

## 4-WIRE PRIVATE LINE SYSTEM

### IDENTIFICATION, ARRANGEMENT, AND INSTALLATION

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**1. GENERAL**

**1.01** The 4-Wire Private Line System is designed for multistation leased line voice and data service with a choice of many service options. This system can be arranged with the Selective Signaling System SS-1-type. The terminating and associated equipment of the system is arranged for installation at customer location.

**1.02** The 4-Wire Private Line System is designed as a series of "building block" units which are similar in application to 200-type key telephone units. Except for the emergency power talking and signaling circuit, these units are assembled on standard 23 by 2-inch and 3-1/32 to 3-17/64 inch mounting plates suitable for mounting in equipment cabinets or on mounting frames. The system contains one plug-in type circuit pack assembly. SS-1-type units normally used with the 4-Wire Private Line System are available in packaged units.

**1.03** Power supplies and fusing are not provided with the 4-Wire Private Line System components and should be supplied from existing equipment or ordered separately. Selective Signaling System SS-1 and SS-1A packaged units are separately fused.

**1.04** For 4-Wire Private Line System general descriptive information, refer to Section 981-249-100. For Selective Signaling System SS-1 general descriptive information, refer to Section 982-325-100.

**SERVICE OPTIONS**

**1.05** See Table A.

**1.06** Table B shows signaling, loop-back maintenance, and emergency power talking and signaling options which are provided with the 4-Wire Private Line System. Certain combinations of options are not possible and are indicated.

**RELATED REFERENCES**

SECTION	TITLE
981-249-100	4-Wire Private Line System, General Description
518-600-400	4-Wire Private Line System, Connections
518-600-401	4-Wire Private Line System, Connections to Selective Signaling System SS-1A Units
AA321.035	4-Wire Private Line Terminating and Station Equipment
982-325-100	SS-1 Selective Signaling System, General Descriptive Information
480-621-200	SS-1 Selective Signaling System, Identification, Installation, Connections, and Service Options
CD & SD 98093-01	SS-1 Selective Signaling System, Pulsing, Counting, and Interdigital Control Circuit
AA388.107	SS-1 Selective Signaling System, Pulsing, Counting, and Interdigital Control Circuit with Appendix 1 and 2 (J99252)

TABLE A

FEATURE OR OPTION				PROVIDE	
				WRG	QUANTITY
4-Wire Line Termination Circuit	Outward signaling	With SS-1-type selective signaling system	Without privacy or station lockout during dialing	Z ZA	1 Per Customer Location
			With privacy or station lockout during dialing	X ZA	
		With 20 Hz, —48V dc simplex or loudspeaker signaling	Without SS1 privacy or inward signaling lockout	E Z	
			With SS-1-type pri- vacy or inward sig- naling lockout	E X	
	Inward signaling	With SS-1-type selective signaling	Without privacy or station lockout during dialing	Z ZB	
			With privacy or station lockout during dialing	X ZB	
		With 20 Hz ac, —48V dc simplex or loudspeaker	Y Z		
	Terminating impedance	150 ohm	G		
		600 ohm	V		
	Data Service	Required	A		
		Not required	W		
	Loopback Test circuit	Required	ED- 69524 GP-1		
		Not required	—		
	On-premise talk back amplifier	Required	227D AMPL		
		Not required	J		
	Emergency Power Talking and Signaling			ZF	

TABLE A (Cont)

FEATURE OR OPTION				PROVIDE	
				WRG	QUANTITY
Pickup Relay Circuit	Signaling	With SS-1-type selective signaling system	Without privacy or station lockout during dialing	Z K	1 per station per 4-wire line
			With privacy or station lockout during dialing	X K	
		With 20 Hz, -48V dc simplex or loudspeaker		ZC Z	
	Push-to-talk	Provided		—	
		Not provided		S	
	Exclusion	For nonexcluded stations		R	
		For master excluder stations		M,R	
		For excluder-excluded stations		Q	
		For excluded stations		N	
		Manual exclusion		T	
Automatic exclusion		H			
Station Circuit (One Per Station)	For SS-1-type selective signaling		—	1 per station	
	For 20 Hz, -48V dc simplex or voice signaling				
On-premise exclusion circuit (J53045E)				—	1 per excluder station per 4-wire line
SS-1-Type Selective Signaling (Notes 1 and 2)	Dial circuit for outward dialing (J53045H)	With privacy or station lockout		X	1 per 2 stations per line
		Without privacy or station lockout		—	1 per two 4-wire terminations
	Selective signaling receive circuit for inward signaling (J53045F)		—	1 per 3 codes	
	Group code circuit (J53045H)		—	1 per group of 10 codes or 1 per group of 5 codes	

TABLE A (Cont)

FEATURE OR OPTION		PROVIDE	
		WRG	QUANTITY
SS-1-Type Selective Signaling Note 1	Time-out circuit (30A KTU or equiv)	—	1 per group of stations on same time-out
20 Hz ac Simplex Signaling (J53045G) Notes 1 and 2	Not locked in	—	1 per 4-wire termination
	Locked in with time-out	B	
-48V dc Simplex Signaling (J53045G) Notes 1 and 2	Not locked in	F	1 per 4-wire termination
	Locked in with time-out	B	
Loudspeaker Control Unit (J53045H)		—	1 per 2 station group (each served by one loudspeaker)
Emergency Power Talking and Signaling	Push-to-talk speaker cut-off	ZD	One per 4-wire line per customer location
	Automatic speaker cut-off	ZE	

**Notes:**

1. To provide interrupted ringing and flashing lamp signals with timeout, a 232B KTU visual and audible signaling circuit or equivalent should be furnished.
2. When interrupted ringing and flashing lamp signals are not required, a 30A KTU or equivalent should be provided for 20 Hz, -48V dc locked in signaling.

**TABLE B**  
**COMPATIBLE OPTIONS AND FEATURES**

OPTION OR FEATURE	SS-1-TYPE SELECTIVE SIGNALING	-48V SIMPLEX SIGNALING	20 Hz SIMPLEX SIGNALING	VOICE SIGNALING	LOOPBACK MAINTENANCE FEATURE	EMERGENCY POWER TALKING AND SIGNALING	REMARKS
SS-1-type Selective Signaling	—			•	•	•	
-48V Simplex Signaling		—		•	•	•	-48V simplex signaling, loopback maintenance feature, and emergency power talking and signaling cannot jointly be provided.
20 Hz Simplex Signaling			—	•	•	•	20 Hz simplex signaling, loopback maintenance feature, and emergency power talking and signaling cannot jointly be provided.
Voice Signaling		•	•	—	•	•	
Loopback Maintenance Feature	•	•	•	•	—	•	Loopback maintenance feature, -48V or 20 Hz simplex signaling, and emergency power talking and signaling cannot jointly be provided.
Emergency Power Talking and Signaling	•	•	•	•	•	—	Emergency power talking and signaling, -48V or 20 Hz simplex signaling and loopback maintenance feature cannot jointly be provided.

