifier provide adjustment of the signal gain. The slope equalizer option provides either 0 or 4 dB of slope equalization.

Dial Backup Mode

3.95 The description in the following paragraphs assumes that the 48B1 data unit (Fig. 56) is installed in the 45A1 or 59A1 data mounting (Fig. 55 or 58), the required DAS 829-type CIU is installed in the data mounting, the required key telephone set is provided, and all necessary connections are made.

3.96 To put the 48B1 data unit in the dial backup mode, the H2, H1, and A relays are operated.

(a) The H2 relay is operated by taking the telephone handset off-hook and depressing the DDD2 and HOLD keys. The H2 relay latches under control of a release circuit in the data unit and the DDD2 lamp on the telephone set lights. The 2-wire dial-up line (DDD2) terminating

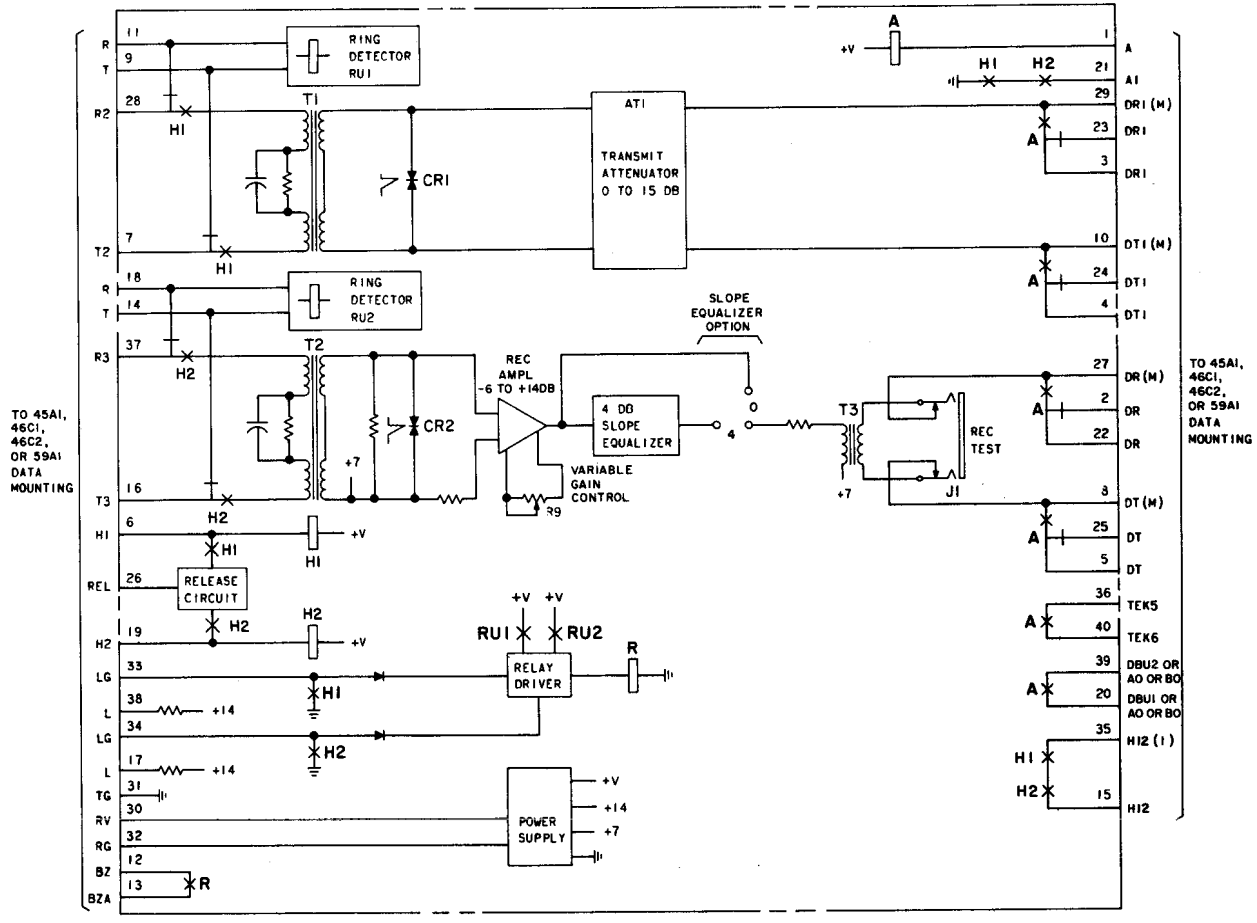


Fig. 56—48B1 Data Unit—Functional Diagram

on T3 and R3 is transferred from the telephone set to the receive circuit of the data unit and is now in the hold mode.

(b) The H1 relay is operated by taking the telephone handset off-hook and depressing the DDD1 and HOLD keys. The H1 relay latches under control of a release circuit in the data unit and the DDD1 lamp on the telephone set lights. The 2-wire dial-up line (DDD1) terminating on T2 and R2 is transferred from the telephone set to the transmit circuit of the data unit and is now in the hold mode.

(c) With the DDD2 and DDD1 dial-up lines in the hold mode (H2 and H1 relays operated), the A relay operates. The modem is transferred from the 4-wire private line to the transmit and receive circuits of the data unit. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

(d) The data unit is now in the dial backup mode (A relay operated) and data transmission can take place over the 4-wire dial backup channel.

Release From Hold Mode

3.97 When either the DDD2 or DDD1 lamp is lighted (H2 or H1 relay operated), the associated 2-wire dial-up line (DDD2 or DDD1) is in the hold mode. Release of a dial-up line from the hold mode is accomplished as follows:

(a) Take the telephone handset off-hook.

(b) Depress the REL key.

(c) The DDD2 or DDD1 lamp goes off (H2 or H1 relay released) indicating that the DDD2 or DDD1 dial-up line is released from the hold mode and returned to telephone set control.

(d) Place the telephone handset on-hook.

Note: The dial-up lines cannot be released from the hold mode except as described above.

Release From Dial Backup Mode

3.98 When both the DDD2 and DDD1 lamps are lighted (H2 and H1 relays operated), the 48B1 data unit is in the dial backup mode (A relay operated). Release of the data unit from the dial backup mode is accomplished as follows:

(a) Take the telephone handset off-hook.

(b) Depress the REL key.

(c) The DDD2 and DDD1 lamps go off (H2 and H1 relays released) indicating the data unit is released from the dial backup mode (A relay released) and the DDD2 and DDD1 dial-up lines are returned to telephone set control.

(d) Place the telephone handset on-hook.

Note: The data unit cannot be released from the dial backup mode except as described above.

3.99 The line holding arrangement described above provides the following features that were not available with the DAS 828C-type CIU.

(a) The telephone handset can be placed on-hook without ending the dial backup mode.

(b) Multiple installations requiring more than one 4-wire dial backup channel can be provided.

Ring Detection

3.100 A ring detector circuit and a 2-wire telephone set line are connected to each 2-wire dial-up line (DDD1 and DDD2). A ringing signal on either idle dial-up line (DDD1 or DDD2) operates the relay (RU1 or RU2) in the ring detector circuit associated with the dial-up line and causes the corresponding lamp (DDD1 or DDD2) to flash. When either the RU1 or RU2 relay is operated, the R relay operates and causes the telephone set buzzer to sound.

3.101 The ring detector circuits and telephone set lines are only connected to the dial-up lines when the data unit is not in the hold or dial backup modes. If the data unit is in the dial backup mode, both ring detector circuits and associated telephone set lines are disconnected. If either

dial-up line is in the hold mode, the associated ring detector circuit and telephone set line are disconnected.

D. Dial Backup Call Sequence

3.102 A preferred dial backup call sequence for two stations, A and B, is described in the following paragraphs. This description assumes that the following conditions exist:

(a) The 4-wire modem is used to transmit and receive data over a 4-wire private line terminated with a DAS 829-type CIU that is conditioned for data transmission and the 48B1 data unit is used for 4-wire dial backup at both stations.

(b) Station A initiates the first call on line 2 and Station B answers the call on line 1.

(c) Station A initiates the second call on line 1 and Station B answers the call on line 2.

3.103 As long as line 1 of one station is connected to line 2 of the other station, either station can initiate both calls, or either station can initiate the first call and the other station can initiate the second call.

Idle State

3.104 At both Station A and Station B, all dial-up line lamps (DDD1 and DDD2) are off and the telephone handsets are on-hook. The modem is connected through the 48B1 data unit to the 4-wire private line terminated by the DAS 829-type CIU. Both 2-wire dial-up lines (DDD1 and DDD2) are released and connected to their ring detector circuits. The 48B1 data unit passes an in-data or not-in-data indication to the modem, as determined by the DAS 829-type CIU. Since the DAS 829-type CIU is conditioned for data transmission, an in-data indication is passed.

First Call

3.105 The sequence begins with Station A deciding for some reason, such as the inability of the modem to send data over the 4-wire private line, that a backup connection should be made. Station A goes off-hook, selects line 2 by depressing the DDD2 key, and dials line 1 of Station B.

3.106 At Station B, a ringing signal causes the line 1 (DDD1) lamp to flash and the telephone set buzzer to sound. Station B then goes off-hook and depresses the DDD1 key. Ringing stops and conversation can now take place. If the connection is not satisfactory, the call can be dropped by placing the handset on-hook, and then reinitiated. At this point both line lamps (DDD1 and DDD2) are off at each station.

3.107 Once the nature of the call is established (backup) and the procedure for the next call determined, both stations hold their respective lines. At Station A, the HOLD key is depressed until the line 2 (DDD2) lamp lights, indicating line 2 is being held. At Station B, a similar procedure puts line 1 on hold. At this point, one line lamp is lighted at each station. The stations need not remain off-hook to hold the call.

Second Call

3.108 Station A selects line 1 by depressing the DDD1 key and dials line 2 of Station B. At Station B, a ringing signal causes the line 2 (DDD2) lamp to flash and the telephone set buzzer to sound. Station B then depresses the DDD2 key and answers the call. If the connection is not satisfactory, the second call can be dropped by placing the telephone handset on-hook, and then reinitiated. Both stations now hold their respective lines by depressing the HOLD key. The stations need not remain off-hook to hold the call.

Data Transmission

3.109 Once the second call is held, the 48B1 data unit at each station enters the dial backup mode, as indicated by the DDD1 and DDD2 lamps at each station being lighted. The modem at each station is transferred from the 4-wire private line to the 4-wire dial backup channel composed of dial-up lines 1 and 2 and an in-data indication is passed to the modems. At this point, each station should go on-hook.

3.110 The modems now have a complete 4-wire data transmission path over the dial backup channel. While the modems are connected to the dial backup channel, the 4-wire private line can be tested from a remote location without interfering with data transmission over the dial backup channel. If alternate voice service is provided, the 4-wire private line can also be used for conversation.

Return to Idle State

3.111 Once the 4-wire private line is cleared for data transmission, the modems can be returned to the 4-wire private line. Each station goes off-hook and the REL key is depressed until the line lamps (DDD1 and DDD2) go off. Each station now goes on-hook and is again in the idle state.

48C1 DATA UNIT AND 46C1 OR 46C2 DATA MOUNTING

3.112 The 48C1 data unit and 46C1 or 46C2 data mounting, when used with the 48D1 and 48B1 data units, provide the switching and transmission circuitry required to add 4-wire switched dial backup service to multiple 4-wire private line data or data with alternate voice service. If the 46C2 data mounting is used, the 48ER1 data unit can be used instead of the 48B1 data unit. The unregulated dc input required by the 48C1 and 48B1 or 48ER1 data units and the 46C1 or 46C2 data mounting is obtained from a bridge rectifier power supply in the 48D1 data unit. The 48D1 data unit also contains the interface circuitry required to concentrate control of 48A1, 48B1 or 48ER1, and 48C1 data units in an 18- or 30-button CALL DIRECTOR key telephone set. The 48B1 and 48ER1 data units contain the circuitry required for proper termination of a 4-wire dial backup channel and are described in paragraphs 3.80 through 3.111 and 3.134 through 3.183, respectively. Differences in operation of the 48B1 or 48ER1 data unit when used with multiple modems instead of a single modem are described in paragraph 3.129. The 48A1 data unit contains the circuitry required to provide alternate voice service and is described in paragraphs 3.62 through 3.79.

3.113 For 4-wire switched dial backup service, up to six 48C1 data units are housed in a 46C1 or 46C2 data mounting. One or two 48B1 data units are also housed in the 46C1 or 46C2 data mounting, or one or two 48ER1 data units are also housed in the 46C2 data mounting. Each 48C1 data unit can connect any one of four 4-wire modems to a 4-wire dial backup channel or to either one of two 4-wire dial backup channels. Since each dial backup channel must be terminated by a 48B1 or 48ER1 data unit, the number of available dial backup channels is determined by the number of 48B1 and/or 48ER1 data units housed in the data mounting. When the maximum number of six 48C1 data units are housed in the data mounting, it appears that twenty-four modems and associated 4-wire private lines can be controlled. However, the maximum number that can actually be controlled is twenty-three, since the 30-button CALL DIRECTOR key telephone set has only twenty-three pickup keys available for control. The DAS 829-type CIUs required for proper termination of the 4-wire private lines are housed in up to three 46A1 or 46A2 data mountings. If alternate voice service is provided, the required 48A1 data units are housed in up to three 46B1 data mountings.

3.114 When used for 4-wire switched dial backup service, the 18- or 30-button CALL DIRECTOR key telephone set must be modified and the pushbuttons labeled as described in Section 598-082-200. For example, the pushbuttons for an 18-button CALL DIRECTOR key telephone set providing control for two 4-wire dial backup channels, control of the switching circuitry for eleven modems, and control of eleven data with alternate voice circuits are labeled as follows:

	REL	RING	TALK — DBU6
*	DDD1A	TALK — DBU1	TALK — DBU7
	DDD2A	TALK — DBU2	TALK — DBU8
†	DDD1B	TALK — DBU3	TALK — DBU9
	DDD2B	TALK — DBU4	TALK — DBU10
	HOLD	TALK — DBU5	TALK — DBU11

* Backup Channel A

† Backup Channel B

A. Data Service

3.115 In the data mode (Fig. 9), 4-wire modem No. 1 can transmit and receive data over 4-wire private line No. 1 since the 48C1 data unit

provides a through connection for the transmission leads of the standard 6-lead interface (DT, DR, DT1, DR1, TEK5, TEK6) that connects the modem to the DAS 829-type CIU. The four transmission leads (DT, DR, DT1, DR1) are complete through the normally-closed contacts of the 1A and 1B relays (for modem No. 1) in the 48C1 data unit as long as the 48C1 data unit remains in the data mode. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6, if the 48A1 data unit and the DAS 829-type CIU are also in the data mode. Two additional interface leads, DBU1 and DBU2, supply a dial backup status signal to the modem. The line status and dial backup status signals normally supplied by the 48B1 or 48ER1 data unit are not used with switched dial backup service.

3.116 The data unit connectors at any vacant positions of the 46B1 multiple data mounting provide a through connection for the 6-lead interface. The data unit connectors at any vacant positions of the 46C1 or 46C2 multiple data mounting ***do not*** provide a through connection for the 6-lead interface.

3.117 For switched dial backup service, the following are the transmission leads from the modem and the corresponding 48B1 or 48ER1 terminal numbers (Fig. 56 or 59):

Designation	48B1 or 48ER1 Terminal Number
DT(M)	8
DR(M)	27
DT1(M)	10
DR1(M)	29

B. Switched Dial Backup Service

3.118 In the dial backup mode (Fig. 9), operation of the 1A or 1B relay in the 48C1 data unit transfers 4-wire modem No. 1 from 4-wire private line No. 1 to 4-wire dial backup channel A or B, respectively. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

3.119 A simplified functional diagram of the switched dial backup control circuitry is shown in Fig. 57. This figure shows the switching logic required to control 4-wire dial backup channel A, to connect 4-wire modem 1 to channel A, and to provide alternate voice service over the 4-wire private line for modem 1. The operation of the control circuitry shown in this figure is described in the following paragraphs.

Dial Backup Mode

3.120 To put the 48B1 or 48ER1 data unit for dial backup channel A in the dial backup mode, the H2, H1, and A relays in the 48B1 or 48ER1 data unit must be operated as follows:

(a) The H2 relay is operated by taking the telephone handset off-hook and depressing the DDD2A and HOLD keys. The H2 relay latches under the control of a release circuit in the 48B1 or 48ER1 data unit and the DDD2A lamp on the telephone set lights. The DDD2A 2-wire dial-up line is now in the hold mode.

(b) The H1 relay is operated by taking the telephone handset off-hook and depressing the DDD1A and HOLD keys. The H1 relay latches under the control of a release circuit in the 48B1 or 48ER1 data unit and the DDD1A lamp on the telephone set lights. The DDD1A 2-wire dial-up line is now in the hold mode.

(c) With the DDD2A and DDD1A dial-up lines in the hold mode (H2 and H1 relays operated), the A relay operates, immediately if the 48B1 data unit is used or after a delay of 10 seconds if the 48ER1 data unit is used, and the 48B1 or 48ER1 data unit is now available for use on dial backup channel A. Dial backup channel A can now be connected to any one of the modems.

3.121 To connect modem 1 to the available dial backup channel A, the 1A relay in the 48C1 data unit must be operated by taking the telephone handset off-hook and depressing the TALK-DBU1 key. Operation of the 1A relay transfers modem 1 from the 4-wire private line to 4-wire dial backup channel A and operates the M1 relay in the 48C1 data unit.

