

## TWO-POINT PRIVATE LINE TELEPHONE CIRCUITS

### VOICE ONLY

### DESCRIPTION

CONTENTS	PAGE
1. GENERAL . . . . .	1
2. STATION ARRANGEMENTS . . . . .	1
3. STATION SIGNALING . . . . .	7
4. TRANSMISSION EQUIPMENT . . . . .	8
5. SIGNALING EQUIPMENT . . . . .	16
6. TYPICAL EQUIPMENT LAYOUTS . . . . .	17
7. REFERENCES . . . . .	17

#### 1. GENERAL

- 1.01 This section describes two-point private line voice-only telephone service.
- 1.02 When this section is reissued, the reasons for reissue will be given in this paragraph.
- 1.03 Two-point private line services are served over nonswitched facilities with no access to the message network. A two-point private line involves a channel between two terminal locations. This channel may or may not be entirely a metallic path. In no event is an end-to-end metallic path guaranteed to the customer.
- 1.04 Other types of private line service such as data, alternate voice/data, PBX, and switched services are covered in other Bell System Practices.
- 1.05 The figures and descriptive information used in this practice pertain to the circuit configurations in common use.

#### 2. STATION ARRANGEMENTS

- 2.01 Various private line station terminating arrangements are available for two-point

private line voice-only telephone service. These may be 2-wire or 4-wire and may use audible and/or visual signaling or voice-call signaling.

#### TALK BATTERY

2.02 The services discussed in this section will usually terminate in 500-type telephone sets and the transmitter talk battery supply may be supplied from various points in the circuit depending on the type and location of equipment used. For instance, Key Telephone Systems (KTSs) supply transmitter talk battery locally, and private line automatic ringdown circuits (PLAR) supply the battery from a central office location. The 500-type telephone sets are equipped with networks which control the efficiency of the set depending on the amount of direct current flowing through the loop.

2.03 Optimum loop currents for 500-type telephone sets are in the range of 36 to 65 milliamperes. Currents less than 36 milliamperes will cause the telephone set transmitter output to decrease while currents greater than 65 milliamps will reduce the efficiency of the receiver.

#### 1A1 and 1A2 KEY TELEPHONE SYSTEMS

2.04 The 1A1 and 1A2 KTSs, Fig. 1, are widely used 2-wire terminations. They use combined telephone sets equipped with keys or telephone sets with externally mounted keys. This allows a number of stations to connect to any one of several lines by operating the key associated with the line to be used. The capacity of the station is limited by the number of keys and buttons available for pickup, signaling, and control purposes.

2.05 With the 1A1 and 1A2 KTSs, provisions are made for:

- (a) Visual and audible signaling and holding functions on central office and PBX lines

## SECTION 310-300-100

- (b) Manual or automatic signaling over private lines
- (c) Manual signaling on intercommunicating lines without attendant assistance
- (d) Exclusion of other stations
- (e) Various cutoff and transfer features
- (f) Transmitter talk battery.

**2.06** The 1A2 KTS, being of later design, features solid state printed wiring boards and plug-in type Key Telephone Units (KTUs).

**2.07** The 204A KTU is used with the 1A1 KTS for manual ringdown service. It supplies key signaling to the called station and connections to the telephone sets. It will also control other KTUs for visual and/or audible signals.

**2.08** The 414A KTU is used with the 1A2 KTS for manual ringdown service. It is used to connect a telephone set to a private line terminated at a distant location. A nonlocking key on a telephone set or an externally mounted key is required for signaling.

**2.09** The 419A KTU is used for automatic ringdown service. The 419A KTU transmits a 2-second spurt of 20-Hz ringing voltage toward the distant end when the handset is lifted off the telephone set and a line key is depressed. It also supplies locked-in visual and/or audible signaling. Although designed primarily for the 1A2 KTS, it may be used with the 1A1 KTS.

### **4-WIRE PRIVATE LINE TERMINATING CIRCUIT (SD-69566-01)**

**2.10** The SD-69566-01 4-wire private line terminating circuit (Fig. 2) permits signaling and talking on 4-wire private lines using loudspeaker, 20 Hz, or dc signaling. The terminations are used as part of long distance services for customers such as airline, bus, or truck lines, to name a few. The 4-wire facilities are routed via central offices to provide amplification and equalization as necessary. The equipment comprising SD-69566-01 is intended for installation at the customer location.

**2.11** The 4-wire terminating unit provides 150- or 600-ohm impedances on the line side and

a low impedance bus on the station side. The low impedance connection for station sets minimizes transmission level changes when the number of bridged sets is increased or decreased. Two 227-type amplifiers allow setting the station transmit and receive levels. A third 227-type amplifier is available on an optional basis if side tone is required.

**2.12** An optional equal level loopback relay arrangement is available to permit testing of transmission facilities between the serving central office and the station without telephone company personnel at the station. The loopback relay, when operated, cuts through a transmission path from the test center through the receive loop and receive amplifier, the level compensating pad, the transmitting amplifier, and back to the test center. Transmission levels may be checked from the serving central office test center by applying battery (−44 to −52 vdc) to the simplex leads. The loopback relay may also be operated by a key at the customer location, or by means of a telegraph loop. The simplex resistance, made up of the parallel resistance of the transmit and receive loops from the serving central office test center to the station, is limited to 1500 ohms.

**2.13** LINE IN and LINE OUT jacks allow bare loop transmission measurements to be made. BUS IN and BUS OUT jacks allow the adjustment of the transmit, receive, and talk-back amplifiers of the 4-wire private line terminating circuit.

**2.14** An exclusion circuit permits disabling of the pickup relays of selected groups of telephone sets at one location to prevent their gaining access to a line in use.

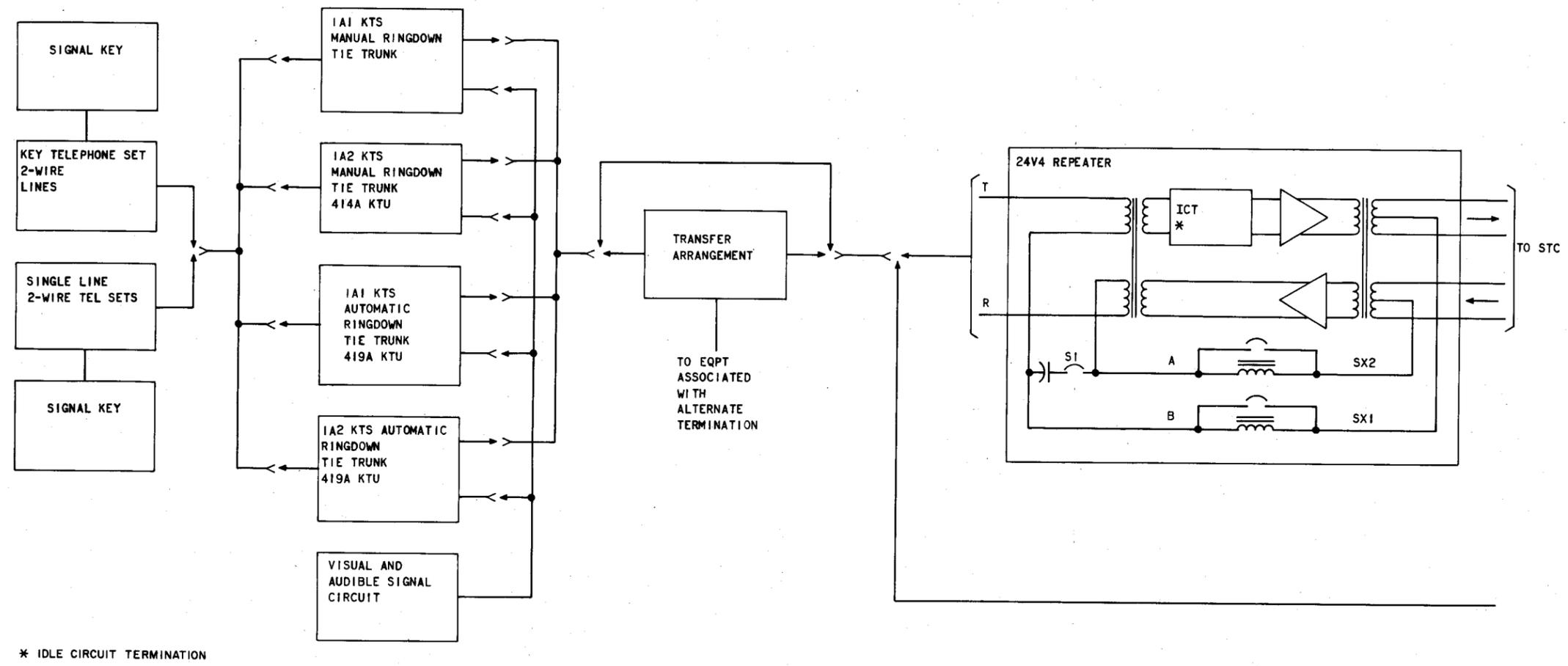
**2.15** Transmitter talk battery is supplied locally by the 4-wire private line terminating circuit.