- CD & SD 69594-01 SS-1A Selective Signaling System Pulsing, Counting and Interdigital Control Circuit
- 812-016-155 SS-1A Selective Signaling System, Pulsing, Counting, and Interdigital Control Circuit, Equipment Design Requirement, Station System

## 2. IDENTIFICATION

### 4-WIRE PRIVATE LINE EQUIPMENT

#### Terminating Unit (J53045A)

**2.01** The 4-wire terminating circuit is arranged with 150- or 600-ohm terminations on the equipment line side and a low impedance bus is provided on the station side. The low impedance connection for station sets minimizes transmission level changes as the number of bridged station sets are increased or decreased. With 20 station sets off-hook at the same time, a nonobjectionable speech level loss will occur. Refer to local engineering. For conferencing requirements using a large number of station sets, a push-to-talk arrangement is recommended. Two 227-type amplifiers are used to adjust transmit and receive transmission levels.

**2.02** Transmission lines may be checked from a serving central office test center by applying -48 volts dc to the simplex leads of the line to operate a loop-back relay in the terminating unit (Fig. 1). The loop-back circuit is capable of operating over the simplex leads of 1500-ohm (maximum) transmit and receive loops using -44 to -52 volts dc. All components of the loop-back circuit, except the loop-back relay, are on a plug-in circuit pack (ED-69524) so that the loop-back maintenance feature may be provided on an optional basis by the terminating unit.

**2.03** A third (optional) 227-type amplifier will provide proper transmission level at the station for conferencing purposes and will also provide side tone.

**2.04** Optional terminal strip wiring permits an installer to arrange the circuit for SS-1-type signaling. Other terminal strip wiring permits data service connections. Jacks have been provided to permit line tests and tests at low impedance station terminals.

#### Multiple Station Line Pickup Relay Unit (J53045B)

**2.05** This unit (Fig. 2) is available to provide connections for up to five 4-wire private lines to one key type station set. Similar units associated with the same or other 4-wire private lines may be interconnected so that each 4-wire private line may be accessible to more than one station set and/or each station set may have access to more than one 4-wire private line. This single-plate unit is equipped with six wire-wrap terminal strips for installer connections.

#### Station Unit (J53045C)

**2.06** The station relay circuit provides talking battery and ground for a 4-wire type telephone set and converts loop dialing to 1- and 2-lead dialing when SS-1-type signaling option is wired. It also provides for station set push-to-talk operation. The station unit (Fig. 3) contains two station relay circuits.

#### Combined Single Station and Pickup Relay Unit (J53045D)

**2.07** This unit (Fig. 4) combines one pickup relay circuit and one station circuit into a key telephone unit. The same circuits are available in separate units; one to provide the pickup relay circuit and one to provide the station circuit.

#### Exclusion Relay Unit (J53045E)

**2.08** The exclusion unit (Fig. 5) provides means for disabling pickup relays of selected station sets at the customer location, preventing undesired station access to lines in use. Several optional levels of exclusion are provided as follows:

- (a) Master Excluder—Excludes all stations on- or off-hook except those wired for nonexclusion. Local conferencing with the master station is possible only with those stations that are wired for nonexclusion.
- (b) Excluder and Excluded—Initial exclusion is permitted only if stations are not already locked out. These stations may be excluded either by a master or another station with the same level of exclusion which has previously initiated lockout.
- (c) Excluded—Excluded stations cannot exclude others but may be locked out.

