PRIVATE LINE SERVICE TERMINATIONS
STATION ENGINEERING INFORMATION
GENERAL INFORMATION

CONTENTS PAGE

1. GENERAL

1.01 This section introduces the Private Line Service Terminations series, and generally considers transmission and signaling aspects as related to Private Line and Special Exchange Services.

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

Mail to:

Bell System
Data Design Engineering Manager
2400 Reynolda Road
Winston-Salem, N.C. 27106

1.02 This section is reissued to provide signaling arrangement information on:

- SS-3 Type Signaling System
- Customer's Premises Facility Terminal (CPFT) for F-Type Signaling System.

1.03 Codes, terms, related documents, and their application to Private Line and Special Exchange Services are covered in this section.

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

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

2. PRIVATE LINE SERVICE TERMINATIONS SERIES

2.01 Station arrangements associated with special service circuits consist of parts of several SD drawings and/or Operating Company designed circuits. The Private Line Service Terminations series is introduced to provide information for application of preferred station arrangements in one set of documents.

2.02 The objectives of this series are to:

- Provide data only about the best currently acceptable arrangements
- Provide standard documentation for certain Operating Company drawings
- Change other standard documentation
- Provide a simplified format
- Reduce engineering cost
- Improve service reaction time.

2.03 With the references found in Part 10 of this section, the series will complement the Intercompany Services Coordination (ISC) plan (3.01).

2.04 The Private Line Service Terminations series will not only serve to reduce research time, but will provide a media for engineer-to-engineer communications. This is vital to the successful operation of the ISC plan.

2.05 This series replaces the Private Line Station Engineering Manual (PLSEM).

2.06 The following sections constitute the Private Line Service Terminations series:

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

2.07 A minimum number of sections is required to perform a task using the Private Line Service Terminations series. Table A gives those sections required for a particular job objective. Example: For PBX Terminations (Tie Trunks and SS-3), Section 812-002-200, 812-002-201, and 812-002-210 would be needed.

TABLE A

JOB RELATED SECTIONS
FOR PRIVATE LINE SERVICE TERMINATIONS SERIES

SECTION	PBX TERMS. (TIE TRUNK AND SS-3)	PBX TERMS. (FX AND WATS)	TELEPHOTO STA ARGTS	STA. EQUIP (VOICE)	STA EQUIP (DATA-VOICEBAND)	STA EQUIP (DATA-WIDEBAND)	ALT ARGTS	ENGINEERING SKETCHES AND SIGNALING DEVICES	V4 REPEATER
812-002-200	•	•	•	•	•	•	•	•	•
812-002-201	•	•	•	•	•	•	•	•	•
812-002-210	•								
812-002-211		•							
812-002-215			•						
812-002-221				•					
812-002-230					•				
812-002-231						•			
812-002-250							•		
812-002-270								•	
812-002-290									•

3. RELATED DOCUMENTS AND CODES

3.01 The following are related documents and codes frequently encountered in the Private Line Service Terminations series:

- ***Uniform Service Order Code (USOC)***—A plan to provide uniform identification of services and hardware throughout the Bell System. The codes consist of 3-digit alpha and/or numeric symbols as main codes and 2-digit alpha or numeric suffixes to further describe the service or hardware to be provided. Portions of the plan which relate to interstate services are used by Long Lines to identify tariff offerings. These are included in the Intercity Services Manual (ISM).

- ***Intercity Services Manual (ISM)***—A series of volumes which extend tariff descriptions to USOC terminology and billing nomenclature. It includes FCC tariff variations from basic offerings with related charges and rates. The ISM defines FCC tariff applications relating to customer billing, and includes extensive tariff changes.

- ***Universal System Service Order (USSO)***—A document designed to provide a total Bell System approach to order writing and processing for Private Line Service. The USSO translates a customer order to tariff, USOC, and billing nomenclature. It is intended to be used by all Operating Companies and Long Lines to create a one-system image by uniformity in service order procedures. The USSO is originated by Sales, Marketing, or Commercial organizations and issued by Intercompany Services Coordination (ISC) teams to authorize the provision of Private Line and Special Exchange services. It is generally distributed to all interested parties via the Administrative Network (ADNET). Part 4 identifies typical codes appearing on a USSO.

- ***Intercompany Services Coordination (ISC)***—A plan introduced in 1966 to effect improvement in coordination of the provision of Private Line and Special Exchange services. The plan provides standardized procedures to be applied to all orders for customer communications requirements involving two or more operating areas and/or companies. Coordinating procedures when negotiating with independent companies (ICO) are also provided. The ISC plan is covered in depth in Division 010.

- ***Scheduled Issue Data (SID)***—The date that the USSO is to be transmitted from the originating CONTROL ISC Team to other ISM Teams and/or other work locations.

- ***Engineering Information Report (EIR)***—Document used to request and report engineering information on station arrangements, local and interexchange channel makeup, and equipment.

- ***Requisition Due Data (RDD)***—The date that the requisition for material and equipment is received by the Western Electric Company.

- ***Engineering Information Report Date (EIRD)***—The date the EIR must be received by the Engineering Control Office (ECO).

- ***Engineering Date Due (ED)***—The day on which all information required to engineer the service is available and all facilities and equipment are assigned, reserved, and/or ordered.

- ***Application Date (APP)***—The data on which the customer has provided the negotiator with a firm order and a sufficient information to proceed with the provision of service.

- ***Pre-Installation Due Date (PRD)***—The day on which Plant is to have everything for the instalation as prescribed on the order.

- ***Plant Test Date (PTD)***—The date the circuit is to be available for overall test.

- ***Engineering Control Office (ECO)***—The office responsible for end-to-end design of the circuit on 2-point and multipoint private line services. The ECO issues the circuit order and provides the layout record for the overall circuit. This office is located in the same area as the sales office.

- ***Accounting Control Office (ACO)***—The accounting office responsible for billing the service on Long Line orders.

- ***Plant Control Office (PCO)***—The office responsible for the installation and maintenance of 2-point and multipoint Private Line services. Located in the vicinity of the customer headquarters.

- ***Station Engineering Control Office (SECO)***—The office responsible for negotiating compatible station arrangements for a 2-point Private Line telephone service. When three engineering groups are involved, one of the groups is designated SECO. This is normally the Customer Service Engineering group in the associated company served by the PCO.

- ***Network Control Office (NCO)***—The office designated as having control over the customer circuits. It handles all requests for service and all reports of outages and service usage.

- ***Traffic Control Office (TCO)***—The Traffic Office responsible for the preparation of customer instruction material and coordination of the training.

4. UNIVERSAL SYSTEM SERVICE ORDER CODES

4.01 The following is a basic format of the sequence and listing of codes (for control service, and equipment) as they appear on the USSO worksheet. See Section 010-520-113 for detailed descriptions. Section 010-520-149 lists all codes and abbreviations.

TO (Addressee)

ORG (Originator)

TN (Telephone Number)

CUS (Customer Code)

CD (Completion Date)

EX (Exchange)

APP (Application Date)

ORD (Order Number)

CS (Class of Service)

SLS (Sales Code)

DD (Due Date)

RO (Related Order)

USSO (Universal System Service Order Number)

CKT (Circuit Number)

NCD (Negotiated Critical Dates)

SID (Scheduled Issue Date)

EIRD (Engineering Information Report Date)

RDD (Requisition Due Date)

ED (Engineering Due Date)

PRD (Pre-Installation Due Date)

PTD (Plant Test Due Date)

PCO (Plant Control Office)

ECO (Engineering Control Office)

SECO (Station Engineering Control Office)

ACO (Accounting Control Office)

TCO (Traffic Control Office)

NCO (Network Control Office)

SLSN (Salesman's Name)

CTN (Salesman's Contact Telephone Number)

5. STANDARD TERMS

5.01 The following are standard terms used in the Private Line Service Terminations series:

- ***Short Haul***—A term applied to a transmission path having a round trip delay of 6 milliseconds or less or where echo is not a controlling factor.

- ***Long Haul***—A term applied to a transmission path having a round trip delay of greater than 6 milliseconds or where echo is a controlling factor. A long haul circuit with VNL of more than 3.5 Db requires additional

treatment and equipment to remove the echo and compensate for circuit losses.

- ***Via Net Loss (VNL)***—The lowest loss in dB at which it is desirable to operate a trunk facility, (cable, carrier system, etc) without objectionable impairment from echo, crosstalk, noise, and singing. (Section 311-350-100). This computed by use of propagation constants of facilities (carrier or cable) and loss factors of the equipment.

- ***In-Band Signaling***—Type of line signaling where the frequency used falls within the normal voiceband of 300 to 3000 Hz.

- ***Out-Of-Band Signaling***—Type of line signaling where the frequency or method used falls outside of the normal voiceband of 300 to 3000 Hz. In cases where the carrier is equipped with built-in signaling, the frequency generally used is 3700 Hz.

- ***E and M Lead Signaling***—Type of signaling where signaling and supervision between a trunk circuit and a separate signaling system is done over two leads; an M lead which transmits battery or ground signals to the signaling system and an E lead which receives open or ground signals from the signaling system. The near end condition is reflected by the M lead and far end condition by the E lead.

- ***Duplex (DX) Signaling***—Method of signaling where supervisory, and dial pulsing signals are transmitted over the cable pairs used for voice transmission. It employs the two conductors of a cable pair and ground return or simplex of 4-wire cable facilities and ground return to tie its terminals together. Equal and independent action, in opposite directions, is provided with this arrangement. The terminals of this system are designated A and B, or T and R. These complement E and M lead signaling.

- ***Composite (CX) Signaling***—Type of signaling which provides for direct current signaling pulses to be superimposed on the voice pair. It is possible to derive two signaling channels per voice pair or four signaling channels per quad. A filtering arrangement (composite set) is provided at each end of the voice path to separate low frequency signaling pulses from voice frequencies.

- ***Single Frequency (SF) Signaling***—Type of signaling which employs a single frequency (usually 2600 Hz) to transmit supervisory and/or dial pulses over carrier or cable facilities.

- ***Line Signaling***—A method of transmitting signals over facilities. May be within the voiceband of 300 to 3000 Hz or out of the voiceband.

- ***Line Equipment***—Equipment physically associated with carrier or cable facilities. This could be that used for line signaling and/or level adjusting equipment, such as repeaters and coils.

- ***Duplex (DX) Operation***—Form of transmission using 2-way simultaneous operation. With this operation, 4-wire facilities are usually required.

- ***Half Duplex (HDX) Operation***—Form of transmission using 2-way nonsimultaneous operation. With this operation 2-wire facilities may be used, except in certain data applications where 4-wire will be used.

- ***Serving Test Center (STC)***—A Telephone Company office which serves a customer location for the establishment of service and maintenance after the service is installed. This role is handled by the nearest Long Lines Plant Operations Office or Operating Company offices. The office fulfilling this role should be one which operates 24 hours per day, 7 days per week.

- ***Amplifier***—A directional device which increases electrical currents and voltages supplied to it.

- ***4-Wire Circuit***—A communication path using one pair of conductors for each direction of transmission.