**2.16** Instructions on installation and line-up procedures can be found in Section 480-615-100.

### **F SIGNALING ON CUSTOMER PREMISES**

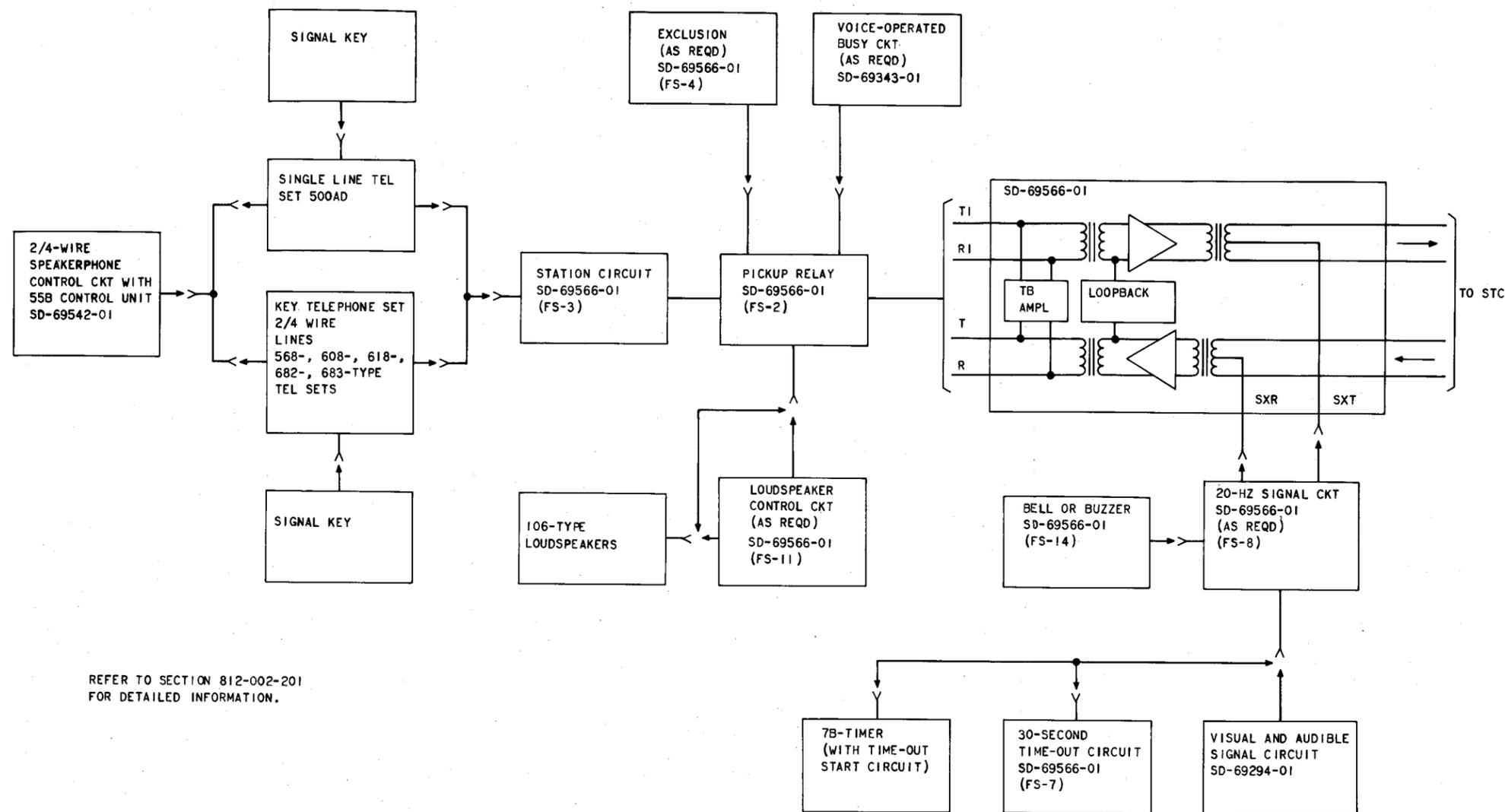
**2.17** The customer premises facility terminal for F type signaling (CPFT-F SIG) Fig. 3, 4, 5 may be used to terminate one or two 4-wire metallic lines in 2-wire or 4-wire telephone sets.

**2.18** Through the application of standard design, the CPFT-F SIG unit may be assembled, tested, and lined up prior to installation.



\* IDLE CIRCUIT TERMINATION

Fig. 1—2-Wire Private Line Station Arrangement



REFER TO SECTION 812-002-201 FOR DETAILED INFORMATION.

Fig. 2—4-Wire Private Line Station Arrangement SD-69566-01

**2.19** The CPFT-F SIG unit is described in Section 332-601-100.

**2.20** When this section was being prepared, a customer premises facility terminal using metallic facility terminal plug-in units was under development. When information about the CPFT-MFT becomes available, this section will be reissued.

### 3. STATION SIGNALING

**3.01** There are four types of signaling which may be used on two-point private line telephone circuits. They are:

- (a) Manual ringdown both ways
- (b) Automatic ringdown both ways
- (c) One-way manual and one-way automatic ringdown
- (d) Voice-call signaling using a loudspeaker.

**3.02** When manual ringdown signaling is used, a pushbutton or lever key, when operated,

will cause a 20-Hz ringing signal to be transmitted to the distant station.

**3.03** In automatic ringdown, the necessity of operating a button or key is eliminated. When the telephone at the calling end of the circuit is placed in the off-hook condition, a 2-second spurt of 20-Hz ringing is transmitted to the distant station. A signal control arrangement at the called station will lock up upon receiving the 2-second signal and supply ringing current to the telephone set until it is answered or until it times out after 30 to 90 seconds. This time interval may be adjusted to suit customer requirements.

**3.04** Voice-call signaling with a loudspeaker has limited application because of room noise limitations, etc, at the customer location. With this arrangement, the called party is summoned to the telephone set by means of a loudspeaker. When the telephone set is off-hook, the loudspeaker is removed from the circuit allowing normal conversation.