3.122 Operation of the M1 relay initiates the following actions:

(a) The TALK-DBU1 lamp on the telephone set lights at one of two levels as follows: (1)

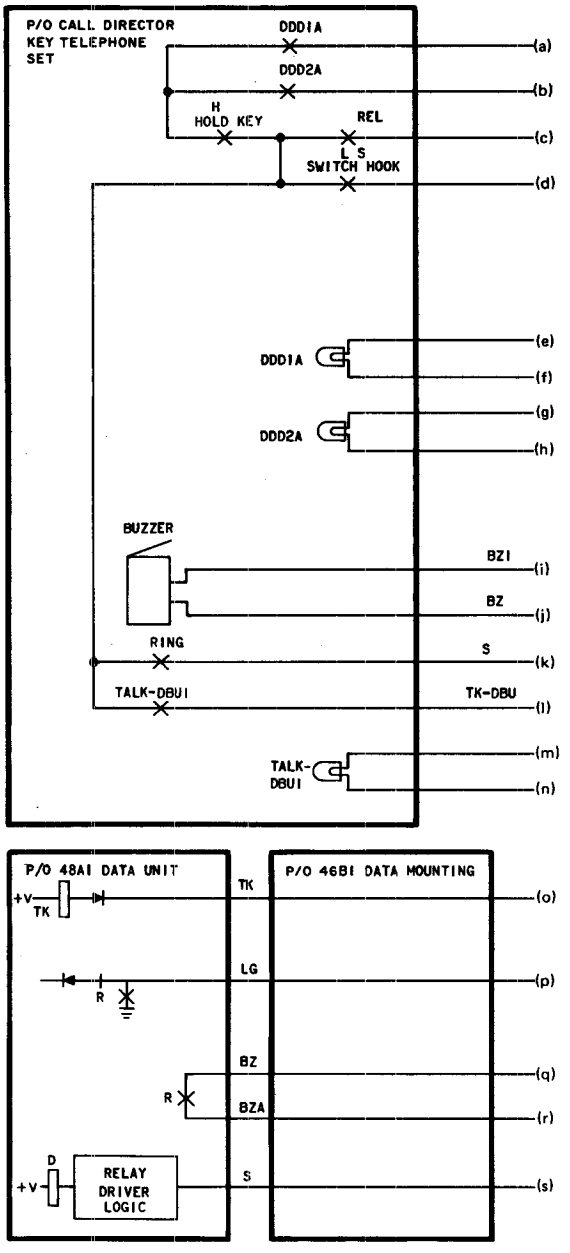


Fig. 57—4-Wire Switched Dial Backup Control Circuitry—Simplified Functional Diagram (Sheet 1 of 3)

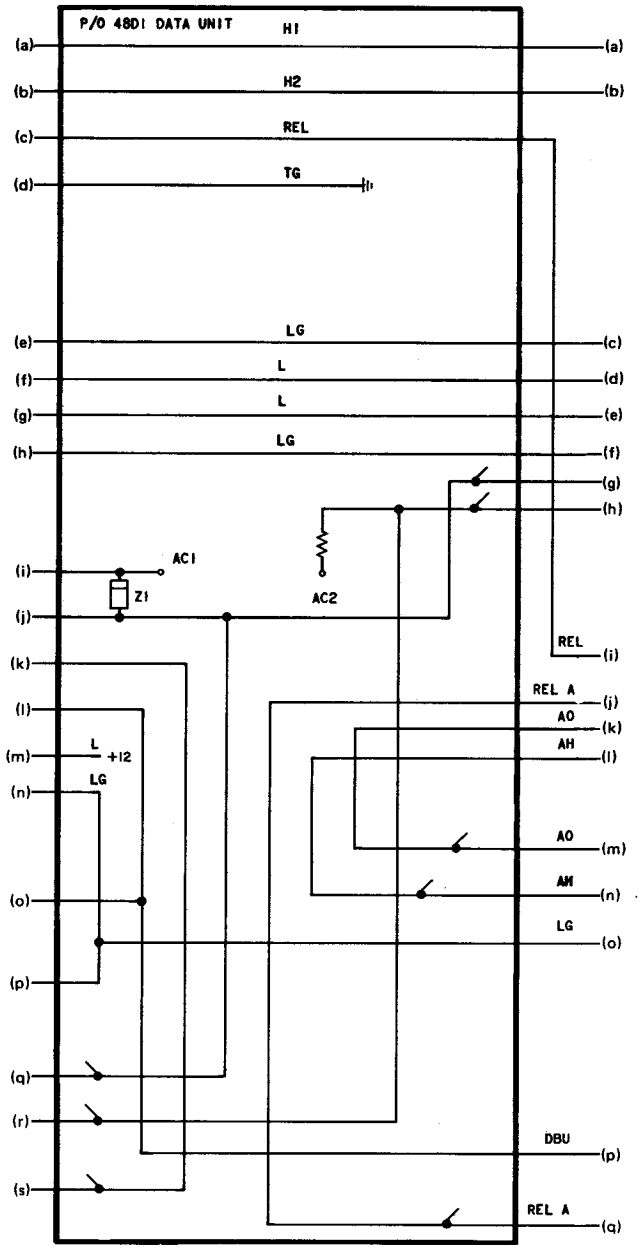


Fig. 57—4-Wire Switched Dial Backup Control Circuitry—Simplified Functional Diagram (Sheet 2 of 3)

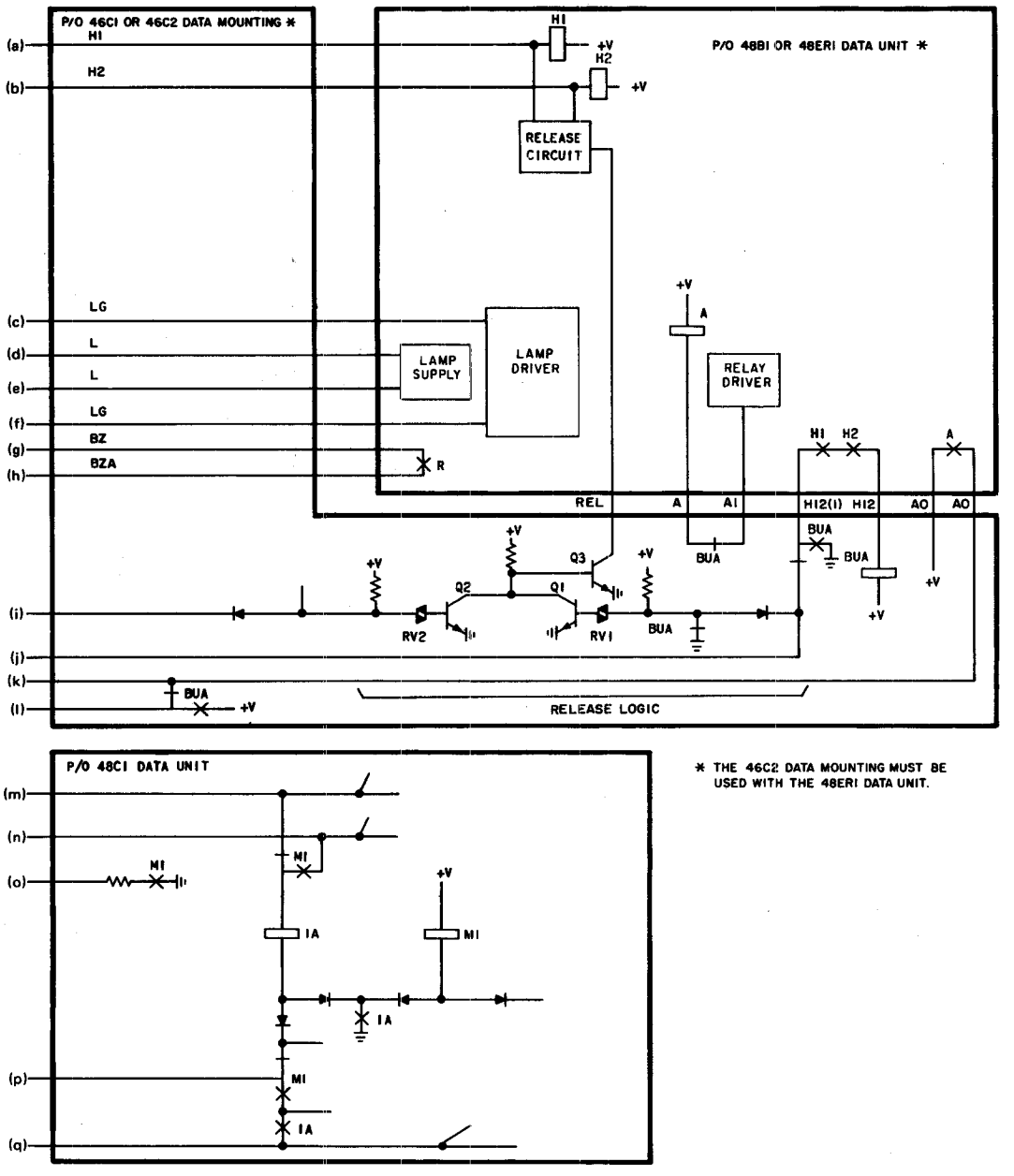


Fig. 57— 4-Wire Switched Dial Backup Control Circuitry—Simplified Functional Diagram (Sheet 3 of 3)

at reduced brightness, if the 48A1 data unit for modem 1 is in the data mode, or (2) at full brightness, if the 48A1 data unit for modem 1 is in the alternate voice mode.

(b) An in-data line status signal is supplied to modem 1 on interface leads TEK5 and TEK6.

(c) A dial backup status signal is supplied to modem 1 on interface leads DBU1 and DBU2.

(d) The BUA (backup A) relay in the 46C1 or 46C2 data mounting operates.

Operation of the BUA relay releases the A relay in the 48B1 or 48ER1 data unit, to prevent connection of any further modems to dial backup channel A.

3.123 To complete the procedure, the TALK-DBU1 key is released by depressing and releasing the HOLD key, and the telephone handset is placed on-hook. The DDD2A, DDD1A, and TALK-DBU1 lamps are lighted.

Release From Dial Backup Mode

3.124 When the DDD2A, DDD1A, and TALK-DBU1 lamps are lighted (H2, H1, 1A, M1, and BUA relays operated), the 48B1 or 48ER1 data unit for dial backup channel A is in the dial backup mode and modem 1 is connected to channel A. Release of modem 1 from channel A is accomplished as follows:

(a) Take the telephone handset off-hook.

(b) Depress the TALK-DBU1 key.

(c) Depress the REL key. The H2 and H1 relays release and the DDD2A and DDD1A lamps go off, immediately if the 48B1 data unit is used or after a delay of 3 seconds if the 48ER1 data unit is used. The DDD2A and DDD1A dial-up lines are released from the hold mode when the H2 and H1 relays release.

(d) The release of the H2 or H1 relay releases the BUA relay thereby releasing the 1A and M1 relays. Modem 1 is released from dial backup channel A when the 1A relay releases.

Note: Taking the telephone handset off-hook and depressing the REL key releases all dial-up lines and backup channels that are not connected to a modem.

(e) The TALK-DBU1 lamp remains lighted indicating the 48A1 data unit is in the alternate voice mode.

(f) Release the TALK-DBU1 key by depressing and releasing the HOLD key.

(g) The TALK-DBU1 lamp goes off indicating modem 1 has been transferred to the 4-wire private line.

(h) Place the telephone handset on-hook.

Note: The 48B1 or 48ER1 data unit cannot be released from the dial backup mode except as described above. Placing the telephone handset on-hook while the 48B1 or 48ER1 data unit is in the dial backup mode will not release the 48B1 or 48ER1 data unit from the dial backup mode.

C. Alternate Voice Call Sequence

3.125 Alternate voice circuits (using 48A1 data units housed in 46B1 data mountings) are concentrated through a 48D1 data unit in an 18- or 30-button CALL DIRECTOR key telephone set. To originate a voice call using the 48A1 data unit, perform the following steps:

(a) Depress the desired TALK or TALK-DBU key and take the telephone handset off-hook. The TALK or TALK-DBU lamp lights.

Note: When the Nth circuit is in either the alternate voice or dial backup mode, the TALK-DBU-N lamp is lighted. However, in the dial backup mode the lamp is not as bright as in the alternate voice mode. Therefore, when the Nth circuit is in the dial backup mode and the handset is off-hook, depressing the TALK-DBU-N key causes the TALK-DBU-N lamp to become brighter.

(b) Depress the RING key until the audible ringback signal (burst of 1300 Hz) is heard in the handset. When the audible ringback signal ceases, the RING key can be depressed again to initiate a new ring cycle.

Note: When the far end is equipped with a DAS 828A-type CIU there is no audible ringback signal. In this case, depress the RING key until the far end responds.

3.126 To answer a voice call, perform the following steps:

(a) Depress the TALK or TALK-DBU key associated with a flashing lamp.

Note: When the Nth circuit is in the dial backup mode, the TALK-DBU-N lamp is lighted. During the interval in the ring cycle that the telephone set buzzer is sounding the TALK-DBU-N lamp flashes brighter.

(b) Take the telephone handset off-hook and talk.

3.127 To end a voice call, perform the following steps:

(a) Depress and release the HOLD key to return the TALK or TALK-DBU key to its normal (released) position.

(b) If a TALK key was released, the TALK lamp goes off indicating the modem is in the data mode (connected to the 4-wire private line). If a TALK-DBU key was released, one of two lamp indications occurs as follows:

(1) The TALK-DBU lamp goes off indicating the modem is in the data mode (connected to the 4-wire private line), or

(2) The TALK-DBU lamp remains lighted but not as brightly indicating the modem is in the dial backup mode (connected to a dial backup channel).

(c) Place the telephone handset on-hook.

D. Switched Dial Backup Call Sequence

3.128 With switched dial backup for multiple modems, a dial backup channel is established; then, a modem is manually selected and connected to the dial backup channel. To release a modem from a dial backup channel, the modem to be released is manually selected; then, when the telephone handset is off-hook and the REL key is depressed, the modem is automatically released.

The 46C1 or 46C2 data mounting provides for up to two 4-wire dial backup channels, designated A and B. The two 2-wire dial-up lines required for dial backup channel A are controlled by the DDD1A and the DDD2A keys. The two 2-wire dial-up lines required for dial backup channel B are controlled by the DDD1B and DDD2B keys.

Note: Only the indicated channels can be used for dial backup. For example, a dial backup channel ***cannot*** be established using the DDD1A and DDD2B keys.

3.129 The switched dial backup call sequence for multiple modems varies in only two respects from the dial backup call sequence for a single modem using a DAS 828C-type CIU, a 48B1 data unit housed in a 45A1 or 59A1 data mounting, or a 48E1 data unit housed in a 59A1 data mounting.

(a) With dial backup for a single modem, the dial backup channel is established; then, the modem is automatically connected to the dial backup channel.

(b) When the telephone handset is off-hook and the REL key is depressed, the modem is automatically released from the dial backup channel.

The dial backup call sequence for a single modem using a 48B1 data unit is described in paragraphs 3.102 through 3.111. The dial backup call sequence for a single modem using a 48ER1 data unit is described in paragraphs 3.169 through 3.176.

3.130 A typical switched dial backup call sequence for two stations, A and B, is described in the following paragraphs. This description assumes that the following conditions exist:

(a) Station A uses a 30-button CALL DIRECTOR key telephone set to control up to twenty-three modems.

(b) Dial backup channel A is to provide switched dial backup for modem 19.

(c) Station B consists of a single modem using a DAS 828C-type CIU, a 48B1 data unit installed in a 45A1 or 59A1 data mounting, or a 48ER1 data unit installed in a 59A1 data mounting.

Originating Call

3.131 The sequence begins with Station A deciding for some reason, such as the inability of modem 19 to send data over the 4-wire private line, that a backup connection should be made. To establish 4-wire dial backup channel A and connect modem 19 to channel A, perform the following steps:

(a) Complete a call between DDD2A at Station A and DDD1 at Station B.

(b) When the call is satisfactorily completed, place DDD2A and DDD1 on hold. The DDD2A and DDD1 lamps are lighted, providing a visual indication of the hold mode.

(c) Complete a call between DDD1A at Station A and DDD2 at Station B.

(d) When the call is satisfactorily completed, place DDD1A and DDD2 on hold. The DDD1A and DDD2 lamps are lighted, providing a visual indication of the hold mode

(e) Station B is now in the dial backup mode, as indicated by the DDD1 and DDD2 lamps being lighted.

(f) Station A has now established dial backup channel A, as indicated by the DDD1A and DDD2A lamps being lighted. A modem can now be selected and connected to channel A.

(g) At Station A, take the telephone handset off-hook and depress the DBU19 or TALK-DBU19 key. When Station A uses a 48B1 data unit, the DBU19 or TALK-DBU19 lamp lights immediately. When Station A uses a 48ER1 data unit, the DBU19 lamp lights after a delay of 10 seconds. The TALK-DBU19 lamp lights immediately but goes off if the TALK-DBU19 key is released before the 10 seconds have elapsed. If this occurs, again depress the TALK-DBU19 key until the TALK-DBU19 lamp remains lighted.

Note: If the 19th circuit is in the alternate voice mode, the TALK-DBU19 lamp will already be lighted.

(h) Depress and release the HOLD key to return the DBU19 or TALK-DBU19 key to its normal (released) position. The DBU19 or TALK-DBU19 lamp remains lighted.

(i) Place the telephone handset on-hook. The DDD1A, DDD2A, and DBU19 or TALK-DBU19 lamps remain lighted, indicating modem 19 is connected to dial backup channel A.