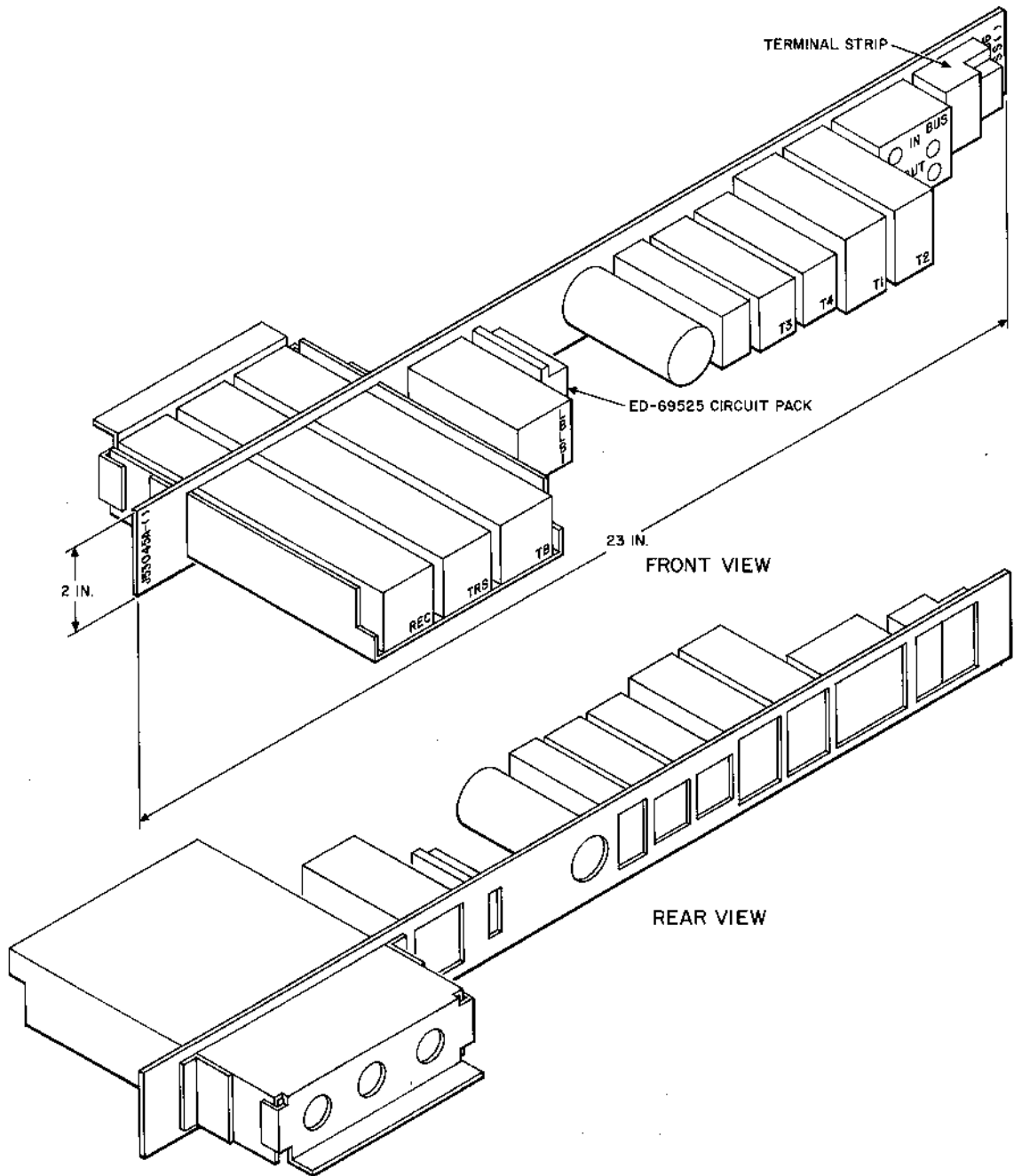


Fig. 1—Terminating Unit

(d) Nonexcluded—Nonexcluded stations cannot be locked out but may be wired so that they lock out other stations on the same line.

The exclusion feature can be optionally arranged to lock out automatically when the set goes off-hook or by the operation of a key.