**3.05** The method used to transmit ringing signals may be a simplex arrangement or E&M lead

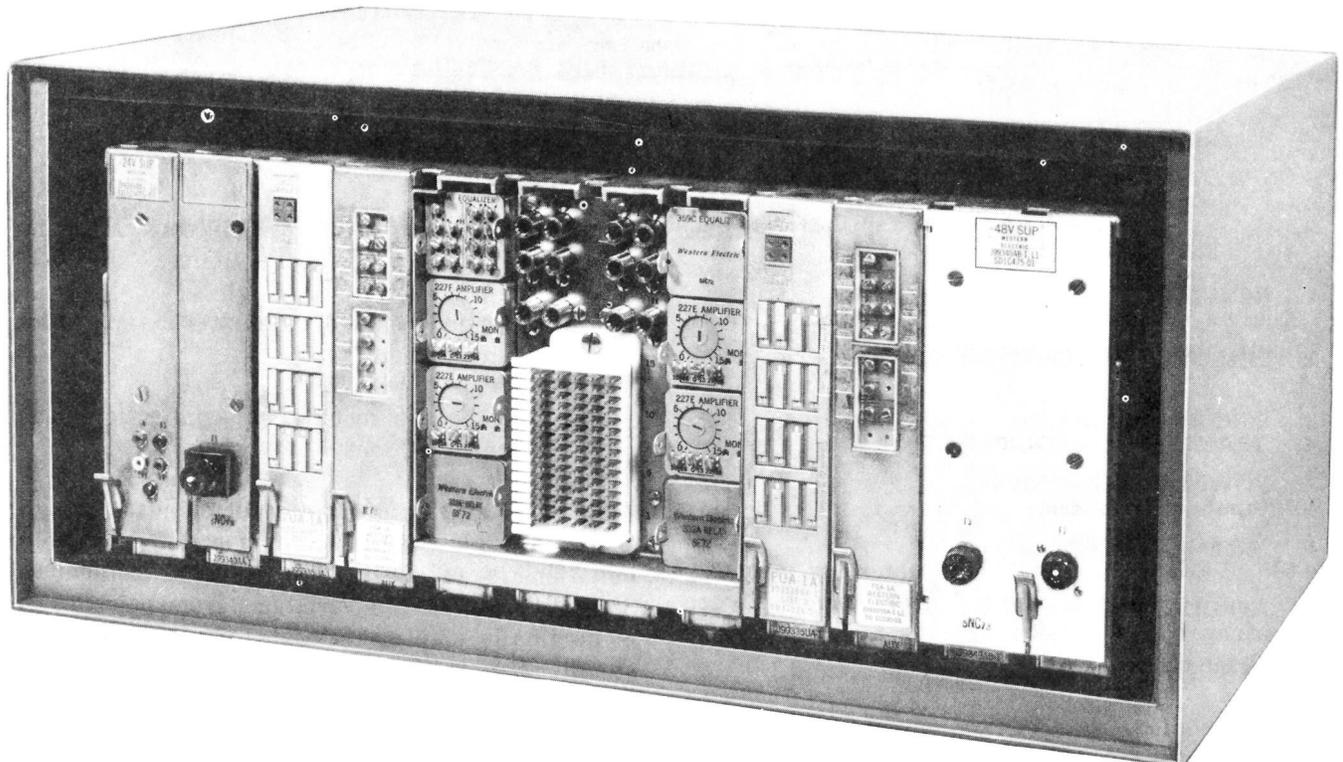


Fig. 3—Type F Signaling Terminal Package Unit for Use at Customer Premises

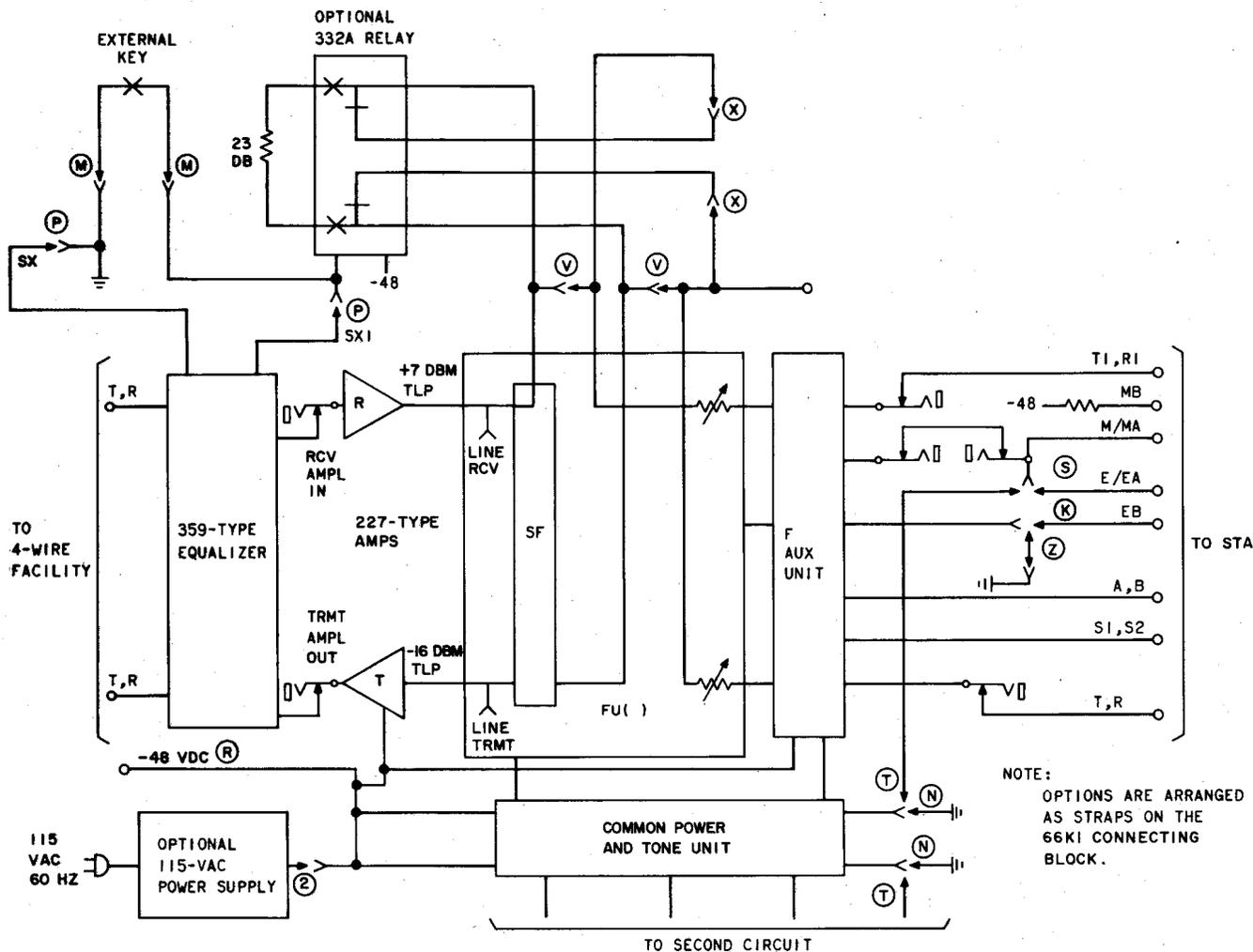


Fig. 4—Block Diagram of Customer Premises Facility Terminal With Type F Signaling

signaling depending on the length of the circuit, facilities used, and equipment available.

4. TRANSMISSION EQUIPMENT

V4 Repeaters—General

4.01 Variations of the V4 repeater are generally used when transmission enhancements are required on two-point private line voice-only telephone circuits.

4.02 There are three general types of V4 repeaters. They are:

- (a) The basic V4 repeater

- (b) The 24V4 repeater

- (c) The 44V4 repeater.

Basic V4 Repeater

4.03 The basic V4 repeater was developed to accommodate either the 227-type amplifiers or 849-type networks, depending on transmission design requirements.

4.04 Any of the 227-type amplifiers may be used on two-point private line voice circuits; however, the 227A, B, E, and F types are preferred.

