43A1 VOICE-FREQUENCY CARRIER TELEGRAPH SYSTEM

(J70112-)

INSTALLATION AND CONNECTION

CONTENTS PAGE

1. GENERAL

1.01 This practice describes the procedures for installing the 43A1 voice-frequency carrier telegraph (VFCT) channel terminal (J70112A-type) and associated equipment required to place one end of a 43A1 VFCT channel in service.

1.02 The channel terminal mounting unit and associated wiring are installed by the Western Electric Company (WECo) installation force. Therefore, this practice covers only the procedures required to install the channel terminal and associated units in a new 43A1 VFCT or to add a channel to an existing system.

1.03 A typical 43A1 VFCT system is shown in Fig. 1. The various units required for the installation of a 43A1 VFCT channel terminal are given in the following tables.

- CHANNEL TERMINALS—Table A
- SEND AND RECEIVE NETWORKS—Table B
- BRANCHING NETWORKS—Table C
- 262-TYPE ELECTRONIC SWITCHES AND 4143-TYPE NETWORKS—Table D
- HYBRID INTEGRATED NETWORKS (HINs)—Table E
- TUBES—Table F.

Note: Tubes are only required if the 262-type electronic switch and 4143-type network, and/or HINs are not available.

2. OPTIONS

2.01 This part describes the options used in a 43A1 VFCT system and the method of selecting the proper equipment required for each channel terminal installed.

2.02 The equipment required for the installation of a 43A1 VFCT channel terminal is dependent on the service to be provided. This information should be given on the service order and, along with a diagram of the circuit, on the circuit layout record card (CLRC). If only the service to be provided is given, select the equipment required as follows.

(1) Determine:

(a) whether hub or neutral operation is required

(b) the speed (baud rate) of service required.

(2) Refer to Table G to determine what type of channel terminal is required.

(3) Refer to Table A to select the proper list number channel terminal to be used.

(4) Refer to Table H to determine which channel is to be used.

(5) Refer to Table B to select the proper send and receive networks to be used.

SW channel terminals MUST be equipped with SW send and receive networks and DW channel terminals MUST be equipped with DW send and receive networks.

(6) If the channel terminal is equipped with electron tubes, refer to Tables D and E to select the appropriate replacement 262-type electronic switch, 4143-type network, and KS-type HINs.

(7) Refer to Table C to select the proper branching network (if required).

3. INSTALLATION

3.01 This part describes the procedures for assembling the components to make up a 43A1 VFCT channel terminal and for installing it into the mounting unit.

3.02 When the appropriate units have been selected in accordance with the service order, CLRC, and/or 2.02, assemble the channel terminal as follows.

(1) Plug the 453-type send network into the rear of the channel terminal per Fig. 2.

(2) Plug the 454-type receive network into the rear of the channel terminal per Fig. 2.

(3) If vacuum tubes are to be used, ensure that the proper tubes are installed per Table F.

(4) If the 262-type switch and 4143-type network are to be used, replace the 429A tubes in accordance with Table D.

(5) If the HINs are to be used, replace the 407A and 408A tubes in accordance with Table E.

(6) Verify that the proper strapping is installed on the terminal block adjacent to J1 on the rear of the channel terminal mounting unit per Part 4.

(7) Verify that the proper cross-connections have been installed per Part 4.

(8) If channel branching is to be provided with the 124-type (SW) or 686-type (DW) channel branching filter networks, install the proper 124- or 686-type network per Table C.

(9) Plug the channel terminal into the mounting unit.

CAUTION: In offices using the 48-volt split filament voltage supply arrangement, a Micro-Switch* that is mounted on the rear of the mounting unit is operated by the right-hand channel terminal guide pin. If this Micro-Switch is out of alignment, the guide pin may break the Micro-Switch actuator arm.

*Product of Honeywell Company

(10) Perform the installation tests in accordance with Part 5.

Be sure to enter the reference voltages taken during testing on the CLRC and tag the front of the channel terminal.

4. CONNECTIONS

4.01 This part describes the terminal strip strapping and cross-connect wiring required for a 43A1 VFCT channel terminal.

TERMINAL STRIP STRAPPING

4.02 In order to install and/or verify the proper strapping of the terminal strip(s), it is necessary to identify the application(s) of the channel terminal to be installed. This information should be given on the service order and/or CLRC. Once the channel application(s) has been determined, refer to one of the following tables for the proper strapping of each option.

PL Applications:

(a) When J1 of the channel terminal mounting unit is associated with only one (CHAN) terminal strip, refer to Table I.

(b) When J1 of the channel terminal mounting unit is associated with two [TS (A) and TS (B)] terminal strips, refer to Table J.

Always check every application listed in the CIRCUIT ARRANGEMENT column to ensure the installation of all the strapping required for the application(s) given on the service order and/or CLRC for the channel terminal.

CROSS-CONNECTIONS

4.03 Since the channel terminal mounting units are installed and tested by the WECo installation forces, installation of wiring for a 43A1 VFCT channel terminal or system requires only the provision of the proper cross-connections. This information should be provided on the service order or CLRC.

4.04 For detailed information pertaining to the wiring and cabling between the channel terminal, line jack connection circuit, line coils, branching networks, pads, and hybrid networks, refer to SD-70553-01.

4.05 The block diagrams in Fig. 3 and 4 show the typical intraoffice arrangements of a 43A1 VFCT channel for both 2-wire (Fig. 3) and 4-wire (Fig. 4) applications. The diagrams in Fig. 5 and 6 show the ways of multipling channels within a channel terminal mounting unit (Fig. 5) and within a mounting unit bay (Fig. 6).

4.06 For the details of the line coil wiring, refer to the following figures listed on SD-70553-01.

(a) 2-wire line coils—Fig. 4 or 6.

(b) 4-wire line coils—Fig. 2, 16, and 19.

Warning: Improper grounding of the line coil will cause high distortion levels.