- ***Tie Trunk***—A circuit between two PBXs over which stations of one PBX may be connected to stations of the other.

- ***Subscriber Line***—A communications channel between a telephone station and the central office which serves it.

- ***Selection***—The mode of access between a PBX station and a trunk or attendant. It may be dial, manual or automatic selection.

6. TRANSMISSION CONSIDERATIONS

Pad Control

6.01 Pad control is recommended on 4-wire tie trunks which will be switched to other tie trunks, central office (CO) trunks, and station lines. These tie trunk circuits are equipped with 2dB switchable pads to protect against echo for terminating connections. The pads should be switched out on through connections to other echo corrected (VNL) facilities and should be left in on terminating connections to station lines or other lines and trunks which do not provide adequate terminal balance. See Section 800-100-100 for additional information.

Physical Facilities

6.02 Because of the strict balance requirements for echo protection, tie trunks to be operated at VNL will require 4-wire facilities throughout. The use of 4-Wire facilities end-to-end is recommended. Facilities that are always operated at higher losses, such as VNL+2 or 3dB or higher, can generally meet loss and balance requirements with 2-wire facilities or 2-wire extensions from 4-wire carrier systems. Circuits that are to be switched at VNL and are equipped with switchable pads must use 4-wire facilities to the PBX where the pads are located.

Idle Circuit Termination (ICT)

6.03 On all repeatered-type services, idle circuit terminations must be provided to prevent the repeater from singing due to the lack of a termination in the idle state of the trunk.

6.04 The ICT should be provided under control of a relay in the transmit path of the 24V4 (or equivalent) repeater on multipoint services having 2-wire termination where 4-wire conversion is not possible at the termination. This will maintain an open hybrid path with the line terminated in 600 ohms in the idle condition.

6.05 Transmission design objectives and other considerations which will provide adequate transmission on switched special services and PBX services are discussed fully in Section 851-300-100.

7. SIGNALING ARRANGEMENTS

7.01 The following descriptions cover commonly used signaling arrangements, and provide information not always obvious when considering station design alone. See Section 800-100-100 for additional information.

Ringdown Signaling

7.02 In ringdown signaling, the ringing voltage (105 volts 20 Hz) is applied to the selected tie trunk to alert the distant PBX or telephone station of an incoming call. This activates a visual and/or audible signal.

7.03 Ringdown signaling is normally manual (attendant operating a ring key), but may be automatic when the trunk is selected.

7.04 A ringdown converter is required in the CO or serving test center for 20 Hz ringing signal conversion. Basically, it performs two functions:

(1) On incoming calls—E and M lead signaling is converted to 20 Hz ringing signal. Signals from the distant terminal are received on the E lead and converted to 20 Hz on the local channel to the station.

(2) On outgoing calls—20 Hz ringing signal is converted to E and M lead signaling. 20 Hz is received from the off-hook station and converted to M lead signaling.

Loop Signaling

7.05 Loop signaling involves the flow of current over the two conductors of the loop, or over the simplex path of a 4-conductor loop. This directly operates a relay or other sensing device to indicate seizure, dial pulsing, disconnect, or other auxiliary signals.

7.06 The maximum signaling range of loop-type signaling is determined by the total external resistance. For some circuits, the resistance is approximately 2500 ohms. This range is reduced

by the use of transmission improvement devices such as repeaters and line building out networks.

7.07 The different types of loop signaling are as follows:

- ***High-low current signaling*** uses a change in current to signal origination on locally originated calls or to signal answer on calls originated at the distant PBX. This change in current is produced by changing the loop resistance. If the local PBX has high-low signaling, the distant PBX may have high-low signaling or reverse-battery signaling. In a typical signaling sequence, a voltage is applied to the circuit at one PBX to indicate seizure (selection) and a change in current (by change in loop resistance at the other PBX) to indicate answer.

- ***Reverse-battery signaling*** uses a reversal of the polarity of potential applied to the loop. This signals answer on calls originated at the distant PBX and signals origination on locally originated calls. A polarized relay is normally used at the distant end. The normally applied polarity of voltage will not energize the relay, but the reversed voltage polarity will. The distant PBX may or may not have the same type of signaling. In a typical signaling sequence, the local PBX seizes the circuit by completing the loop so that a voltage source at the distant PBX causes current to flow in the loop. At answer, the distant PBX reverses the polarity of the applied voltage. To release, the loop is opened by the calling PBX.

- ***Battery and ground signaling*** is an arrangement in which a voltage is applied at the distant PBX. The loop at the local PBX is open during the idle condition. To seize the circuit, the local PBX applies a voltage to the loop that is in series and aiding the voltage at the distant PBX. To answer, the distant PBX reverses the polarity of its applied voltage. To hold the call, the local PBX reverses its voltage polarity. To release the connection, the loop is opened at the calling PBX. This system is similar to reverse-battery signaling but can operate over a greater range.

E and M Lead Signaling (5.01)

7.08 With trunk facilities of greater resistance than loop signaling permits, various signal transmission systems are used. These signal transmission systems have been designed to provide a common signaling interface with trunk circuits. This common interface consists of a uniform system of leads designated E and M lead signaling.

7.09 Intermediate signaling links may use duplex (DX), composite (CX), single frequency (SF) signal transmission systems, or out-of-band built in systems. No more than two types of signaling may be used for anyone circuit.

Loudspeaker Signaling

7.10 With loudspeaker signaling, the called stations are summoned by means of bridged loudspeakers. The loudspeaker will be cut off and conversation possible when the summoned party lifts the handset or operates a push-to-talk key. Loudspeaker signaling is normally used on multipoint circuits.

7.11 For this arrangement, signaling equipment is not required in the CO. Talk back must be provided at the customers location for conferencing service and sidetone.

Selective Signaling

SS-1 Type

7.12 SS-1A selective signaling system permits dialing of stations, independently or simultaneously by a combination of 2-digit codes. A total of 81 codes can be assigned within any one SS-1 type system, without the digit 1 being used in a code. The digit 1 is used to provide cancellation for a digit error.

7.13 A rotary dial is used to send dc pulses to a keyer which converts them to 2400 and 2600 Hz signals, which are then transmitted to the line over a 4-wire facility. In a case where a TOUCH-TONE® instrument is provided, a TOUCH-TONE-to-dial pulse converter must be provided.

7.14 The 2400 and 2600 Hz signals are restored to dc pulses by the receiving SF unit at all receiving locations. These dc pulses operate decoders

which respond to the pulses transmitted over the system and produce a momentary ground output from a code relay. This output is used to activate bells, buzzers, or switches for the particular service.

7.15 Privacy feature for the SS-1A Selective Signaling System is optional. Where privacy is desired, either manual or automatic features are provided. These permit an originating station to dial the station or stations desired and all other stations are locked out of the conversation. The circuit is restored by the on-hook action of the originating station.

7.16 When the SS-1A circuits are installed on customer premises, a 4-way or 6-way 4-wire bridge and associated amplifiers are required at the CO only if the circuits are multipoint.

SS-3 Type

7.17 SS-3 Type Selective Signaling System uses TOUCH-TONE® frequencies to provide a method of selectively signaling a maximum of 648 3-digit codes over one 4-wire facility. Optional wiring provides two separate modes of operation, the privacy mode (only called stations participate in the conversation) or nonprivate mode (party line operation).

7.18 A single 3-digit code may be assigned to one station (station code), or may be used to signal serveral stations simultaneously (group code).

7.19 A typical SS-3 System will have equipment located at many different customer locations. Equipment at each location consists of a TOUCH-TONE receiver, integrated logic circuits, TOUCH-TONE telephone sets and the 4-wire private line terminating unit.

Customer's Premises Facility Terminal (CPFT) for F-Type Signaling System

7.20 The CPFT for F-type signaling terminates one or two 4-wire metallic facilities and is intended for special service applications requiring single frequency (SF) signaling installations on customer's premises. Each CPFT provides an equipment mounting for:

- Dual-unit F signaling plug-ins
- Gain and equalizer units of the V4 family
- A common 2600-Hz tone supply
- A 20-Hz ringing supply
- An optional 115-V ac power supply
- An optional 332A relay for loopback maintenance

The CPFT also permits the following:

- Use of −48V dc power where available
- Jack access to transmission leads, signaling leads, and power supply outlets
- Access for the use of external echo suppression or equalization
- Easy access to external connections and strapping options.

7.21 Through the application of standard design, the unit is suitable for complete assembly, initial lineup, and testing prior to installation. Since there are slight variations from pair-to-pair in normally identical layouts, the control office should require operational tests, stability tests, and measurement of overall loss after installation at the customer's premises.

7.22 This CPFT can be used in COs for plain old telephone service (POTS) and for special service applications. However, the standard F signaling arrangements described in Section 975-260-101 are a better alternative if six or more circuits are required.

8. TIE TRUNKS

8.01 The following tie trunk arrangements will complement station arrangements found in other sections of the Private Line Service Terminations series. Table B provides application of typical signaling arrangements in this section to individual sections in the series.

8.02 Figures containing block diagrams are provided to show the relationship between the arrangements and various equipment. It is not intended to show transmission configurations except where signaling is involved.

TABLE B

APPLICATION OF TYPICAL SIGNALING ARRANGEMENTS TO INDIVIDUAL SECTIONS IN THE PRIVATE LINE SERVICE TERMINATIONS SERIES

SECTION 812-002-200 FIGURES	PRIVATE LINE SERVICE TERMINATIONS SERIES AND RELATED FIGURES
1	812-002-210, Fig. 8 * 812-002-221, Fig. 1
2	812-002-210, Fig. 7 812-002-221, Fig. 1, 3 812-002-230, Fig. 3, 4, 6
3 †	812-002-210, Fig. 2
4	812-002-210, Fig. 5, 6, 9, 10 *
5, 6	812-002-210, Fig. 2 812-002-221, Fig. 5
7	812-002-211, Fig. 2, 6, 8 812-002-221, Fig. 2
8	812-002-211, Fig. 8 812-002-221, Fig. 2
9	812-002-211, Fig. 1, 9, 13 812-002-221, Fig. 2
10	812-002-211, Fig. 1 812-002-221, Fig. 2
11	812-002-211, Fig. 2, 8 812-002-221, Fig. 2
12,13,14	812-002-221, Fig. 2

*Where 2-wire (2-wire local channel) is shown, the tie trunk will be located at the PBX, and the 24V4 at the central office. In some arrangements an impedance compensator will be used.

† Section 812-002-211, Fig. 3,4, 11, 12 show arrangements using duplex (DX) signaling units at customer location. The complementing CO arrangements will include a signal lead extension circuit and single frequency (SF) unit as shown in Fig. 3 of this section.

Ringdown Tie Trunk Circuits (Fig. 1 and 2)

8.03 The ringdown tie trunk circuits can be seized from either end and require ringing voltage (20 Hz ac) power applied to the circuit to signal the distance end.

8.04 At PBX installations ringdown is normally manual except for tie trunk circuits associated with switching equipment which has ringing power applied automatically to the circuit for approximately 2 seconds when the circuit is seized. These automatic ringing systems also provide automatic disconnect at the dial PBX when the station at the PBX goes on-hook. Key system installations may be manual or automatic, as required.