**Note:** The 227A and 227B amplifiers are manufacture discontinued.

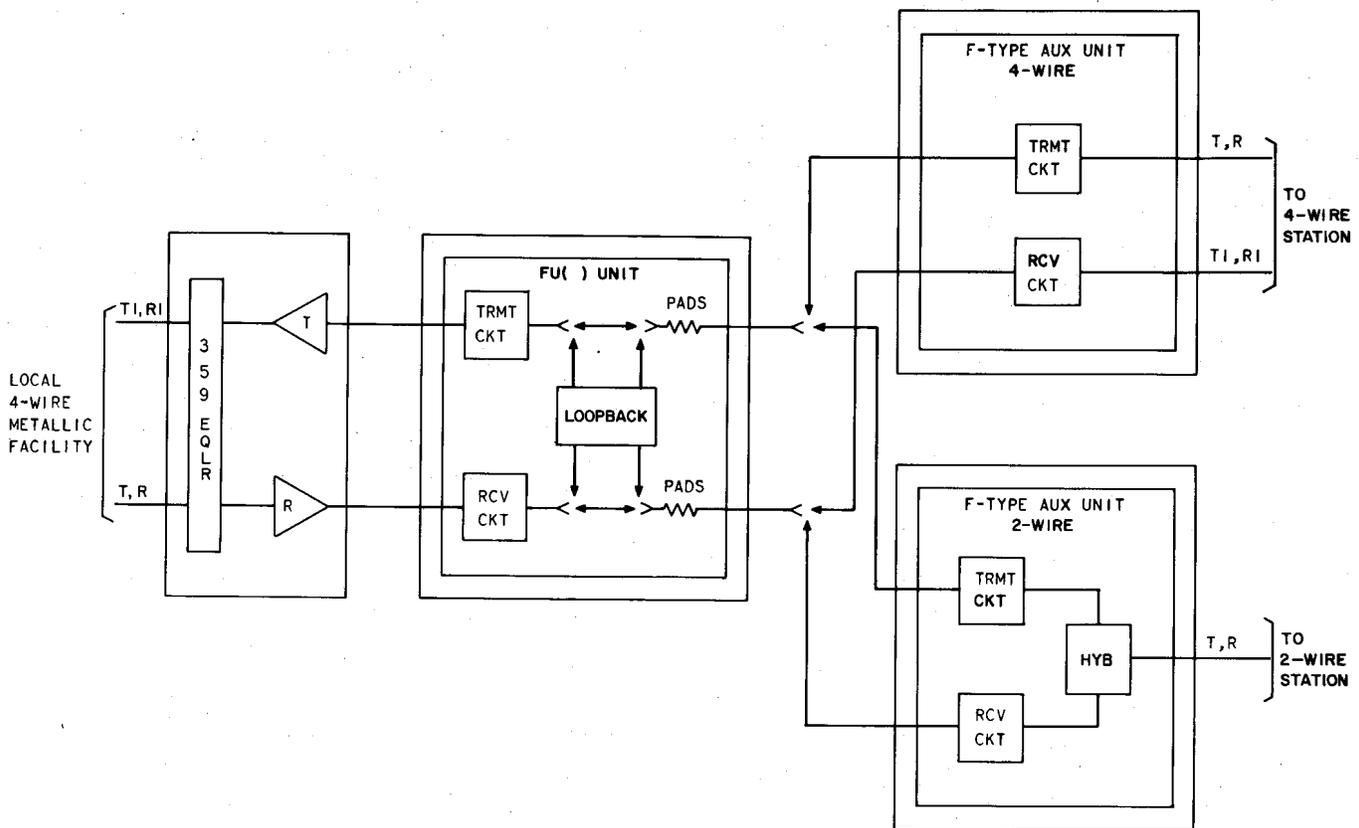


Fig. 5—Simplified Application Schematic of CPFT With Type F Signaling

The 227C and D amplifiers, designed primarily for data service, have extended low-frequency gain characteristics. This may cause difficulty in meeting singing margin limits as excessive gain can exist at the low frequencies if the circuit is not well equalized. Issue 2 of Section 332-116-201 contains strapping information for 359A and 359D equalizers to obtain optimum equalization when using 227C and 227D amplifiers.

**4.05** Private line channels utilize telephone company facilities in common with other services, and in order to prevent cross talk and excessive noise it is necessary to limit the power of the signal applied to the facilities. In installations where excessive levels are expected or experienced a volume limiter may be used. The F58122 amplifier installed in the station transmit path has this capability. A description of the F58122 amplifier may be found in Section 332-104-100. Tests and adjustments are covered in Section 332-104-503.

**4.06** Improper equalization affects the frequency attenuation or slope characteristics of a circuit

and reduces the singing margin. Most of the distortion occurs in the cable facilities; however, signaling and terminating equipment also contribute distortion. The 24V4 and 44V4 repeaters have provisions for mounting 359-type equalizers which correct for the frequency attenuation distortion.

**4.07** A list of the 359-type equalizers that may be used in two-point private line telephone service is shown in Table A. The equalizers most commonly used are the 359A, D, and P types. These equalizers are for use with loaded cable, are adjustable, and may be used to correct for slope or for excessive gain at the low frequencies or excessive loss at the high frequencies. Information for initial adjustments of the equalizers should be available on the circuit layout record (CLR). Information on adjustment of the equalizers is contained in Section 332-104-500. Strapping information for 359A and D type equalizers is contained in Section 332-116-201. Section 332-116-214 covers strapping of the 359P equalizer. The 359B or M and 359F or N equalizers are used for

## SECTION 310-300-100

nonloaded cable. These nonadjustable equalizers are used as shown in Table B.

### 24V4 Repeater

**4.08** The 24V4 repeater is used between the 2-wire and 4-wire portions of a circuit. In addition to permitting conversion from a 2-wire circuit to a 4-wire circuit, the 24V4 also has the capability of supplying gain and equalization when transmission requirements specify this.

**4.09** Four variations of the 24V4 repeater mounting arrangements are described in Section 332-105-10Z.

**4.10** The 24V4A and 24V4B mountings have space for the following plug-in units:

- (a) 1-type terminating set or 4182-type network
- (b) 227-type amplifier, F58122 amplifier, or 849-type network in the transmit side
- (c) 227-type amplifier or 849-type network in the receive side
- (d) 359-type equalizer.

**4.11** The 24V4C mounting has additional space for these plug-in units:

- (a) 4066-type network
- (b) 648A low-pass filter
- (c) 434A plug (continuity plug).

**4.12** The 24V4D mounting has all the plug-in spaces of the 24V4C with an additional space for a 332A plug-in relay. This is required when emergency power is not available but continuity of service is essential. Whenever the power supply is interrupted, the relay automatically switches the transmission path around the amplifiers.

**4.13** There are several 1-type terminating sets available which may be used on 2-point private line telephone services. These are described in Sections 332-800-ZZZ. Table C is a list of 1-type terminating sets available and the characteristics of each.

**4.14** The 1-type terminating set to be used will be specified on the CLR. For two-point private line telephone services, the 2-wire side of the terminating set will normally be 600-ohms impedance unless specified otherwise.

### 44V4 Repeater

**4.15** The 44V4 repeater is used when amplification and equalization is required in the 4-wire portion of a telephone circuit. The 44V4A repeater mounting shelf has mounting space for two 44V4 repeaters. Each repeater consists of four mountings with space for one 227-type amplifier or 849-type network and one 359-type equalizer in each direction.

**4.16** Simplex (SX and SX1) paths are available for dc- and low-frequency signaling.

**4.17** Test jacks are permanently wired into the repeater mounting shelf circuit to give access to the amplifier inputs and outputs for testing and maintenance and to permit high impedance monitoring at these points.

**4.18** The test jack designations and their wiring in the repeater circuit are permanently marked on the faceplate of the test jack field.

**4.19** Descriptive information on the 44V4 repeater is available in Section 332-106-101.

### E6 Repeaters

**4.20** The E6 repeater is a transistorized, negative impedance, voice-frequency 2-wire 2-way device. Transmission gains up to approximately 12.5 dB may be provided by the E6 repeater when used as an intermediate repeater. Crosstalk considerations limit the gain to about 7 dB when used as a terminal repeater. Direct current and 20-Hz signaling currents are passed through the repeater without serious impairment and without the use of auxiliary bypassing equipment.

**4.21** The use of E6 repeaters is limited in that only two E6 repeaters may be used on any private line circuit. These may be terminal or intermediate repeaters in any combination.

**4.22** The following sections contain information on the E6 repeater:

332-206-100	Description
332-206-200	Installation
332-206-500	Tests and Adjustments

TABLE A

359-TYPE EQUALIZERS

EQUALIZER	SECTION NO. 332-116-	4-WIRE FACILITY	EQUALIZATION		1 KHz Loss BETWEEN NOMINAL IMPEDANCES (Note 3)	TRANSFORMER IMPEDANCE RATIO		IMPEDANCE FACING FACILITIES (OHMS)	ADJUSTABLE	SIMPLEX PATH RESISTANCE PER TRANSFORMER (OHMS) (Note 1)
			TRMT	RCV		EQPT	LINE			
359A	101	Loaded Cable — H88 With Gain (Amplifier) Required	No	Yes	6.2 to 9.2	—	—	1200	Yes	No Tap
359B	102	Long Lengths Nonloaded Cable	Yes	Yes	0.5 (Note 5)	600	150	150	No	1.3
359C Dummy	103	600-ohm Eqpt (No Equalization)	No	No	0	—	—	600	No	No Tap
359D	104	Loaded Cable — H88 With 849B Network Required	No	Yes	0 to 3.0	—	—	1200	Yes	No Tap
359E Dummy	105	Short Lengths Loaded Cable — H88 With Amplifier (No Equalization)	No	No	0	—	—	1200	No	No Tap
359F	106	Short Lengths Nonloaded Cable	Yes	Yes	0.5 (Note 5)	600	600	600	No	6.75
359G	107	Loaded Cable or Carrier Channels Data	No	Yes	8.5 to 20.0	—	—	1200 (Note 4)	Yes	No Tap
359H	108	Loaded Cable or Carrier Channels Data	No	Yes	0.9 to 1.2	—	—	600	Yes	No Tap

TABLE A (Cont)