3.132 The above sequence established 4-wire dial backup channel A and connected modem 19 to channel A. The sequence can now be repeated to establish 4-wire dial backup channel B and connect another modem, such as modem 8, to channel B. With both modems 8 and 19 connected to a dial backup channel, the DDD1A, DDD2A, DDD1B, DDD2B, DBU8 or TALK-DBU8, and DBU19 or TALK-DBU19 lamps are lighted. The actual indication of a modem being in the dial backup mode is given by the DBU-N or TALK-DBU-N lamp being lighted with the DBU-N or TALK-DBU-N key in the normal (released) position.

Releasing Call

3.133 Once the 4-wire private line is cleared for data transmission, the modem can be returned to the 4-wire private line. To return modem 19 of the above example to the 4-wire private line, perform the following steps:

(a) Take the telephone handset off-hook.

(b) Depress the DBU19 or TALK-DBU19 key.

(c) Depress the REL key. The DDD1A and DDD2A lamps go off, immediately when Station A uses a 48B1 data unit or after a delay of 3 seconds when Station A uses a 48ER1 data unit, indicating dial backup channel A has released.

(d) Depress and release the HOLD key to return the DBU19 or TALK-DBU19 key to its normal (released) position. The DBU19 or TALK-DBU19 lamp goes off, indicating modem 19 has been returned to the 4-wire private line.

(e) Place the telephone handset on-hook. In this example, the DDD1B, DDD2B, and DBU8 or TALK-DBU8 lamps remain lighted, indicating dial backup channel B is still established and modem 8 is still connected to channel B.

48ER1 DATA UNIT

3.134 The 48ER1 data unit provides the switching, ring detection, and transmission circuitry required to add 4-wire dial backup service with manual or automatic dialing to 4-wire private line data service. If manual dialing is used, alternate voice service can also be added. A dc power supply in the data unit obtains its unregulated input from a bridge rectifier power supply associated with the data mounting (46C2 or 59A1) that houses the data unit. All connections to the data unit are made through the data mounting.

A. Options

3.135 The 48ER1 data unit is provided with several options that may be requested by the customer. The desired options must be specified when the data unit is ordered. Refer to Table B for a summary of the options.

3.136 ***Call Control:*** The calls required to enable the 48ER1 data unit to establish a 4-wire dial backup channel are initiated by either manual or automatic dialing.

(a) With manual dialing (option M), a key telephone set is used.

(b) With automatic dialing (option A), the following items are used: a station dial and a customer- or modem-provided contact; a station dial and the O/R (originate/release) switch on the faceplate of the 48ER1 data unit; or an automatic calling unit (ACU) and a customer- or modem-provided contact.

3.137 ***Unit Control:*** Operating control of the 48ER1 data unit is provided by a key telephone set, a customer- or modem-provided contact, or the O/R (originate/release) switch on the faceplate of the 48ER1 data unit.

(a) With a key telephone set (option T), the 48ER1 data unit will establish a 4-wire dial backup channel and connect the modem to the dial backup channel when directed by control signals from the key telephone set. To release the dial backup channel and return the modem to the 4-wire private line, the required control signals are again provided by the key telephone set. The key telephone set can be used to control single or multiple installations.

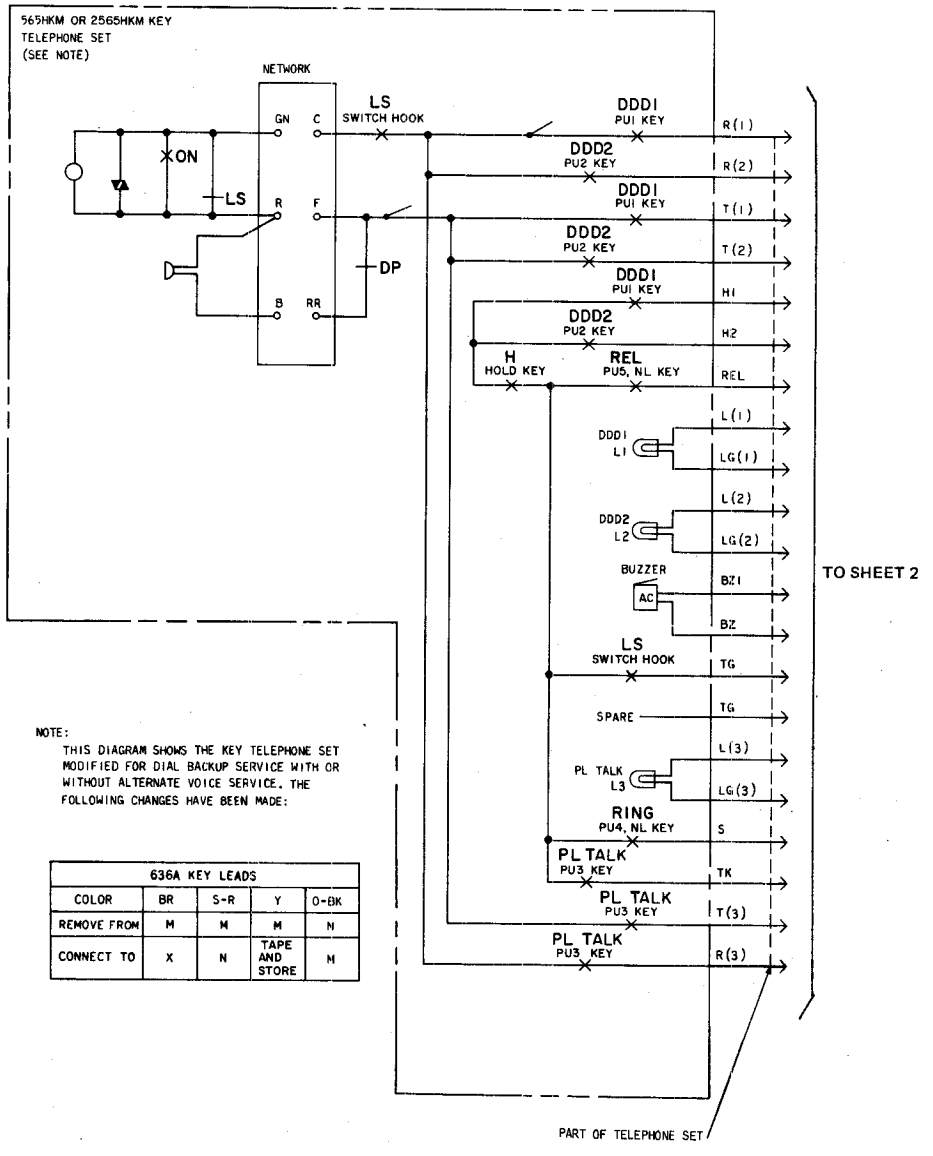
(b) With a customer- or modem-provided contact (option D), the 48ER1 data unit and an associated station dial or ACU will attempt to establish a 4-wire dial backup channel when the customer or modem provides and maintains a

TABLE B

48ER1 DATA UNIT OPTIONS

FEATURE	OPTION	PLUG-IN STRAP(S)		PROVIDE
		QUANTITY	POSITION	
Call Control	Manual Dialing (M)	9	M1-M9	One Per Unit
	Automatic Dialing (A)	9	A1-A9	
Unit Control	Key Telephone Set (T)	1	T	One Per Unit
	Customer- or Modem-Provided Contact (D)	1	D	
	O/R (Originate/Release) Switch (S)	1	S	
Power Supply	24 Vac (N)	1	N	One Per Unit
	-48 Vdc (-48)*	1	-48	

* Use not permitted.



NOTE:
THIS DIAGRAM SHOWS THE KEY TELEPHONE SET MODIFIED FOR DIAL BACKUP SERVICE WITH OR WITHOUT ALTERNATE VOICE SERVICE. THE FOLLOWING CHANGES HAVE BEEN MADE:

636A KEY LEADS				
COLOR	BR	S-R	Y	O-BK
REMOVE FROM	M	M	M	N
CONNECT TO	X	N	TAPE AND STORE	M

Fig. 58—59A1 Data Mounting—Interface Diagram (Sheet 1 of 5)

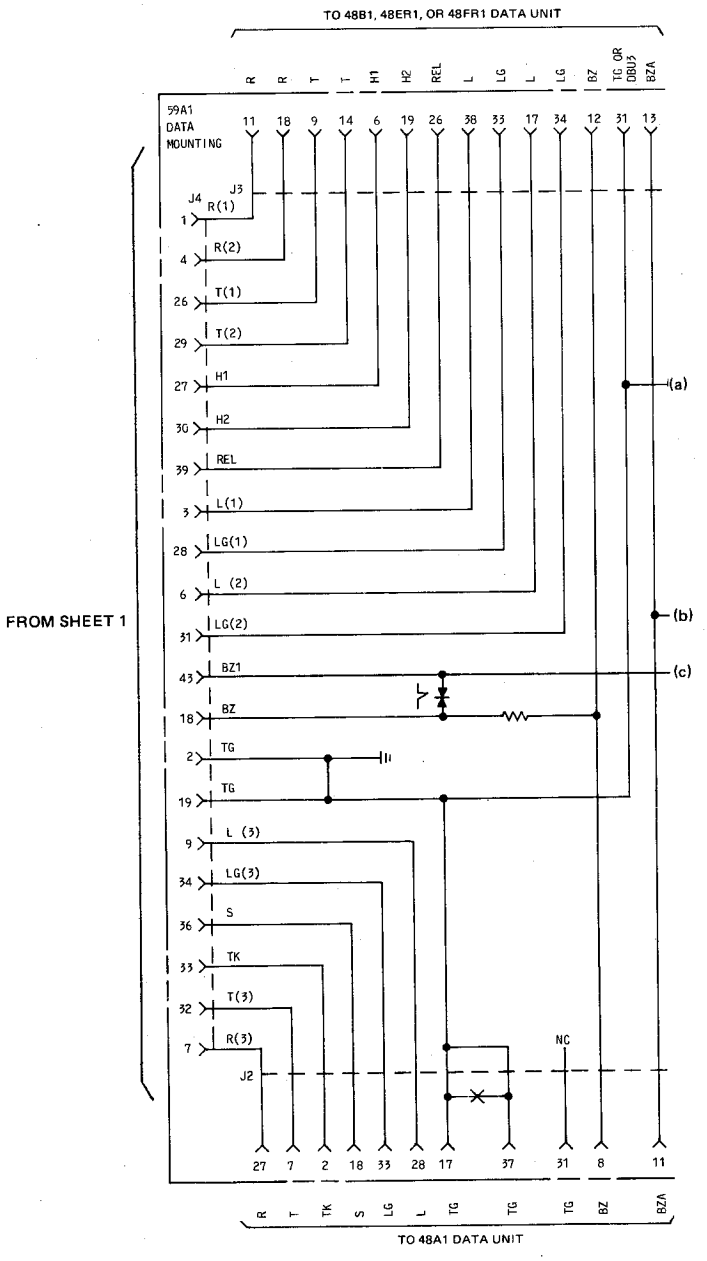


Fig. 58—59A1 Data Mounting—Interface Diagram (Sheet 2 of 5)

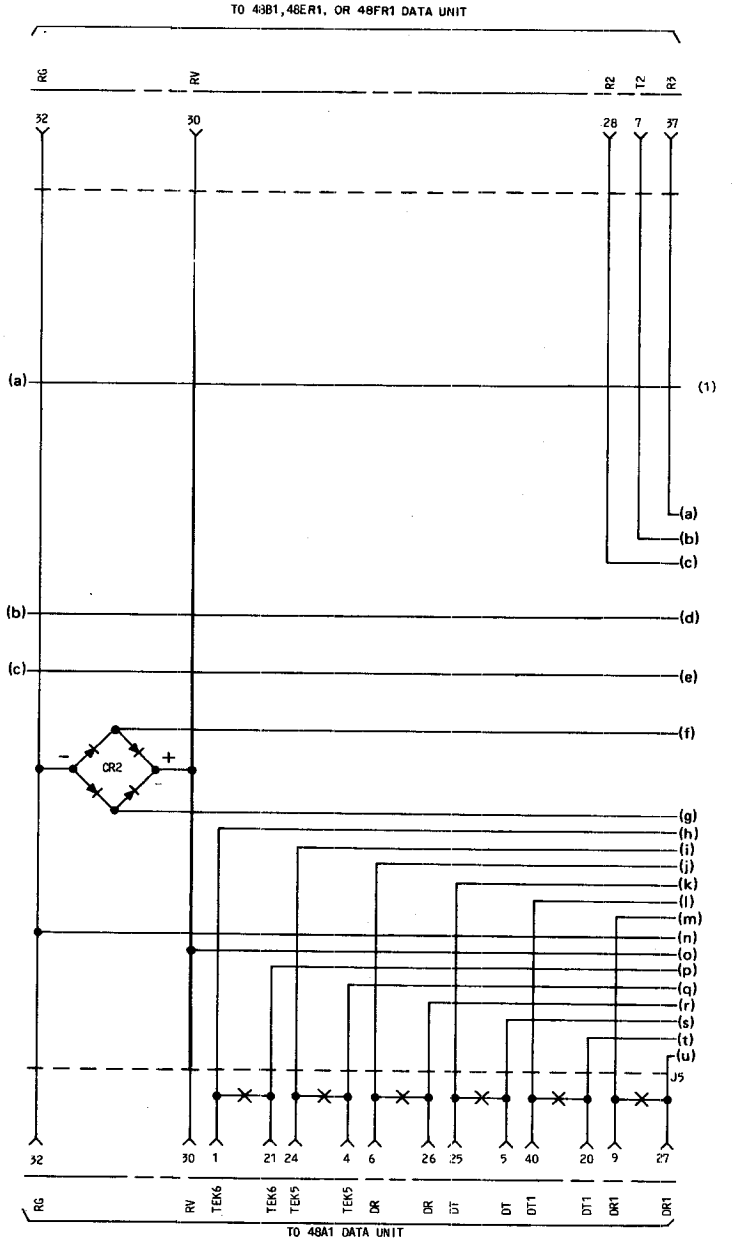


Fig. 58—59A1 Data Mounting—Interface Diagram (Sheet 3 of 5)

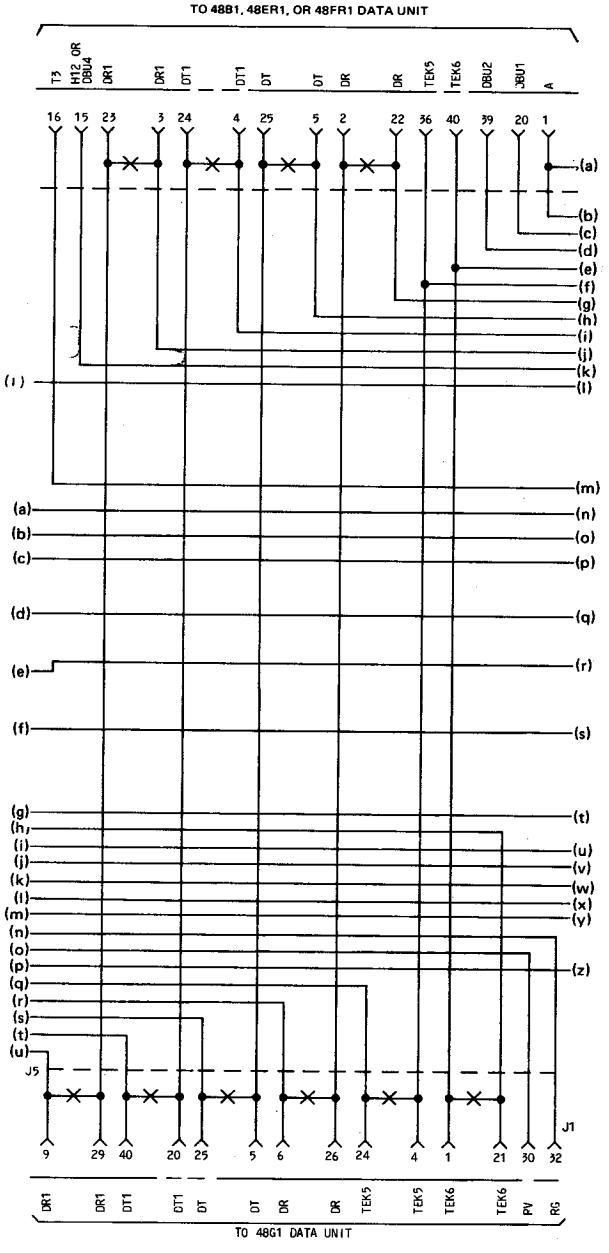


Fig. 58—59A1 Data Mounting—Interface Diagram (Sheet 4 of 5)

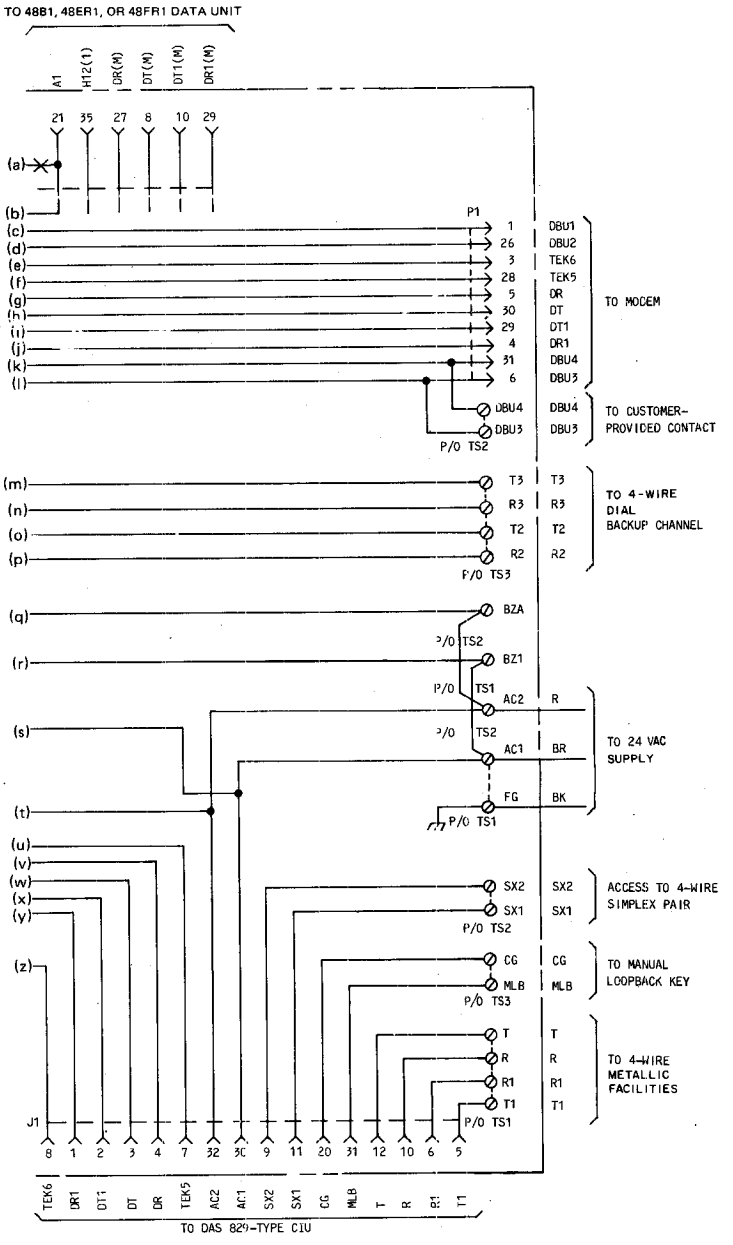


Fig. 58—59A1 Data Mounting—Interface Diagram (Sheet 5 of 5)

contact closure. When the dial backup channel is established, the 48ER1 data unit will connect the modem to the dial backup channel. If the dial backup channel is not established within 3 minutes, the customer or modem must generate a retry request by interrupting the contact closure for a minimum of 25 ms. To release the dial backup channel and return the modem to the 4-wire private line, the customer or modem removes the contact closure. At present, the customer- or modem-provided, contact cannot be used to control multiple installations.