4.07 The various means of line branching are described in Part 3B of the section entitled 43A1 Voice-Frequency Carrier Telegraph (VFCT) System—(J70112-)—Description and Operation (312-700-100). The details for wiring in the branching arrangements are given in SD-70553-01.

5. TESTING

5.01 Perform the installation tests in accordance with the section entitled 43A1 Voice-Frequency Carrier Telegraph (VFCT) System—(J70112-)—Testing Procedures (312-700-500).

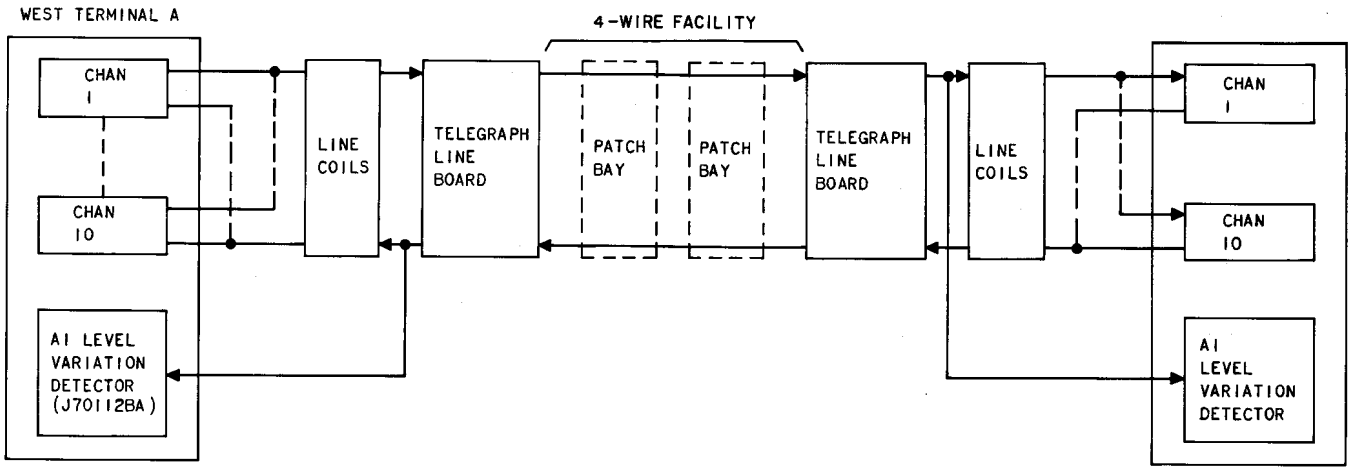


Fig. 1—Typical 43A1 VFCT System

TABLE A

43A1 VFCT CHANNEL TERMINALS

EQUIPMENT AND RATING	DESCRIPTION	EQUIPMENT STAMPING	EQUIVALENT EQUIPMENT	REMARKS
J70112 A-1 and A-2				
List 1 MD	Basic unit			
2	Neutral SW			
3	Hub SW			
4	Hub SW			
5	Hub SW	L3, 5	L4	Convert L3 to L4
6	Hub SW	L2, 6	L4	Convert L2 to L4
7 MD	Cover*			
J70112 A-3				
List 8 MD	Basic unit			
9	Neutral SW			Improvement and SH.
10	Hub SW			L9 plus return space directional control (RSDC)
11				
12 MD	Neutral DW			
	Hub DW			
J70112 A-1 and A-2				
List 13 A&M	Neutral DW	L2, 13	L11	Changed SW to DW
14	Hub DW	L2, 14	L12	Changed SW to DW
15	Hub DW	L4, 5, 15	L12	Changed SW to DW
16	Hub SW	L4, 5, 16	L10	Improved supervisory circuit
17	Neutral SW	L2, 17	L9	Improved supervisory circuit
18 A&M	Hub SW	L2, 18	L10	Changed Neutral SW to Hub SW
J70112 A-4				
List 19 Std	Basic unit			
20	Neutral SW			Overcome rec net drift and improve EH 2, 3, and 4 up to 75 baud.
21				
22	Hub SW			L20 plus reduce distortion on first character after change in direction of transmission.
23				
24 Std				
	Neutral DW			
	Hub DW			
	Cover*			
J70112 A-4				
List 25 A&M	Neutral SW	L2, 17, 25		Improved transmission
26 A&M	Hub SW	L4, 16, 26		Improved transmission and directional control

* Cover is used when a send or receive network is omitted, as in one-way service.

TABLE A (CONT)

EQUIPMENT AND RATING	DESCRIPTION	EQUIPMENT STAMPING	EQUIVALENT EQUIPMENT	REMARKS
J70112 A-4 List 27 A&M	Neutral SW	L9, 27		Improved transmission
J70112 A-4 List 28 A&M	Hub SW	L18, 28		Improved transmission and directional control
29 A&M	Hub SW & DW	L10, 29; L12, 29; L14, 15, 29; or L16, 18, 29	L21 L23 L23 L21	Improved directional control Improved directional control
J70112 A-4 List 30 Std	Hub and Neutral SW and DW	L30		Protective guard
J70112 A-4 List 31 A&M	Hub and Neutral SW and DW	L31		Improved transmission when terminal is equipped with HINs

TABLE B

SEND AND RECEIVE NETWORKS

NETWORKS		CHANNEL FREQUENCIES (HZ)				CHANNEL NUMBERS
SEND	RECEIVE	MIDBAND	HIGH	LOW	SHIFT	
SW Voiceband Channels						
453AE	454AE	425	460	390	70	1
453A	454A	595	630	560		2
453B	454B	765	800	730		3
453C	454C	935	970	900		4
453D	454D	1105	1140	1070		5
453E	454E	1275	1310	1240		6
453F	454F	1445	1480	1410		7
453AA	454AA	1615	1650	1580		8
453G	454G	1785	1820	1750		9
453H	454H	1955	1990	1920		10
453J	454J	2125	2160	2090		11
453K	454K	2295	2330	2260		12
453L	454L	2465	2500	2430		13
453M	454M	2635	2670	2600		14
453AB	454AB	2805	2840	2770		15
453AC	454AC	2975	3010	2940		16
453AD	454AD	3145	3180	3110	70	17
DW Voiceband Channels						
453AK	454AK	1360	1430	1290	140	51
453AL	454AL	1700	1770	1630		52
453AM	454AM	2040	2110	1970		53
453AN	454AN	2380	2450	2310		54
453AP	454AP	2720	2790	2650		55
453AR	454AR	3060	3130	2990	140	56