8.05 Disconnection (cord lamp supervision) on a manual switchboard not having automatic ringing is achieved by applying ringing to the tie trunk before the connecting plug is removed. Disconnection from stations making dial accessed calls is automatic.

Automatic Tie Trunk Circuits (Fig. 3 and 4)

8.06 Automatic tie trunk circuits can be seized from either end. The circuits may use E and M lead signaling (7.08) or loop signaling (7.05). The circuits using loop signaling are normally designed for high-low current signaling.

8.07 Access to the trunks may be either manual, dial, or both manual and dial. On dial accessed calls, disconnect is automatic when the station goes on-hook. For all manually accessed calls, disconnect is done manually.

8.08 There are several variations in the automatic tie trunk circuit configurations because of differences in connecting equipment, signaling, and depending upon whether the circuit has 2-wire or 4-wire facilities.

Dial Repeating Tie Trunk Circuits (Fig. 5 and 6)

8.09 Dial repeating tie trunk circuits can be seized from either end. The circuits may use E and M lead signaling (7.08).

8.10 The dial repeating circuits follow and repeat outgoing and incoming dial pulses. Most circuits have a pulse correcting feature for incoming pulses.

8.11 Access to the trunk may be either dial or manual and dial. Disconnect is automatic when the station goes on-hook or the attendant disconnects the connection.

8.12 A variety of repeating coils, terminating circuits, repeaters, carrier systems, and signal circuits may be used with the tie trunk circuit to provide the signaling and transmission requirements between the connecting PBXs.

9. SPECIAL SERVICE ARRANGEMENTS

9.01 Many special service arrangements exist, but only those covered by the Private Line Service Terminations series are included in this section.

Foreign Exchange (FX) Service (Fig. 7, 8, 9, 10, and 11)

9.02 A foreign exchange (FX) service provides service between a station at a customer premises and a remote CO other than the CO which normally would serve that customer location.

9.03 The CO end or office supplying the telephone number is known as the ***switching end.*** The customer location is known as the ***station end.*** The station end terminates in an attendant CO trunk (for loop start), combination CO trunk (for ground start), or a common battery telephone set (key or nonkey).

LOOP-START SIGNALING

9.04 Loop-start signaling is the normal type of signaling between a CO and a noncoin-, nondial-PBX, subscriber station, or between a PBX and a PBX station. This is sometimes called plain ordinary telephone service (POTS).

9.05 When the handset is removed from its cradle or switchhook at the station end, a resistance of approximately 200 ohms is placed across the line toward the switching end as a request for service.

9.06 Loop-start signaling may be used when providing service to a manual PBX.

9.07 An incoming call to the station end is recognized by the receipt of the 20 Hz ringing signal only.

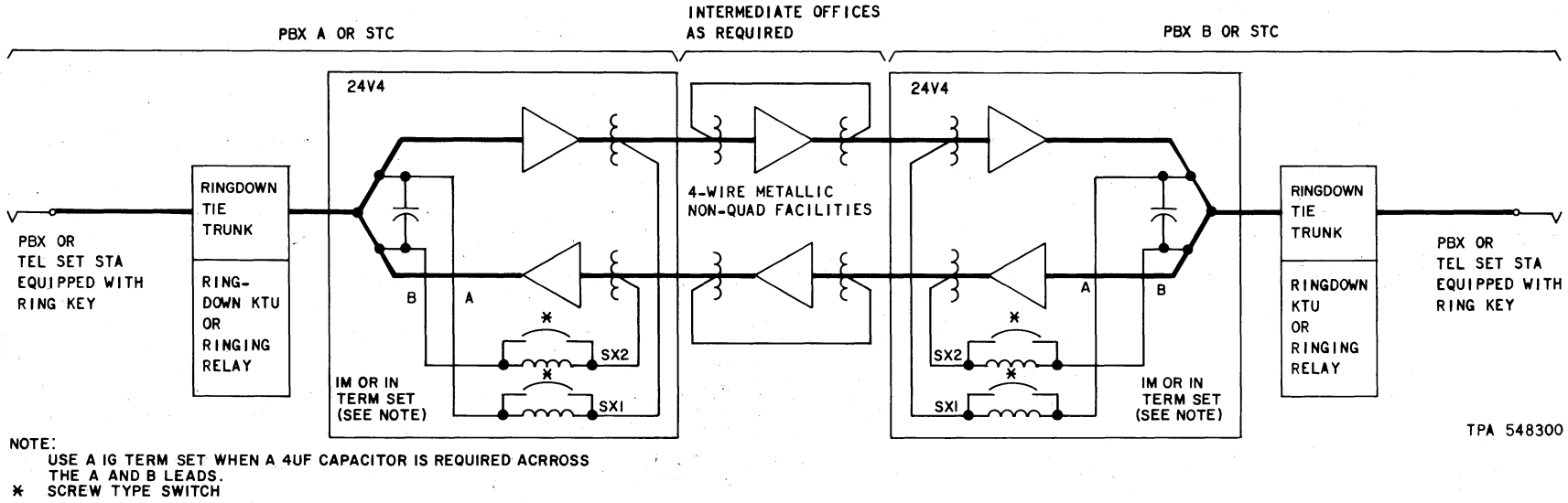


Fig. 1—Ringdown Tie Trunk Arrangement—4 Wire Metallic—With No Signal Conversion

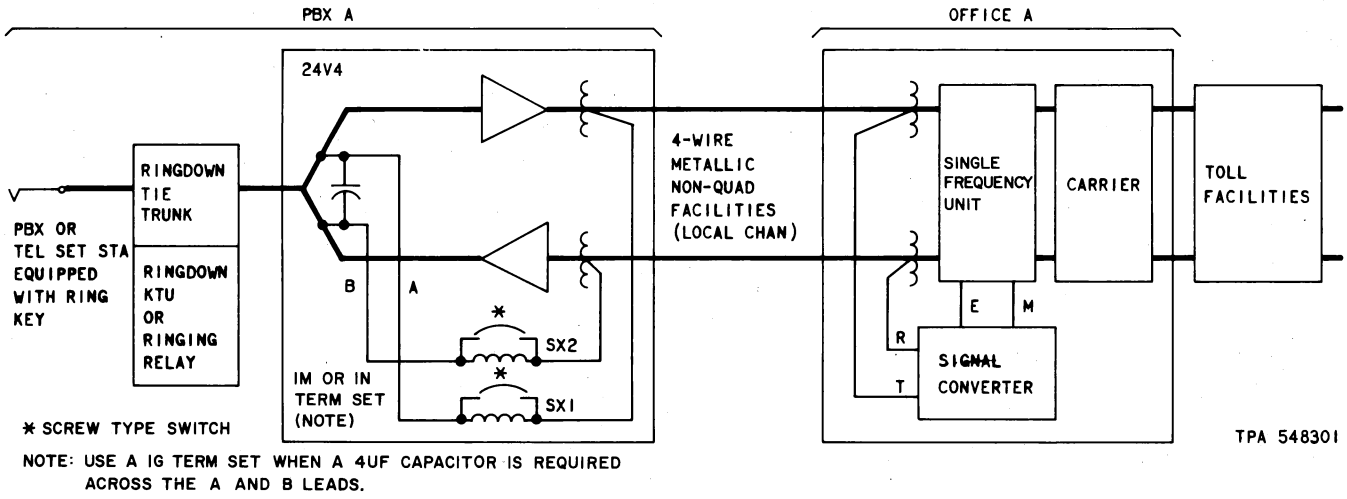


Fig. 2—Ringdown Tie Trunk Arrangement—4-Wire Metallic and Carrier With Signal Conversion (Sheet 1)

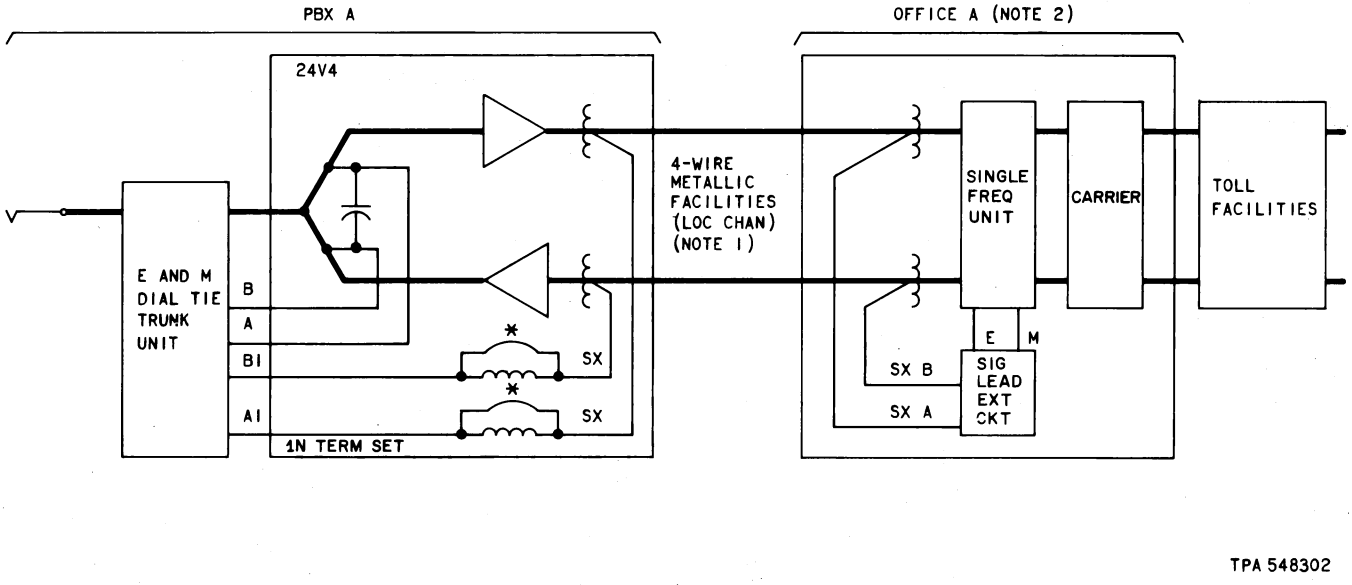


Fig. 3—Automatic PBX Tie Trunk Service Arrangement—Signal Conversion Required (Sheet 1)

GROUND-START SIGNALING

9.08 Ground-start signaling is required when providing service to a dial PBX, or to an ACD. Typical dial PBXs include the 701, 740, 756, 757, 770A, 800A, 801A, and 805A. Typical ACDs include the 2A, 2B, and 3A.

9.09 With ground-start, the subscriber line circuit at the CO is modified by removing the ground which is normally connected to the tip conductor of the line.

9.10 The dial PBX recognizes the presence of battery and ground on the loop as a seizure signal from the CO. At this time, the trunk circuit becomes unavailable to outgoing calls from the PBX. When 20 Hz signal is received, a signal is given to indicate an incoming call.