(c) With the O/R switch (option S), the 48ER1 data unit and an associated station dial will attempt to establish a 4-wire dial backup channel when the O/R switch is operated. When the dial backup channel is established, the 48ER1 data unit will connect the modem to the dial backup channel. If the dial backup channel is not established within 3 minutes, a retry request must be generated by releasing and then operating the O/R switch. To release the dial backup channel and return the modem to the 4-wire private line, the O/R switch is released. At present, the O/R switch cannot be used to control multiple installations.

3.138 ***Power Supply:*** Operating power for the 48ER1 data unit can be provided by either a 24 Vac (option N) or a -48 Vdc (option -48) supply.

Note: Use of a -48 Vdc supply is not permitted.

B. Arrangements

3.139 The 48ER1 data unit can be used to provide 4-wire dial backup service in the following equipment arrangements: single installation (manual dialing), single installation (automatic dialing), and multiple installation (manual dialing).

Single Installation (Manual Dialing)

3.140 For 4-wire dial backup service with manual dialing on a single 4-wire private line, the 48ER1 data unit is equipped with options M, N, and T and housed in a 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU and a 48A1 data unit (if alternate voice service is provided). A 6-button key telephone set (565HKM or 2565HKM) provides control of the 48ER1 data unit.

(a) When used for dial backup service only, the key telephone set must be modified as shown in Fig. 58, the fifth pickup key (REL) converted to nonlocking operation, and the six pushbuttons labeled as follows:

HOLD	DDD1	DDD2	—	—	REL

(b) When used for dial backup and alternate voice service, the key telephone set must be modified as shown in Fig. 58, the fourth pickup key (RING) and the fifth pickup key (REL) converted to nonlocking operation, and the six pushbuttons labeled as follows:

HOLD	DDD1	DDD2	PL TALK	RING	REL

3.141 For a detailed description of the single installation (manual dialing) arrangement, refer to paragraphs 3.147 through 3.162 and 3.169 through 3.176.

Single Installation (Automatic Dialing)

3.142 For 4-wire dial backup service with automatic dialing on a single 4-wire private line, the 48ER1 data unit is equipped with options A, N, and D or S and housed in a 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU. A 43A or 53A station dial or an 801CR-L1/2 ACU is required for automatic dialing. When a 43A or 53A station dial is used, a customer- or modem-provided contact (option D) or the O/R switch (option S) provides control of the 48ER1 data unit. When an 801CR-L1/2 ACU is used, a customer- or modem-provided contact (option D) provides control of the 48ER1 data unit.

3.143 When a 43A or 53A station dial is used, the station dial must be optioned for the restricted mode of operation. For those installations that have precise dial tone available, a 1A350 tone detector can be used with either the 43A or 53A station dial. The minimum time required to establish a dial backup channel is obtained when a 53A station dial equipped with a 1A350 tone detector is used. If the 1A350 tone detector is not used, an internal timer starts the station dial.

3.144 For a detailed description of the single installation (automatic dialing) arrangement, refer to paragraphs 3.147 through 3.155, 3.163 through 3.168, and 3.177 through 3.183.

Multiple Installation (Manual Dialing)

3.145 For 4-wire dial backup service with manual dialing on multiple 4-wire private lines, the 48ER1 data unit is equipped with options M, N, and T and housed in a 46C2 data mounting and switched dial backup is used. An 18- or 30-button CALL DIRECTOR key telephone set provides control of the 48ER1 data unit.

3.146 For a detailed description of the multiple installation (manual dialing) arrangement, refer to paragraphs 3.112 through 3.133.

C. Data Service

3.147 In the data mode (Fig. 3), the 4-wire modem can transmit and receive data over the 4-wire private line since the 48ER1 data unit provides a through connection for the transmission leads of the standard 6-lead interface (DT, DR, DT1, DR1, TEK5, TEK6) that connects the modem to the DAS 829-type CIU. The four transmission leads (DT, DR, DT1, DR1) are complete through the normally-closed contacts of the A relay in the 48ER1 data unit as long as the 48ER1 data unit remains in the data mode. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6, if the 48A1 data unit and the DAS 829-type CIU are also in the data mode. Two additional interface leads, DBU1 and DBU2, supply a dial backup status signal to the modem.

3.148 When data units are not installed in all positions of the 59A1 data mounting, the data unit connectors at the vacant positions of the data mounting provide a through connection for the 6-lead interface.

3.149 The following are the transmission leads from the DAS 829-type CIU (or a 48A1 data unit, if alternate voice service is provided) and the corresponding 48ER1 terminal numbers (Fig. 59):

Designation	48ER1 Terminal Number
DT	25
DR	2
DT1	24
DR1	23

3.150 For 4-wire dial backup service on a single 4-wire private line, the following are the transmission leads from the modem and the corresponding 48ER1 terminal numbers (Fig. 59):

Designation	48ER1 Terminal Number
DT	5
DR	22
DT1	4
DR1	3

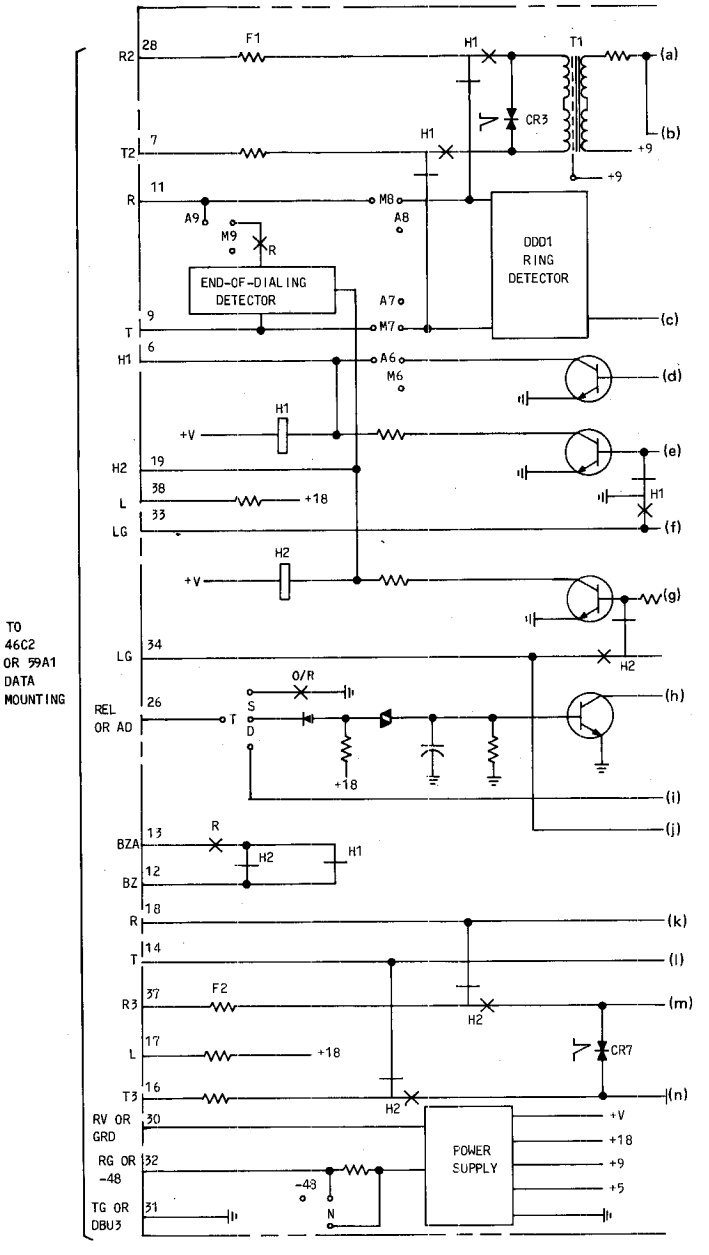


Fig. 59—48ER1 Data Unit—Functional Diagram (Sheet 1 of 3)

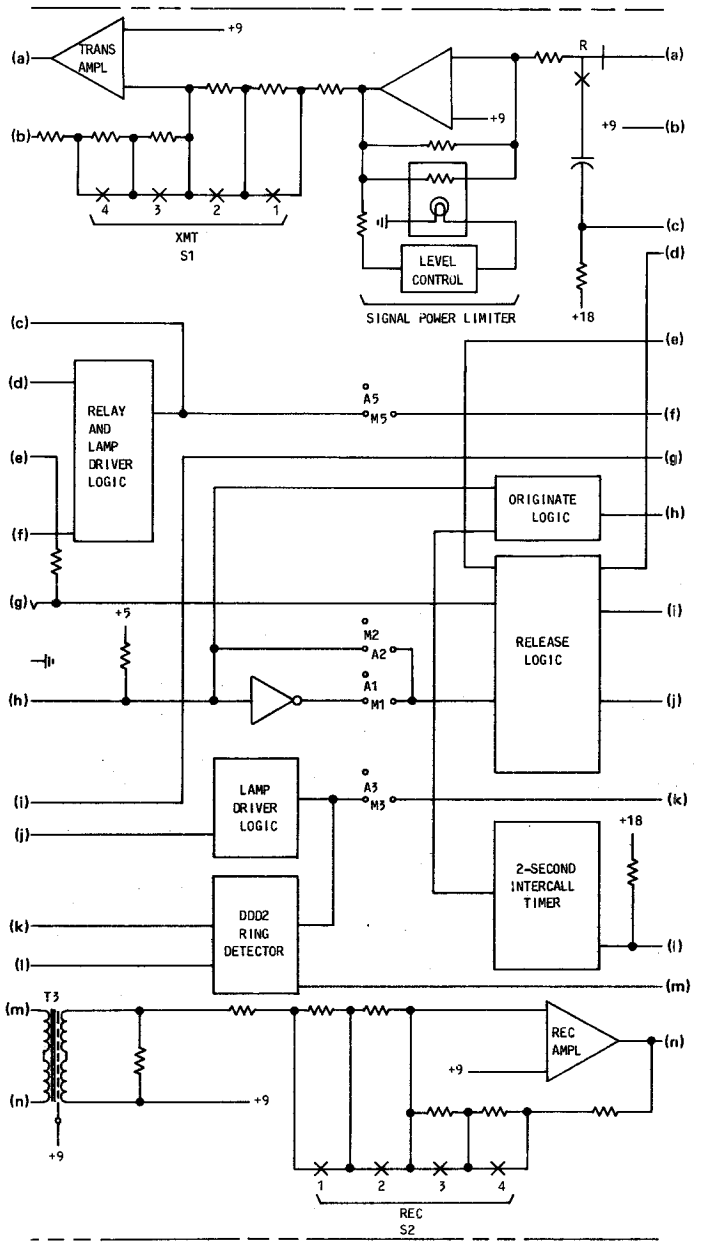


Fig. 59—48ER1 Data Unit—Functional Diagram (Sheet 2 of 3)

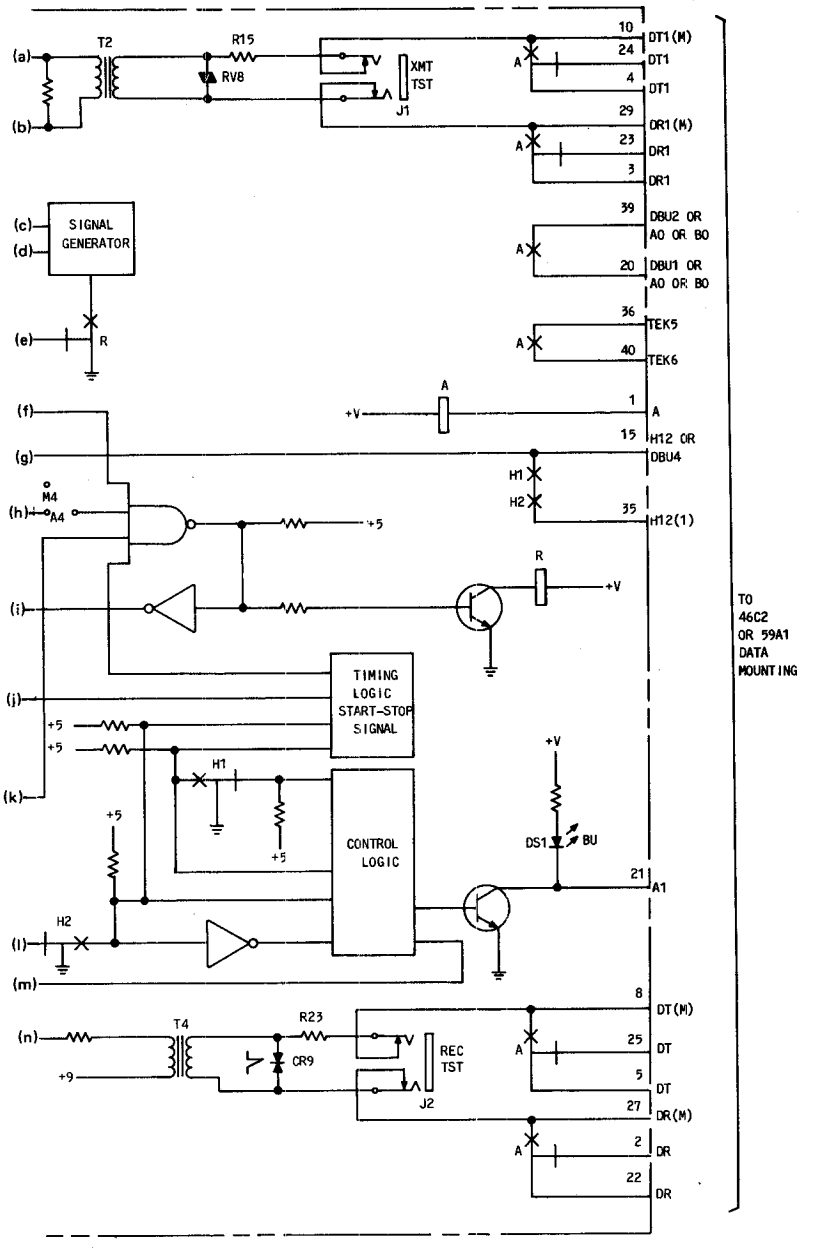


Fig. 59—48ER1 Data Unit—Functional Diagram (Sheet 3 of 3)

D. Dial Backup Service

3.151 In the dial backup mode (Fig. 3), operation of the A relay in the 48ER1 data unit transfers the 4-wire modem from the 4-wire private line to the 4-wire dial backup channel. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

Transmit Circuit

3.152 In the dial backup mode (A relay operated, Fig. 59), the modem transmit pair (DT1, DR1) is connected through the normally-open contacts of relay A, the normally-closed contacts of test jack J1 (XMT), isolation transformer T2, the normally-closed contact of relay R, the signal power limiter circuit, the transmit amplifier, line-holding transformer T1, and the normally-open contacts of relay H1 to the 2-wire dial-up line terminating on T2 and R2.

3.153 The 48ER1 data unit provides a 600-ohm termination for the dial-up line and a 600-ohm termination for the modem. Resistors R15 and F1 function as fuses for the modem transmit pair (DT1, DR1) and the dial-up transmit pair (T2, R2), respectively. If excessive power is dissipated in resistor R15 or F1, the resistor opens to disconnect the hazardous voltage. Diode CR3 and varistor RV8 limit voltage surges in the circuit. Switch S1 (XMT) provides adjustment of the signal gain. The signal power limiter circuit assures that the signal level does not exceed -4 dBm when averaged over any 3-second period.

Note: The setting of XMT switch S1 is fixed in registered arrangements.