TABLE C

124-TYPE (SW) AND 686-TYPE (DW)
CHANNEL BRANCHING FILTER NETWORKS

SW CHANNEL NUMBER	MIDBAND FREQUENCY (HZ)	NETWORK CODE	INSERTION LOSS (dB)		DW CHANNEL NUMBER	MIDBAND FREQUENCY (HZ)	NETWORK CODE	INSERTION LOSS (dB)	
			S	M				S	M
1	425	124A	3.5	3.5					
2	595	124B	3.5	3.5					
3	765	124C	3.7	3.5	(21)	680	686G	1.9	1.6
4	935	124D	4.0	3.5					
5	1105	124E	3.6	4.3	(22)	1020	686H	2.0	1.9
6	1275	124F	4.5	4.5					
7	1445	124G	4.0	4.1	51(23)	1360	686A	2.2	2.2
8	1615	124H	5.2	5.2					
9	1785	124J	6.0	5.5	52(24)	1700	686B	2.1	2.4
10	1955	124K	6.0	5.0					
11	2125	124L	6.5	6.0	53(25)	2040	686C	2.1	2.4
12	2295	124M	6.5	6.5					
13	2465	124N	6.5	7.0	54(26)	2380	686D	2.0	2.7
14	2635	124P	7.0	6.5					
15	2805	124R	6.5	7.0	55(27)	2720	686E	2.1	2.6
16	2975	124S	7.0	6.5					
17	3145	124T	6.0	6.5	56(28)	3060	686F	1.7	3.9

TABLE D

262-TYPE SWITCH AND 4143-TYPE NETWORK USE

UNITS	REPLACES
262B Switch	One 429A tube (V5) in hub channel terminal.
262C Switch	One 429A tube (V5) in neutral channel terminal.
4143A	One 429A tube (V7) in hub channel terminal.
4143B Network	One 429A tube (V6) in neutral channel terminals for 62.5-mA loops.
4143C Network	*

*Neutral channel terminals for 20-mA loops do not use a tube in V6. However, when the tube in V5 is replaced by the 262C switch, a 4143C network *must* be installed in the socket V6.

TABLE E

HIN USE

TYPE CHAN TERM.	SOCKET		REPLACED BY HIN
	407A	408A	
Hub and Neutral	V1	—	KS-21082
	V2	—	KS-21083
	V3	—	KS-21084
	—	V4	KS-21075
Hub	V8		KS-21085

TABLE F

CHANNEL TERMINAL TUBES

TYPE	DESIGNATION		FUNCTION
Tubes Used in Both Neutral and Hub Channel Terminals			
407A	V1	V1a V1b	Send amplifier Oscillator
407A	V2	V2a V2b	Supervisory amplifier Send control
407A	V3	V3a V3b	1st amplifier-limiter 2nd amplifier-limiter
408	V4		3rd amplifier-limiter
429A*	V5		Receive output
Tube Used in Neutral Channel Terminals, 62.5-mA Loops Only			
429A*	V6		Receive output
Tubes Used in Hub Channel Terminals Only			
429A* 407A	V7 V8	 V8a V8b	Directional control dc amplifier Directional control flip-flop
*May be replaced by 262-type switch or 4143-type network (see Table C).			

Note: In hub channel terminals, tube V6 is omitted and tubes V7 and V8 are added. Tube V7 is mounted in the position occupied by tube V6 in neutral channel terminals, and tube V8 is mounted in a socket that is not provided in neutral channel terminals.

TABLE G

CHANNEL TERMINAL SELECTION

TYPE OPERATION	BAUD RATE		TYPE CHANNEL TERMINAL REQUIRED
	UP TO 75 BAUD	UP TO 150 BAUD	
Hub	√		Hub single bandwidth (SW) (HUB SW)
		√	Hub double bandwidth (DW) (HUB DW)
Neutral	√		Neutral SW (BAL LP SW)
		√	Neutral DW (BAL LP DW)

TABLE H

43A1 VFCT SYSTEM CHANNEL ASSIGNMENTS

CHANNEL		SPEED (BAUD) UP TO	
SW	DW	SW	DW
1	—	45	—
2	—	56	—
3	—	56	—
4	—	56	—
5	—	56	—
6	51	75	150
7		75	
8	52	75	150
9		75	
10	53	75	150
11		75	
12	54	75	150
13		75	
14	55	75	150
15		75	
16	56	75	150
17		75	