## 359-TYPE EQUALIZERS

EQUALIZER	SECTION NO. 332-116-	4-WIRE FACILITY	EQUALIZATION		1 KHz LOSS BETWEEN NOMINAL IMPEDANCES (Note 3)	TRANSFORMER IMPEDANCE RATIO		IMPEDANCE FACING FACILITIES (OHMS)	ADJUSTABLE	SIMPLEX PATH RESISTANCE PER TRANSFORMER (OHMS) (Note 1)
			TRMT	RCV		EQPT	LINE			
359J Dummy	109	Short Lengths Loaded Cable — H88 With 849B Network Required (No Gain or Equalization)	No	No	0	—	—	1200	No	No Tap
359K (Note 2)	110	Loaded Cable — H44 With Gain (Amplifier) Required	No	Yes	6.2 to 7.8	—	—	600	Yes	No Tap
359L	111	Loaded Cable — H44 With 849G Network	No	Yes	0 to 1.6	—	—	600	Yes	No Tap
359P (Note 2)	114	Unigauge	No	Yes	6.2 to 24.5	—	—	1200	Yes	No Tap

*Notes:*

1. For calculations of signaling ranges, add 15% to the tabulated average values. This compensates for manufacturing variations and temperature.
2. Includes a 6.2 dB pad.
3. This is the loss used in computation of levels. See Section 852-307-101 for 359-type equalizer screw settings.
4. Shelf wiring provides connection from the 4-wire line through the equalizer to the 1200-ohm side of the 227-type amplifier. The equalizer is wired in tandem with the receiving amplifier input circuit where it works between nominal 600-ohm terminations.
5. Transformer loss only.

TABLE B

## EQUALIZER ASSIGNMENTS FOR NONLOADED REPEATER SECTION (1)

GAUGE	COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
	359F AT BOTH ENDS	359B AT ONE END 359F AT OTHER END	359B AT BOTH ENDS	359B AT BOTH ENDS
All 19 LC	8-11 kf	11.1-18 kf	18.1-33 kf	33.1-45 kf
All 19 HC	7-9	9.1-16	16.1-28	28.1-38
All 22	4-8	8.1-14	14.1-22	22.1-30
All 24	3-7.5	7.6-12	12.1-17	17.1-22
All 26	2-7	7.1-10	10.1-15	15.1-20
Mixed	1-3.3 dB	3.4-5.3 dB	5.4-8.0 dB	8.1-10.5

*Note:* The 359M equalizer is similar to the 359B and the 359N equalizer is similar to the 359F. The 359M and 359N equalizers are designed for critical services such as data and contain improved shielding and transformers for better transmission characteristics.

TABLE C

## I-TYPE TERMINATING SETS

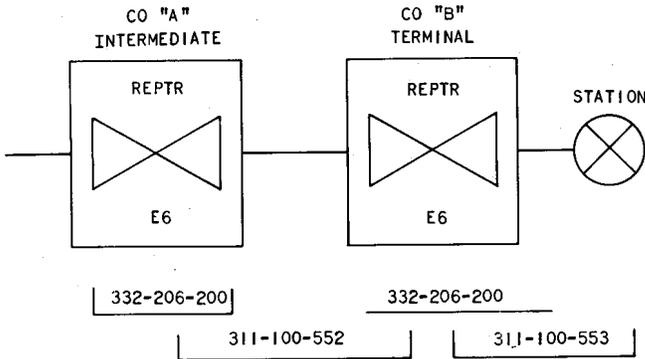
TERM. SET (Notes 7 and 8)	SECTION NO. 332-800-	NOMINAL 2-WIRE IMPEDANCE (OHMS) (Note 2)	2-WIRE D.C. RESISTANCE (OHMS) (Note 3)	1 kHz 2W-TO-4W POWER LOSS (Note 10) BETWEEN NOMINAL IMPEDANCES			NOMINAL MIDPOINT CAPACITANCE (Mf)	EQUIPPED WITH SIMPLEX INDUCTOR (Notes 4, 5, and 6)	EQUIPPED WITH PAD SOCKETS (Note 9)
				HYBRID ALONE	HYBRID WITH AMPL SCREWS DOWN	HYBRID WITH NO AMPL SCREWS DOWN			
1A	101	900	51.6	3.8	4.1	4.2	1	Yes	No
1B	102	600	42.8	3.7	4.4	4.5	1	Yes	No
1C*	103	900	51.6	4.2	—	—	1	No	Yes
1D*	104	600	42.8	4.5	—	—	1	No	Yes
1F*	103	900	51.6	4.2	—	—	1	Yes	Yes
1G*	105	900	51.6	4.2	—	—	1 or 4	No	Yes
1H	106	Note 1							
1J	107	Note 1							
1K	101	900	51.6	3.8	4.1	4.2	1	Yes	No
1L	102	600	42.8	3.7	4.4	4.5	1	Yes	No
1M*	103	900	51.6	4.2	—	—	1	Yes	Yes
1N*	104	600	42.8	4.5	—	—	1	Yes	Yes

**TABLE C (Cont)**

*Notes:*

1. See SD-97138-01 for Term. Set circuits. Special purpose 1H and 1J Term sets are not to be used in general applications. These sets are listed for reference only.
  2. Nominal 4-wire impedance is 600 ohms for all Term. sets.
  3. For calculations of signal ranges, add 15% to the tabulated average values. This compensates for manufacturing variations and temperature.
  4. All Term. sets equipped with inductors allow optionally shorting the inductors (except the 1F).
  5. The simplex inductors are wired in series with the A and B leads on Term. sets 1F, 1K, 1L, 1M, and 1N. They are wired in series with the SX and SX1 leads on Term. sets 1A and 1B.
  6. Term. sets with inductors in series with A & B leads must be used to prevent transmission of longitudinal noise from the 4-wire circuit over the simplex leads to the 2-wire circuit. This applies when used in combination with Dial Long Line circuits. (See Note 5.)
  7. Maximum 2-wire current is 120 milliamps.
  8. 4182-type networks may be used interchangeable with 1-type Term. sets. Substitution of a 4182-type network for the 1-type Term. set effectively converts the 24V4 to a 44V4 repeater. This should be considered where 2-wire and 4-wire flexibility advantages outweigh space losses.
  9. See Section 852-307-102 for pad information.
  10. This is the loss used in computations of levels.
- \* This unit is equipped with a hybrid circuit with a fixed impedance improving shunt. It does not have AMPL screws.

4.23 BSP references for lineup procedures of the E6 repeater and 2-wire links are as shown below.



4.26 MFT mounting arrangements are available in two basic types. The single module shelf is available for cases where only transmission or only signaling equipment is required. A double module shelf arrangement is available for circuits requiring both transmission and signaling equipment. All wiring between the transmission and signaling slot is permanent and does not change for different combinations of plug-ins. With the use of MFT, most cross connections have been eliminated.

4.27 The MFT signaling units applicable to two-point private line telephone circuits are discussed in 5.04 and 5.06. Descriptive information on the MFT can be found in Section 332-910-100.

**METALLIC FACILITY TERMINAL**

4.24 The Metallic Facility Terminal (MFT), SD-1C359-01, is a standard arrangement normally installed in a central office which supplies complete interface functions to terminate a metallic cable pair on station equipment. A typical MFT application is shown in Fig. 6.

4.25 In the MFT, transmission functions are performed by one group of plug-ins, transmission units, and signaling functions are performed by a second set of plug-ins, signaling units.

**5. SIGNALING EQUIPMENT**

5.01 Except for voice-call signaling using a loud-speaker arrangement, all two-point private line telephone circuits use a form of ringdown signaling. In many cases, particularly on short circuits using metallic facilities, 20-Hz ringing voltages are sufficient to provide the signaling requirements. Longer circuits, and particularly those that use VF carrier facilities in their makeup use E and M lead signaling. DC (SG lead) signaling may also be used at times.