Receive Circuit

3.154 In the dial backup mode (A relay operated, Fig. 59), the modem receive pair (DT, DR) is connected through the normally-open contacts of relay A, the normally-closed contacts of test jack J2 (REC), isolation transformer T4, the receive amplifier, line-holding transformer T3, and the normally-open contacts of relay H2 to the 2-wire dial-up line terminating on T3 and R3.

3.155 The 48ER1 data unit provides a 600-ohm termination for the dial-up line and a 600-ohm termination for the modem. Resistors R23 and F2 function as fuses for the modem receive pair (DT, DR) and the dial-up receive pair (T3, R3), respectively. If excessive power is dissipated in resistor R23 or F2, the resistor opens to disconnect the hazardous voltage. Diodes CR7 and CR9 limit voltage surges in the circuit. Switch S2 (REC) provides adjustment of the signal gain.

Note: The setting of REC switch S2 is fixed in registered arrangements.

Dial Backup Mode (Manual Dialing)

3.156 The description in the following paragraps assumes that the 48ER1 data unit (with options M, N, and T installed, Fig. 59) is installed in the 59A1 data mounting (Fig. 58), the required DAS 829-type CIU is installed in the data mounting, the required key telephone set is provided, and all necessary connections are made.

3.157 To put the 48ER1 data unit in the dial backup mode, the H2 and H1 relays are operated, a start signal is transmitted, and the A relay is operated.

(a) The H2 relay is operated by taking the telephone handset off-hook and depressing the DDD2 and HOLD keys. The H2 relay latches under control of the release logic in the data unit and the DDD2 lamp on the telephone set lights. The 2-wire dial-up line (DDD2) terminating on T3 and R3 is transferred from the telephone set to the receive circuit of the data unit and is now in the hold mode.

(b) The H1 relay is operated by taking the telephone handset off-hook and depressing the DDD1 and HOLD keys. The H1 relay latches under control of the release logic in the data unit and the DDD1 lamp on the telephone set lights. The 2-wire dial-up line (DDD1) terminating on T2 and R2 is transferred from the telephone set to the transmit circuit of the data unit and is now in the hold mode.

(c) With the DDD2 and DDD1 dial-up lines in the hold mode (H2 and H1 relays operated), the timing logic in the data unit operates the R relay for 10 seconds causing the signal generator in the data unit to transmit a 941-Hz start signal

during the 10-second period. If a 48FR1 data unit is used at the far end of the dial backup channel, the detection and removal of the start signal places the 48FR1 data unit in the dial backup mode.

(d) At the end of the start signal, the control logic in the data unit operates the A relay. The modem is transferred from the 4-wire private line to the transmit and receive circuits of the data unit. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

(e) The data unit is now in the dial backup mode (A relay operated) and data transmission can take place over the 4-wire dial backup channel. A light-emitting diode, DS1 (BU), on the faceplate of the data unit is lighted to provide visual indication of the dial backup mode.

Release From Hold Mode (Manual Dialing)

3.158 When either the DDD2 or DDD1 lamp is lighted (H2 or H1 relay operated), the associated 2-wire dial-up line (DDD2 or DDD1) is in the hold mode. Release of a dial-up line from the hold mode is accomplished as follows:

(a) Take the telephone handset off-hook.

(b) Depress the REL key.

(c) The DDD2 or DDD1 lamp goes off (H2 or H1 relay released) indicating that the DDD2 or DDD1 dial-up line is released from the hold mode and returned to telephone set control.

(d) Place the telephone handset on-hook.

Note: The dial-up lines cannot be released from the hold mode except as described above.

Release From Dial Backup Mode (Manual Dialing)

3.159 When both the DDD2 and DDD1 lamps are lighted (H2 and H1 relays operated) and transmission of the start signal has been completed, the BU lamp is lighted and the 48ER1 data unit is in the dial backup mode (A relay operated). Release of the data unit from the dial backup mode is accomplished as follows:

(a) Take the telephone handset off-hook.

(b) Depress the REL key.

(c) The timing logic in the data unit operates the R relay for 3 seconds causing the signal generator in the data unit to transmit a 941-Hz and 1633-Hz stop signal during the 3-second period. If a 48FR1 data unit is used at the far end of the dial backup channel, the stop signal releases the 48FR1 data unit from the dial backup mode.

(d) At the end of the stop signal, the DDD2 and DDD1 lamps go off (H2 and H1 relays released) indicating that the DDD2 and DDD1 dial-up lines are released from the hold mode and returned to telephone set control. The BU lamp also goes off (A relay released) indicating that the 48ER1 data unit is released from the dial backup mode.

(e) Place the telephone handset on-hook.

Note: The data unit cannot be released from the dial backup mode except as described above.

3.160 The line holding arrangement described above provides the following features that were not available with the DAS 828C-type CIU.

(a) The telephone handset can be placed on-hook without ending the dial backup mode.

(b) Multiple installations requiring more than one dial backup channel can be provided.

Ring Detection (Manual Dialing)

3.161 A ring detector circuit and a 2-wire telephone set line are connected to each 2-wire dial-up line (DDD1 and DDD2). A ringing signal on either idle dial-up line (DDD1 or DDD2) causes the associated lamp (DDD1 or DDD2) to flash and the R relay to operate. Operation of the R relay causes the telephone set buzzer to sound.

3.162 The ring detector circuits and telephone set lines are only connected to the dial-up lines when the data unit is not in the hold or dial backup

modes. If the data unit is in the dial backup mode, both ring detector circuits and associated telephone set lines are disconnected. If either dial-up line is in the hold mode, the associated ring detector circuit and telephone set line are disconnected.

Dial Backup Mode (Automatic Dialing)

3.163 The description in the following paragraphs assumes that the 48ER1 data unit (with options A, N, and S or D installed, Fig. 59) is installed in the 59A1 data mounting (Fig. 58), the required DAS 829-type CIU is installed in the data mounting, the required station dial or ACU is provided (instead of the key telephone set shown in Fig. 58), and all necessary connections are made.

3.164 To put the 48ER1 data unit in the dial backup mode, the H2 and H1 relays are operated, a start signal is transmitted, and the A relay is operated.

(a) When a station dial is used with the 48ER1 data unit, the H2 relay (Fig. 59) is operated as follows: The O/R (originate/release) switch on the faceplate of the data unit is operated (if option S is installed) or a customer- or modem-provided contact is operated (if option D is installed) causing the originate logic in the data unit to operate the R relay. With the R relay operated, loop current is detected by the station dial causing the station dial to place a call, on the 2-wire dial-up line terminating on T3 and R3 (DDD2) of the 48ER1 data unit, to the number of the DDD1 dial-up line for the 48FR1 data unit at the far end of the dial backup channel. When dialing is completed, loop current is detected by the end-of-dialing detector in the 48ER1 data unit causing the H2 relay to operate and then latch under control of the release logic in the data unit. The DDD2 dial-up line of the 48ER1 data unit is transferred from the station dial to the receive circuit of the data unit and is now in the hold mode.

(b) When an ACU is used with the 48ER1 data unit, the H2 relay (Fig. 59) is operated as follows: A customer- or modem-provided contact is operated (option D) installed) and then the customer requests the ACU to place a call, on the 2-wire dial-up line terminating on T3 and R3 (DDD2) of the 48ER1 data unit, to the number of the DDD1 dial-up line for the 48FR1 data unit at the far end of the dial backup channel. When the customer has presented all the digits of the number to be dialed to the ACU, the customer presents an end-of-number (EOM) signal to the ACU. The ACU then signals the 48ER1 data unit to operate the H2 relay. The H2 relay remains operated under control of the release logic in the data unit. The DDD2 dial-up line of the 48ER1 data unit is transferred from the ACU to the receive circuit of the data unit and is now in the hold mode.

Note: The EOM signal must be presented to the ACU before the 48ER1 data unit can proceed to establish the dial backup channel.

(c) The H1 relay (Fig. 59) is operated as follows: When the 48FR1 data unit at the far end of the dial backup channel detects a ringing signal on the DDD1 dial-up line, the associated station dial places a call on the DDD2 dial-up line to the number of the 2-wire dial-up line terminating on T2 and R2 (DDD1) of the 48ER1 data unit. When the DDD1 ring detector in the 48ER1 data unit detects a ringing signal on the DDD1 dial-up line, the DDD1 ring detector causes the H1 relay to operate and then latch under control of the release logic in the data unit. The DDD1 dial-up line is transferred from the DDD1 ring detector to the transmit circuit of the data unit and is now in the hold mode.

(d) With the DDD2 and DDD1 dial-up lines in the hold mode (H2 and H1 relays operated), the timing logic in the data unit operates the R relay for 10 seconds causing the signal generator in the data unit to transmit a 941-Hz start signal during the 10-second period. At the end of the start signal, the control logic in the data unit operates the A relay. The modem is transferred from the 4-wire private line to the transmit and receive circuits of the data unit. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

(e) The data unit is now in the dial backup mode (A relay operated) and data transmission can take place over the 4-wire dial backup channel. A light-emitting diode, DS1 (BU), on the faceplate of the data unit is lighted to provide visual indication of the dial backup mode.

Release From Hold Mode (Automatic Dialing)

3.165 When the H2 relay is operated or both the H2 and H1 relays are operated but transmission of the start signal has not been completed, the associated 2-wire dial-up line (DDD2 or DDD1) is in the hold mode. Release of a dial-up line from the hold mode is accomplished as follows:

(a) Release the O/R switch on the faceplate of the data unit (if option S is installed) or release the customer- or modem-provided contact (if option D is installed)

(b) If only the H2 relay is operated, the H2 relay and the DDD2 dial-up line are released immediately.

(c) If both the H2 and H1 relays are operated but transmission of the start signal has not been completed, the H2 and H1 relays and the DDD2 and DDD1 dial-up lines are released after a minimum delay of 3 seconds.

Release From Dial Backup Mode (Automatic Dialing)

3.166 When both the H2 and H1 relays are operated and transmission of the start signal has been completed, the BU lamp is lighted and the 48ER1 data unit is in the dial backup mode (A relay operated). Release of the data unit from the dial backup mode is accomplished as follows:

(a) Release the O/R switch on the faceplate of the data unit (if option S is installed) or release the customer- or modem-provided contact (if option D is installed).

(b) The timing logic in the data unit operates the R relay for 3 seconds causing the signal generator in the data unit to transmit a 941-Hz and 1633-Hz stop signal during the 3-second period. The stop signal releases the 48FR1 data unit at the far end of the dial backup channel from the dial backup mode.

(c) At the end of the stop signal the H2 and H1 relays release and the BU lamp goes off (A relay released), indicating that the 48ER1 data unit is released from the dial backup mode.

Ring Detection (Automatic Dialing)

3.167 A ring detector circuit is connected to each 2-wire dial-up line (DDD1 and DDD2). If the H2 relay is operated, a ringing signal on dial-up line DDD1 causes the H1 relay to operate and place DDD1 on hold. If the H2 relay is released, the DDD1 line will not respond to a ringing signal. The DDD2 line will not respond to a ringing signal at any time.

3.168 The ring detector circuits are only connected to the dial-up lines when the data unit is not in the hold or dial backup modes. If the data unit is in the dial backup mode, both ring detector circuits are disconnected. If either dial-up line is in the hold mode, the associated ring detector circuit is disconnected.

E. Dial Backup Call Sequence (Manual Dialing)

3.169 A typical manual dialing call sequence for two stations, A and B, is described in the following paragraphs. This description assumes that the following conditions exist:

(a) The 4-wire modem is used to transmit and receive data over a 4-wire private line terminated with a DAS 829-type CIU that is conditioned for data transmission, a 48ER1 data unit is used for dial backup at Station A, and a 48ER1 or 48FR1 data unit is used for dial backup at Station B.

(b) The 48FR1 data unit at Station B is optioned for automatic answering enabled by the unit internal logic.

(c) Station A initiates the first call on line 2.

(d) Station A initiates the second call on line 1 when Station B is equipped with a 48ER1 data unit or with a 48FR1 data unit that is optioned for two calls answered.

(e) Station A answers the second call on line 1 when Station B is equipped with a 48FR1 data unit that is optioned for automatic call back.

Idle State

3.170 At Station A, all dial-up line lamps (DDD1 and DDD2) are off, the telephone handset is on-hook, and the BU lamp is off. The modem

is connected through the 48ER1 data unit to the 4-wire private line terminated by the DAS 829-type CIU. Both 2-wire dial-up lines (DDD1 and DDD2) are released and connected to their ring detector circuits. The 48ER1 data unit passes an in-data or not-in-data indication to the modem, as determined by the DAS 829-type CIU. Since the DAS 829-type CIU is conditioned for data transmission, an in-data indication is passed.

First Call

3.171 The sequence begins with Station A deciding for some reason, such as the inability of the modem to send data over the 4-wire private line, that a backup connection should be made. An attendant at Station A places the telephone handset off-hook, selects line 2 by depressing the DDD2 key, and dials line 1 of Station B. Station B responds to the call in one of two ways.

(a) When Station B is equipped with a 48ER1 data unit, a ringing signal causes the line 1 (DDD1) lamp to flash and the telephone set buzzer to sound. An attendant at Station B places the telephone handset off-hook and depresses the DDD1 key. Ringing stops and conversation can now take place. If the connection is not satisfactory, the call can be dropped by placing the handset on-hook, and then reinitiated. At this point both line lamps (DDD1 and DDD2) are off at each station. Once the nature of the call is established (backup), both stations hold their respective lines. At station A, the HOLD key is depressed until the line 2 (DDD2) lamp lights, indicating line 2 is being held. At Station B, a similar procedure puts line 1 on hold. At this point, one line lamp is lighted at each station. The stations need not remain off-hook to hold the call.

(b) When Station B is equipped with a 48FR1 data unit, the data unit is unattended and automatically answers the call on line 1 by placing line 1 on hold. When Station B answers the call, the ringback signal is removed from the line. At Station A, the HOLD key is then depressed until the line 2 (DDD2) lamp lights, indicating line 2 is being held. Station A need not remain off-hook to hold the call.

Second Call

3.172 When Station B is equipped with a 48ER1 data unit or with a 48FR1 data unit that is optioned for two calls answered, the attendant at Station A selects line 1 by depressing the DDD1 key and dials line 2 of Station B. Station B responds to the call in one of two ways.

(a) When Station B is equipped with a 48ER1 data unit, a ringing signal causes the line 2 (DDD2) lamp to flash and the telephone set buzzer to sound. An attendant at Station B depresses the DDD2 key and answers the call. If the connection is not satisfactory, the second call can be dropped by placing the telephone handset on-hook, and then reinitiated. Both stations now hold their respective lines by depressing the HOLD key. The stations need not remain off-hook to hold the call.

(b) When Station B is equipped with a 48FR1 data unit that is optioned for two calls answered, the data unit automatically answers the call on line 2 by placing line 2 on hold. When Station B answers the call, the ringback signal is removed from the line. The attendant at Station A then places line 1 on hold by depressing the HOLD key. Station A need not remain off-hook to hold the call. If the second call is not completed within 2 minutes after line 1 of Station B is placed on hold, line 1 is placed on-hook and the ring detector for line 2 of Station B is disabled. In this case, the entire call sequence must be repeated.

3.173 When Station B is equipped with a 48FR1 data unit that is optioned for automatic call back, the data unit places a station dial connected to line 2 off-hook after a call is answered on line 1. The station dial then automatically dials line 1 of Station A. When dialing is completed, the 48FR1 data unit at Station B places line 2 on hold and disconnects the station dial. At Station A, a ringing signal causes the line 1 (DDD1) lamp to flash and the telephone set buzzer to sound. The attendant at Station A depresses the DDD1 key, answers the call, and then depresses the HOLD key. Station A need not remain off-hook to hold the call.

Data Transmission

3.174 Once the second call is held, the 48ER1 data unit at Station A sends a start signal to the 48ER1 or 48FR1 data unit at Station B and the data unit at each station then enters the dial backup mode, as indicated by the BU lamp at each station being lighted. The DDD1 and DDD2 lamps are lighted at Station A, and also at Station B when a 48ER1 data unit is used at Station B. The modem at each station is transferred from the 4-wire private line to the 4-wire dial backup channel composed of dial-up lines 1 and 2, and in-data and dial backup indications are passed to the modems. At this point, Station A should go on-hook, and also Station B when a 48ER1 data unit is used at Station B.

3.175 The modems now have a complete 4-wire data transmission path over the dial backup channel. While the modems are connected to the dial backup channel, the 4-wire private line can be tested from a remote location without interfering with data transmission over the dial backup channel. If alternate voice service is provided, the 4-wire private line can also be used for conversation.

Return to Idle State

3.176 Once the 4-wire private line is cleared for data transmission, the modems can be returned to the 4-wire private line. Station A goes off-hook and the REL key is depressed. When Station B is equipped with a 48ER1 data unit, Station B also goes off-hook and the REL key is depressed. When Station B is equipped with a 48FR1 data unit, a stop signal from the 48ER1 data unit at Station A causes the 48FR1 data unit at Station B to release from the dial backup mode. The line lamps (DDD1 and DDD2) and the BU lamps go off. Station A and Station B (when equipped with a 48ER1 data unit) now go on-hook and the stations are again in the idle state.

F. Dial Backup Call Sequence (Automatic Dialing)

3.177 A typical automatic dialing call sequence for two stations, A and B, is described in the following paragraphs. This description assumes that the following conditions exist:

(a) The 4-wire modem is used to transmit and receive data over a 4-wire private line terminated with a DAS 829-type CIU that is conditioned for data transmission, a 48ER1 data unit is used for dial backup at Station A, and a 48FR1 data unit is used for dial backup at Station B.

(b) The customer commands the 48ER1 data unit at Station A to originate a dial backup channel through use of a customer- or modem-provided contact and a station dial or an ACU.