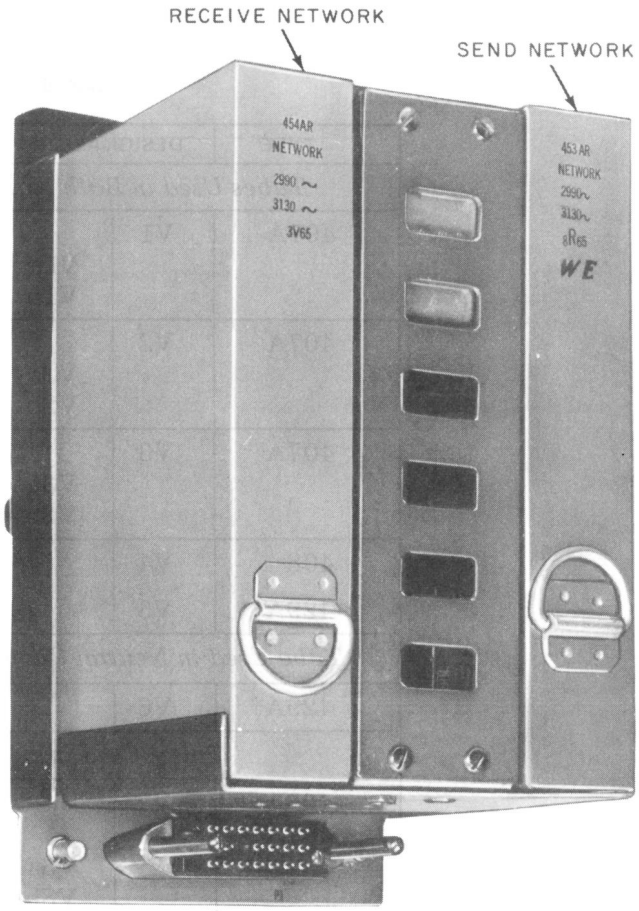


Fig. 2—Send and Receive Network Installation

TABLE I

CHANNEL TERMINAL MOUNTING
CHAN TERMINAL STRIP (FIG. 56)
STRAPPING FOR PL SERVICES

*CIRCUIT ARRANGEMENT	*TYPE SERVICE	STRAPPING FROM	STRAPPING TO	*REMARKS
±130 volt, 62.5-mA operation testboard (TLT) for use in PLS services and auto. sig trunk circuits or for use in No. 1 serviceboard offices [Fig. 2 (MD)].	HDX only where no FDX required [Fig. C (STD)]	2	3	Only when supervisory-alarm relay circuit [Fig. 14 (STD)] IS NOT provided.
		2	19	Only when back-to-back interconnection circuit [Fig. 12 (STD)] AND 62.5-mA duplex switch [Fig. R (MD)] are provided.
		13	14	Always.
		16	20	
		23	28	
	HDX or FDX when 62.5-mA duplex switch provided [Fig. D (STD) or R (MD)].	3	7	Only when supervisory-alarm relay circuit [Fig. 14 (STD)] IS NOT provided.
		1	5	Always.
		2	6	
		13	14	
		16	20	
		22	23	
		23	28	
Connection to telegraph serviceboards Nos. 2 and 9B. [Fig. 6 (MD)].	HDX or FDX	2	19	Only when back-to-back interconnection circuit [Fig. 12 (STD)] AND 62.5-mA duplex switch [Fig. R (MD)] are provided.
		3	4	Always.
		10	14	
		16	20	
		23	28	

TABLE I (Cont)

*CIRCUIT ARRANGEMENT	*TYPE SERVICE	STRAPPING FROM	STRAPPING TO	*REMARKS
+130 volt/ground, +130 volt/—48 volt, 62.5- or 20-mA operation for use in offices without —130 volt telegraph battery testboards (TLT) [Fig. 7 (STD) and Fig. G (MD) or H (MD)].	HDX only [Fig. C (STD)].	2	3	Only when supervisory-alarm relay circuit [Fig. 14 (STD)] IS NOT provided.
		2	19	Only when back-to-back interconnection circuit [Fig. 12 (STD)] AND 62.5-mA duplex switch [Fig. R(MD)] are provided.
		10	14	Only for +130 volt/ground connections [Fig. G (MD)].
		13	23	
		14	15	Only for +130 volt/—48 volt connections [Fig. H (MD)].
		23	27	
		16	20	Always.
	HDX or FDX when 20- or 62.5-mA duplex switch is provided [Fig. M (MD) or R (MD)].	1	5	Always.
		2	6	
		3	7	
		16	20	
		22	23	
		10	14	Only for +130 volt/ground connections [Fig. G (MD)].
		13	23	
		14	15	Only for +130 volt/—48 volt connections [Fig. H (MD)].
		23	27	
Connection to ±48 volt, 20-mA telegraph repeater for use with telegraph serviceboard No. 1 [Fig. 10 (A&M)].	HDX only [Fig. E (MD) or C (MD) or equipped with duplex switch for direct leg operation [Fig. P (MD)].	2	3	Only when supervisory-alarm relay circuit [Fig. 14 (STD) IS NOT provided.
		2	19	Only when back-to-back interconnection circuit [Fig. 12 (STD)] AND 62.5-mA duplex switch [Fig. R(MD)] are provided.
		14	15	Always.
		16	20	
		23	27	

TABLE I (Cont)

*CIRCUIT ARRANGEMENT	*TYPE SERVICE	STRAPPING FROM	STRAPPING TO	*REMARKS
	HDX or FDX [Fig. M (MD)].	2	19	Only when back-to-back interconnection circuit [Fig. 12 (STD)] AND 62.5-mA duplex switch [Fig. R(MD)] are provided.
		3	7	Only when supervisory-alarm relay circuit [Fig. 14 (STD)] is provided.
		2	6	Always.
		14	15	
		16	20	
		22	23	
		23	27	
Connection for back-to-back operation at intermediate point [Fig. 11 (STD)] or interconnection circuit for back-to-back connections [Fig. 12 (STD)].	HDX or FDX.	2 22	6 23	Only when 62.5-mA duplex switch [Fig. R(MD)] is provided.
		3	7	Only when 62.5-mA duplex switch [Fig. R(MD)] IS provided AND supervisory-alarm relay circuit [Fig. 14 (STD)] IS NOT provided.
		3	4	Only when bac-to-back interconnection circuit [Fig. 12 (STD)] is provided.
		18	19	
		23	24	
		10	14	Only for +130 volt/ground connections [Fig. G (MD)].
		17	23	
		13	14	Only for ±130 volt connections [Fig. T (MD)].
		23	28	
		14	15	Only for +130 volt/—48 volt connections [Fig. H (MD)].
		23	27	
		16	20	Only when SS lead IS NOT used [Fig. 13 (STD)].
		17	21	Only when battery restore key and lamp circuit for back-to-back interconnection network [Fig. X (STD)].