9.11 An outgoing call from the PBX toward the CO causes a ground to be placed on the ring conductor toward the CO. The CO equipment recognizes this as a seizure signal and prepares to receive dialing.

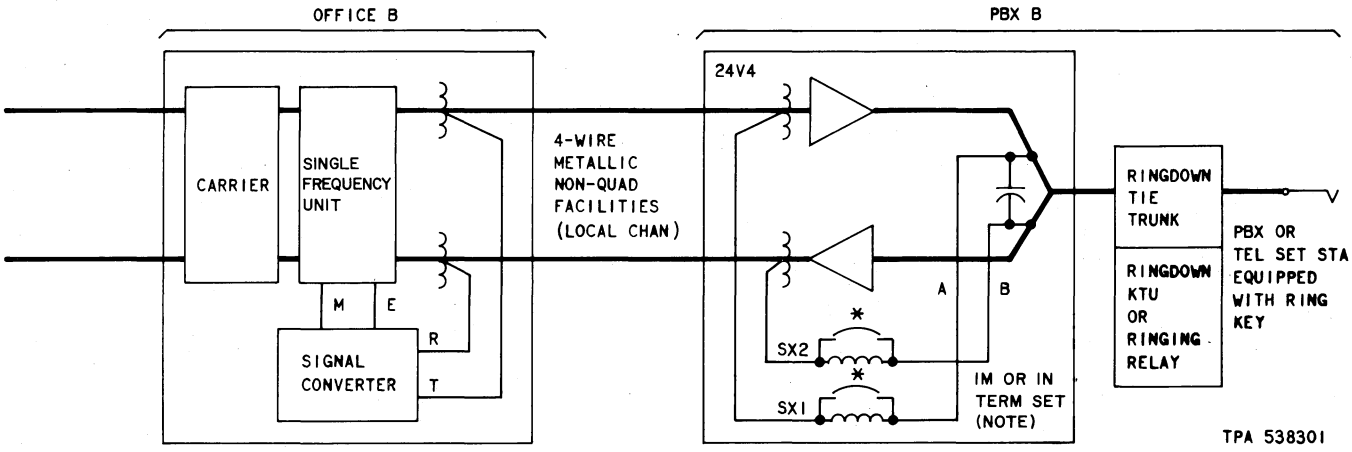


Fig. 2—Ringdown Tie Trunk Arrangement—4 Wire Metallic and Carrier With Signal Conversion (Sheet 2)

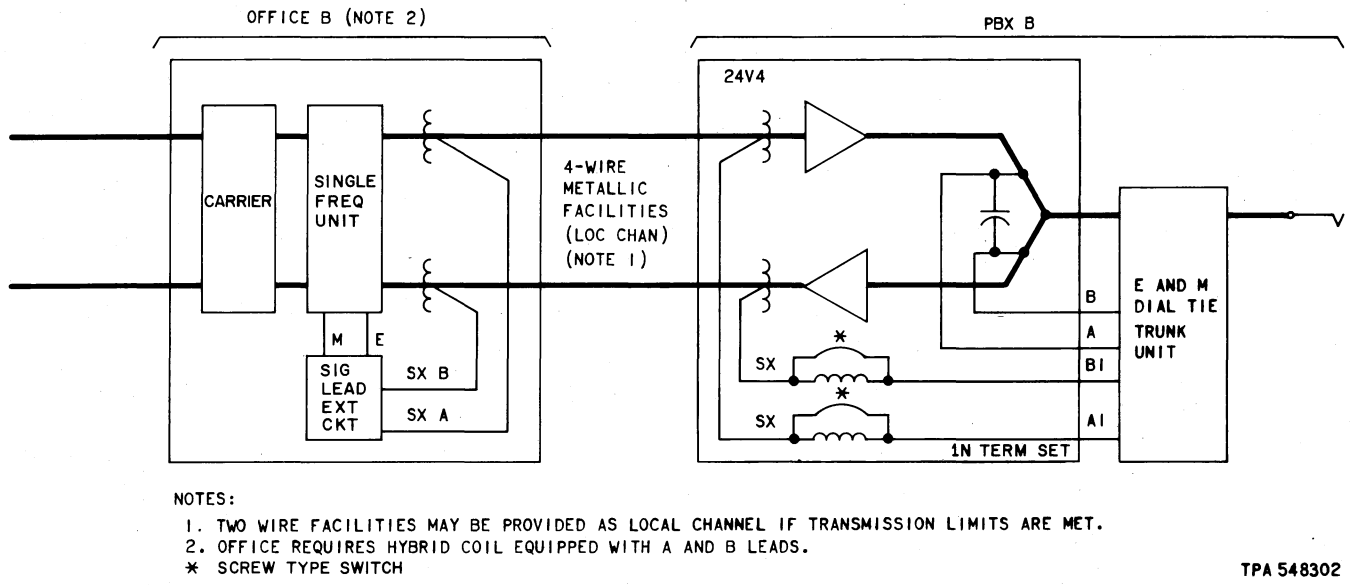


Fig. 3—Automatic PBX Tie Trunk Service Arrangement—Signal Conversion Required (Sheet 2)

9.12 The dial PBX recognizes the removal of battery and ground from the loop as a disconnect signal. The CO switching equipment recognizes the opening of the ring conductor as a disconnect signal.

Off-Premises Station (OPS) Lines—(Fig. 12, 13, and 14)

9.13 Off-premises station (OPS) lines provide the same service as on-premises station lines except that the telephone station equipment is located off the premises of the PBX.

9.14 The dial PBX end or customer location supplying the station code is commonly known as the switching end of the OPS service. The manual switchboard and telephone set (key or nonkey) end is known as the station end.

9.15 The line between the PBX and the OPS can pass through one or more COs. The

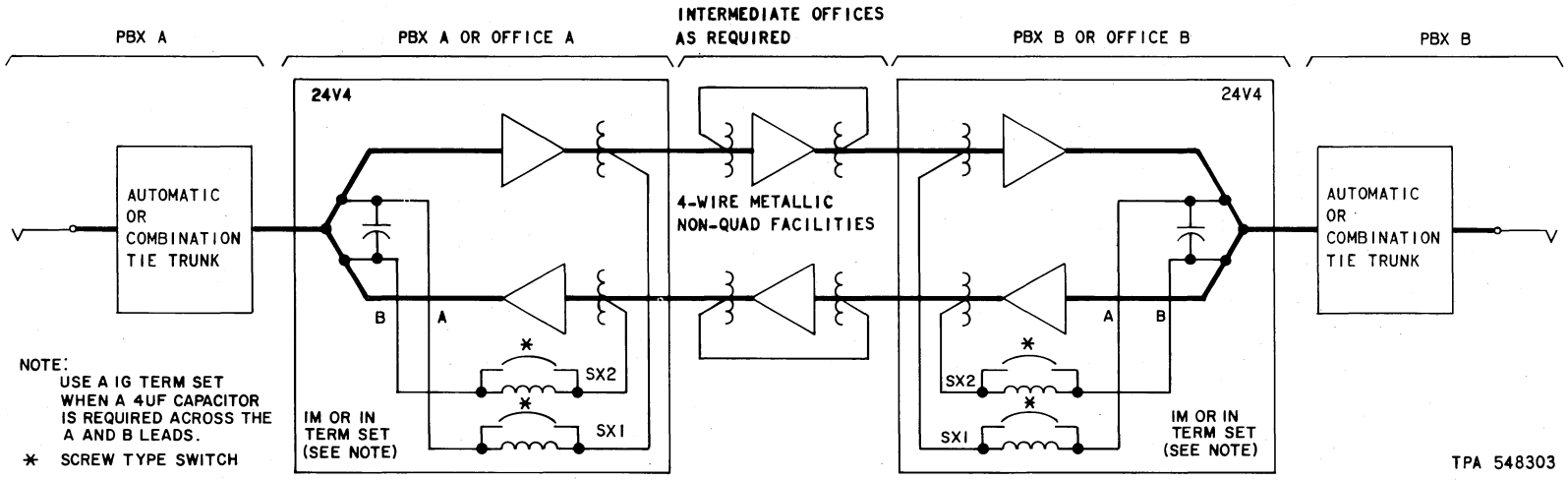


Fig. 4—Automatic Tie Trunk (or Combination) Arrangement—4-Wire Metallic Facilities—No Signal Conversion Required

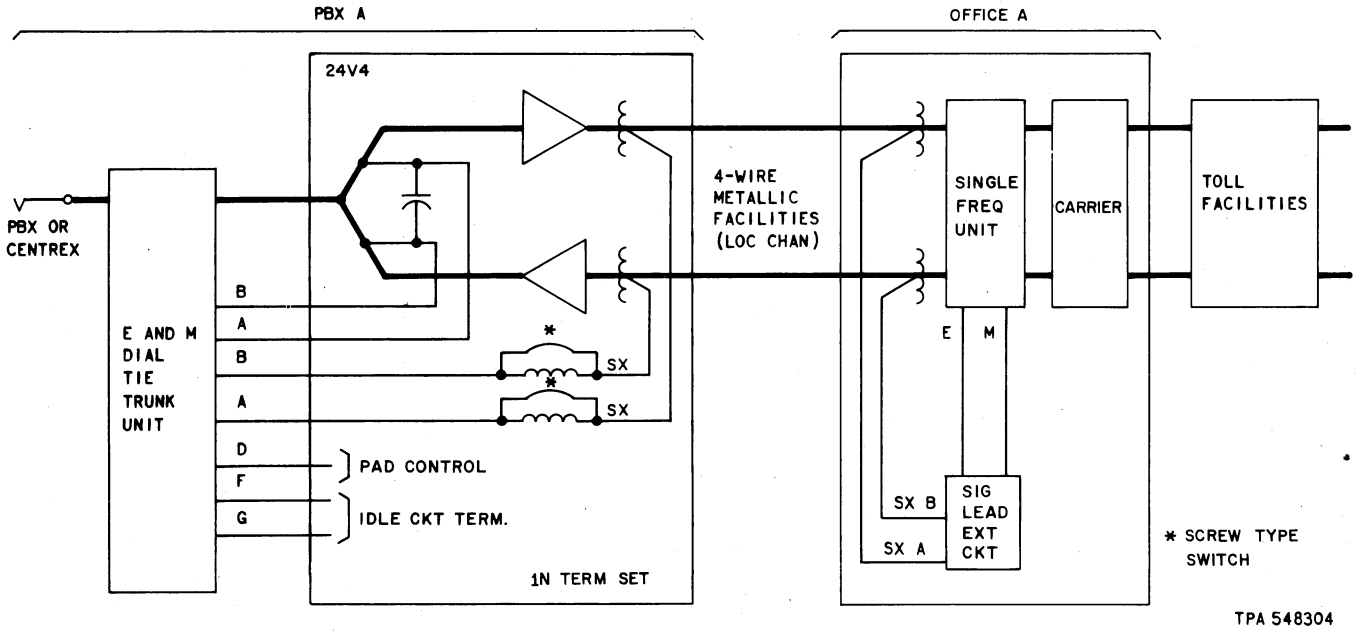


Fig. 5—Dial Repeating Tie Trunk Arrangement—Signal Converter-Carrier Facilities—In-Band Signaling (Sheet 1)