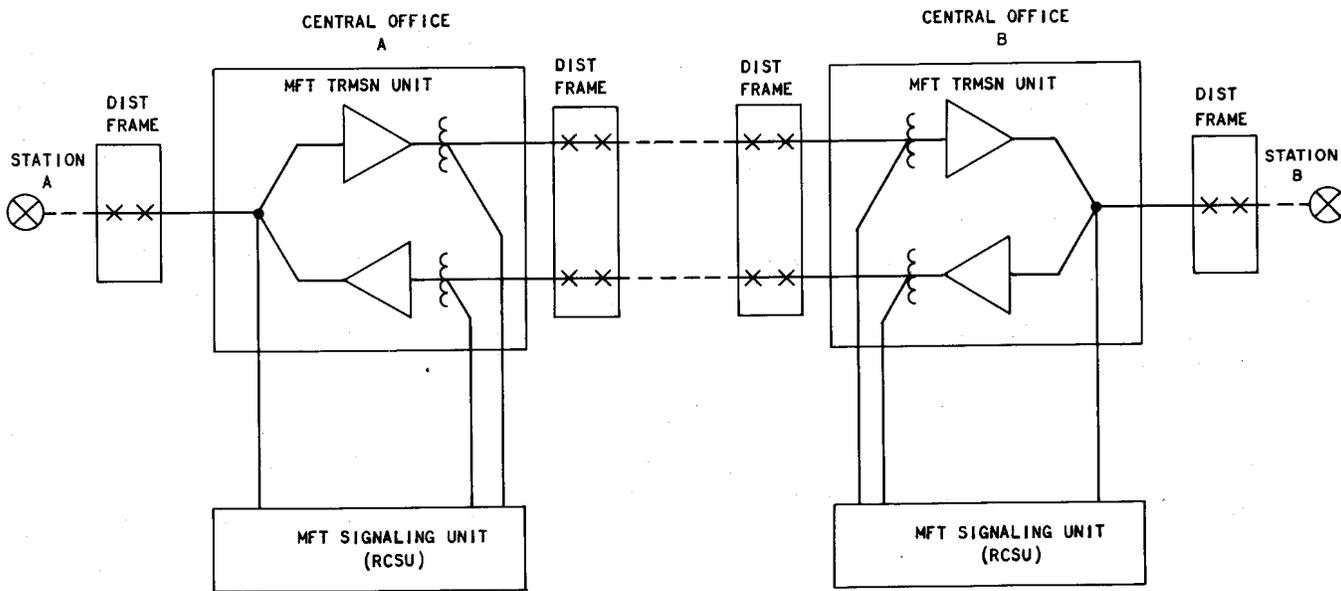


Fig. 6—Typical Application of MFT to Two-Point Private Line Telephone Circuits

**5.02** Equipment units to convert these signals, their functions, and drawing or BSP references are shown in Table D.

**5.03** The D1B signal converter (Fig. 7A) is the unit most frequently used in two-point private line telephone service. A typical application of the unit is shown in Fig. 7B.

**5.04** In the MFT family, a ringdown converter signal unit (RCSU) is available which replaces the D1B, D0B, and 10D converters. The RCSU, J99343EB, described in circuit pack 26 of SD-1C359-01, is designed to operate in the signaling position of MFT double module bays and shelves. Sixteen screw switches are mounted on the unit for the purpose of selecting the conversion mode. A description of the RCSU is contained in Section 332-911-104.

#### **PRIVATE LINE AUTOMATIC RINGDOWN CIRCUIT (PLAR)**

**5.05** The PLAR SD-96147-01 is used to connect two 2-wire telephone sets without using KTSs. When either telephone handset is removed from the switchhook, the distant station is automatically signaled with 20-Hz ringing. This equipment,

normally located in a central office, supplies transmitter talk battery and signaling voltages to both ends of the circuit. The PLAR circuit per SD-96147-01 requires metallic facilities and serves loops up to 2320 ohms dc resistance.

**5.06** The SD-96147-01 is being replaced by equipment designated PLAR signaling unit J99343EC which is a part of the MFT System. This unit is electrically, but not physically, interchangeable with the SD-96147-01. The new PLAR circuit, described in Section 332-911-104, and circuit pack schematic (CPS) 28 of SD-1C359-01 will serve loops up to 2750 ohms without signal regeneration equipment.

#### **6. TYPICAL EQUIPMENT LAYOUTS**

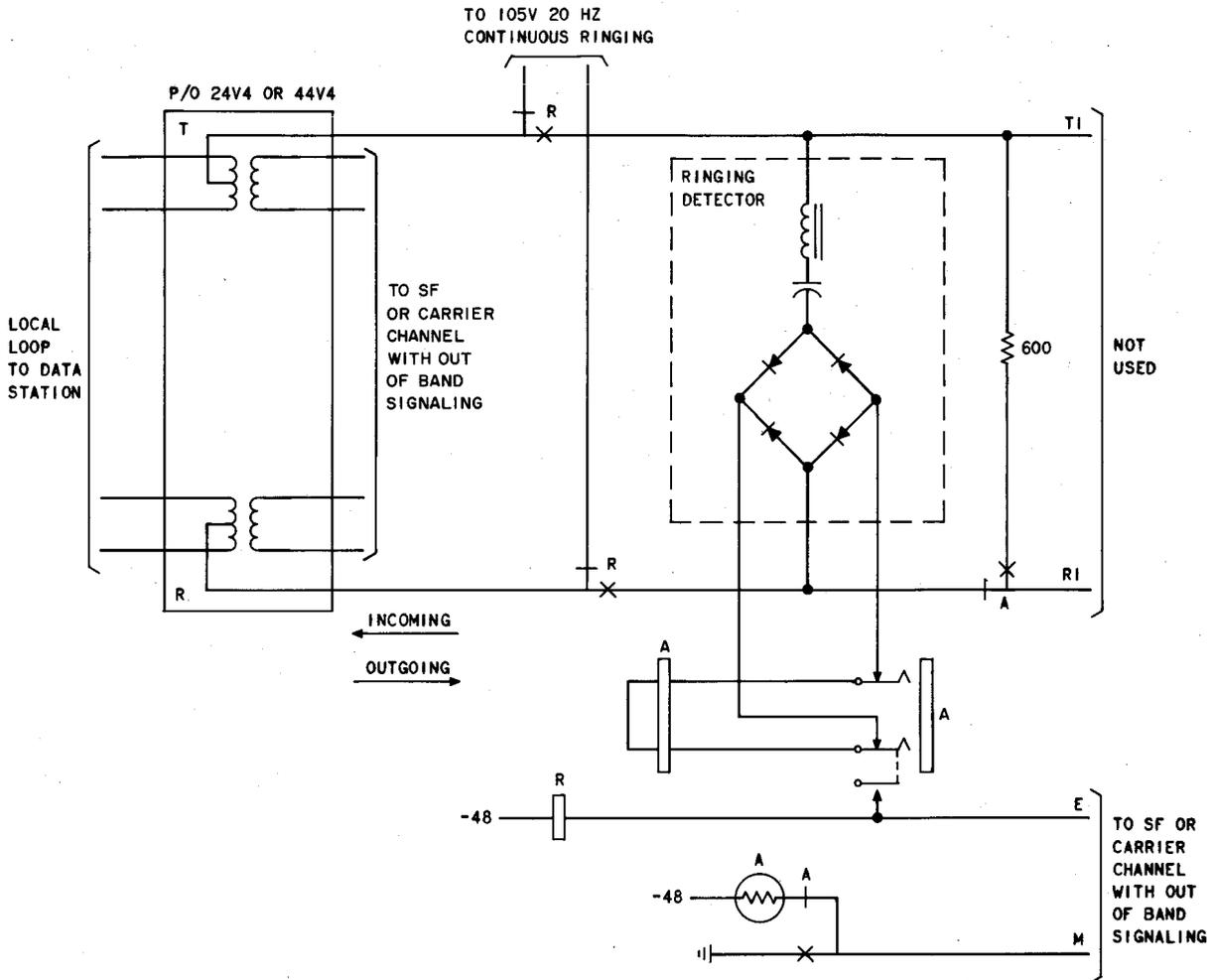
**6.01** Fig. 8, 9, and 10 are typical equipment layouts that may be used on two-point private line voice circuits.

#### **7. REFERENCES**

**7.01** The following documents contain additional information applicable to private line voice-only telephone service.

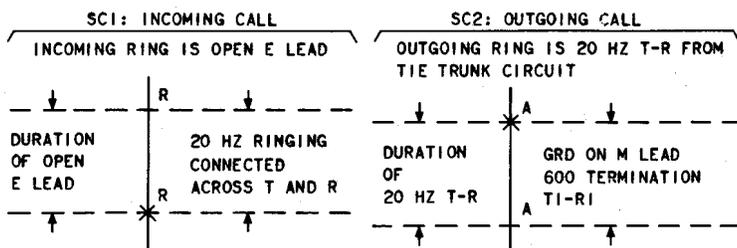
**TABLE D**

Name	Function	Reference
D1B	E&M to 20-Hz Converter	SD-56163-01
D0B	E&M to DC (SG) Converter	SD-56159-01
10D	DC (SG) to 20-Hz Converter	SD-55560-01
SF Units (General)	E&M to 2600 Hz	BSP 170 Series
FGM Aux. Sig. Unit	2600 Hz to 20 Hz (2-wire)	BSP 332-601-100
FHM Aux. Sig. Unit	2600 Hz to 20 Hz (4-wire)	BSP 332-601-100
PLAR	20 Hz to 20 Hz	SD-96147-01
PLAR (MFT)	20 Hz to 20 Hz	BSP 332-911-104
RCSU (MFT)	E&M to 20 Hz	BSP 332-911-104
	E&M to DC (SG lead)	
	DC (SG lead) to 20 Hz	



SIMPLIFIED SEQUENCE CHARTS

IDLE CIRCUIT: NO 20 HZ FROM TIE TRUNK CIRCUIT, A RELAY RELEASES BAT ON M LEAD; GRD ON E LEAD, R RELAY OPERATED, NO 20 HZ TOWARD TIE TRUNK CIRCUIT.