TABLE I (Cont)

*CIRCUIT ARRANGEMENT	*TYPE SERVICE	STRAPPING FROM	STRAPPING TO	*REMARKS
Interchangeable use in others with ±130 volt supply and the following: (1) HDX or FDX neutral loop operation or (2) No. 2 serviceboard (Fig. W) [Fig. 15 (STD)].	HDX or FDX.	2	19	Always.
		4	7	
		13	14	
		23	28	
		17	21	Only for TLX circuits.
		1	R104	Disconnect 20-mA duplex switch [Fig. M (MD)] from terminals 1 and 9 of terminal strip.
		9	R104	
Interchangeable use in offices with ±130 volt supply and the following: (1) HDX or FDX neutral loop operation or (2) No. 2 serviceboard (Fig. W) [Fig. 15 (STD)] and (3) (3) supervisory-alarm relay circuit [Fig. 14 (STD)].	HDX or FDX.	2	19	Always.
		3	4	
		13	14	
		16	20	
		23	28	
Send bias control potentiometer for 20-mA loop operation [Fig. U (STD)].	HDX or FDX.	6	9	Always.
		11	19	

*The information shown in brackets is the schematic drawing (SD-70552-01) apparatus wiring figure number and its rating.

TABLE J

CHANNEL TERMINAL MOUNTING TS(A) AND TS(B) TERMINAL STRIPS (FIG. 85) STRAPPING FOR PL SERVICES

*CIRCUIT ARRANGEMENT	*TYPE SERVICE	STRAPPING				*REMARKS
		TS(A)		TS(B)		
		FROM	TO	FROM	TO	
Send bias control potentiometer for 20-mA loop operation. [Fig. U (STD)].	HDX only [Fig. C (STD)].	2	18	3	4	Always.
		18	23	5	6	
±130 volt, 62.5-mA operation testboard (TLT) application for use in PLS services and auto. sig trunk circuits or for use in No. 1 serviceboard offices [Fig. 2 (MD)].	HDX or FDX.	12	16	—	—	Always.
		14	17			
		16	20			
		23	28			
Send bias control potentiometer for 20-mA loop operation [Fig. U (STD)] and duplex switch for 20-mA loops [Fig. AB (MD)].	HDX or FDX.	2	6	3	4	Always.
		6	18			
		22	23	5	6	
Duplex switch for use with 62.5-mA loops or with HDX interconnecting network (Fig. 20) [Fig. Y (MD)] or duplex switch for 62.5-mA loops [Fig. AA (MD)].	HDX only [Fig. Y (MD)] or HDX or FDX [Fig. AA (MD)].	2	6	—	—	Always.
		22	23			
Duplex switch for 20-mA loops [Fig. AB (MD)].	HDX or FDX.	2	6	—	—	Always.
		6	19			
		22	23			
±130 volt/ground, +130 volt/—48 volt, 20- or 62.5-mA operation for use in offices without —130 volt telegraph battery testboard (TLT) applications [Fig. 7 (STD)].	HDX or FDX.	12	16	—	—	Always.
		16	20			
For +130 volt and ground connections [Fig. G (MD)].	HDX or FDX.	10	14	—	—	Always.
		17	23			

TABLE J (Cont)

*CIRCUIT ARRANGEMENT	*TYPE SERVICE	STRAPPING				*REMARKS
		TS(A)		TS(B)		
		FROM	TO	FROM	TO	
For +130 volt and —48 volt connections [Fig. H (MD)].	HDX or FDX.	14	15	—	—	Always.
		23	27			
Connection to ±48 volt, 20-mA repeater for use with telegraph serviceboard No. 1 [Fig. 10 (MD)].	HDX or FDX.	12	16	—	—	Always.
		14	15			
		16	20			
		23	27			
For ±130 volt connections [Fig. T (MD)].	HDX or FDX.	14	17	—	—	Always.
		23	28			
Connection for back-to-back operation at intermediate point [Fig. 11 (STD)].	HDX or FDX.	1	19	—	—	Always.
		12	16			
Interconnection circuit for back-to-back operation [Fig. 12 (STD)].	HDX or FDX.	2	R110	—	—	For units equipped with duplex switch for direct leg operation [Fig. P (STD)], R110 is 150 kΩ. When connection to —48 volt signal battery for filament supply to a pair of channel terminals [Fig. Q (MD) Fig. AE] is used, R110 is 42.2kΩ.
		19	R110			
		19	R111	—	—	When duplex switch for 62.5-mA loops [Fig. D (MD)] is used, R111 is 49.9 kΩ. When +130 volt/ground connection [Fig. G (MD)] is used, R111 is 42.2 kΩ. When +130 volt/—48 volt connections [Fig. H (MD)] is used, R111 is 24.9 kΩ. When ±130 volt connection [Fig. T (MD)] is used, R111 is 15 kΩ.
		23	R111			

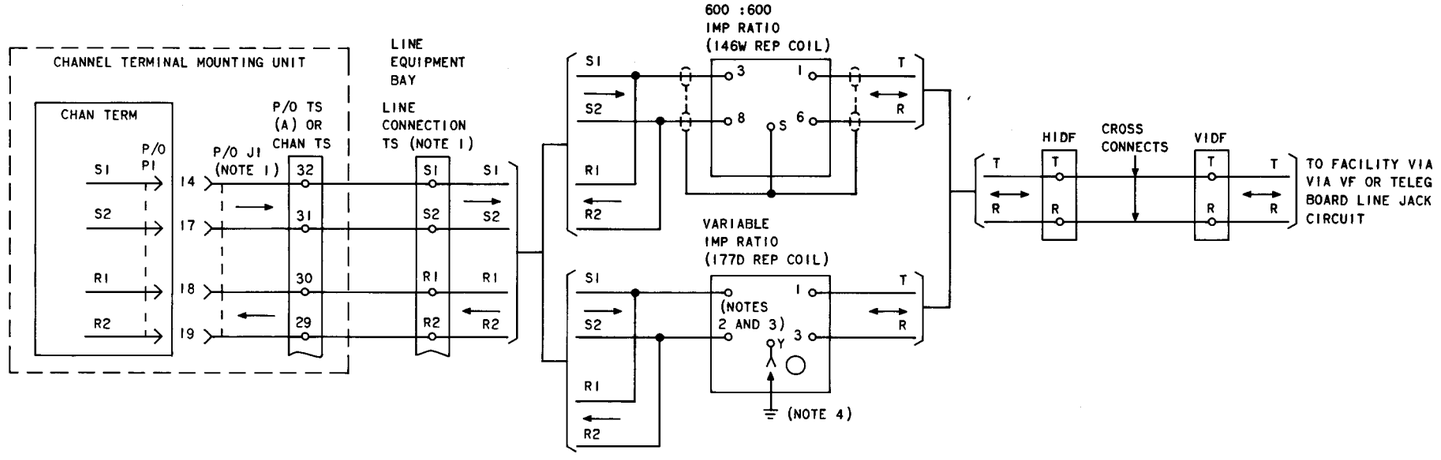
TABLE J (Cont)