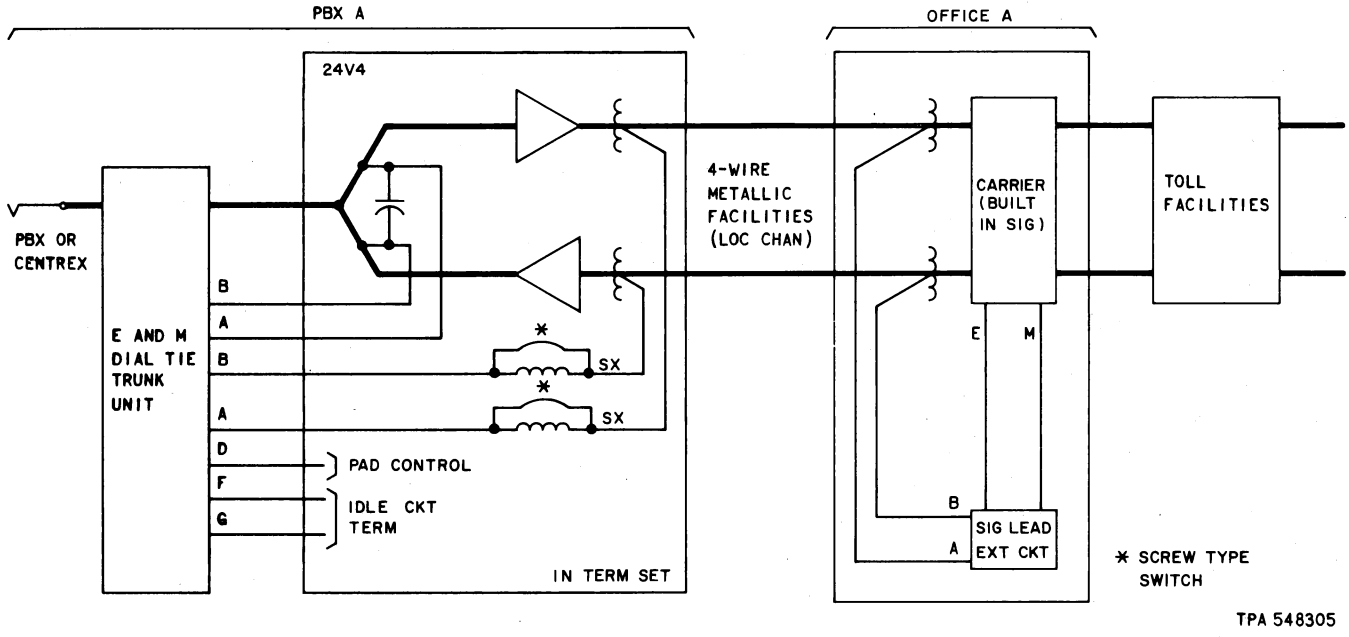


Fig. 6—Dial Repeating Tie Trunk Arrangement—Out-of-Band Signaling (Sheet 1)

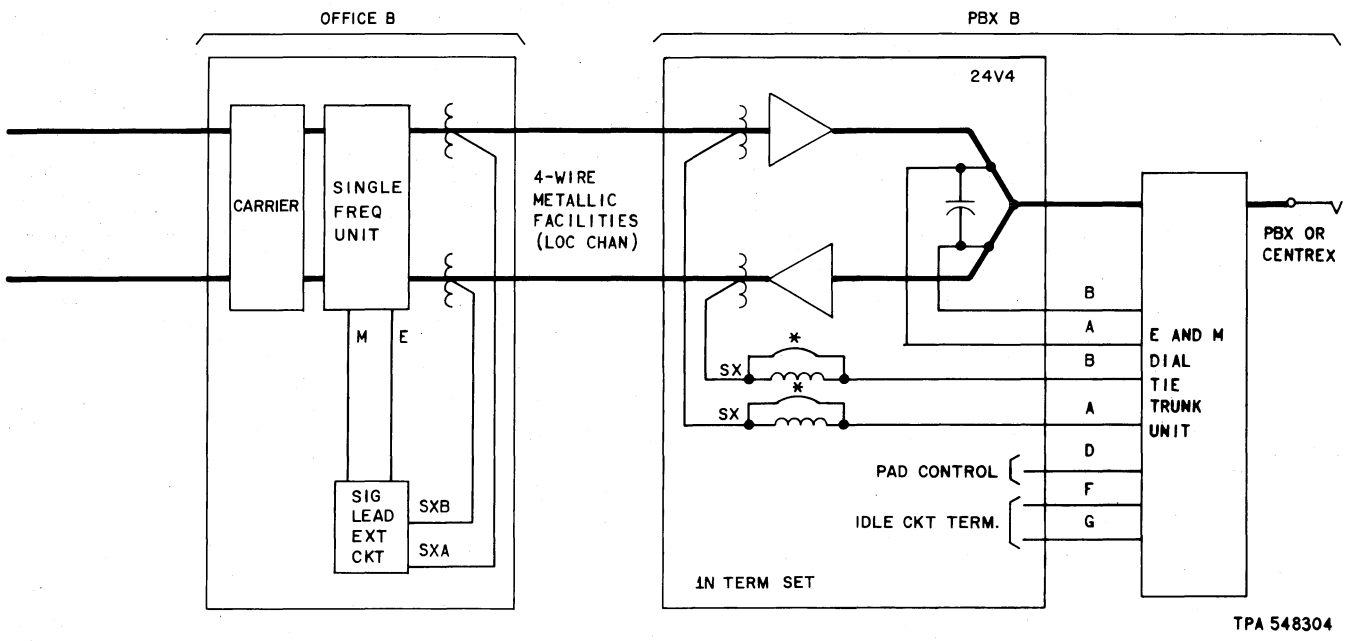


Fig. 5—Dial Repeating Tie Trunk Arrangement—Signal Converter-Carrier Facilities—In-Band Signaling (Sheet 2)

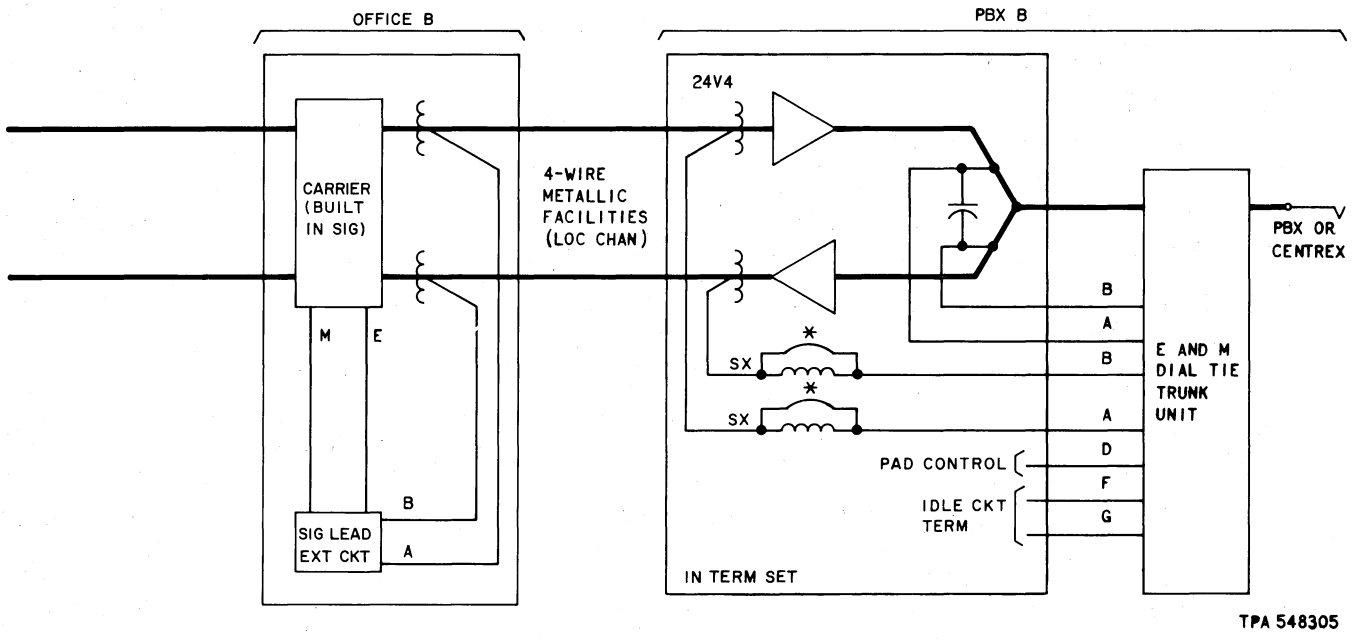


Fig. 6—Dial Repeating Tie Trunk Arrangement—Out-of-Band Signaling (Sheet 2)