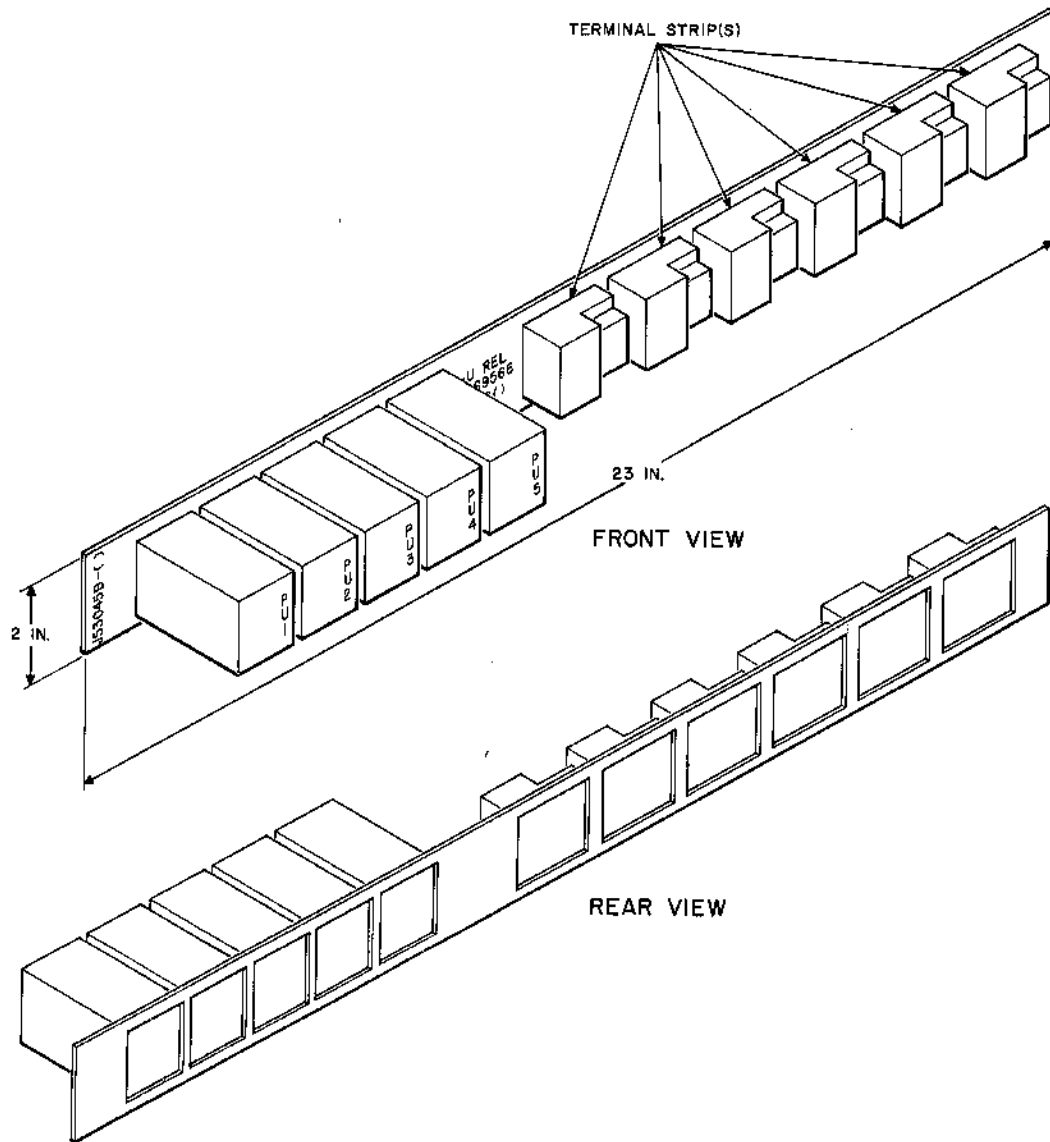


Fig. 2—Multiple Station Line Pickup Relay Unit



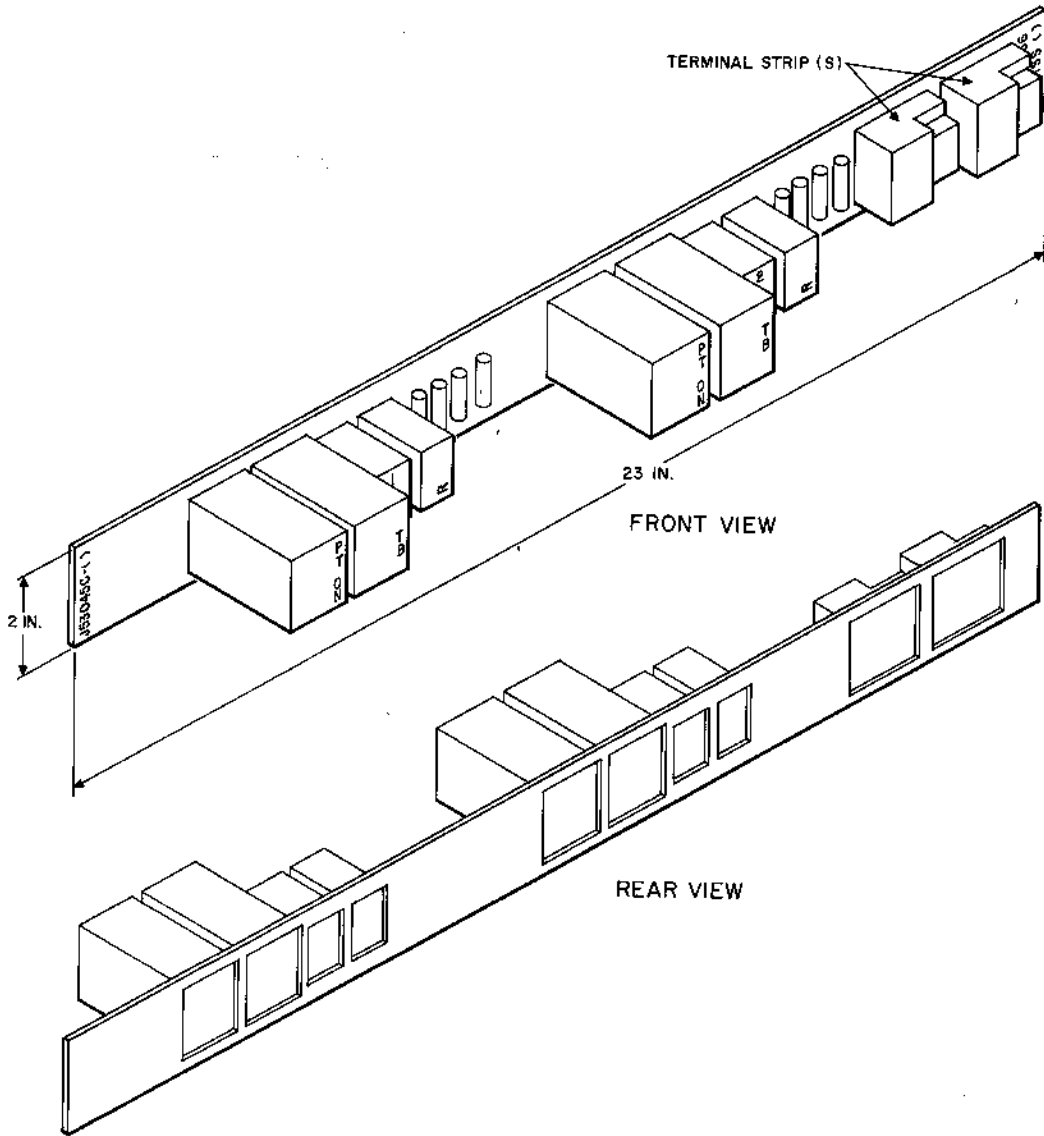


Fig. 3—Station Unit

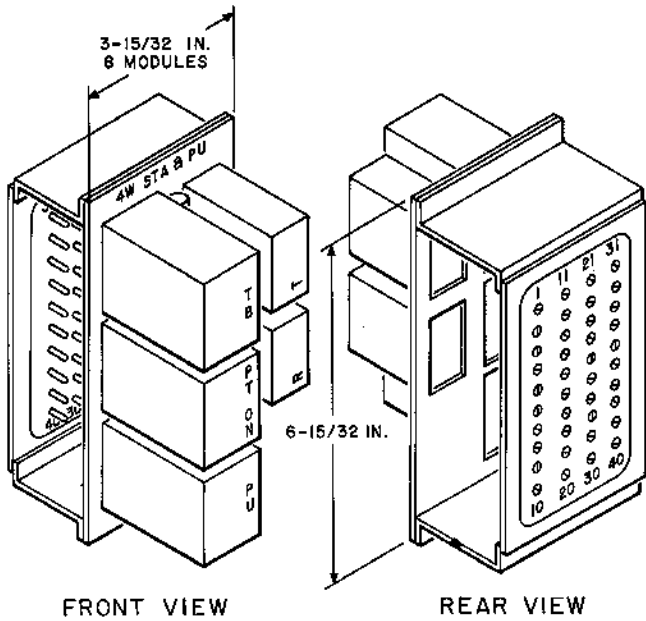


Fig. 4—Combined Single Station and Pickup Relay Unit

**Signaling Relay Unit (SS1) (J53045F)**

2.09 Since SS-1 signaling systems provide only a momentary incoming coded signal (100-millisecond) to a selected station, a signaling relay unit (Fig. 6), in conjunction with other signaling equipment is used to repeat and control the signal. One unit is needed for each three or less stations per 4-wire private line equipped with SS-1-type signaling.

**AC or DC Signaling Relay Unit (J53045G)**

2.10 When incoming or outgoing signaling, or both, is provided from a station using -48 volts dc or 20 Hz, the ac or dc signaling relay unit (Fig. 7) is required. This unit detects inward signaling and originates outward signaling over the simplex leads of the 4-wire line. Part of the incoming signal detector is a wired-in circuit pack (CP1) to facilitate maintenance. This unit, in connection with others, provides both audible and visual signaling. One ac or dc signaling relay unit is required for each line terminating unit. The 20 Hz signaling circuit operates from 20 Hz, 80 to 105 volts, over a maximum 1500-ohm loop.