(c) The 48FR1 data unit at Station B is optioned for automatic answering enabled by the unit internal logic.

Idle State

3.178 At Station A, the customer- or modem-provided contact is open and the BU lamp is off. The modem is connected through the 48ER1 data unit to the 4-wire private line terminated by the DAS 829-type CIU. Both 2-wire dial-up lines (DDD1 and DDD2) are released and connected to their ring detector circuits. The 48ER1 data unit passes an in-data or not-in-data indication to the modem, as determined by the DAS 829-type CIU. Since the DAS 829-type CIU is conditioned for data transmission, an in-data indication is passed.

First Call

3.179 The sequence begins with Station A deciding for some reason, such as the inability of the modem to send data over the 4-wire private line, that a backup connection should be made. The customer- or modem-provided contact at Station A is closed by the customer causing the station dial or ACU connected to line 2 of Station A to automatically dial line 1 of Station B. When dialing is completed, the 48ER1 data unit at Station A places line 2 on hold and disconnects the station dial or ACU. The 48FR1 data unit at Station B automatically answers the call on line 1 by placing line 1 on hold. The customer- or modem-provided contact at Station A must remain closed until a release or retry command is to be initiated.

Second Call

3.180 The 48FR1 data unit at Station B places a station dial connected to line 2 off-hook after a call is answered on line 1. The station dial then automatically dials line 1 of Station A. When dialing is completed, the 48FR1 data unit at Station

B places line 2 on hold and disconnects the station dial. The 48ER1 data unit at Station A automatically answers the call on line 1 by placing line 1 on hold.

Data Transmission

3.181 Once the second call is held, the 48ER1 data unit at Station A sends a start signal to the 48FR1 data unit at Station B and the data unit at each station then enters the dial backup mode, as indicated by the BU lamp at each station being lighted. The modem at each station is transferred from the 4-wire private line to the 4-wire dial backup channel composed of dial-up lines 1 and 2, and in-data and dial backup indications are passed to the modems.

3.182 The modems now have a complete 4-wire data transmission path over the dial backup channel. While the modems are connected to the dial backup channel, the 4-wire private line can be tested from a remote location without interfering with data transmission over the dial backup channel.

Return to Idle State

3.183 Once the 4-wire private line is cleared for data transmission, the modems can be returned to the 4-wire private line. The customer- or modem-provided contact at Station A is opened causing the 48ER1 data unit at Station A to release from the dial backup mode, as indicated by the BU lamp going off, and to send a stop signal to the 48FR1 data unit at Station B. The stop signal causes the 48FR1 data unit to release from the dial backup mode, as indicated by the BU lamp going off. The stations are again in the idle state.

48FR1 DATA UNIT

3.184 The 48FR1 data unit provides the switching, ring detection, and transmission circuitry required to add 4-wire dial backup service with automatic answering to 4-wire private line data service. A dc power supply in the data unit obtains its unregulated input from a bridge rectifier power supply associated with the 59A1 data mounting that houses the data unit. All connections to the data unit are made through the data mounting.

A. Options

3.185 The 48FR1 data unit is provided with several options that may be requested by the customer. The desired options must be specified when the data unit is ordered. Refer to Table C for a summary of the options.

3.186 ***Call Control:*** Two methods of automatic answering are provided.

(a) With two calls answered (option T), the 48FR1 data unit automatically answers a

TABLE C

48FR1 DATA UNIT OPTIONS

FEATURE	OPTION	PLUG-IN STRAP(S)		PROVIDE
		QUANTITY	POSITION	
Call Control	Two Calls Answered (T)	6	T	One Per Unit
	Automatic Call Back (A)	6	A	
Unit Control	Unit Internal Logic (E)	1	E	One Per Unit
	Customer- or Modem-Provided Contact (D)	1	D	
Power Supply	24 Vac (N)	1	N	One Per Unit
	-48 Vdc (-48)*	1	-48	

* Use not permitted.

call on line 1 and then automatically answers a call on line 2, if the second call is received within 2 minutes of the time line 1 went on hold.

(b) With automatic call back (option A), the 48FR1 data unit automatically answers a call on line 1 and then automatically initiates a call on line 2.

3.187 ***Unit Control:*** Two methods of enabling automatic answering are provided.

(a) With unit internal logic (option E), automatic answering is enabled by the internal logic in the 48FR1 data unit. The data unit can automatically answer a call on line 1 and then automatically answer or initiate a call on line 2.

(b) With a customer- or modem-provided contact (option D), automatic answering is enabled only when the customer or modem provides and maintains a contact closure. The data unit can automatically answer a call on line 1 and then automatically answer or initiate a call on line 2.

3.188 ***Power Supply:*** Operating power for the 48FR1 data unit can be provided by either a 24 Vac (option N) or a -48 Vdc (option -48) supply.

Note: Use of a -48 Vdc supply is not permitted.

B. Arrangements

3.189 The 48FR1 data unit can be used to provide 4-wire dial backup service with automatic answering on a single 4-wire private line in the following equipment arrangements: single installation (two calls answered), and single installation (automatic call back).

Single Installation (Two Calls Answered)

3.190 For this arrangement, the 48FR1 data unit is equipped with options N, T, and E or D and housed in a 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU. Automatic answering is enabled by internal logic in the 48FR1 data unit (option E) or by a customer- or modem-provided contact (option D). This arrangement provides that the far end of a 4-wire dial backup channel is established when the following sequence is completed within 2 minutes: a call is automatically answered on line 1, a call is then automatically answered on line 2, and a start signal is received on line 2.

3.191 For a detailed description of the single installation (two calls answered) arrangement, refer to paragraphs 3.199 through 3.216 and 3.223 through 3.230.

Single Installation (Automatic Call Back)

3.192 For this arrangement, the 48FR1 data unit is equipped with options A, N, and E or D and housed in a 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU. Automatic answering is enabled by internal logic in the 48FR1 data unit (option E) or by a customer- or modem-provided contact (option D). This arrangement provides that the far end of a 4-wire dial backup channel is established when the following sequence is completed within 2 minutes: a call is automatically answered on line 1, a call is then automatically initiated on line 2, and a start signal is received on line 2.

3.193 A 43A or 53A station dial is required for automatic call back. The station dial must be optioned for the restricted mode of operation. For those installations that have precise dial tone available, a 1A350 tone detector can be used with either the 43A or 53A station dial. The minimum time required to establish a dial backup channel is obtained when a 53A station dial equipped with a 1A350 tone detector is used. If the 1A350 tone detector is not used, an internal timer starts the station dial.

3.194 For a detailed description of the single installation (automatic call back) arrangement, refer to paragraphs 3.199 through 3.208 and 3.217 through 3.230.

C. Security

3.195 Arrangements that include a 48ER1 data unit at the near end station of a 4-wire private line and a 48FR1 data unit at an unattended far end station enable the customer to establish a 4-wire dial backup channel, through use of the switched network, to a data set at the unattended station. These arrangements also enable an unauthorized party to access the unattended station unless security measures are taken. The security

measures should ensure that an unauthorized party cannot access the unattended station or deny access to the customer. To accomplish these objectives, the security measures should ensure that an unauthorized party cannot use the switched network to establish a 4-wire dial backup channel to the unattended station.

3.196 When the 48FR1 data unit is equipped with option D, the data unit is controlled by a customer- or modem-provided contact. This is the most secure arrangement as a 4-wire dial backup channel cannot be established until the customer or modem enables the unattended station by providing a contact closure. However, the equipment at the unattended station must be capable of controlling the contact closure.

3.197 When the 48FR1 data unit is equipped with option E, the data unit is controlled by internal logic. With this arrangement the unattended station is enabled whenever a call is received on line 1. This arrangement provides various degrees of security as follows:

(a) When the 48FR1 data unit is equipped with option T, a 4-wire dial backup channel is established whenever the unattended station answers calls on both lines 1 and 2. This arrangement provides minimum security since any party knowing the two telephone numbers to be called and also knowing the required call sequence can establish a 4-wire dial backup channel to the unattended station.

(b) When the 48FR1 data unit is equipped with option A, a 4-wire dial backup channel is established whenever the unattended station answers a call on line 1 and then originates a call on line 2. However, it is still possible to make the unattended station answer calls on both lines 1 and 2. Therefore, any improvement in security with this arrangement is due solely to the fact that the telephone number of the call-back line (line 2) at the unattended station would not normally be known to an unauthorized user.

(c) If the customer requires maximum security, the 48FR1 data unit at the unattended station must be equipped with option A and the call-back line (line 2) must be an originate-only line. With this arrangement, an unauthorized party cannot use the switched network to establish a 4-wire dial backup channel to the unattended station.

3.198 It is expected that the 48ER1 data unit at the near end station will normally be equipped for manual dialing (option M installed) and the near end station will be attended. With this arrangement, there are no security problems. However, if the 48ER1 data unit is equipped for automatic dialing (option A installed) and maximum security is required, line 2 at the near end station must be an originate-only line.

D. Data Service

3.199 In the data mode (Fig. 3), the 4-wire modem can transmit and receive data over the 4-wire private line since the 48FR1 data unit provides a through connection for the transmission leads of the standard 6-lead interface (DT, DR, DT1, DR1, TEK5, TEK6) that connects the modem to the DAS 829-type CIU. The four transmission leads (DT, DR, DT1, DR1) are complete through the normally-closed contacts of the A relay in the 48FR1 data unit as long as the 48FR1 data unit remains in the data mode. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6, if the DAS 829-type CIU is also in the data mode. Two additional interface leads, DBU1 and DBU2, supply a dial backup status signal to the modem.

3.200 When data units are not installed in all positions of the 59A1 data mounting, the data unit connectors at the vacant positions of the data mounting provide a through connection for the 6-lead interface.

3.201 The following are the transmission leads from the DAS 829-type CIU and the corresponding 48FR1 terminal numbers (Fig. 60):

Designation	48FR1 Terminal Number
DT	25
DR	2
DT1	24
DR1	23

3.202 The following are the transmission leads from the modem and the corresponding 48FR1 terminal numbers (Fig. 60):

Designation	48FR1 Terminal Number
DT	5
DR	22
DT1	4
DR1	3

3.203 The 48FR1 terminals (Fig. 60) designated DT(M), DR(M), DT1(M), and DR1(M) are not used.

E. Dial Backup Service

3.204 In the dial backup mode (Fig. 3), operation of the A relay in the 48FR1 data unit transfers the 4-wire modem from the 4-wire private line to the 4-wire dial backup channel. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

Transmit Circuit

3.205 In the dial backup mode (A relay operated, Fig. 60), the modem transmit pair (DT1, DR1) is connected through the normally-open contacts of relay A, the normally-closed contacts of test jack J1 (XMT), isolation transformer T2, the signal power limiter circuit, the transmit amplifier, line-holding transformer T1, and the normally-open contacts of relay H1 to the 2-wire dial-up line terminating on T2 and R2.

3.206 The 48FR1 data unit provides a 600-ohm termination for the dial-up line and a 600-ohm termination for the modem. Resistors R15 and F1 function as fuses for the modem transmit pair (DT1, DR1) and the dial-up transmit pair (T2, R2), respectively. If excessive power is dissipated in resistor R15 or F1, the resistor opens to disconnect the hazardous voltage. Diode CR3 and varistor RV10 limit voltage surges in the circuit. Switch S1 (XMT) provides adjustment of the signal gain. The signal power limiter circuit assures that the signal level does not exceed -4 dBm when averaged over any 3-second period.

Note: The setting of XMT switch S1 is fixed in registered arrangements.

Receive Circuit

3.207 In the dial backup mode (A relay operated, Fig. 60), the modem receive pair (DT, DR) is connected through the normally-open contacts of relay A, the normally-closed contacts of test jack J2 (REC), isolation transformer T4, the receive amplifier, line-holding transformer T3, and the normally-open contacts of relay H2 to the 2-wire dial-up line terminating on T3 and R3.

3.208 The 48FR1 data unit provides a 600-ohm termination for the dial-up line and a 600-ohm termination for the modem. Resistors R23 and F2 function as fuses for the modem receive pair (DT, DR) and the dial-up receive pair (T3, R3), respectively. If excessive power is dissipated in resistor R23 or F2, the resistor opens to disconnect the hazardous voltage. Diodes CR7 and CR9 limit voltage surges in the circuit. Switch S2 (REC) provides adjustment of the signal gain.

Note: The setting of REC switch S2 is fixed in registered arrangements.

Dial Backup Mode (Two Calls Answered)

3.209 The description in the following paragraphs assumes that the 48FR1 data unit (with options N, T, and E or D installed, Fig. 60) is installed in the 59A1 data mounting (Fig. 58), the required DAS 829-type CIU is installed in the data mounting, and all necessary connections are made. If option D is installed, the customer- or modem-provided contact is closed. The key telephone set shown in Fig. 58 is not required for this arrangement.

3.210 To put the 48FR1 data unit in the dial backup mode, the H1 and H2 relays are operated, a start signal is received, and the A relay is operated.

(a) The H1 relay (Fig. 60) is operated as follows: When the DDD1 ring detector in the 48FR1 data unit detects a ringing signal on the DDD1 dial-up line, the DDD1 ring detector causes the H1 relay to operate and then latch under control of the release logic in the data unit. The DDD1 dial-up line is transferred from the DDD1 ring detector to the transmit circuit of the data unit and is now in the hold mode.

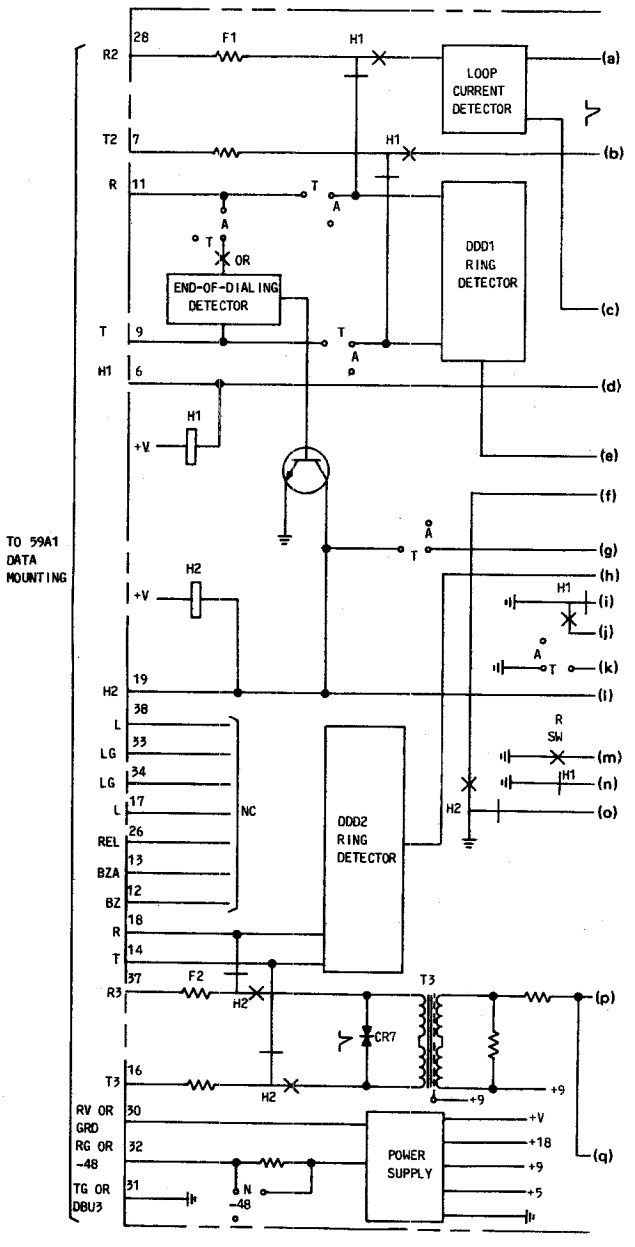


Fig. 60—48FR1 Data Unit—Functional Diagram (Sheet 1 of 3)