*CIRCUIT ARRANGEMENT	*TYPE SERVICE	STRAPPING				*REMARKS
		TS(A)		TS(B)		
		FROM	TO	FROM	TO	
Interchangeable use in offices with ±130 volt supply with the following: (1) HDX or FDX neutral loop operation or (2) No. 2 serviceboard (Fig. W) [Fig. 15 (STD)].	HDX or FDX.	1	18	—	—	Only when channel terminal equipped with wiring option ZC.
		9	23			
		2	19	—	—	Always.
		12	16	—	—	
		14	17	—	—	
		23	28	—	—	
		16	20	—	—	Only when SS and B2 leads ARE NOT run to the IDF.
TLX supervisory circuit for service-board offices [Fig. 16 (MD)].	HDX or FDX.	17	21	—	—	Always.
For no-carrier alarm without open loop feature [Fig. 14 (STD)] and Fig. 17 (MD)].	HDX or FDX.	3	7	—	—	Always.
TLX supervision for channel terminal circuits equipped with Fig. 14 [Fig. 16 (MD) and Fig. 17 (MD)].	HDX or FDX.	3	7	—	—	Connect lead E2 of Fig. 14 to ground.
Connecting circuit for use with HDX-interconnecting network or for FDX where HDX is not required [Fig. V (STD)].	HDX only or FDX only.	2	19	—	—	Always.
		4	7	—	—	
SS lead not used [Fig. 13 (STD)].	HDX or FDX.	16	20	—	—	Always.
For interchangeable use in offices with ±130 volt supply and the following: (1) HDX or FDX neutral loop operation; (2) No. 2 serviceboard (Fig. W) (Fig. 15) for other than back-to-back TLX service [Fig. 18 (MD)].	HDX or FDX.	16	20	—	—	Remove option Fig. 19 (MD).
When universal duplex switch [Fig. AC (STD)] is used.	HDX or FDX.	2	6	—	—	Always.
		11	19	—	—	
		22	23	—	—	

TABLE J (Cont)

*CIRCUIT ARRANGEMENT	*TYPE SERVICE	STRAPPING TS(A) FROM	STRAPPING TS(A) TO	STRAPPING TS(B) FROM	STRAPPING TS(B) TO		*REMARKS
Connection to +130 volt/ground or +130 volt/—48 volt, 20-mA or 62.5-mA TWX toll subscriber line circuit for use at intermediate point [Fig. 9 (MD)]	HDX or FDX.	1	18	—	—	Always.	
		2	3				
		3	19				
		9	23				
		12	16				
Connection to +130 volt/ground or +130 volt/—48 volt, 20-mA or 62.5-mA TWX toll subscriber line circuit for use at intermediate point [Fig. 9 (MD)] with type-2 hub operation service-boards Nos. 2 and 9B [Fig. B (STD)].	HDX or FDX.	2	3	3	4	Always.	
		3	18				
		12	16	5	6		
Connection to +130 volt/ground or +130 volt/—48 volt, 20-mA or 62.5-mA TWX toll subscriber line circuit for use at intermediate point [Fig. 9 (MD)] with the duplex switch for 20-mA loops [Fig. M/(MD)].	HDX or FDX.	1	R104	—	—	Always.	
		23	R104				
		2	3				
		3	19				
		12	16				

* The information shown in brackets is the schematic drawing (SD-70552-01) apparatus wiring figure number and its rating.



NOTES:

1. SEE FIG. 5 FOR THE WAYS CHANNELS ARE MULTIPLED.
2. 177D REPEAT COIL CONNECTIONS WHEN IMP RATIO IS KNOWN.

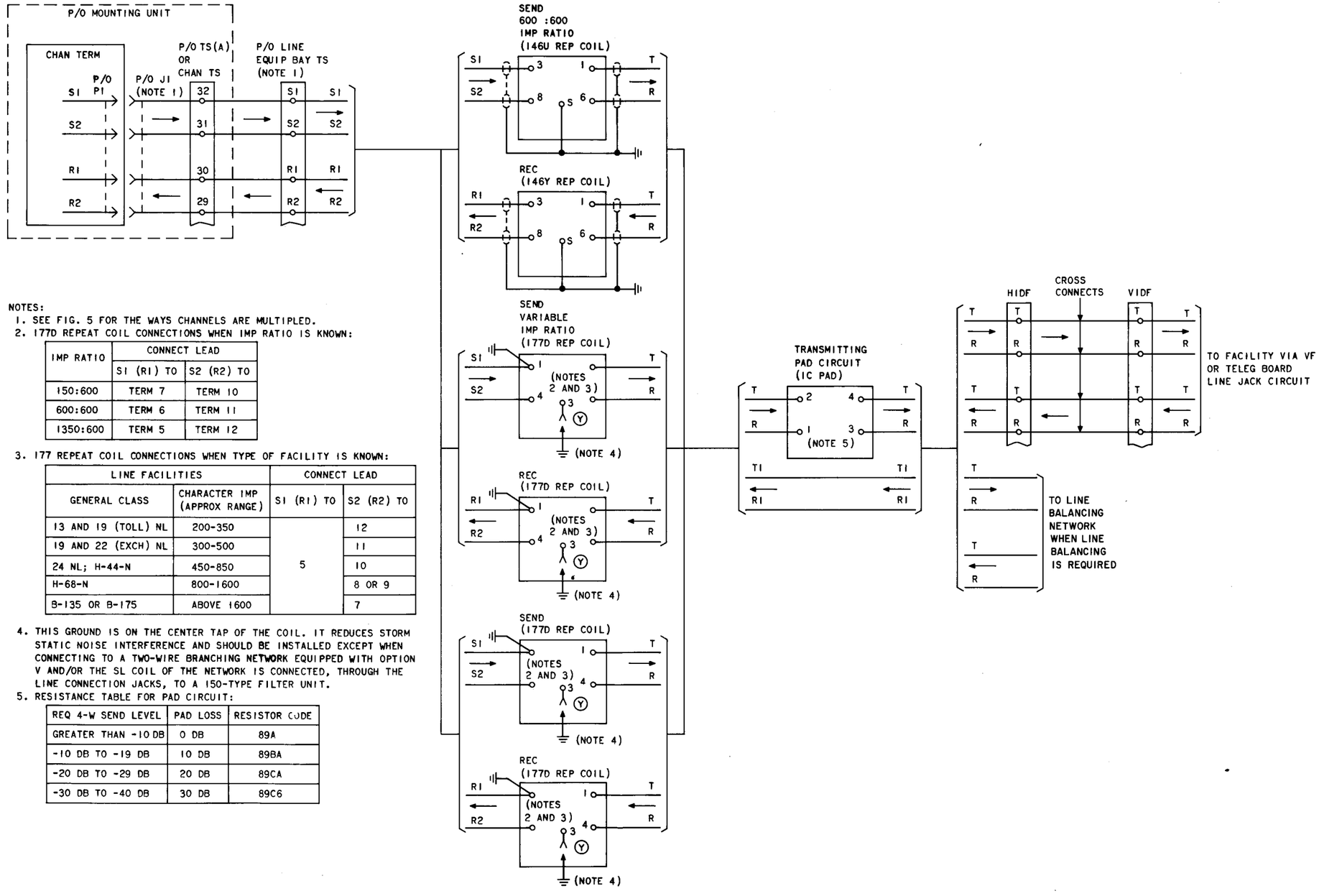
IMP RATIO	CONNECT LEAD	
	S1 (R1) TO	S2 (R2) TO
150:600	TERM 7	TERM 10
600:600	TERM 6	TERM 11
1350:600	TERM 5	TERM 12

3. 177D REPEAT COIL CONNECTIONS WHEN TYPE OF FACILITY IS KNOWN.

LINE FACILITIES		CONNECT LEAD	
GENERAL CLASS	CHARACTER IMP (APPROX RANGE)	S1 (R1) TO	S2 (R2) TO
13 AND 19 (TOLL) NL	200-350	5	12
19 AND 22 (EXCH) NL	300-500		11
24 NL; H-44-N	450-850		10
H-68-N	800-1600		8 OR 9
B-135 OR B-175	ABOVE 1600		7

4. THIS GROUND IS ON THE CENTER TAP OF THE COIL. IT REDUCES STORM STATIC NOISE INTERFERENCE AND SHOULD BE INSTALLED EXCEPT WHEN CONNECTING TO A TWO-WIRE BRANCHING NETWORK EQUIPPED WITH OPTION V AND/OR THE SL COIL OF THE NETWORK IS CONNECTED, THROUGH THE LINE CONNECTION JACKS, TO A 150-TYPE FILTER UNIT.

Fig. 3—Typical Intra-Office Wiring of a Channel for 2-Wire Applications



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5. RESISTANCE TABLE FOR PAD CIRCUIT:

REQ 4-W SEND LEVEL	PAD LOSS	RESISTOR CODE
GREATER THAN -10 DB	0 DB	89A
-10 DB TO -19 DB	10 DB	89BA
-20 DB TO -29 DB	20 DB	89CA
-30 DB TO -40 DB	30 DB	89C6