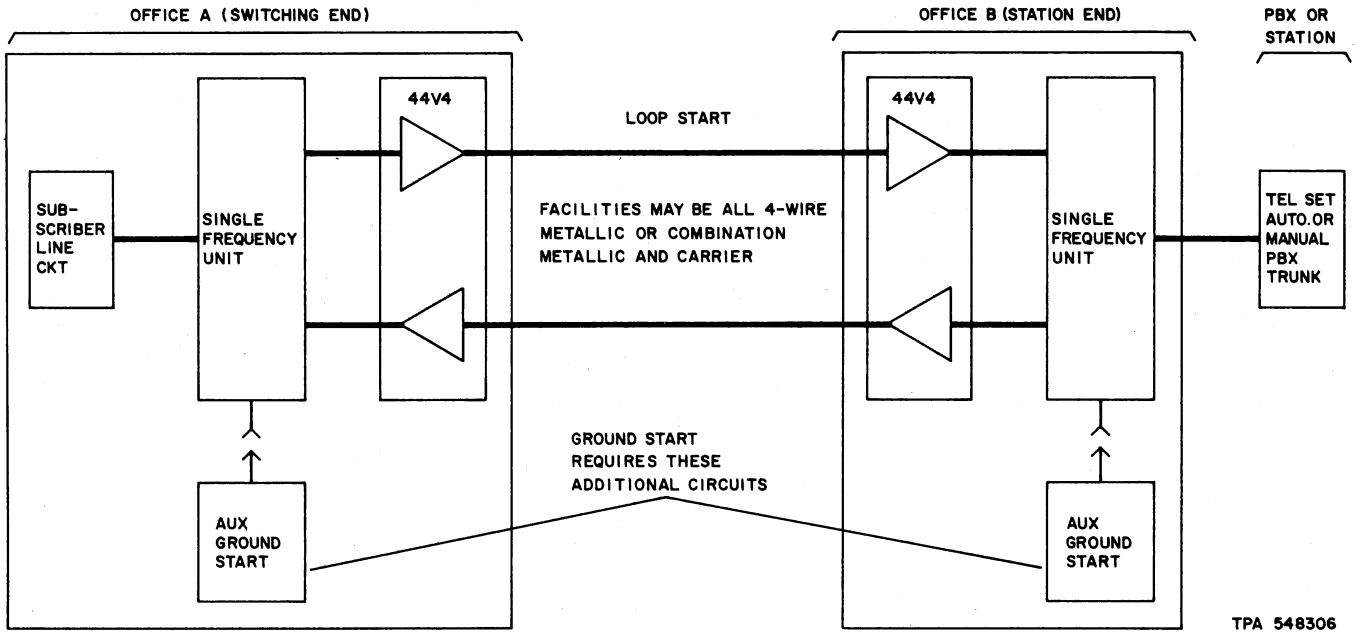


Fig. 7—Foreign Exchange—Newer Types of Equipment

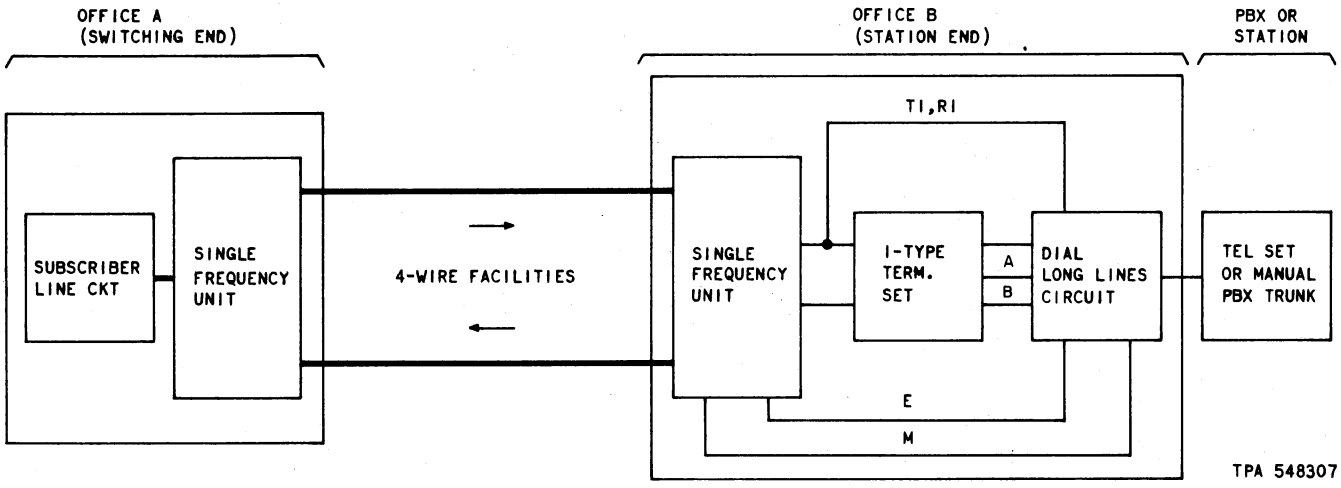


Fig. 8—Foreign Exchange Arrangement—Loop Start

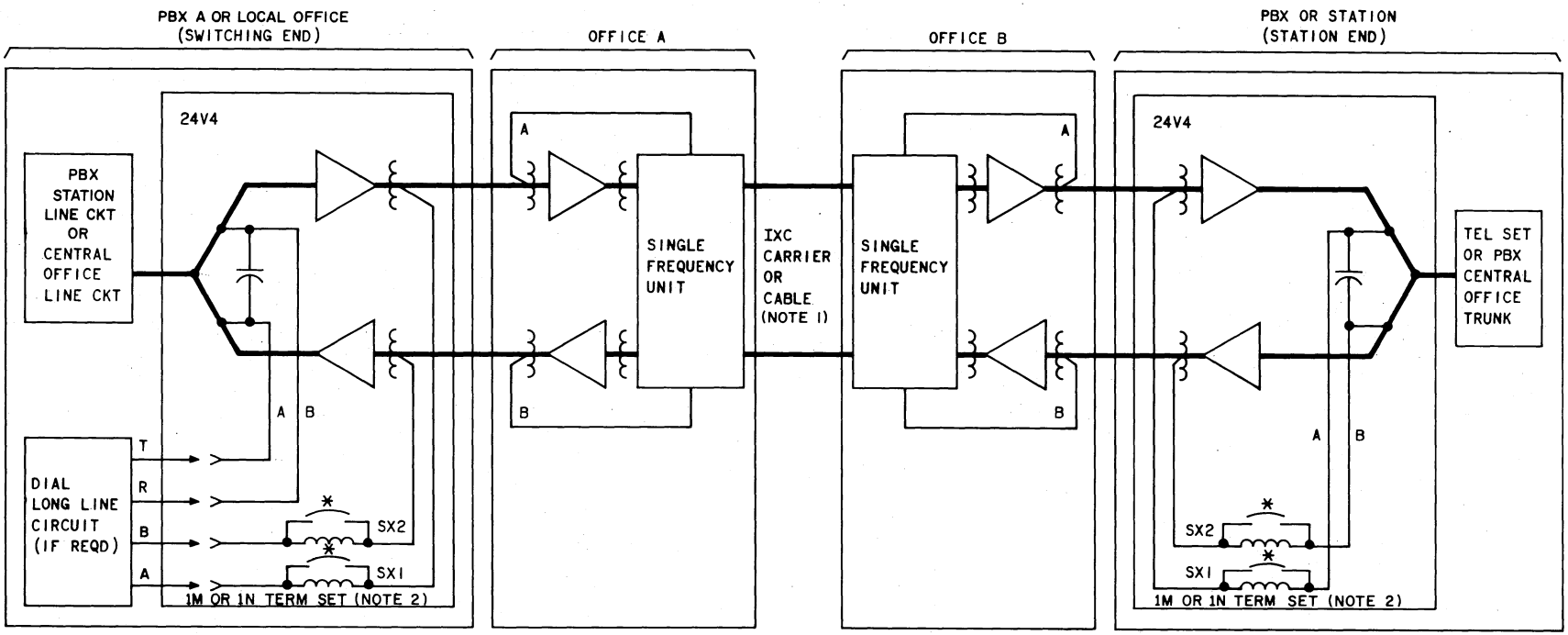
overall design of this service is similar to FX service.

Alternate Services (Fig. 15 and 16)

9.16 Alternate services provide a transfer arrangement from one type of service to another. To provide alternate service, a transfer key must be provided which connects to a dc control channel.

9.17 The signaling on manually controlled alternate services is normally the same for both services involved.

9.18 Figures 15 and 16 show typical alternate arrangements for both ends of a Full Period



NOTES:

1. WHEN CABLE IS USED AN AMPLIFIER IS NEEDED ON THE LINE SIDE OF THE SF UNIT
2. USE A 1G TERM SET WHEN A 4UF CAPACITOR IS REQUIRED ACROSS THE A AND B LEADS

* SCREW TYPE SWITCH

Fig. 9—Foreign Exchange Services or Off-Premise Station Arrangement—4-Wire Facilities (Switching End Remote from Carrier Office)

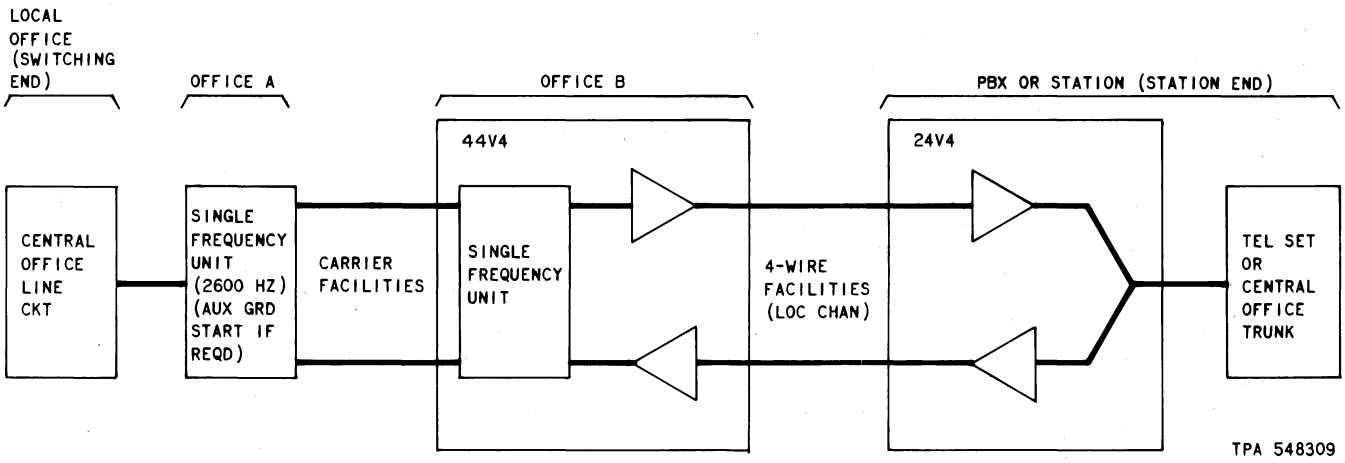


Fig. 10—Foreign Exchange Arrangement—4-Wire Facilities (Switching End in Close Proximity With Carrier Office-3dB or Less)

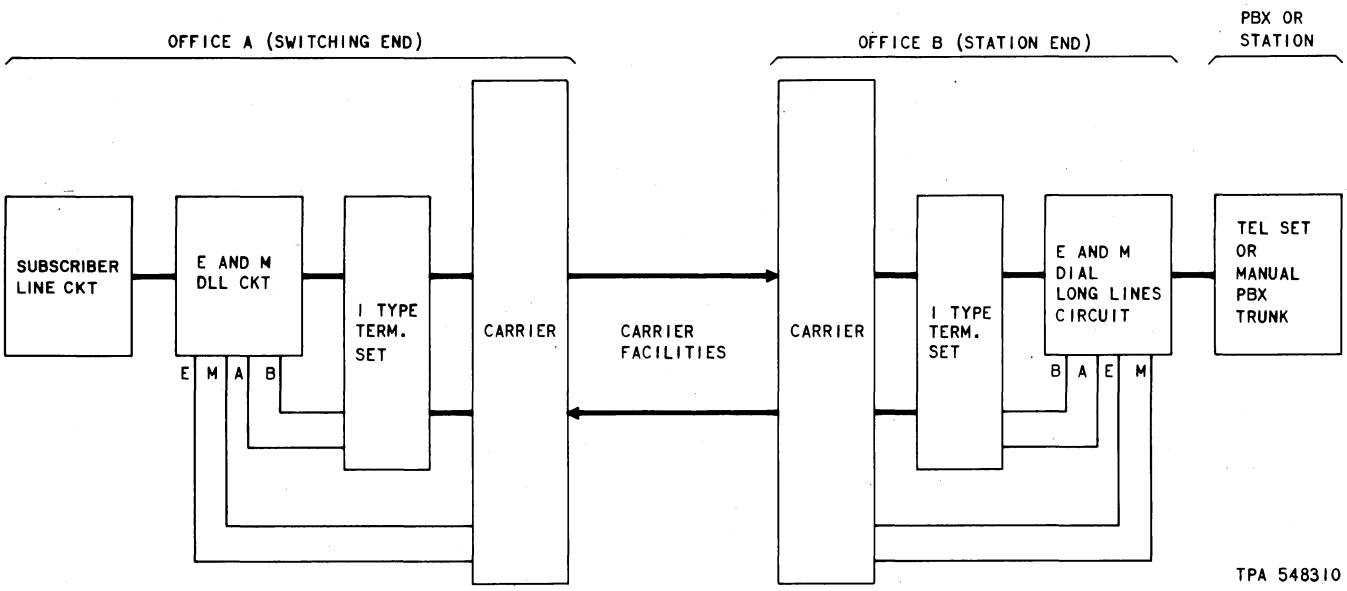


Fig. 11—Foreign Exchange Application (for use with Facilities Equipped with Built-in or Out-of-Band Signaling)

(FP)/ Foreign Exchange (FX). These show CO arrangements involved.