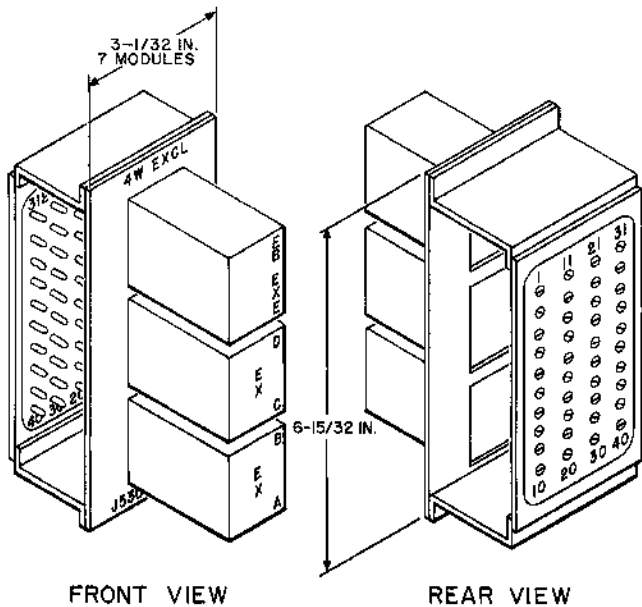


Fig. 5—Exclusion Relay Unit

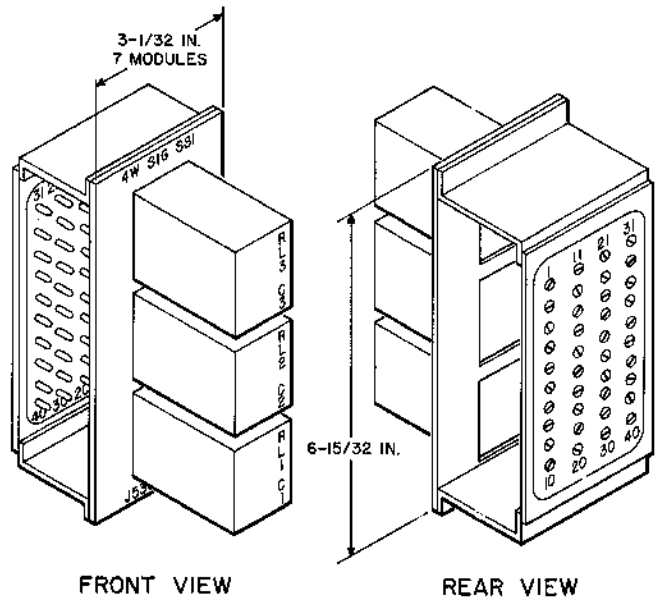
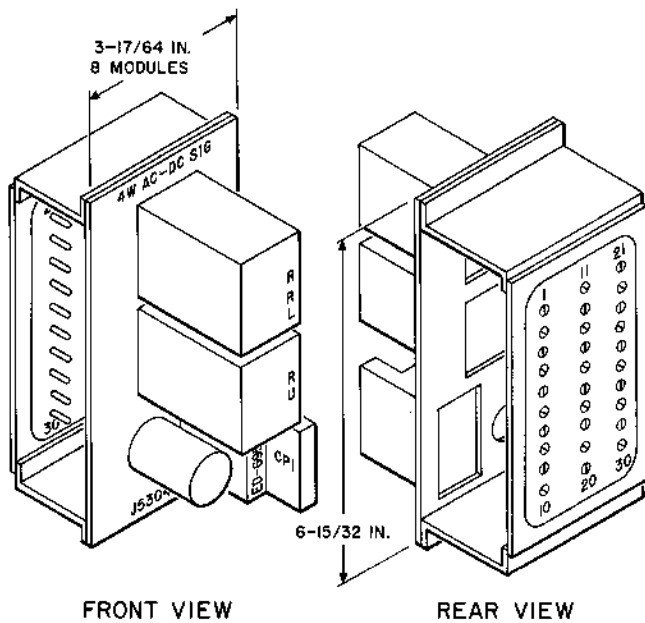


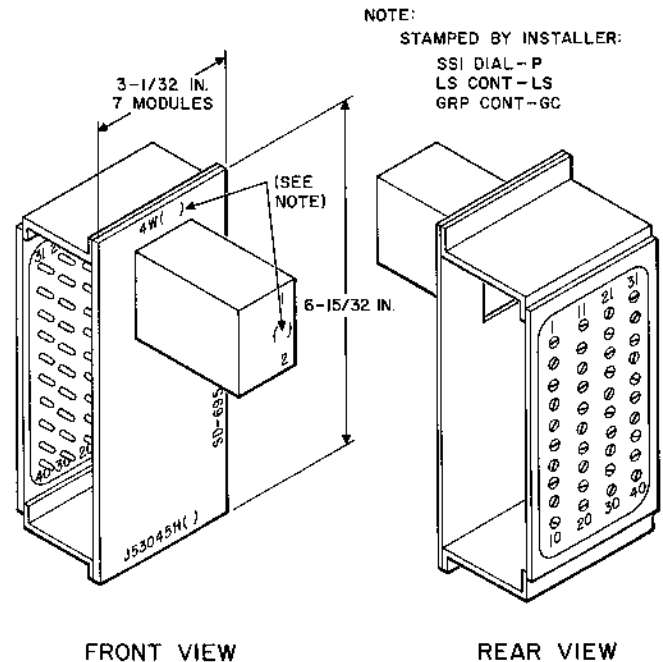
Fig. 6—Signaling Relay Unit (SS1)



FRONT VIEW

REAR VIEW

Fig. 7—AC or DC Signaling Relay Unit



FRONT VIEW

REAR VIEW

Fig. 8—SS1 Dialing, Group Code, or Loudspeaker Control Unit

### SS1 Dialing, Group Code, or Loudspeaker Control Relay Unit (J53045H)

2.11 This unit can be used to accomplish any one of three functions. An AK relay is used in each unit (Fig. 8) which is arranged for two circuits.

2.12 The *SS-1 dialing circuit*, in conjunction with the station circuit and the pickup relay circuit, prevents mutilation of dial pulses on a private line equipped with SS-1-type signaling when a second station at the same location goes off-hook. When the SS-1 System is equipped with privacy, a separate dialing circuit (SS1 dialing unit) is furnished with each station to provide separate 1- and 2-lead dialing to each SS-1 common control or SS-1-type station control circuit.

2.13 The *group code circuit* provides a means of simultaneously signaling up to ten stations

for one code or two groups of five stations for two codes at one location.

2.14 The *loudspeaker control circuit* is used to cut off a loudspeaker, bridged across the receive side of the station bus, when a telephone set associated with the same line goes off-hook. It is required where any one of several station sets cuts off the same loudspeaker. It may also be used to provide a push-to-talk arrangement to cut off the loudspeaker.

### Plug-In Circuit Pack Assembly (Loop-Back) (ED-69524 Group 1)

2.15 The plug-in loop-back circuit pack (Fig. 9) can be provided when the loop-back feature is required. It has been arranged as a plug-in unit to facilitate maintenance and to permit optional use. The pack provides part of the terminating unit detection circuit for the loop-back maintenance feature and a fixed pad arrangement used when measuring loop transmission losses.

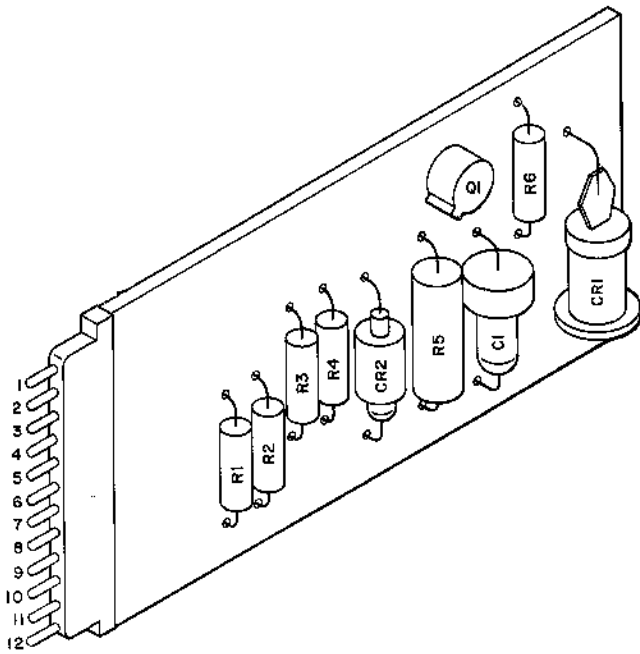


Fig. 9—Plug-In Circuit Pack Assembly (Loop-Back)

**Wired-in Circuit Pack Assembly (Signaling) (ED-69525 Group 1)**

2.16 The wired-in signaling circuit pack assembly (Fig. 1) is part of the ac or dc signaling circuit. It contains part of the detection circuit for inward signaling. A circuit pack arrangement is used to facilitate maintenance.

