Technical Manual

LYNCH TYPE B37

CARRIER TELEPHONE SYSTEM

GENERAL SYSTEM DESCRIPTION

Lynch®

TELEPHONE SYSTEMS

LYNCH CARRIER SYSTEMS, INC.

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IMPORTANT NOTE

This manual applies specifically ONLY to the equipment unit noted below. If no unit has been specified, this manual may be considered to be generally typical for the equipment type only. LYNCH CARRIER SYSTEMS, INC. reserves the right to make changes in specific units without notice other than that contained in the manual for that unit.

This manual applies to:

Terminal

Sales Order No.

Inspector

TYPE B37

GENERAL SYSTEM DESCRIPTION

1.0 DESCRIPTION

a. General. The Type B37 Carrier Telephone System can be used to obtain from one to five 2-way voice channels from an existing pair of wires, on top of the "physical" circuit. Each derived channel is composed of two Type B37 Carrier-Telephone terminals, one at each end of the circuit. The B57 Repeater provides 2-way amplification on a single channel to extend the circuit length. Any channel(s) may be added or transferred without affecting existing B37 equipment or the physical circuit.

Each unit of B37 equipment is completely self contained, and does not require an external power supply or group equipment. The B37 terminal unit includes a carrier transmitter and receiver, a power supply and signaling facilities. The B57 Repeater provides 2-way amplification on a single channel to extend the circuit length. The B40 Terminal Pilot Regulator and the B62 Repeater Pilot Regulator may be added to any channel(s) to compensate for changing weather conditions along the carrier line.

b. Operating Characteristics. The B37 Carrier Telephone system employs single side-band suppressed carrier transmission for all channels.

The maximum recommended electrical length over which a pair of terminals (without repeater) may be operated is 36 db. Voice frequencies from 250 to 2850~ are transmitted with low distortion.

Each channel has its own carrier shift signaling system that can be strapped for AC or DC ringdown, or E and M dial, as required.

c. Operating Frequencies (drawing B37-27). The frequency allocations are arranged to provide five derived talking circuits in the range from 3.5 to 62 kc. Where it is desirable to have several channels operating on each side circuit of a phantom group, the channels used on one side must be the "A" allocation and those on the other side must be the "B" allocation system in order to minimize cross-talk between carrier side circuits.

Each B37 terminal unit is identified on its nameplate as EAST or WEST terminal of the "A" or "B" allocation. A B37 terminal unit of the "A" allocation will not operate on the same channel with a B37R terminal unit of the "B" allocation.

The frequency allocations provided for B37 carrier-telephone equipment fully coordinate with the standards of the industry on directions of transmission. Channels 2 to 5 may be operated above a Western Electric "H" or equivalent carrier systems of other manufacturers on the same pair of wires.

d. Unit Description. The chief characteristics of the B37 system units are listed in figure 1-1.

Unit	Function	Number used	Size (in.)	Weight (lb)
B37 Carrier Telephone Terminal	a. Converts voice signals and dial or RD signaling to single sideband suppressed-carrier signals for transmission. b. Receives SSB carrier signals, translates them to original voice and dial or RD signaling.	1 per channel. 5 channels max.	19 wide 7 high 15 deep	85
B40 Terminal Pilot Regulator	Adds or decreases gain of one B37 receiver to automatically compensate for varying carrier line loss due to weather changes.	2 per channel where required (Note)	19 wide 5-1/4 high 15 deep	50
B57 Repeater	Single channel 2-way repeater. Provides 30-36 db gain in each direction.	1 per channel where required	19 wide 5-1/4 high 15 deep	50
B62 Repeater Pilot Regulator	Adds or decreases gain of B57 in one direction to automatically compensate for varying carrier line loss due to weather changes.	2 per repeater where required (Note)	19 wide 5-1/4 high 15 deep	50

Note. In some cases regulation in only one direction of transmission is required per channel.

Figure 1-1. B37 System Units

1.1 CARRIER TELEPHONE TERMINAL B37: ELECTRICAL SPECIFICATIONS

a. Carrier Frequency Characteristics.

Method of transmission ..... Single sideband, suppressed carrier.

Operating frequencies ...... 5 channels in the range 3.5 to 62 kc (drawing B37-27).

Transmit level .... +16 dbm max (for 0 dbm 2-wire or -13 dbm 4-wire v-f input).

Receive level .... -20 dbm min (for -4 dbm 2-wire or +4 dbm 4-wire v-f output).