TALKING CONDITIONS ARE IDENTICAL TO IDLE CIRCUIT CONDITIONS.

Fig. 7A—Simplified Schematic for D1B Ringdown Converter

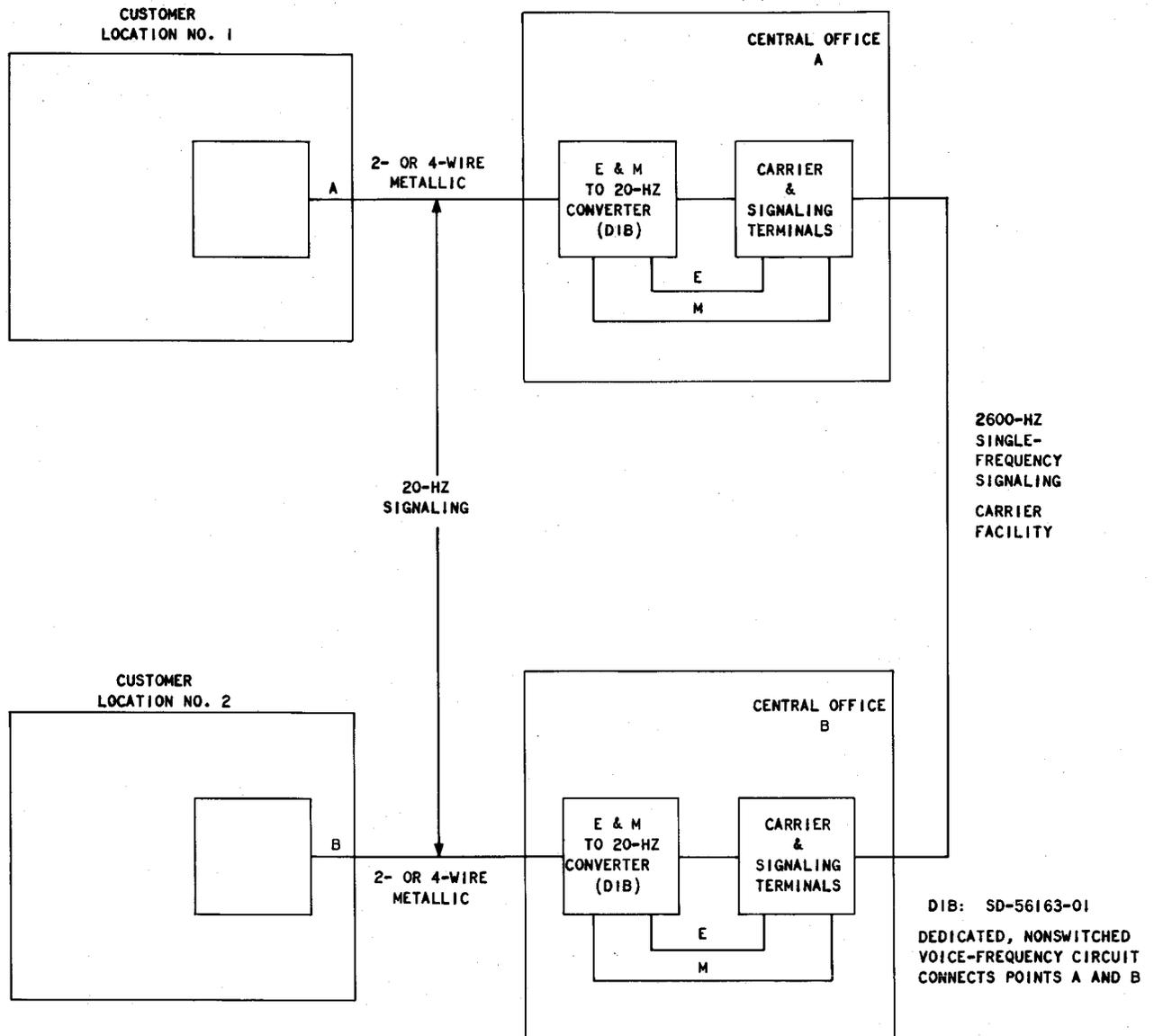
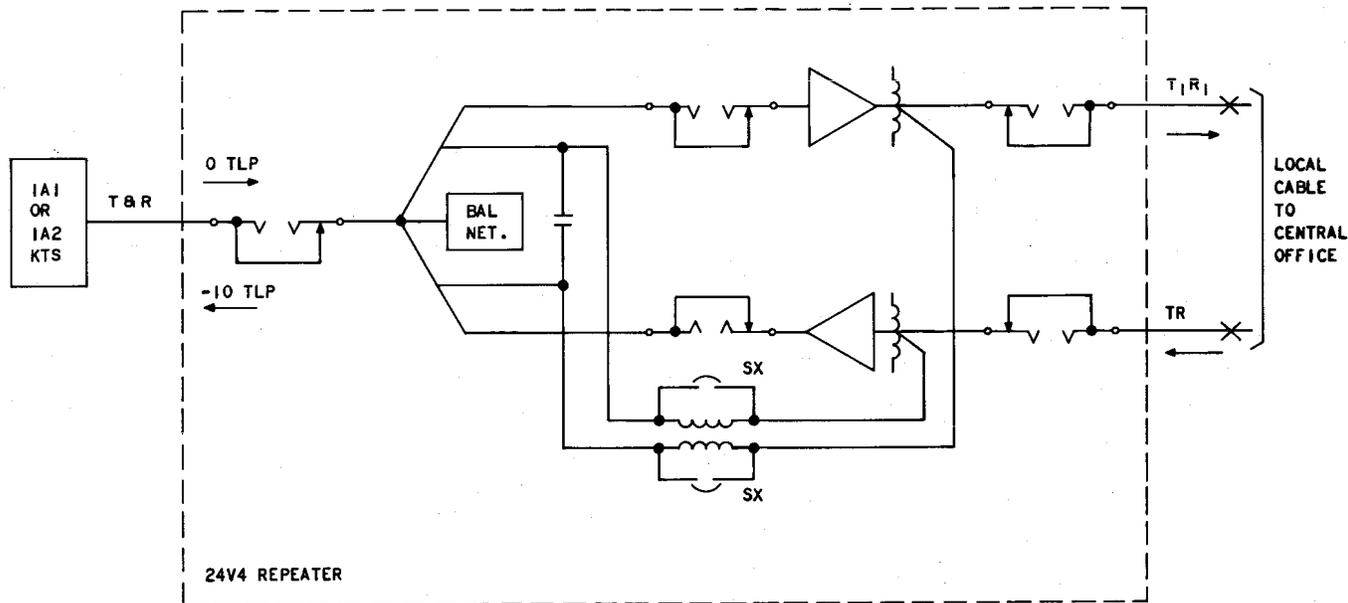


Fig. 7B—Typical Ringdown Circuit With E&M to 20-Hz Converters (DIB)