Wide Area Telecommunications Service (WATS)

9.19 WATS is a service permitting a customer to have a special access line to the toll switching network for long distance calls.

9.20 ***Outward WATS*** is a customer line that is used exclusively for outgoing calls to the toll network.

9.21 A customer line that is used exclusively for incoming calls for the toll network is called ***inward WATS.***

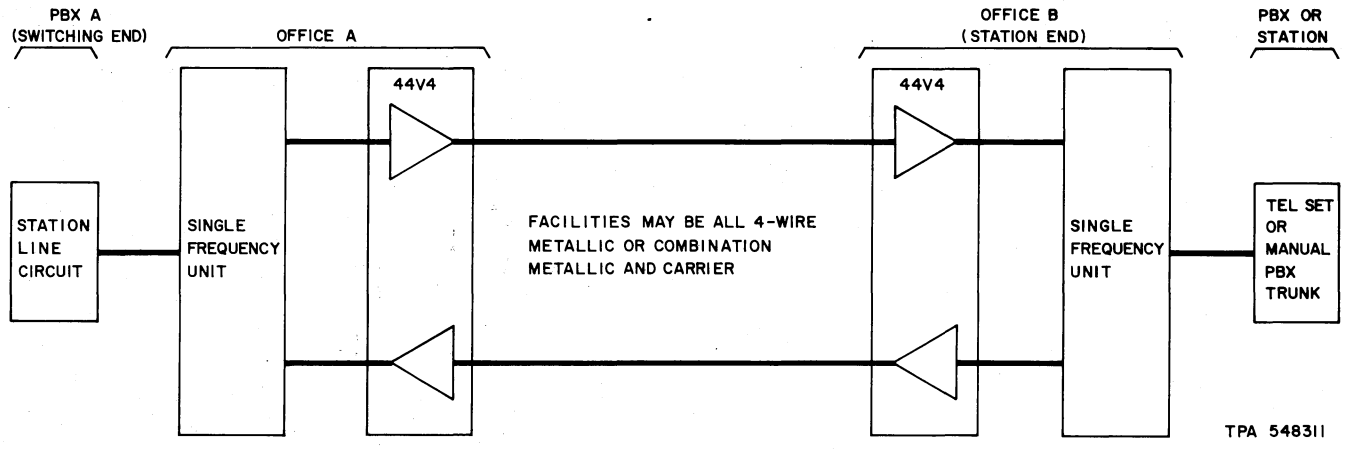


Fig. 12—Off-Premises Station Arrangement—E-Type Signaling Equipment

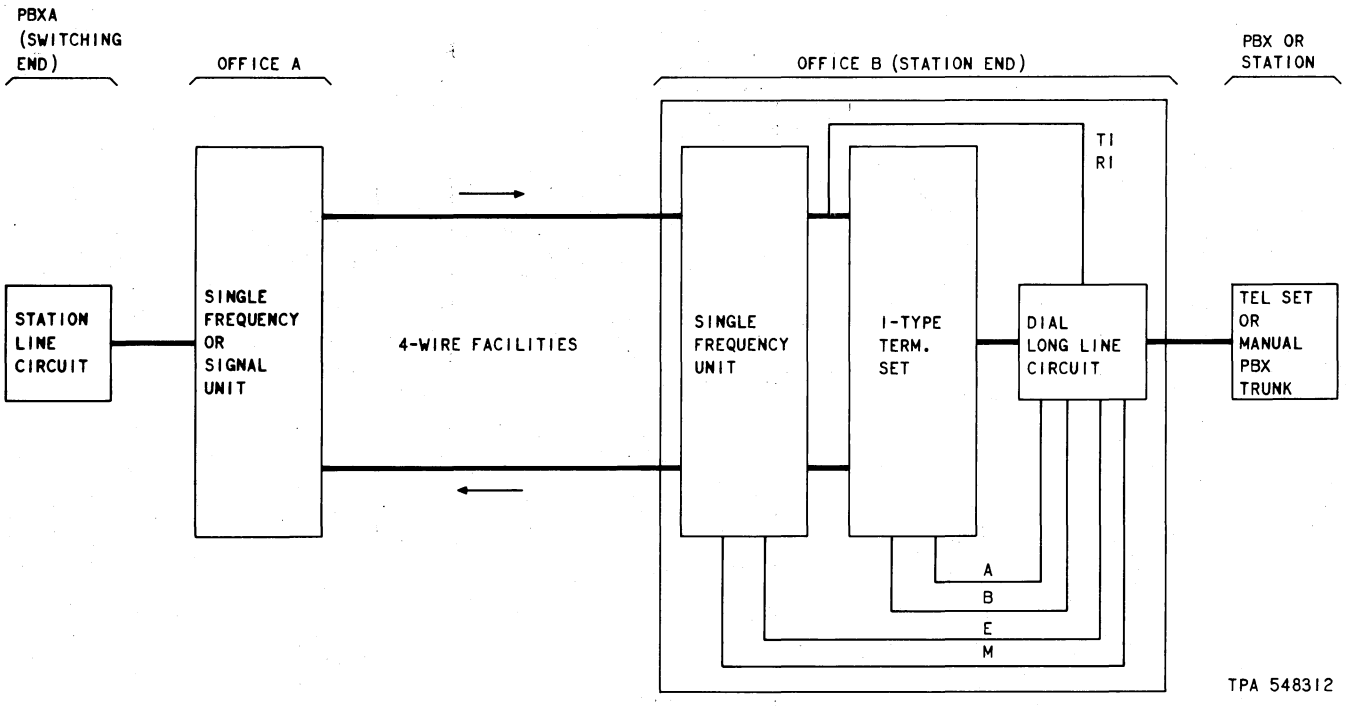


Fig. 13—Off-Premises Station Arrangement—Combination Dial Long Line Unit and E-Type Signaling Equipment

9.22 WATS lines may terminate either in the same CO that normally serves the customer location or in a distant CO.

9.23 PBX WATS trunks are similar to WATS lines, except that they connect a PBX instead of a telephone to a WATS CO.

10. CUSTOMER'S PREMISES FACILITY TERMINAL (CPFT)

10.01 A simplified application schematic of the CPFT equipped for F-type signaling is provided in Fig. 17. For more details on the CPFT, refer to Section 332-601-100 and 332-601-200.

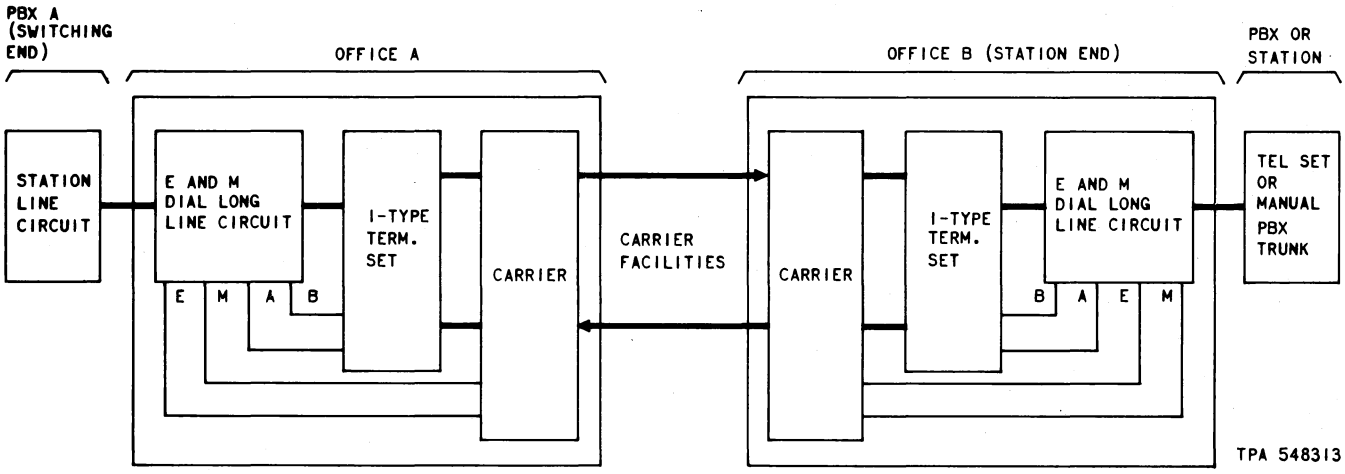


Fig. 14—Off-Premises Station Arrangement—Dial Long Line Equipment With Carrier Equipped With Built-in Signaling