Line attenuation	36 db recommended maximum without repeaters.
Line impedance	Channels 1-3 : 600 Ω unbalanced. Channels 4-5 : 150 Ω unbalanced.

b. Voice Frequency Characteristics.

Voice-frequency response ...	250 to 2850 ~, effective transmission band (drawing B37-29).
V-F drop impedance	2- and 4-wire : 600 Ω balanced.
V-F drop, 2-wire levels ...	Transmit : 0 dbm nominal. Receive : adjustable to -1 dbm max.

Note. The range of adjustment permits each channel, with appropriate hybrid balance, to operate on a 2-wire v-f basis with 1 db overall loss. However, the usual practice is to adjust to a 2 or 4 db overall loss in order to obtain a high degree of stability.

V-F drop, 4-wire levels	Transmit : -13 dbm nominal. Receive : +4 dbm nominal.

Signaling characteristics:

Type of signaling	Frequency shift, out-of-band. Frequency shift ± 100 ~ , all channels. Mean frequency: 3250 ~ , channels 2-5; 3600 ~ , channel 1.
Signaling level	10 db below message level.
Signaling options	E & M dial: AC or DC ringdown. Each channel may transmit dial one way and ringdown the other.
Dial signaling speed	20 pps (with 50% break).
Dial signaling distortion....	2% max at 20 pps for 10 db variation in receive signal level.

c. Operating Power.

AC operation	117 volts, 50/60 ~ , 60 watts.
DC operation	B+: 130V, 90 ma. FIL: 24V, .9 amp or 48V .45 amp.

d. Options....................	See section 2.2b.

1.2 TERMINAL PILOT REGULATOR B40: ELECTRICAL SPECIFICATIONS

Operating frequencies	3.5 to 62 kc, corresponding to associated B37 units.
Input and output levels	-20 dbm nominal.
Gain	0 db nominal, +20 db max, -10 db min.
Pilot signal level	-12 dbm nominal input.
Regulation	Within ± 1 db for ± 10 db variation in receive signal level.
Impedance	Channels 1-3 : 600Ω Channels 4-5 : 150Ω

Operating Power

AC operation	117 volts, 50/60~ , 50 watts.
DC operation	B+ : 130V, 60 ma. FIL: 24V, 0.6 amp or 48V, 0.3 amp.

Options .... See section 2.2b.

1.3 REPEATER B57: ELECTRICAL SPECIFICATIONS

Operating frequencies	One B57 transmits pass band of a B37 channel E-W and W-E in 3.5 to 62 kc range. (See drawing B37-27.)
Frequency response	Flat within ± 1 db over channel pass band.
Output level	+16 dbm max.
Input level	-20 dbm min for +16 dbm output.
Loop gain	72 db max, channels 2-5. 52 db max, channel 1.
Gain, each direction	36 db max, channels 2-5. 30 db max, channel 1.
Carrier line impedance.....	600Ω unbalanced, channels 1-3. 150Ω unbalanced, channels 4-5.

Operating Power

AC operation	117 volts, 50/60~ , 60 watts.

2.0 INSTALLATION, EXTERNAL CONNECTIONS AND LINE-UP

2.1 INSTALLATION

a. Receipt of Equipment

(1) Remove the equipment list from the carton labeled "equipment list enclosed" and check the equipment received. Separate out the packed units which must be shipped to another location.

(2) Install the relay rack in the desired location. (Leave 30 inches of free aisle space at the front and rear. Space is not required at the sides.) Unpack the equipment near the relay rack.

b. Relay Rack Mounting. Mount the equipment according to the rack profile drawings, if supplied. Otherwise, the B37 terminal units or B57 repeater units may be stacked in any convenient (and reasonable) order in the relay racks. Locate each B40 regulator unit, when used, directly above or below the associated B37 unit. Locate each B62 regulator unit, when used, directly above or below the associated B57 unit. Install each unit as follows:

(1) Leave 30 inches aisle space behind the equipment. No space is required at the sides.

(2) Remove the rear cover and the screws which hold the unit in the cabinet during shipment. These screws, on each side of the cabinet, pass through the cabinet and enter tapped holes on the side of the unit.

(3) Gently tip the unit back so that it rests on the rear terminals. Place a cloth or paper underneath before tipping to protect the terminals. Lift the cabinet straight up so that it clears the unit.

(4) Replace the rear cover on the empty cabinet and close the front. (This prevents bending during installation.) Place the empty cabinet in the relay rack and fasten in place with mounting screws.

(5) Lift the front cover and slide the unit in place.

(6) Remove the rear cover to expose the rear terminals. The cabinet screws removed in step (2) may be replaced after line-up is complete.

c. Check of Tubes and Fuses. The table, figure 2-1, lists the fuse ratings and tube types for each unit.