**Emergency Power Talking and Signaling Unit (J53045)**

2.17 This unit (Fig. 10) provides termination to a separate telephone set at customer locations for emergency use in the event of a commercial power failure that renders all station sets out of service. When local power fails, a 500AD telephone set is then connected to the 4-wire transmission facilities and furnished common battery from the central office by a simplex arrangement. Inward voice signaling is provided by using a 107A loudspeaker set also powered by central office common battery. Handset push-to-talk option is available. Certain simplex arrangements cannot be provided when this option is provided (Table B). This unit may be adapted for use with voice signaling and SS-1-type signaling.

2.18 For SS-1-type signaling with privacy, optional unit wiring provides a continuous low level 2400 Hz signal to the 4-wire line when local power fails. The 2400 Hz signal indicates that privacy has been broken and that a power failure has occurred on the 4-wire private line. The 2400 Hz signal oscillator is also powered by CO common battery and remains applied to the private line until local power has been restored.

2.19 The unit is designed to operate over 4-wire systems with simplex loop resistance up to 1500 ohms.

**30A Key Telephone Unit**

2.20 The 30A KTU furnishes the time-out feature.

**229B Key Telephone Unit**

2.21 The 229B KTU provides a single station pick-up relay where required.

**232B Key Telephone Unit**

2.22 The 232B KTU provides interrupted ringing and flashing lamp signals with timeout. When interrupted ringing and flashing lamp signals are not required, a 30A KTU should be provided for 20 Hz or -48 volts dc locked-in signaling.

**SELECTIVE SIGNALING SS-1-TYPE EQUIPMENT**

2.23 SS-1 equipment normally used with the 4-Wire Private Line System is:

- Decoder unit (J99252K)
- Keyer unit (J99252L)
- Sending and code relay unit (J99252B)
- Common control unit (J99252N)
- Station control unit (J99252P)
- Interarea switching unit (J99252G)

For identification information, refer to Section 480-621-200.

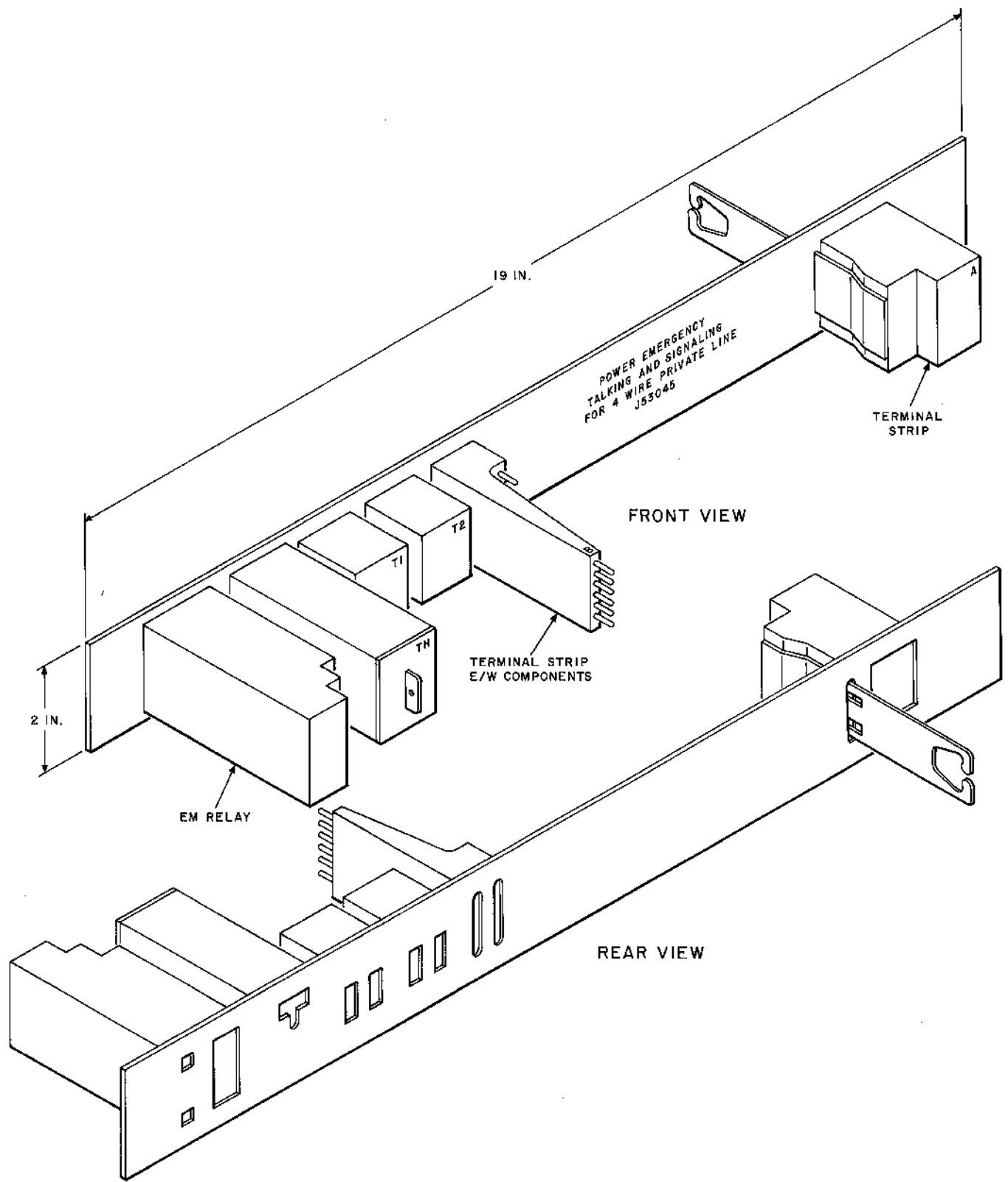


Fig. 10—Emergency Power Talking and Signaling Unit

## SECTION 518-600-100

**2.24** SS-1A Signaling System replaces SS-1 Signaling System and is recommended for use with the 4-Wire Private Line System. The SS-1A System equipment consists of one packaged unit and three separate units as follows:

- Decoder \*
- Keyer \*
- 1st Digit Code Relay \*
- 4-Wire Private Line Unit (J53045A) \*
- Station Control Unit Without Privacy (J53047B)
- Station Control Unit with Manual Privacy (J53047C)
- Station Control Unit with Automatic Privacy (J53047D)

\* Packaged Unit (J53047A)

### 3. ARRANGEMENT

**3.01** Fig. 11 shows typical 4-Wire Private Line arrangements which may be used to estimate space requirements for various service options. The arrangements do not include provisions for power. Refer to Plant Series Division 167 for information on power units suitable for installation at customer location.