Fig. 4—Typical Intra-Office Wiring of a Channel for 4-Wire Applications

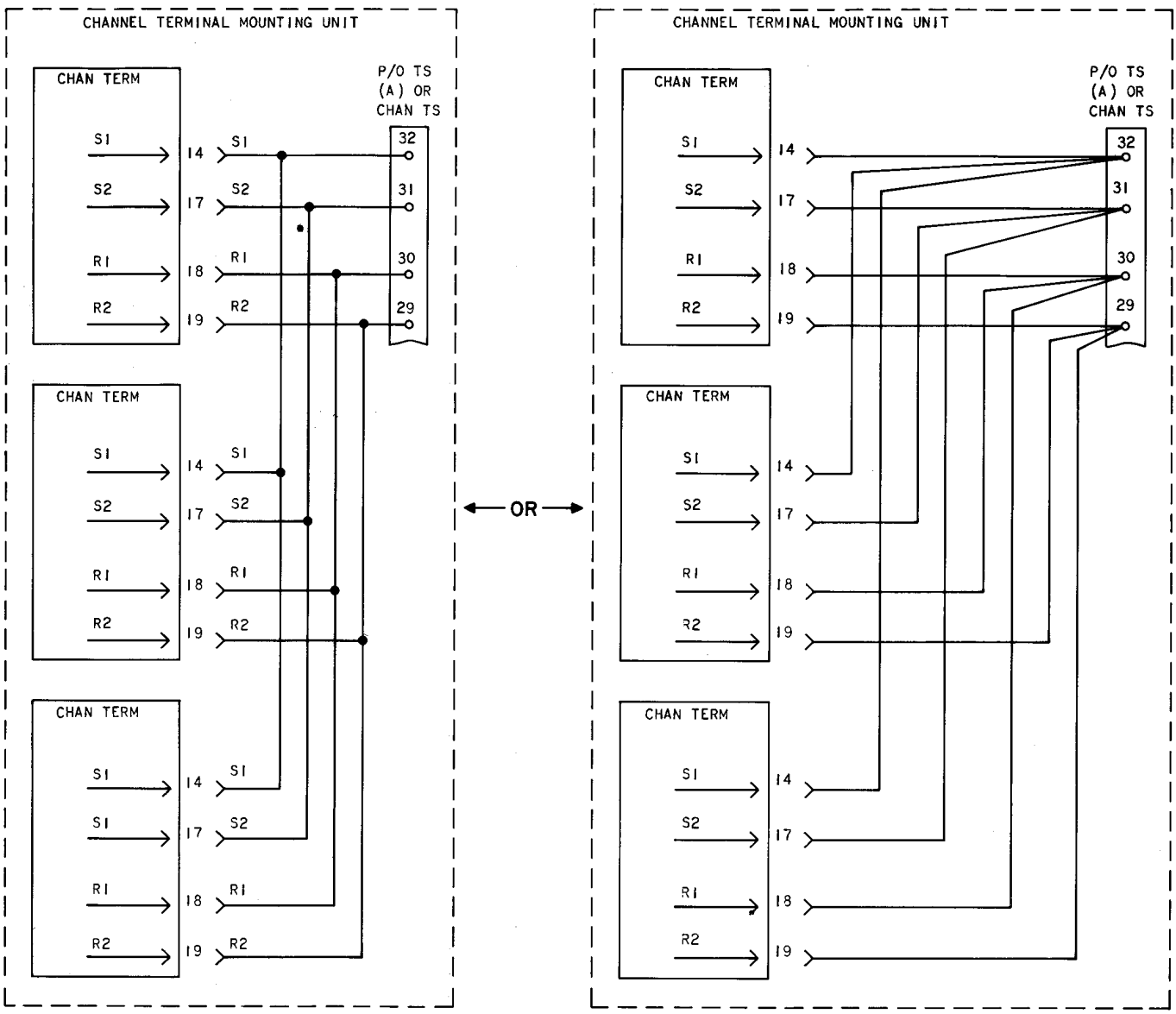

Fig. 5—Methods of Multipling Channel Terminals Within a Mounting Unit

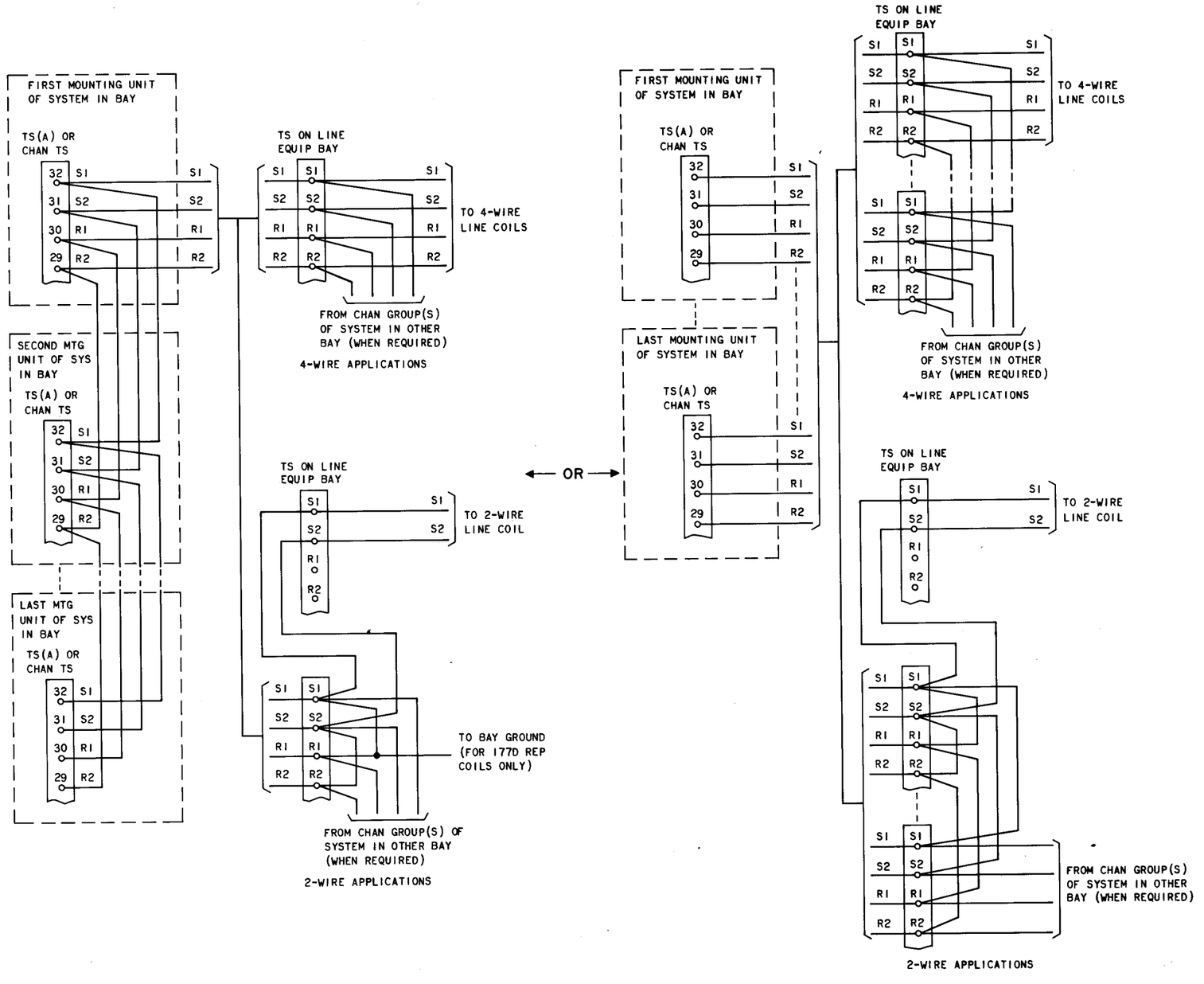

Fig. 6—Methods of Multipling Channel Terminal Groups Within a Bay