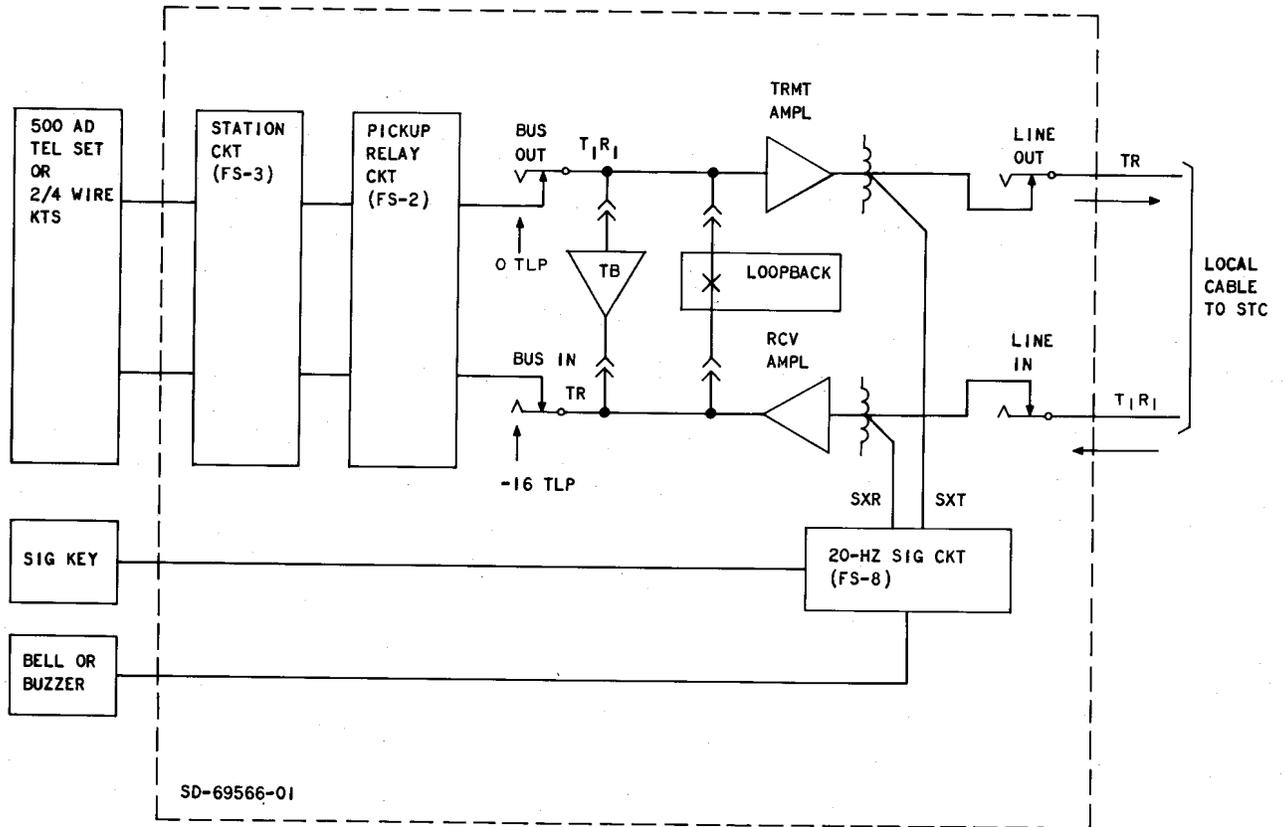
SD-, CD-	TITLE	SD-, CD-69566-01	4-wire Private Line Terminating and Station Circuit
SD-, CD-1C359-01	Metallic Facility Terminal Circuit	SD-, CD-96147-01	Private Line Automatic Ringdown Circuit
SD-, CD-69203-01	Station Systems—Key Telephone System No. 1A1 Line and Signaling CKT	SD-, CD-1C475	Customer Premises Facility Terminal for F Type Signaling
SD-, CD-69559-01	Station Systems—Key Telephone System No. 1A2 Tie Line and Station Line Circuits		
		<b>SECTION</b>	<b>TITLE</b>
		103-106-105	2D and 2E Singing Point Test Set—Description



- NOTES:  
 1. TLP - TRANSMISSION LEVEL POINT  
 2. X - DISTRIBUTING FRAME

Fig. 8—Typical 2-Wire Station Termination

103-106-110	54C Return Loss Measuring Set—Description	331-850-502	Methods for Identifying and Correcting Inductive Noise
103-106-115	KS-20501 Return Loss Measuring Set—Description and Operation	332-015-100	Simplified Theory of Singing Point Tests
310-300-300	Two-point Private Line Voice-Only Test Requirements	332-104-100	V4 Telephone Repeater
310-300-500	Two-point Private Line Voice-Only Telephone Circuits Maintenance Procedures	332-104-500	Initial Line-up
		332-104-501	227-Type Amplifiers—Tests and Adjustments
311-100-552	Special Service Link Line-up CO to CO 2-wire Link Using E6 Repeaters	332-105-10Z	24V4 Repeaters—Description
		332-115-10Z	849-Type Networks—Description
311-100-553	Special Service Link Line-up CO to Station 2-wire Link Using E6 Repeaters	332-116-10Z	359-Type Equalizers—Description
		332-116-20Z	Strapping Charts for 359-Type Equalizers
331-100-100	Message Circuit Noise—General Information	332-206-100	E6 Repeater—Description
331-850-501	Noise Measurements on 2-wire Subscriber Loops—Methods and Requirements—At Stations	332-206-200	E6 Repeater—Alignment Procedure



NOTE:  
TLP = TRANSMISSION LEVEL POINT

Fig. 9—Typical Two-Point 4-Wire Private Line Telephone Station Termination Using SD-69566-01

332-206-500	E6 Repeater—Tests and Adjustments	332-911-ZZZ	Metallic Facility Terminal—Signaling Units
332-601-ZZZ	Customer Premises Facility Terminal for Type F Signaling System	332-912-ZZZ	Metallic Facility Terminal—Transmission Units
332-910-100	Metallic Facility Terminal—General Description	480-615-100	4-wire Private Line Terminating Circuit—SD-69566-01 Identification, Installation, Connections and Line-up Procedures
332-910-180 (to be issued)	Metallic Facility Terminal—Application Information	518-YYY-ZZZ	Key Telephone Systems

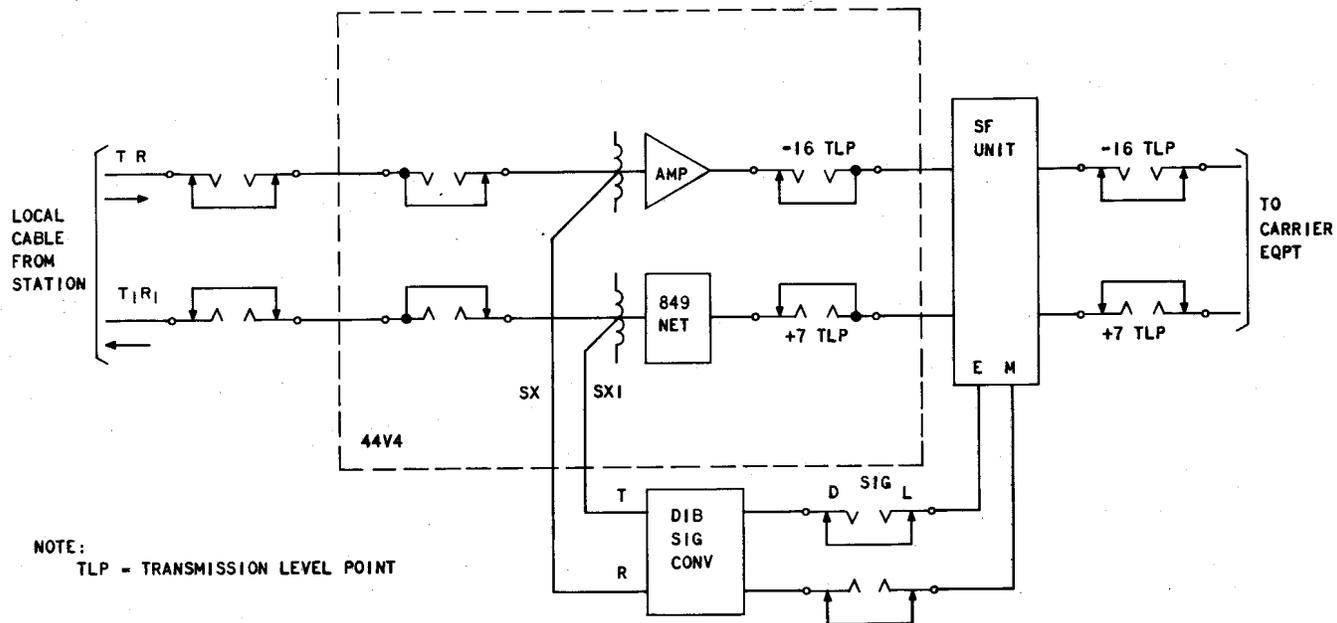


Fig. 10—Typical Central Office Arrangement for Two-Point Private Line Telephone Service