**3.02** Table C shows equipment and mounting space requirement information which may be used when specific service options are to be provided.

**3.03** Factors which affect equipment arrangements are:

- (a) Existing facilities with available space
- (b) Customer provided space for equipment cabinets or racks
- (c) Type of equipment cabinets or racks specified for the installation
- (d) The number of station sets to be provided

- (e) The signaling option selected
- (f) Other options to be provided
- (g) The requirement to provide for expansion

### 4. INSTALLATION

**4.01** Special tools are not required for installation of 4-Wire Private Line Equipment.

**4.02** For information on equipment cabinets and apparatus mountings, refer to Section 463-140-100. The 4-Wire Private Line Equipment may be mounted in wall or floor-type cabinets.

**4.03** Section 460-110-180 contains information on selection of equipment location.

**4.04** When uncrating each unit, inspect carefully for:

- Transposed (crossed) contact springs
- Broken or jammed actuating cards
- Slipped coverplates
- Cracked plastic parts



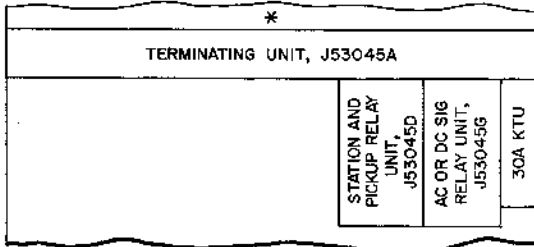
*Exercise care when handling, storing, and shipping system units to avoid damage to components. These units are shipped in a reusable blister pack, and must be stored in the blister pack until ready for actual use. Defective units must be stored and shipped in blister packs.*

**4.05** When a 229B KTU is specified, the installer must mount a 446F diode (D3) between terminals 39 and 40, and he must stamp PU on the relay.

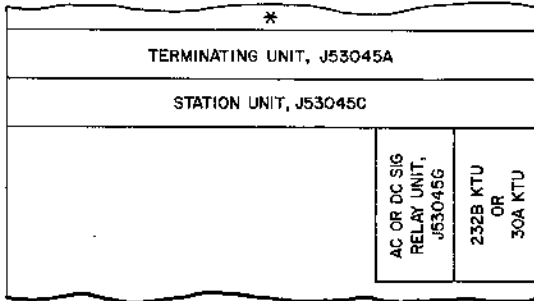
**4.06** When unit J53045H is provided, installer shall stamp unit and relay designations in accordance with unit use, as shown in Table D.

**4.07** Section 069-132-811 contains information on method of making and removing wrapped connections.

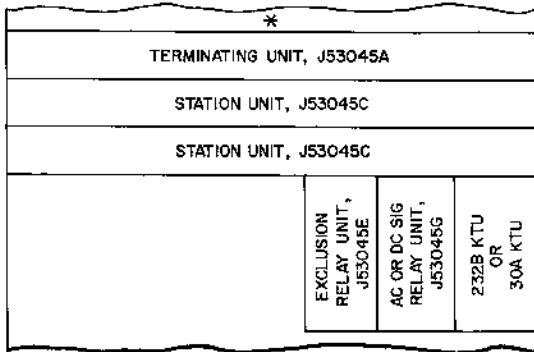
(A) FOR ONE STATION SET USING SIMPLEX SIGNALING.



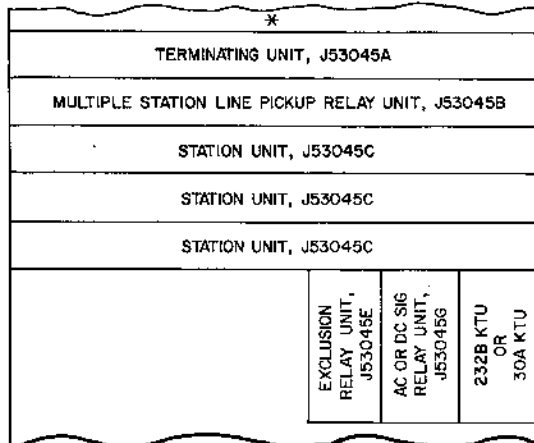
(B) FOR TWO STATION SETS USING SIMPLEX SIGNALING.



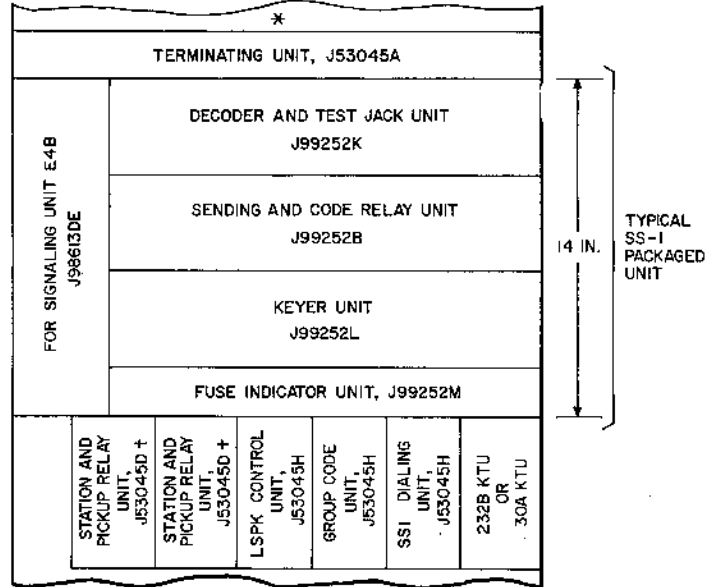
(C) FOR FOUR STATION SETS USING SIMPLEX SIGNALING WITH EXCLUSION.