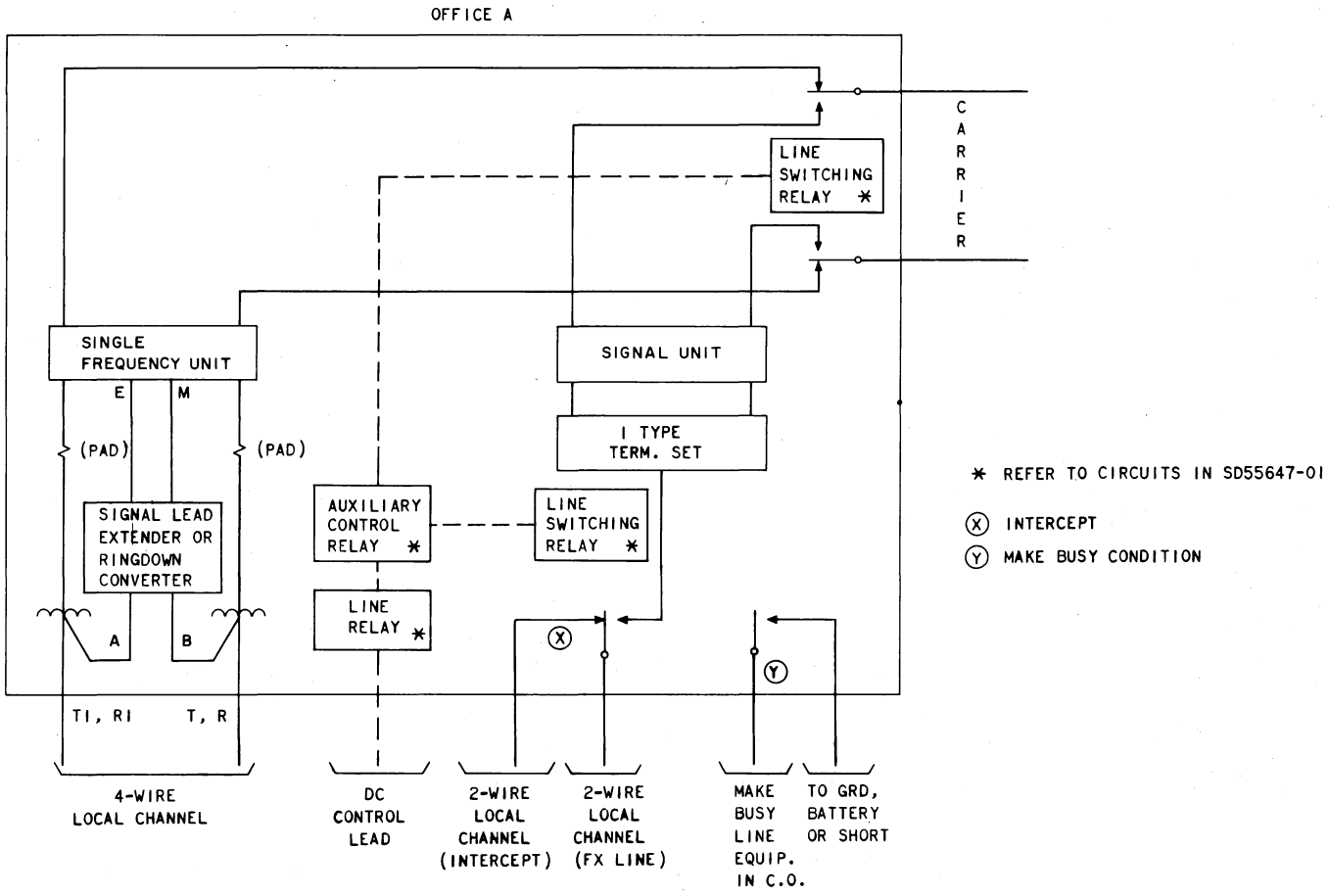


Fig. 15—Alternate Service (Full Period—Foreign Exchange Manual)—Switching End

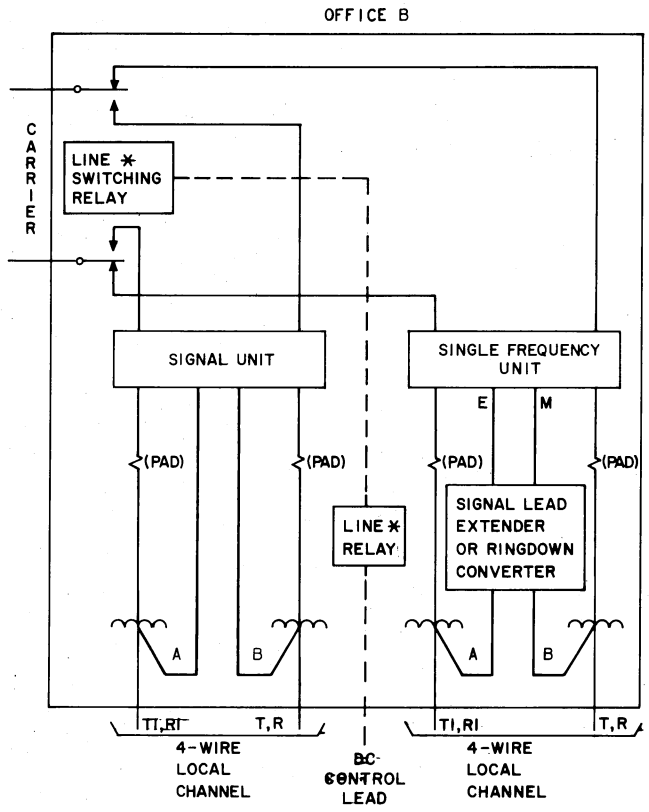


Fig. 16—Alternate Service (Full Period—Foreign Exchange Manual)—Station End

11. REFERENCES

11.01 The following Bell System Practices, circuit descriptions (CD), schematic diagrams (SD), and manuals provide a source of reference for Private Line Service Terminations. Titles are condensed and rearranged for use as a ready reference.

Intercity Services Manual (ISM)-Uniform Service Order Codes (USOC)

010-520-100 through 149-Intercompany Services Coordination (ISC)

SECTION	TITLE
179-100-304	Compatibility of Type E Signaling Systems
304-162-100 851-300-101	Exchange Cable Losses at 1000 Hz.
304-204-100	1000 Hz Loss Through Repeating Coils.
304-208-100	Miscellaneous Equipment Losses at 1000 Hz.
310-405-100	Multistation Systems Description
310-405-500	Multistation Requirements
311-200-180	Foreign Exchange Circuit Arrangements—General Description
311-350-100	PBX 4-Wire Via Net Loss Tie Trunks-Balance Testing
332-103-100	V3 Telephone Repeater
332-104-100	V4 Telephone Repeater Equipment Description
332-104-500	V4 Telephone Repeater-Transmission Characteristics
332-601-100	CPFT-Description
332-601-200	CPFT-Identification, Connections and Installation
463-220-100	106-Type Loudspeaker
463-221-100	107A Loudspeaker

Division 590 through 598-Data Systems and Data Sets (100-800 Series)

SECTION	TITLE
809-006-151	PBX Range Information—General
800-100-100	Notes On Distance Dialing
851-200-100	Design Considerations—Multipoint Service
851-300-100	Transmission Design Considerations—Switched Special Services and PBX Services

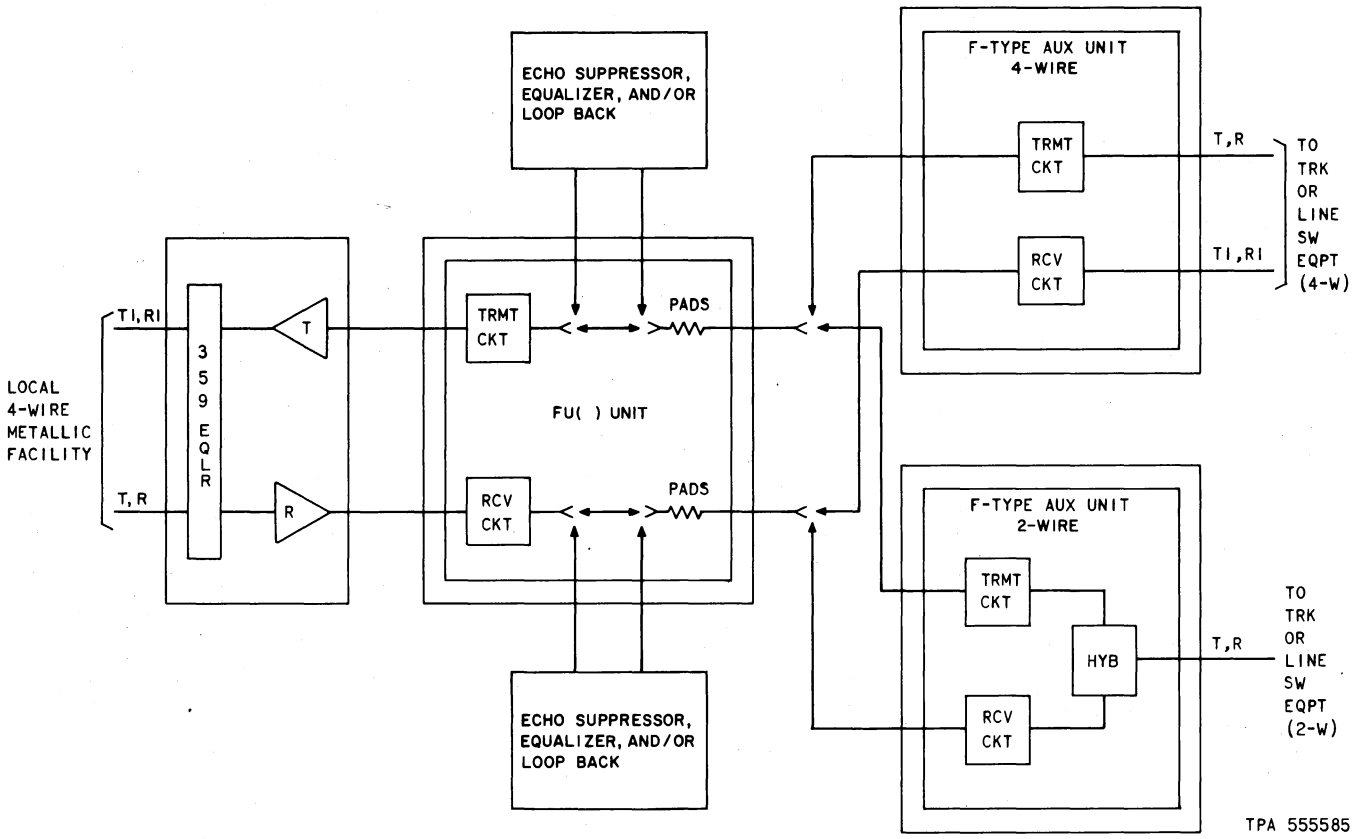


Fig. 17—Simplified Application Schematic of the Customer's Premises Facility Terminal Equipped for F-Type Signaling

851-310-101	Special Service Systems—Effect of PBX Trunk and Cord Circuits on Station Loop Current
902-115-101	Application of Resistance Design to Local Channel
852-307-101	V4 Telephone Repeater—Plug-in Units
852-307-102	V4 Telephone Repeater—Design Procedures
859-100-100	Signal Transmission—Engineering Considerations
859-291-101	20 Hz Signal Equipment—Signaling Range
859-501-101	Signal Transmission—Compatibility with V4 Equipment
975-115-100	Signals and Signaling Systems—Between Offices
975-230-100	Duplex (DX) Signaling System
981-010-100	PBX Tie Trunk Circuits—General Description.
981-249-100	4-Wire Private Line Terminations (SD-69566-01)
982-326-100	SS-1A Selective Signaling System—General Description
982-328-100	SS-3 TOUCH-TONE Selective Signaling System—General Description
CD-& SD-56163-01	Toll Systems-Signaling
CD-& SD-65718-02	PBX Systems—Tie Trunk Circuit

SECTION	TITLE
CD-& SD-69594-01	SS-1A Selective Signaling Systems
CD-& SD-95487-01	Duplex (DX) Signaling
CD-& SD-95488-01	Signaling—Signal Lead Extension Circuits
CD-& SD-1C363-01	Duplex (DX) Signaling (Replaces SD-95487-01)
CD-& SD-1C364-01	Pulse Link Repeater and Signal Lead Extension Circuit
CD-& SD-97047-01	24V4 and 44V4 Repeaters (except 24V4B)
CD-& SD-99739-01	24V4B Repeaters
CD-& SD-1C475-01	CPFT for F-Type Signaling System
CD-& SD-1G265-01	SS-3 TOUCH-TONE Selective Signaling System