UNIT	ITEM	POWER OPTION		
		117 VAC	130V, 24V	+130V,48V
B37	F1	1-1/2	2	2
	F2	1-1/2	1/4	1/4
	VT-1 VT-2 VT-3 VT-5	6SN7/GT	6SN7/GT	12SN7/GT
	VT-4	25L6/GT	25L6/GT	50L6/GT
	VT-6	5Y3/GT	-	-
B40	F1	1	2	2
	F2	1	1/4	1/4
	VT-1 VT-2 VT-3 VT-4	6SN7/GT	6SN7/GT	12SN7/GT
	VT-5	5Y3/GT	-	-
B57	F1	1-1/2	2	2
	F2	1-1/2	1/4	1/4
	VT-1 VT-4	6SN7/GT	6SN7/GT	12SN7/GT
	VT-2 VT-3	25L6/GT	25L6/GT	50L6/GT
	VT-5	5Y3/GT	-	-
B62	F1	1-1/2	2	2
	F2	1-1/2	1/4	1/4
	VT-1 VT-2 VT-3 VT-4	6SN7/GT	6SN7/GT	12SN7/GT
	VT-5	25L6/GT	25L6/GT	50L6/GT
	VT-6	5Y3/GT	-	-

Figure 2-1. Fuse ratings and tube types.

2.2 EXTERNAL CONNECTIONS

The external leads may be brought to each unit from the left and right sides. For consistency, the AC line or battery leads enter from the left (looking at the rear of the unit) and carrier leads enter from the right. Signaling and switchboard leads may enter on either side. Leave a 12-inch loop in the wiring at the rear of each cabinet so that the unit may be pulled forward during operation without straining the rear connections. A separate repeat coil is required to couple channels 1-3 and 4-5 to the external carrier frequency circuit. Refer to the Lynch bulletin "Repeat Coils" for strapping and connection instructions.

a. Recommended Wire Size. Carrier frequency leads must be twisted pairs; however, for runs over 10 feet, single conductor shielded wire may be required, especially for the higher frequency channels. AC line cord should be AWG 18 minimum. For battery operation, the 130 volt leads should be AWG 18 minimum, and the 24 or 48 volt leads should be AWG 14 minimum. (Since the filament voltage at the equipment terminals must be 24 or 48 volts, these leads must be larger gauge for long runs. The filament currents are given in sections 1.1 - 1.4). Use switchboard wire for signaling and all other leads.

b. Wiring Options. The options below may be changed in the field. The underlined items are strapped at the factory unless other options are specified. The units containing these options are indicated. Refer to the unit schematic diagram if a field change is required.

(1) AC or battery power (B37, B40, B57, B62).
(2) For battery operation, 24 or 48 volt filament operation. (B37, B40, B57, B62)
(3) E & M dial or ringdown signaling (B37).
(4) Two or 4-wire carrier line connection (B37, B57).
(5) Two or 4-wire drop (B37).
(6) Internal compromise or external hybrid termination (B37).
(7) External alarm out or in (B40, B62).

Note. In the B40, B57 and B62, all option strapping is done at the rear terminals. In the B37, in addition to rear strapping on TB - "A", strapping is located on TB - "B" on top of the chassis for the power and signaling options (drawing B37-14).

c. Connecting external circuits. The tables, figures 2-3, 2-4, 2-5, 2-6 list the external connextions to the B37, B40, B57, and B62 units.

d. Changing DC Filament Voltage. To change DC filament voltage in the field, follow the instructions in figure 2-2.

Unit	Procedure
B37	Change tubes, fig 2-1.
B40	Change tubes, fig 2-1. Change strapping, fig 2-4.
B57	Change tubes, fig 2-1. Change R1 and R2, drawing B57-5.
B62	Change tubes, fig 2-1. Change strapping, fig 2-6.

Figure 2-2. DC filament voltage field change procedure.