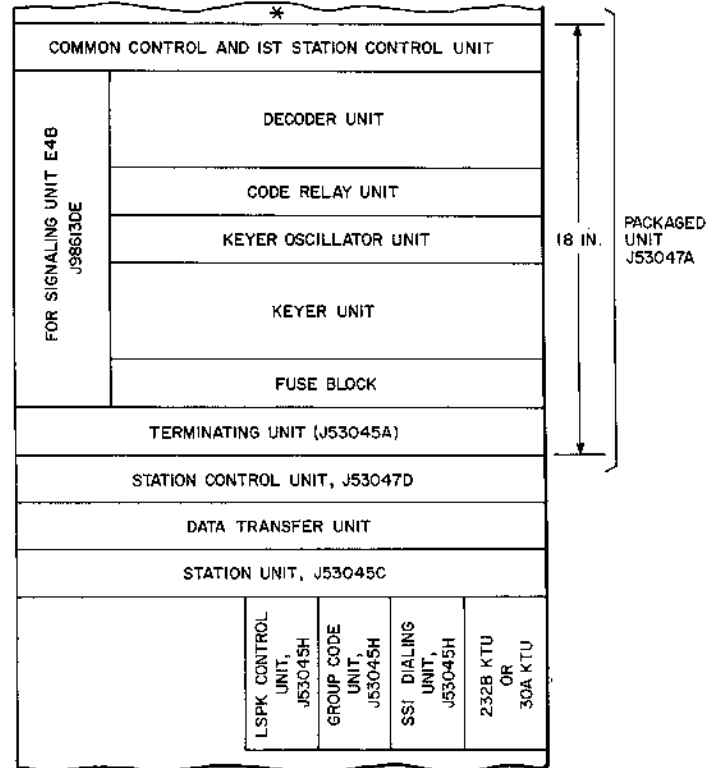
(D) FOR SIX STATION SETS USING SIMPLEX SIGNALING WITH EXCLUSION.



(E) FOR TWO STATION SETS USING SELECTIVE SIGNALING SS-I WITHOUT PRIVACY.



(F) FOR TWO STATION SET USING SELECTIVE SIGNALING SS-1A WITH PRIVACY AND DATA SERVICE.



\* ALLOW SPACE AT TOP OF ARRANGEMENT FOR UPWARD GROWTH.

† ONE STATION UNIT (J53045C) MAY BE USED INSTEAD OF TWO STATION AND PICKUP RELAY UNITS (J53045D).

Fig. 11—Typical Equipment Arrangements

**TABLE C**  
**EQUIPMENT AND MOUNTING SPACE REQUIREMENTS**

UNIT	DESCRIPTION	NUMBER OF UNITS REQUIRED	HEIGHT INCHES	WIDTH INCHES	MODULES
J53045A	One 4-Wire Terminating Circuit	One per 4-Wire Customer Location	2	23	—
J53045B	Five Pickup Relay Circuits	One per Five 4-Wire Terminations per Customer Location	2	23	—
J53045C	Two Station Circuits	One per Two Station Sets	2	23	—
J53045D	One Pickup Relay and Station Circuit	One per Station Set	6-15/32	3-15/32	8
J53045E	One Exclusion Circuit	One per Excluder Station Set	6-15/32	3-1/32	7
J53045F	One Selective Signaling Receive Circuit (3 codes)	One per every Three Codes at Customer Location	6-15/32	3-1/32	7
J53045G	One ac or dc Signaling Circuit	One per 4-Wire Line	6-15/32	3-17/64	8
J53045H	Two SS-1 Dialing Circuits One Group Code for Ten Stations or Two Group Codes for Five Stations Two Loudspeaker Control Circuits	One per Two Stations per 4-Wire Line or One per Two 4-Wire Lines One per Group of Ten Codes or One per Two Groups of Five Codes One per two Station Group each served by one loudspeaker	6-15/32	3-1/32	7
J53045	One 4-Wire Emergency Power Talking and Signaling Circuit	One per 4-Wire Termination per Customer Location	2	19	—
30A KTU	One Time-Out Circuit	One per Customer Location	5-7/32	1-23/32	4
229B KTU	One Pickup Relay Circuit	One per Station Set	6-15/32	3-1/32	7
232B KTU	One Visual and Audible Signaling Circuit	One per Customer Location	6-15/32	3-15/32	8
J99252( )	Refer to Section 480-621-200 (SS-1)				
J53047( )	Refer to CD and SD 69594 and Section 812-016-155				



**TABLE D**  
**RELAY STAMPING**

UNIT DESIGNATION	RELAY DESIGNATION
SS-1 DIAL	P
GRP CODE	GC
LS CONT	LS

- 4.08** Use distinctive colors of 24-gauge BG or BW wire for strapping and cross-connecting units:
- Red for battery leads
  - Black for ground leads
  - Green for all other leads
- 4.09** Use a 20-gauge wire, or equivalent between lamp power supply and station set.
- 4.10** Customer should provide commercial power wiring as follows:
- (a) 105- to 125-volt 60 Hz service on a separate 15-ampere fuse not controlled by a switch.
  - (b) 3-wire circuit with third wire grounded in distribution cabinet.
  - (c) Hubbell No. 5261 (3-wire) or equivalent receptacle.
  - (d) Receptacle should be located adjacent to cabinet and in a position readily accessible for removal of plug for maintenance purposes.

(Locate receptacle at a height above normal to prevent accidental removal of power cord plug.) Where local regulations permit, an ES-528772 cord clamp bracket together with a Tinnerman cord clamp of proper size may be used to prevent accidental removal of power cord plug. Refer to Section 167-400-200 for further information.

- 4.11** The 4-Wire Private Line Equipment requires the following voltages:

- -24 volts signal battery
- -24 volts talk battery
- $\pm 105$  volts 20 Hz ringing supply
- -48 volts dc ringing supply

These voltages may be furnished in conjunction with other requirements or with existing equipment of adequate capability. Power requirements for the 4-Wire Private Line units are shown in Table E.

- 4.12** Power for visual lamp signals is not included. This requirement is determined by the number and type of station sets at individual customer locations, and should be referred to local engineering.

- 4.13** Recommended power units are the 29C- or 30C-type (Section 167-446-101). For other power unit information, refer to Plant Series Division 167.

- 4.14** The 29C and 30C power units are arranged with fused multiterminations.

**TABLE E**  
**4-WIRE PRIVATE LINE EQUIPMENT POWER REQUIREMENTS**

UNIT	DESIG	CURRENT AMPS	VOLTAGE
Terminating	Talk A	.060	14-28 VDC
Multiple station line pickup relay	Sig. B	.075	16-28 VDC
229B Key Telephone	Sig. B	.075	16-28 VDC
Station	Talk A	.060	14-28 VDC
	Sig. B	.080	16-28 VDC
Exclusion	Sig. B	.080	16-28 VDC
SS-1 dialing	Sig. B	.040	16-28 VDC
AC or DC Signal relay	Sig. B	.060	16-28 VDC
Selective signaling receive	Sig. B	.120	16-28 VDC
Group code	Sig. B	.040	16-28 VDC
Loudspeaker control	Sig. B	.040	16-28 VDC
Emergency Power talking and signaling	Talk A	Furnished by CO	-48 VDC