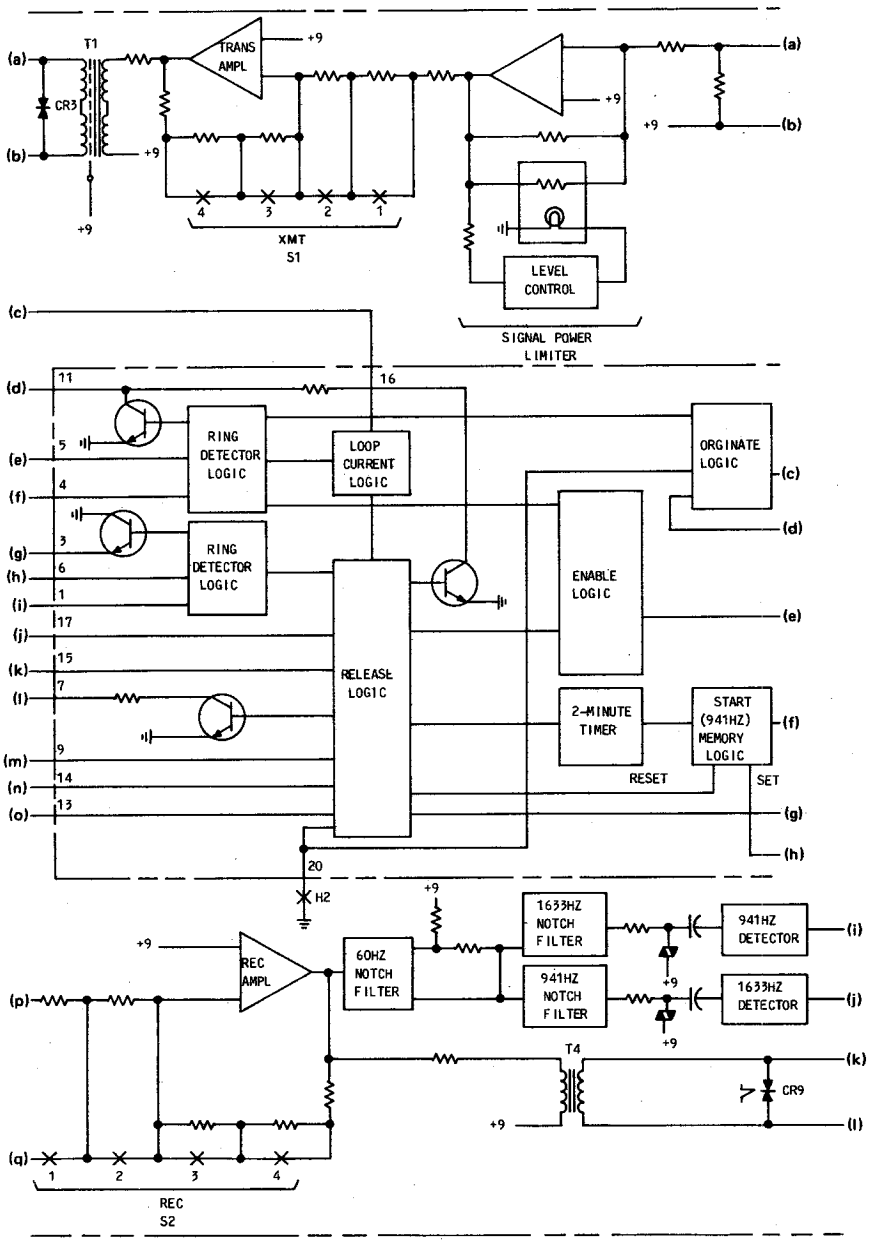


Fig. 60 — 48FR1 Data Unit—Functional Diagram (Sheet 2 of 3)

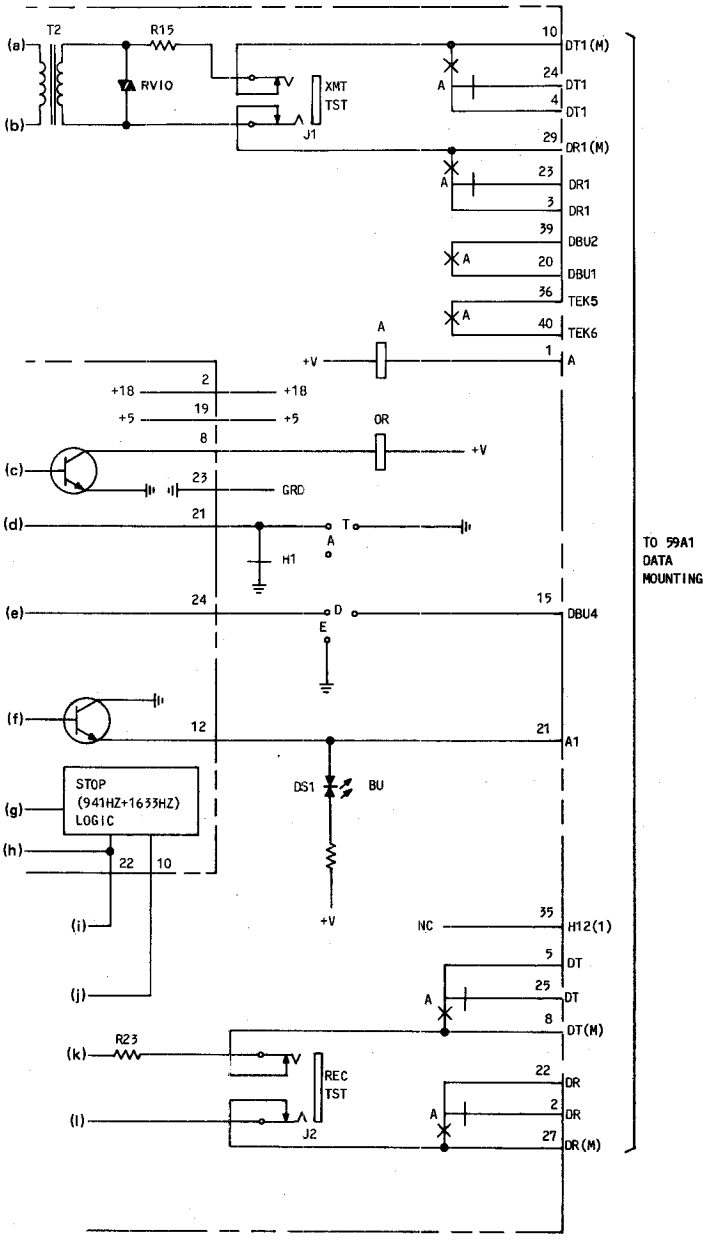


Fig. 60—48FR1 Data Unit—Functional Diagram (Sheet 3 of 3)

(b) The H2 relay (Fig. 60) is operated as follows: When the DDD2 ring detector in the 48FR1 data unit detects a ringing signal on the DDD2 dial-up line within the 2-minute interval provided by a 2-minute timer in the data unit that is started by operation of the H1 relay, the DDD2 ring detector causes the H2 relay to operate and then latch under control of the release logic in the data unit. The DDD2 dial-up line is transferred from the DDD2 ring detector to the receive circuit of the data unit and is now in the hold mode.

(c) With the DDD1 and DDD2 dial-up lines in the hold mode (H1 and H2 relays operated), the A relay operates when a start signal, supplied by the 48ER1 data unit at the near end of the dial backup channel, is detected and removed within the 2-minute interval provided by the 2-minute timer. The modem is transferred from the 4-wire private line to the transmit and receive circuits of the 48FR1 data unit. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

(d) The data unit is now in the dial backup mode (A relay operated) and data transmission can take place over the 4-wire dial backup channel. A light-emitting diode, DS1 (BU), on the faceplate of the data unit is lighted to provide visual indication of the dial backup mode.

Release From Hold and Dial Backup Modes (Two Calls Answered)

3.211 When either the H1 or H2 relay is operated, the associated 2-wire dial-up line (DDD1 or DDD2) is in the hold mode. When both the H1 and H2 relays are operated and a start signal has been detected and removed, the 48FR1 data unit is in the dial backup mode (A relay operated). Release of a dial-up line from the hold mode and release of the data unit from the dial backup mode is accomplished in the following ways:

(a) When the 2-minute interval provided by a 2-minute timer in the 48FR1 data unit has elapsed.

(b) When loop current for the DDD1 dial-up line is interrupted for more than 5 ms.

(c) When a stop signal is received.

(d) When the R (release) switch on the faceplate of the 48FR1 data unit is operated.

3.212 When the data unit is improperly accessed, the H1 and/or H2 relays are released by the 2-minute timer. When the data unit is properly accessed and a dial backup channel is established, the data unit is normally released by receipt of the stop signal. If the stop signal cannot be received and the line control circuitry provides an interruption in the loop current when the calling party disconnects, the data unit is released by this interruption. The R switch provides a way to release the data unit when the normal ways cannot be used.

3.213 When the 48FR1 data unit is released from the dial backup mode by one of the previous ways, the BU lamp goes off (A relay released), indicating that the 48FR1 data unit is released from the dial backup mode.

Ring Detection (Two Calls Answered)

3.214 A ring detector circuit is connected to each 2-wire dial-up line (DDD1 and DDD2). A ringing signal on dial-up line DDD1 causes the H1 relay to operate and place DDD1 on hold. Operation of the H1 relay also starts a 2-minute timer.

3.215 If the H1 relay is operated and the 2-minute interval provided by the 2-minute timer has not elapsed, a ringing signal on dial-up line DDD2 causes the H2 relay to operate and place DDD2 on hold. If the H1 relay is released, the DDD2 line will not respond to a ringing signal.

3.216 The ring detector circuits are only connected to the dial-up lines when the data unit is not in the hold or dial backup modes. If the data unit is in the dial backup mode, both ring detector circuits are disconnected. If either dial backup line is in the hold mode, the associated ring detector circuit is disconnected.

Dial Backup Mode (Automatic Call Back)

3.217 The description in the following paragraphs assumes that the 48FR1 data unit (with options A, N, and E or D installed, Fig. 60) is installed in the 59A1 data mounting (Fig. 58), the required DAS 829-type CIU is installed in the data

mounting, the required station dial is provided (instead of the key telephone set shown in Fig. 58), and all necessary connections are made. If option D is installed, the customer- or modem-provided contact is closed.

3.218 To put the 48FR1 data unit in the dial backup mode, the H1 and H2 relays are operated, a start signal is received, and the A relay is operated.

(a) The H1 relay (Fig. 60) is operated as follows: When the DDD1 ring detector in the 48FR1 data unit detects a ringing signal on the DDD1 dial-up line, the DDD1 ring detector causes the H1 relay to operate and then latch under control of the release logic in the data unit. The DDD1 dial-up line is transferred from the DDD1 ring detector to the transmit circuit of the data unit and is now in the hold mode.

(b) The H2 relay (Fig. 60) is operated as follows: Operation of the H1 relay in the 48FR1 data unit starts a 2-minute timer and causes the originate logic to operate the OR relay. With the OR relay operated, loop current is detected by the station dial causing the station dial to place a call, on the 2-wire dial-up line terminating on T3 and R3 (DDD2) of the 48FR1 data unit, to the number of the DDD1 dial-up line for the 48ER1 data unit at the near end of the dial backup channel. When dialing is completed, loop current is detected by the end-of-dialing detector in the 48FR1 data unit causing the H2 relay to operate and then latch under control of the release logic in the data unit. The DDD2 dial-up line of the 48FR1 data unit is transferred from the station dial to the receive circuit of the data unit and is now in the hold mode.

(c) With the DDD1 and DDD2 dial-up lines in the hold mode (H1 and H2 relays operated), the A relay operates when a start signal, supplied by the 48ER1 data unit at the near end of the dial backup channel, is detected and removed within the 2-minute interval provided by the 2-minute timer. The modem is transferred from the 4-wire private line to the transmit and receive circuits of the 48FR1 data unit. An in-data line status signal is supplied to the modem on interface leads TEK5 and TEK6. A dial backup status signal is supplied to the modem on interface leads DBU1 and DBU2.

(d) The data unit is now in the dial backup mode (A relay operated) and data transmission can take place over the 4-wire dial backup channel. A light-emitting diode, DS1 (BU), on the faceplate of the data unit is lighted to provide visual indication of the dial backup mode.

Release From Hold and Dial Backup Modes (Automatic Call Back)

3.219 Release of a dial-up line from the hold mode and release of the data unit from the dial backup mode is accomplished in the same ways as described in paragraphs 3.211 through 3.213 for the two calls answered arrangement.

Ring Detection (Automatic Call Back)

3.220 A ring detector circuit is connected to each 2-wire dial-up line (DDD1 and DDD2). A ringing signal on dial-up line DDD1 causes the H1 relay to operate and place DDD1 on hold. Operation of the H1 relay also starts a 2-minute timer and after a 5-second delay causes the data unit to initiate a call on dial-up line DDD2.

3.221 If the H1 relay is operated and the 5-second delay has not elapsed, a ringing signal on dial-up line DDD2 causes the H1 relay to release. If the H1 relay is released, the DDD2 line will not respond to a ringing signal.

3.222 The ring detector circuits are only connected to the dial-up lines when the data unit is not in the hold or dial backup modes. If the data unit is in the dial backup mode, both ring detector circuits are disconnected. If either dial-up line is in the hold mode, the associated ring detector circuit is disconnected.

F. Dial Backup Call Sequence (Two Calls Answered or Automatic Call Back)

3.223 A typical automatic answering call sequence for two stations, A and B, is described in the following paragraphs. This description assumes that the following conditions exist:

(a) The 4-wire modem is used to transmit and receive data over a 4-wire private line terminated with a DAS 829-type CIU that is conditioned for data transmission, a 48ER1 data unit is used for dial backup at Station A, and a

48FR1 data unit is used for dial backup at Station B.

(b) The 48FR1 data unit at Station B is optioned for automatic answering enabled by the unit internal logic.

(c) Station B answers the first call on line 1.

(d) Station B answers the second call on line 2 when the 48FR1 data unit at Station B is optioned for two calls answered.

(e) Station B initiates the second call on line 2 when the 48FR1 data unit at Station B is optioned for automatic call back.

Idle State

3.224 At Station B, the H1, H2, and A relays are released and the BU lamp is off. The modem is connected through the 48FR1 data unit to the 4-wire private line terminated by the DAS 829-type CIU. Both 2-wire dial-up lines (DDD1 and DDD2) are released and connected to their ring detector circuits. The 48FR1 data unit passes an in-data or not-in-data indication to the modem, as determined by the DAS 829-type CIU. Since the DAS 829-type CIU is conditioned for data transmission, an in-data indication is passed.

First Call

3.225 The sequence begins with a ringin signal on line 1 of Station B, as a result of a call initiated on line 2 of Station A. The 48FR1 data unit at Station B automatically answers the call on line 1 by operating the H1 relay. Operation of the H1 relay places line 1 on hold and starts the 2-minute timer that restores the data unit to idle when the data unit is improperly accessed. In addition, the H1 relay enables the data unit to answer a call on line 2 when the data unit is optioned for two calls answered, or to initiate a call on line 2 when the data unit is optioned for automatic call back. After the call to line 1 of Station B is completed, line 2 of Station A is placed on-hold.

Second Call

3.226 When the 48FR1 data unit at Station B is optioned for two calls answered, Station A initiates a call on line 1 to line 2 of Station B. The 48FR1 data unit at Station B automatically answers the call on line 2 by operating the H2 relay, if less than 2 minutes has elapsed since the H1 relay operated. Operation of the H2 relay places line 2 on hold. If the second call is not completed within 2 minutes after line 1 of Station B is placed on hold, line 1 is placed on-hook and the ring detector for line 2 of Station B is disabled. In this case, the entire call sequence must be repeated.

3.227 When the 48FR1 data unit at Station B is optioned for automatic call back, the data unit places a station dial connected to line 2 off-hook after a call is answered on line 1. The station dial then automatically dials line 1 of Station A. When dialing is completed, the 48FR1 data unit at Station B operates the H2 relay. Operation of the H2 relay places line 2 on hold and disconnects the station dial. Station A answers the call on line 1 and then places line 1 on hold.

Data Transmission

3.228 Once the second call is held, the 48ER1 data unit at Station A sends a start signal to the 48FR1 data unit at Station B. The start signal disables the 2-minute timer and operates the A relay in the 48FR1 data unit. The data unit at each station then enters the dial backup mode, as indicated by the BU lamp at each station being lighted. The modem at each station is transferred from the 4-wire private line to the 4-wire dial backup channel composed of dial-up lines 1 and 2, and in-data and dial backup indications are passed to the modem.

3.229 The modems now have a complete 4-wire data transmission path over the dial backup channel. While the modems are connected to the dial backup channel, the 4-wire private line can be tested from a remote location without interfering with data transmission over the dial backup channel.

Return to Idle State

3.230 Once the 4-wire private line is cleared for data transmission, the modems can be returned to the 4-wire private line. When Station A is released from the dial backup mode, as indicated by the BU lamp going off, the 48ER1 data unit at Station A sends a stop signal to the 48FR1 data unit at Station B. The stop signal releases the H1, H2, and A relays causing the

48FR1 data unit to release from the dial backup mode, as indicated by the BU lamp going off. The stations are again in the idle state.

48G1 DATA UNIT

3.231 The 48G1 data unit contains the circuitry required to provide conversion from a 2-wire to a 4-wire channel. A dc power supply in the data unit obtains its unregulated input from a bridge rectifier power supply in the 46B1, 59A1, or 62A1 data mounting that houses the data unit. A 2-position power supply option in the data unit enables the associated dc power supply to operate on 24 Vac (N position), -24 Vdc (N position), or -48 Vdc (-48 position). All connections to the data unit are made through the data mounting.

3.232 For data only service on a single 2-wire private line, the 48G1 data unit is housed in a 59A1 or 62A1 data mounting. This data mounting also houses the required DAS 829-type CIU. If alternate voice service is also provided, the 48G1 data unit is housed in a 59A1 data mounting. This data mounting also houses the required DAS 829-type CIU and the required 48A1 data unit.

3.233 For data only service on multiple (up to eight) 2-wire private lines, the 48G1 data units are housed in a 46B1 data mounting. The required DAS 829-type CIUs are housed in a 46A1 or 46A2 data mounting. If alternate voice service is also provided, the required 48A1 data units are housed in a separate 46B1 data mounting.

3.234 Hybrid transformer T3 (Fig. 61) provides the interface between the 2-wire modem and the DAS 829-type CIU that terminates a standard 16-dB channel. The transmit and receive amplifiers in the transmit and receive pairs of the 48G1 data unit have a fixed gain that offsets the circuit losses and provides a 0-dB insertion loss in the transmit and receive paths.

POWER SUPPLIES

3.235 The 44A1, 44A2, 45A1, 46A1, 46A2, 46B1, 59A1, and 62A1 data mountings and the 48D1 data unit have power supplies that require a power source of 105 to 129 volts at 57 to 63 Hz.

A. 44A1 and 44A2 Data Mountings

3.236 The 44A1 or 44A2 data mounting provides input power for the DAS 829-type CIU that is housed in the data mounting. The CIU normally requires a 24-Vac input that is provided by a transformer supplied with the data mounting. Overcurrent protection for the CIU is provided by a thermal breaker in the primary winding of the transformer. If the CIU requires a -24 or -48 Vdc input, locally supplied power connections must be provided.