CKT	OPTION	CONNECT EXT CKT	to B37 REAR TERMINALS (unless otherwise specified)	STRAPPING
Operating Power	AC	117 VAC LINE	1-2	TB "B" : 13-14: 15-16; 17-18; 19-20.
	DC	130V	2(+) & 4(-)	TB "B" : 14-15; 16-17; 18-19.
		24 or 48V	1(-) & 3(+)	
Carrier Line	2-wire	2-W line	35 & 36	TB "A" : 37-39; 38-40.
	4-wire	4-W send line 4-W rcv line	35 & 36 39 & 40	-
V-f drop	2-wire Dial	2-W swbd line	17-18	TB "A" : 5-7; 6-8; 13-15; 14-16.
	2-wire RD	2-W swbd line	21-22	
	4-wire Dial or RD	4-W swbd send line	5-6	-
		4-W swbd rcv line	13-14	
Signaling	Dial 48V	M-lead	31(-)	TB "B" : 22-23; 25-26; 28-29; 31-32.
	Dial 24V	M-lead	32(-)	
	Dial	G-lead	30(+)	
		E-lead	27	
		F-lead	26	
		N-lead	25	
	Ringdown	Swbd line	21-22	TB "A" : 17-19; 18-20. TB "B" : 21-22; 24-25; 27-28; 30-31.
		20∼ supply	23-24	
Hybrid Termination	Internal			TB "A" : 9-11; 10-12.
	External	External network	9-10	-
B40 Regulator	When used	B40:33 & 34 (gnd)	33 & 34 (gnd)	-
		B40:39 & 40 (gnd)	TB "B" : 33 & 34 (gnd)	
		B40:37 & 38 (gnd)	TB "B" : 35 & 36 (gnd)	
	Not used	-	-	TB "B" : 33-35; 34-36.

Figure 2-3. B37, External Connections.

CKT	OPTION or FUNCTION	CONNECT Ext Ckt	to B40 rear terms	STRAPPING ON REAR TERM BD & NOTE
Operating power	AC	117 VAC	1-2	5-6; 7-8; 9-10; 11-12-13
	DC	130 V	2(+) & 4(-)	6-7
		24 V or	1(-) & 3(+)	10-11-13
		48 V	1(-) & 3(+)	10-11; 13-14
B37 unit	Pilot line	B37 TB "A": 33 & 34 (gnd)	33 & 34 (gnd)	—
	From B37 receive filter	B37 TB "B": 33 & 34 (gnd)	39 & 40 (gnd)	—
	To B37 demodulator	B37 TB "B": 35 & 36 (gnd)	37 & 38 (gnd)	—
External alarm	When used	External Alarm	29-30	Ext alm ckt must be 0-200Ω max, and draw 30 ma nominal, 120 VDC above ground.
	Not used	—	—	29-30

Figure 2-4. B40, External Connections.

CKT	OPTION or FUNCTION	CONNECT Ext Ckt	to B57 rear terms	STRAPPING ON REAR TERM BD
Operating power	AC	117 VAC	1-2	5-6; 7-8; 9-10; 11-12
	DC	130 V	2(+) & 4(-)	6-7
		24 or 48 V	1(-) & 3(+)	10-11
Carrier line connections	2-wire	Westbound line	21-2	23-25; 24-26; 33-35; 34-36
		Eastbound line	31-32	
	4-wire	Rcv line from East terminal	35-36	—
		Send line to West terminal	23-24	
		Rcv line from West terminal	25-26	
		Send line to East terminal	33-34	
B62 E-W Regulator	When used	B62: 37-38	37-38	—
		B62: 39-40	39-40	
	Not used	—	—	37-39; 38-40
B62 W-E Regulator	When used	B62: 37-38	27-28	—
		B62: 39-40	29-30	
	Not used	—	—	27-28; 29-30

Figure 2-5. B57, External Connections

CKT	OPTION	CONNECT Ext Ckt	to B62 rear terms	STRAPPING TO REAR TERMS BD & NOTE
Operating power	AC	117 VAC	1-2	5-6; 7-8; 9-10; 11-12-13
	DC	130 V	2(+) & 4(-)	6-7
		24 V or	1(-) & 3(+)	10-11-13
		48 V	1(-) & 3(+)	10-11; 13-14
B57	E-W	B57: 37-38	37-38	—
		B57: 39-40	39-40	
	W-E	B57: 27-28	37-38	
		B57: 29-30	39-40	
Ext alarm	When used	Ext alarm ckt	29-30	Ext alm ckt must be 0-200Ω max, and drain 30 ma nominal, 120 watt above ground.
	Not used	—	—	29-30

Figure 2-6. B62, External Connections.

2.3 INSTALLATION LINE UP

Installation line-up for the B40, B57 and B62 consists of the complete procedures given in figures 2-8 and 2-9. However, for the B37 terminals, the complete line-up procedure given in figure 2-7 may not be required for several years after the equipment is placed in service. It is not necessary or advisable to repeat the adjustments which have been carefully made at the factory prior to shipment. For initial line-up of B37 terminal units, perform only the following:

<u>a</u>. Adjust the transmit carrier level, step 2 in figure 2-7.
<u>b</u>. Adjust the carrier receive gain, step 7 in figure 2-7.
<u>c</u>. Adjust the 2-wire v-f receive gain, step 8 in figure 2-7.

2.4 ORDER OF LINE-UP

Line up the transmitting circuits of each channel at each B37 terminal; then line up the receiving circuits at each terminal. If B40 terminal regulators are used, line them up after the associated receiving circuit adjustments are completed.

If B57 repeaters are used, line them up in both directions for each channel (with associated B62 repeater regulators) before adjusting the terminal receiving circuits.

2.5 USE OF LINE-UP TABLES

The line-up tables, figures 2-7, 2-8 and 2-9, give the step-by-step procedures for line up of each unit in the B37 system. The procedure indicated in step 2 of figure 2-7, for example, is as follows:

<u>a</u>. To adjust the transmit carrier level for each channel terminal, connect the test oscillator (section 2.6), arranged to deliver 1000~ at 0 dbm, to the HYBRID LINE jack on the B37 unit under adjustment. (For 4-wire v-f operation, connect the oscillator to the MOD IN jack at -13 dbm level.)

<u>b</u>. Insert an opening plug in the SIGNALING SF OUT jack. Connect the DB meter, terminated in 600 or 150 ohms according to the channel, and connect it to the CARRIER SF OUT jack.

<u>c</u>. Adjust the CARRIER SEND GAIN control for +16 db reading on the meter unless otherwise specified in the system information.

2.5.1 B37 LINE-UP TABLE, ADDITIONAL INSTRUCTIONS

<u>a. Dial Signaling Adjustment</u> (step 10b, fig. 2-7). This procedure consists of transmitting 50% break pulses at the far end and adjusting the receive signaling circuits at the testing end to reproduce these 50% break pulses.

(1) At the far end, connect the source of 50% break pulses to M-lead terminal 32 (48V) or 31 (24V) on the channel B37. If a Lynch B118 is used with a 24 or 48 volt battery, it delivers 50% break pulses at 10 pps.

(2) At the testing end, connect a signaling test set to rear terminals 27 (E-lead) and 28 (F-lead) on the channel B37. Adjust control PO-5 for 50% break indication on the test set. If a Lynch B118 is used, 50% break is indicated by center-scale reading on the meter.

b. Carrier Synchronization (step 12, fig. 2-7).

(1) At the far end, arrange the test oscillator to deliver 1000~ at 0 dbm (2-wire) or -13 dbm (4-wire) level. Shunt a diode (IN34 or equivalent) across the oscillator output terminals and connect the oscillator to the HYBRID LINE (2-wire) or MOD IN (4-wire) jack on the channel B37.

(2) At the testing end, shunt a diode (IN34 or equivalent) across the DB meter input terminals, and connect the meter to the HYBRID LINE (2-wire) or DEMOD OUT (4-wire) jack on the channel B37.

(3) At the testing end, for channels 2-5, adjust the CARRIER OSCILLATOR TRIMMER, REC (C15) for zero beat on the meter. Since this cannot be obtained exactly for more than a few seconds, the correct setting will produce large, slow fluctuations on the DB meter. (For channel 1 only, adjust the CARRIER OSCILLATOR TRIMMER, TRANS (C16). This adjustment is required at only one terminal per channel.)

2.5.2 B57 & B62 LINE-UP TABLE, ADDITIONAL INSTRUCTIONS

a. The line-up table, figure 2-9, is written for E-W line-up only. For this direction of transmission, the EAST B37 channel terminal is used to transmit the test tone. When adjusting the E-W B62, if used, the W-E patch cord is used in steps 5 and 6 to disable the W-E direction of transmission. When lining up in the opposite direction of transmission, the E-W and W-E directions in the table must be reversed, and the WEST B37 terminal used to transmit the test tone.

b. For channels 2-5 the maximum B57 repeater gain (with B62's patched out) is 36 db in each direction of transmission. The repeater gain is the difference in level between the measurements in steps 2 and 3 in the table. For channel 1 only, the maximum gain in one direction is 30 db. Further, the maximum loop gain is 52 db, that is, the gains in both directions must not exceed 52 db when added together. For example, if the E-W gain is adjusted for 30 db, the W-E gain must not exceed 22 db.

2.6 RECOMMENDED TEST EQUIPMENT

Refer to Appendix B for correction factors to be added when connecting the recommended DB meter to a 600 or 150 Ω circuit.