B. 45A1 Data Mounting

3.237 The 45A1 data mounting provides input power for a DAS 829-type CIU, a 48A1 data unit, and/or a 48B1 data unit that are housed in the data mounting. The CIU normally requires a 24-Vac input. Each data unit requires an unregulated dc input. The input to the data units is provided by a bridge rectifier power supply in the data mounting. A transformer supplied with the data mounting provides the 24-Vac input to the CIU and the bridge rectifier power supply. Overcurrent protection for the CIU and the data units is provided by a thermal breaker in the primary winding of the transformer.

C. 46A1 and 46A2 Data Mountings

3.238 The 46A1 or 46A2 data mounting provides input power for up to eight DAS 829-type CIUs that are housed in the data mounting. The CIUs normally require a 24-Vac input that is provided by a transformer in the 46A1 or 46A2 data mounting. Overcurrent protection for each CIU is provided by fuses F1 through F8 in the transformer output circuit. Overcurrent protection for the transformer is provided by fuse F9 in the transformer input circuit. If the CIUs require a -24 or -48 Vdc input, the 46A2 data mounting must be used. The transformer is disconnected, by use of an installer option, and a -24 or -48 Vdc power source is connected to the data mounting.

D. 46B1 Data Mounting

3.239 The 46B1 data mounting provides input power for up to eight 48A1 or 48G1 data units that are housed in the data mounting. The data units require an unregulated dc input that is provided by a bridge rectifier power supply in the data mounting. A transformer in the data mounting

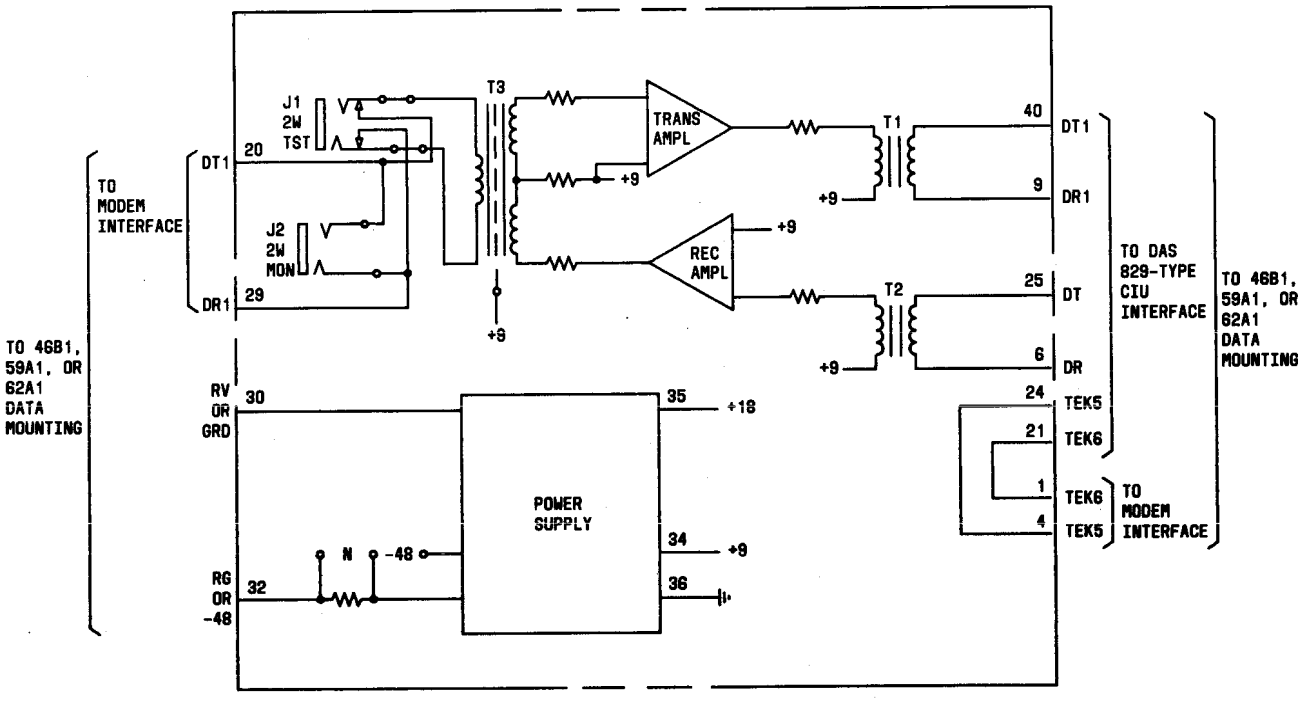


Fig. 61—48G1 Data Unit—Functional Diagram

provides a 24-Vac input to the bridge rectifier power supply. Overcurrent protection for each data unit is provided by fuses F1 through F8 in the bridge rectifier output circuit. Overcurrent protection for the transformer is provided by fuse F9 in the transformer input circuit.

E. 59A1 Data Mounting

3.240 The 59A1 data mounting provides input power for a DAS 829-type CIU, a 48A1 data unit, a 48B1, 48ER1, or 48FR1 data unit, and a 48G1 data unit that are housed in the data mounting. The CIU normally requires a 24-Vac input. Each data unit requires an unregulated dc input. The input to the data units is provided by a bridge rectifier power supply in the data mounting. A transformer supplied with the data mounting provides the 24-Vac input to the CIU and the bridge rectifier power supply. Overcurrent protection for the CIU and the data units is provided by a thermal breaker in the primary winding of the transformer.

F. 62A1 Data Mounting

3.241 The 62A1 data mounting provides input power for a DAS 829-type CIU and a 48G1 data unit that are housed in the data mounting. The CIU normally requires a 24-Vac input. The data unit requires an unregulated dc input. The input to the data unit is provided by a bridge rectifier power supply in the data mounting. A transformer supplied with the data mounting provides the 24-Vac input to the CIU and the bridge rectifier power supply. Overcurrent protection for the CIU and the data unit is provided by a thermal breaker in the primary winding of the transformer. If the CIU and the data unit require a -24 or -48 Vdc input, locally supplied power connections must be provided.

G. 48D1 Data Unit

3.242 The 48D1 data unit provides input power for a 46C1 or 46C2 data mounting and the data units that are housed in the data mounting. The 46C1 data mounting houses one or two 48B1 and up to six 48C1 data units. The 46C2 data mounting houses one or two 48B1 or 48ER1 and up to six 48C1 data units. The 46C1 or 46C2 data mounting, each 48B1, 48C1, and 48ER1 data unit, and a regulated power supply in the 48D1 data unit require an unregulated dc input that is provided by a bridge rectifier power supply in the 48D1 data unit. The regulated power supply provides +12 Vdc lamp power to an 18- or 30-button key telephone set. A transformer in the 48D1 data unit provides a 24-Vac input to the bridge rectifier power supply and to the buzzer in the key telephone set. Overcurrent protection for each 48B1 or 48ER1 data unit is provided by fuses F1 and F2 in the bridge rectifier output circuit. Overcurrent protection for the 46C1 or 46C2 data mounting, the 48C1 data units, and the regulated power supply is provided by fuse F3 in the bridge rectifier output circuit. Overcurrent protection for the transformer is provided by fuse F4 in the transformer input circuit.

4. TRANSMISSION DESIGN

4.01 The following paragraphs describe the basic ground rules for determining transmission design. Typical circuit arrangements are provided.

4.02 Transmission design involves selection of the correct DAS 829-type CIU and the proper options. The basic ground rules for determining transmission design are as follows:

(a) -13 dBm0 design.

(b) The modem interface is +13 TLP (0 dBm) transmit and -3 TLP (-16 dBm) receive.

(c) Equal level loopback is always provided.

4.03 The selection of a particular DAS 829-type code is determined by transmission design with V4 repeaters. Refer to Section 852-307-101 for typical transmission design information on equalizer assignments and adjustments.

4.04 Table D provides information for the selection of DAS 829-type CIUs and options to be used with nonloaded facilities. The nonloaded repeater section to be equalized can be terminated with CIUs at both ends, or by a CIU at one end and a V4 repeater at the other end. When selecting a CIU, either one or both of the V4 repeaters, with its appropriate equalizer, can be replaced by a DAS 829-type CIU equivalent in the following situations:

- V4 in central office
- V4 in DAS 828-type CIU

- V4 in locally engineered data only service.

4.05 The following general rules apply to the selection of a DAS 829-type CIU to be used to terminate both ends of a nonloaded facility.

(a) When a 359N equalizer is specified at both ends of a nonloaded repeater section, the DAS 829A-L1 or L1A CIU (provided with the 600-ohm option) should be used at both ends.

(b) When a 359M equalizer is specified at one end and a 359N equalizer is specified at the other end, the DAS 829B-L1 or L1A CIU (150-ohm option) should be used for the 359M end and the DAS 829A-L1 or L1A CIU (600-ohm option) should be used for the 359N end. If gain is required in the receive pair, the DAS 829B-L1 or L1A CIU (600-ohm option) should be used for the 359N end.

(c) When a 359M equalizer is specified at both ends, the DAS 829B-L1 or L1A CIU (150-ohm option) should be used at both ends.

4.06 The following general rules apply to the selection of a DAS 829-type CIU to be used to terminate a nonloaded facility that is to have a CIU at one end and a V4 repeater at the other end.

(a) When a 359N equalizer is specified at both ends of a nonloaded repeater section, the DAS 829A-L1 or L1A CIU (600-ohm option) should be used at the CIU end, and a V4 repeater equipped with a 359N equalizer should be used at the other end.

(b) When a 359M equalizer is specified at one end and a 359N equalizer is specified at the other end, the DAS 829A-L1 or L1A CIU (600-ohm option) should be used at the CIU end, and a V4 repeater equipped with a 359M equalizer should be used at the other end. If gain is required in the receive pair, the DAS 829B-L1 or L1A CIU (600-ohm option) should be used for the 359N equalizer at the CIU end.

(c) When a 359M equalizer is specified at both ends, the DAS 829B-L1 or L1A CIU (150-ohm option) should be used at the CIU end and a V4 repeater equipped with a 359M equalizer should be used at the other end.

4.07 The following general rules apply to a long loaded facility:

(a) When the facility can be equalized through the use of a 359A equalizer, the DAS 829C-L1 or L1A CIU (359A option) should be used at the CIU end.

(b) When the facility can be equalized through the use of a 359K equalizer, the DAS 829C-L1 or L1A (359K option) should be used at the CIU end.

4.08 The equalization of loaded cable is determined by the following steps:

(a) Refer to Section 852-307-101 to determine the type of equalizer required for the cable end section in question.

TABLE D

SELECTION OF DAS 829-TYPE CIU—NONLOADED LOOPS*

V4 REPEATER EQUIPPED WITH	NO RECEIVE GAIN REQUIRED	RECEIVE GAIN REQUIRED
359N	829A-L1 or L1A (600 Option)	829B-L1 or L1A (600 Option)
359M	829B-L1 or L1A (150 Option)	829B-L1 or L1A (150 Option)
359A	829C-L1 or L1A†	829C-L1 or L1A*

* The 359M and 359N are common equalizers providing 150- and 600-ohm line termination, respectively. Equivalent equalizers providing 150- or 600-ohm line termination should also use the DAS 829-type CIU.

† A, B, C, D option as required.

(b) Refer to Table E for the DAS 829-type CIU providing equalization capabilities equivalent to the equalizer specified by the V4 practices.

4.09 Table F illustrates the procedure in paragraph 4.08. As an example, assume the end section to be equalized is 38 kilofeet of 19H88 HC cable. Table F shows that from zero to 42 kilofeet of 19H88 HC cable can be equalized with a 359A equalizer having the screws designated A1, A2, A3, A4, B3, C1, C2, C3, and C4 in the "screw down" position and the remaining screws in the "screw up" position. This configuration can be provided (see Table E) by a DAS 829C-L1 or L1A CIU having the 359A option and the A1, A2, A3, A4, B3, C1, C2, C3, and C4 options provided. The other equalizer options remain in their storage positions.

4.10 When Table F indicates a screw code as a "screw down" position, the DAS 829C-L1 or L1A CIU should be provided with a strap that corresponds to the screw code. When Table F indicates a screw code as a "screw up" position, the DAS 829C-L1 or L1A CIU strap for that code must remain in its storage position.

TABLE E

SELECTION OF DAS 829-TYPE CIU–LOADED LOOPS*

V4 REPEATER EQUIPPED WITH	NO RECEIVE GAIN REQUIRED	RECEIVE GAIN REQUIRED
359E	829A-L1 or L1A (1200 Option)	829B-L1 or L1A (1200 Option)
359J	829A-L1 or L1A (1200 Option)	829B-L1 or L1A (1200 Option)
359A	829C-L1 or L1A (359A Option)†	829C-L1 or L1A (359A Option)†
359K	829C-L1 or L1A (359K Option)†	829C-L1 or L1A (359K Option)†

* The 359E and 359J are common equalizers providing 1200-ohm line termination. Equivalent equalizers providing 1200-ohm line termination should also use the DAS 829-type CIU.

† A, B, C, D option as required.

TABLE F

PRESCRIPTION ADJUSTMENTS AND COMPONENT VALUES OF
359A AND 359D EQUALIZERS FOR CABLE END SECTIONS 1500 TO 4500 FEET

19H88 HC CABLE									
Cable Length in Kilofeet*				0 to 42	60	78	96	114	132	150
Cable Length in Miles*				0 to 8.0	11.4	14.8	18.2	21.6	25.0	28.4
Screw Designation			Screw Code							
HF	IN	Resistance	A1	•	•	•	•	•	•	•
	75		A2	•	o	•	•	•	o	o
	150		A3	•	o	•	o	o	o	•
	300		A4	•	o	•	o	o	•	•
	600	Resistance	B2	o	•	•	o	o	o	o
	1200		B3	•	o	o	•	•	•	•
	2400		B4	o	•	•	•	•	•	•
LF	0.25	Capacitance	C1	•	o	•	o	•	o	o
	0.50		C2	•	•	o	o	•	•	•
	1.0		C3	•	o	o	o	•	•	•
	2.0		C4	•	•	•	•	o	o	o
	250	Resistance	D1	o	o	o	•	•	•	•
	500		D2	o	o	o	o	•	•	•
	1000		D3	o	o	o	o	o	o	o
	2000		D4	o	o	o	o	o	o	o
1200-Ohm Insertion Loss (dB) of Cable at 1 kHz				0	3.4	4.8	6.8	7.7	9.3	10.6	12.1
Loss of Equalizer (dB) at 1 kHz			359D	0.9	1.4	1.9	2.2	2.2	2.5	3.0
			359A	7.1	7.6	7.1	8.6	8.4	8.7	9.2
HF Total Res			(Ohms)	3000	1725	1200	1050	1050	825	675
LF Total Cap.			(μF)	3.75	2.50	2.25	2.0	1.75	1.50	1.50
LF Total Res			(Ohms)	3750	3750	3750	3500	3000	3000	3000

* For an exact cable length shown at the top of the table, use the adjustment for the shorter lengths.

Example: For 60 kft, use the adjustment for the range 42 to 60 kft.

o Indicates "screw up" (3 full turns)

• Indicates "screw down"

5. REFERENCES

5.01 Additional information concerning the DAS 829-type CIU and the supplemental data units and data mountings is contained in the following publications:

SECTION	TITLE
314-410-100	Voice Bandwidth Private Line Data Circuits—Description
314-410-300	Voice Bandwidth Private Line Data Circuits—Maintenance
314-410-500	Voice Bandwidth Private Line Data Circuits—Tests and Requirements
314-821-100	Data Systems—Central Office—406A Tone Generator—Description
314-821-200	Data Systems—Central Office—406A Tone Generator—Installation and Connections
314-821-500	Data Systems—Central Office—406A Tone Generator—Test Procedures
332-104-500	V4-Type Repeaters—Initial Line-Up
332-116-201	Strapping Charts for 359A and 359D Equalizers or 4182C Network
461-200-102	Adapters—148, 149, 153, and 3-Way Bridging Types—Identification
461-604-100	Connecting Blocks 66-Type—Tools, Terminating, Adapters, and Maintenance
463-140-100	Equipment Cabinets and Apparatus Mountings—Installation
590-010-200	Data Sets and Data Access Arrangements—General Installation and Connection Information
590-010-201	Data Sets—Multiple Installation Information
590-100-131	44A1 Data Unit—Tone Detector—Description
590-100-134	48-Type Data Units—Identification
590-102-134	44A1 Data Mounting—Identification
590-102-135	45A1 Data Mounting—Identification
590-102-136	46-Type Data Mountings—Identification
590-102-144	59A1 Data Mounting—Identification
590-102-164	62A1 Data Mounting—Identification
598-080-100	Data Auxiliary Set 828A—Description and Operation
598-080-101	Data Auxiliary Set 828C—Description and Operation
598-080-200	Data Auxiliary Set 828A—Installation and Connections
598-080-201	Data Auxiliary Set 828C—Installation and Connections
598-080-500	Data Auxiliary Set 828A—Maintenance and Test Procedures
598-080-501	Data Auxiliary Set 828C—Maintenance and Test Procedures
598-082-200	Data Auxiliary Set 829-Type—Channel Interface Units—Voiceband Private Line Channels—Installation and Connections
598-082-500	Data Auxiliary Set 829-Type—Channel Interface Units—Voiceband Private Line Channels—Maintenance and Test Procedures
852-307-101	V4 Telephone Repeaters—Engineering—Message Circuits
856-200-200	Equalizer Selection Programs Deldis and Delman for the GE-235 Time Sharing Computer
880-420-100	Private Line Data Circuits—Voice Bandwidth General Design Information

5.02 Detailed information concerning the DAS 829-type CIU and the supplemental data units and data mountings is contained in CD- and SD-1D247-01.