(1) DB METER.............. High-impedance electronic voltmeter with db scale (reading directly in dbm when measurement is across 600 Ω), and with AC volts scale.
Frequency response: Flat from 250 ~ to 200 kc.
(Hewlett-Packard Model 400D or equivalent.)

(2) TEST OSCILLATOR...... Frequency output: 250 ~ to 65 kc.
Output impedance: 600 Ω balanced.
Output level: Adjustable to +10 dbm max.
(Hewlett-Packard Model 200 CD or equivalent.)

(3) TEST CORDS AND TERMINATIONS....... Test cords to connect the testing equipment to the B37 units.
Terminating resistors (600 and 150 Ω) for use with item (1). (These parts are included in Test Kit 120; see drawing K120-1.)

(4) MULTIMETER.......... Ohms scale: Low and high.
AC volts scale: 0 to 250 V, 1000 Ω/v.
DC volts scale: 0 to 250 V, 20,000 Ω/v.
(Simpson Model No. 260 or equivalent.)

(5) DOT SOURCE (DIAL PULSE GENERATOR).. Source of 50% break, -48 V pulses in the range 8-14 pps. (This may be obtained by using a Lynch Type B118 Bias Distortion Measuring Set, or equivalent, in series with a 48 V battery.)

(6) BIAS DISTORTION MEASURING SET...... Apparatus capable of measuring dial signaling distortion for pulses between 8 and 14 pps.
(Lynch Type B118 or equivalent.)

Items (5) and (6) are required at each terminal for adjustment of dial signaling circuits.
Items (1), (3) and (4) are required at each terminal and repeater.
Item (2) is normally required at each terminal only.

LINE-UP TESTS IN NUMERICAL SEQUENCE.		PURPOSE OF TEST.	1000 ~ TEST TONE Level (dbm)	Connect to	SPECIAL CIRCUIT CONDITION Tstg. End	Far End	MEASURING REQUIREMENT TERMINATED IN ( ) Tstg. End	MEASURE AT TEST-POINT: Tstg. End	IF NECESSARY ADJUST Tstg. End (except step 6)	READJUST IF OUT OF TEST LIMITS TO (meter reading)	TEST LIMITS (meter reading) Min	Max	NOTES
Local transmitting tests at each B37 terminal.	1.	2-wire send v-f level adjust.	0	HYBRID LINE jack.			DB meter (600 Ω)	MOD LINE jack.	HYBRID OUT PAD	-13 db	-15 db	-11db	Required for 2-wire v-f operation only.
	2.	Xmt Cxr level adjust.	0 2-w v-f operation or -13 4-w v-f operation	HYBRID LINE jack MOD IN jack	Opening plug in SIGNAL-ING SF OUT jack.	—	DB meter (600 Ω, CH 1-3; 150 Ω, CH 4-5)	CARRIER SF OUT jack.	CARRIER SEND GAIN control.	+16 db CH 1-3 +10 db CH 4-5	0 db CH 1-3 -6 db CH 4-5	+18 db CH 1-3 +12 db CH 4-5	See Appendix B. Reduce level for coordination if necessary. Adjust PO-1 if it is necessary to exceed READJUST level.
	3.	Xmt Cxr leak adjust.	—	—	Opening plugs in SIGNALING SF OUT & MOD LINE jacks.	—	DB meter (600 Ω, CH 1-3; 150 Ω, CH 4-5)	CARRIER SF OUT jack.	PO-1M & PO-2M on modulator assembly.	Minimum reading obtainable.	—	20 db less than reading in step 2.	Adjust each control and repeat until min. reading is obtained.
	4.	Sig tone Xmt level adjust.	—	—	Opening plug in MOD LINE jack.	—	DB meter (600 Ω, CH 1-3; 150 Ω, CH 4-5)	CARRIER SF OUT jack.	SIGNALING SEND GAIN control.	+6 db nominal	+5 db	+7 db	READJUST level is 10 db less than level in step 2.
	5.	Sig tone Xmt level check.	—	—	—	—	DB meter (600 Ω)	SIGNALING SF OUT jack.	—	—	-25 db	-21 db	Test limits correspond to +6 db level in step 4. Record reading for maintenance.
Receiving tests at each terminal while transmitting from far terminal.	6.	RCV level check.	0 **	HYBRID LINE jack at far end.	—	—	DB meter (600 Ω, CH 1-3; 150 Ω, CH 4-5)	RF OUT jack.	CARRIER SEND GAIN at far end. See note.	Min. test limit or above (with dry open wire line).	-20 db CH 1-3 -26 db CH 4-5	—	If signal is too low when level at CARRIER SF OUT jack at far end is max, reduce transmission loss between terminals.
	7.*	Cxr rcv gain	0 **	HYBRID LINE jack at far end.	—	—	DB meter (600 Ω)	DEMOD OUT jack.	CARRIER RECEIVE GAIN control.	+4 db	—	—	Use +4 db unless otherwise specified.
	8.	2-wire v-f rcv gain adjust.	0 **	HYBRID LINE jack at far end.	—	—	DB meter (600 Ω)	HYBRID LINE jack.	HYBRID IN PAD	-4 db	—	-1 db	Use -4 db unless otherwise specified.
	9.	Sig tone rcv gain check.	—	—	—	—	DB meter (600 Ω)	SIGNALING RF OUT jack.	—	-15 db nominal	-20 db	-6 db	Record reading for maintenance. If outside test limits, check steps 4 and 5 at far end.
	10a.	Rcv relay adjust (Dial or RD)	—	—	Opening plug in SIGNALING RF OUT jack.	—	Milliammeter	RBMA jack	--	—	3 ma	8 ma	Record reading.
			—	—	Opening plug in SIGNALING RF OUT jack.	—	Milliammeter	ROMA jack	ROMA control.	1 ma higher than reading at RBMA jack.	—	—	—
	10b.	DIAL signaling adjust	—	—	—	10 pps, 50% break, 24 or 48V pulses.	Signaling test set.	Rear term 27 (E) & 28 (F)	PO-5	50% break	46%	54%	See section 2.5.1a.
	10c.	Ringdown signaling check.	—	—	—	Apply ringing to channel drop.	—	2-wire drop.	PO-5 to mid-position.	—	—	—	Ringing should appear at local drop when ringing is applied to channel at far end.
	11.	Rcv Cxr leak.	—	—	—	—	DB meter (600 Ω, CH 1-3; 150 Ω, CH 4-5)	CARRIER RF IN jack.	PO-1D & PO-2D on demodulator assembly.	Minimum reading obtainable.	—	-30 db CH 1-3 -36 db CH 4-5	Adjust each control and repeat until min. reading is obtained.
	12.	Cxr synchronization.	—	—	—	Connect 300 ~ 0 dbm to HYBRID LINE jack.** Connect diode across test osc.	DB meter (diode)	HYBRID LINE jack.	CXR OSC TRIMMER, REC (CH 2-5); TRANS (CH 1)	Zero beat. See note.	—	2 ~ beat	Meter needle deflects 1-2 db at slow rate. Adjustment at one terminal only is required for channel 1. See section 2.5.1b.

* (Step 7). If B40 is used, first patch RF OUT to REC IN jack on B40 and complete line-up above. Then remove patch cord and line up B40 unit, figure 2-8.

** For 4-w v-f, apply -13 dbm to MOD IN jack.

Figure 2-7. B37 Line-up table.

Line-up tests in sequence		Purpose of test	1000~ input to B37 At far end* Level (dbm)	Connect to	Special circuit condition Tstg end	Far end	Measuring equipment terminated in ( ) Tstg end	Measure at test point Tstg end	If necessary adjust Tstg end	Adjust to Tstg end	Notes
Perform these tests at each channel terminal with B40 after line-up of B37 ckts (fig. 2-7) is completed.	1.	B37 far end and near end rcv levels.	0	HYBRID LINE jack	Patch RF OUT to REC IN jack on B40.	–	DB meter (600Ω)	DEMOD OUT jack (B37)	CARRIER RECEIVE GAIN control (B37)	+4 dbm See note	Use +4 dbm unless otherwise specified. Do not remove DB meter until end of step 4.
	2A.	Preliminary reg ckt adjust.	0	HYBRID LINE jack	Patch RF OUT to REC IN jack on B40.	–	Milliammeter 0-35 DC ma	PILOT MA jack (B40)	PO-2 & PILOT CONTROL (B40)	See note	Turn controls fully clockwise and record reading. External meter not required if built-in meter option is supplied. Do not remove meter until end of step 4.
	2B.	Preliminary reg ckt adjust.	0	HYBRID LINE jack	Patch RF OUT to REC IN jack on B40.	–	Milliammeter 0-35 DC ma	PILOT MA jack (B40)	PILOT CONTROL (B40)	3 ma below reading in step 2A.	–
	3A.	Reg ckt adjust.	0	HYBRID LINE jack	Remove patch cord.		Milliammeter 0-35 DC ma	PILOT MA jack (B40)	PO-2 (B40)	3 ma below reading in step 2A.	Adjust for identical reading to step 2B.
	3B.	Reg ckt adjust.	0	HYBRID LINE jack	–	–	DB meter (600Ω)	DEMOD OUT jack (B37)	PILOT CONTROL (B40)	Same as reading of step 1.	PILOT CONTROL and PO-2 interact, so repeat steps 3A and 3B until required readings are obtained simultaneously.
	4A.	Sig tone equalization, dial only	0	HYBRID LINE jack	–	Apply -24 or -48V to M-lead, then remove.	DB meter (600Ω)	DEMOD OUT jack (B37)	PO-3 (B40)	Same reading with and without voltage on far end M-lead.	–
	4B.	Sig tone equalization, ring-down only.	0	HYBRID LINE jack	–	Ground pin 7 on relay K2 in B37, then remove.	DB meter (600Ω)	DEMOD OUT jack (B37)	PO-3 (B40)	Same reading with pin 7 on K2 grounded and ungrounded.	–

* For 4-W v-f, apply -13 dbm to MOD IN jack.

Figure 2-8. B40 Line-up Table.

	Line-up tests in sequence	Purpose of test	1000~0 dbm input to HYBRID LINE jack on B37 [3,4]	Special ckt condition B62, if used (2)	Measuring equipment terminated in ( ) B57 Rptr	Measure at test-point B57 Rptr	If necessary adjust At Rptr	Readjust if out of test limits to (Meter Reading)	Test Limits (meter reading) Min	 Max	Notes
B57 repeater gain tests. Perform in W-E and E-W directions. [1]	1.	B37 transmit level adjust.	AS REQ'D	E-W & W-E patch cords (B62).	–	–	–	–	–	–	Perform local transmitting tests at B37 terminal, steps 1-5 in fig. 2-7. [3]
	2.	Incoming sig level check.	YES	E-W & W-E patch cords (B62).	DB meter (600 Ω, CH 1-3; 150 Ω, CH 4-5)	E-W SF OUT jack (B57) [1]	See notes	Within test limits (with dry open-wire line).	-20 db CH 1-3 -26 db CH 4-3	-6 db CH 1-3 -12 db CH 4-5	If rcv level is too low when B37 terminal Xmtr output is max, check transmission.
	3.	B57 Gain adjust.	YES	E-W & W-E patch cords (B62).	DB meter (600 Ω, CH 1-3; 150 Ω, CH 4-5)	E-W RF OUT jack (B57) [1]	E-W GAIN CONTROL (B57)	+16 db CH 1-3 +10 db CH 4-5	0 db CH 1-3 -6 db CH 4-5	+16 db CH 1-3 +10 db CH 4-5	Use +16 dbm unless otherwise specified. See Appendix B. See section 2.5.2b.
B62 reg test. Perform in E-W and W-E directions. [1]	4.	E-W prelim B62 reg ckt adjust.	YES	E-W & W-E patch cords (B62)	Milliammeter 0-35 DC ma	PILOT MA E-W jack (B62) [1]	—	1.5 ma	0 ma	3 ma	Correct reading indicates NO pilot signal.
	5A.	E-W B62 reg adjust.	YES	W-E patch cord only [1]	DB meter (600 Ω, CH 1-3; 150 Ω, CH 4-5)	E-W SF OUT jack (B57) [1]	PILOT CONTROL (E-W B62) [1]	Same as step 2	–	–	Do not use E-W GAIN CONTROL on B57 when B62 is in circuit [1].
	5B.	E-W B62 reg adjust.	YES	W-E patch cord only (B62) [1]	Milliammeter 0-35 DC ma	PILOT MA jack (E-W B62) 1	PO-2 (E-W B62) [1]	25 ma	24 ma	26 ma	If PO-2 is adjusted repeat steps 5A & 5B.
	6A.	Sig tone equalization, dial only.	YES	W-E patch cord only (B62) [1]	DB meter (600 Ω, CH 1-3; 150 Ω, CH 4-5)	E-W SF OUT jack (B57) [1]	PO-3 (E-W B62) [1]	Same reading with & without voltage on far end M-lead See note.	–	–	Apply -24 or -48V to far end M-lead, then remove & compare meter readings.
	6B.	Sig tone equalization, ring-down only.	YES	W-E patch cord only (B62) [1]	DB meter (600 Ω, CH 1-3; 150 Ω, CH 4-5)	E-W SF OUT jack (B57) [1]	PO-3 (E-W B62) [1]	Same reading with pin 7 on K2 grounded & ungrounded.	–	–	Ground pin 7 on relay K2 in B37 terminal, then remove. [3]

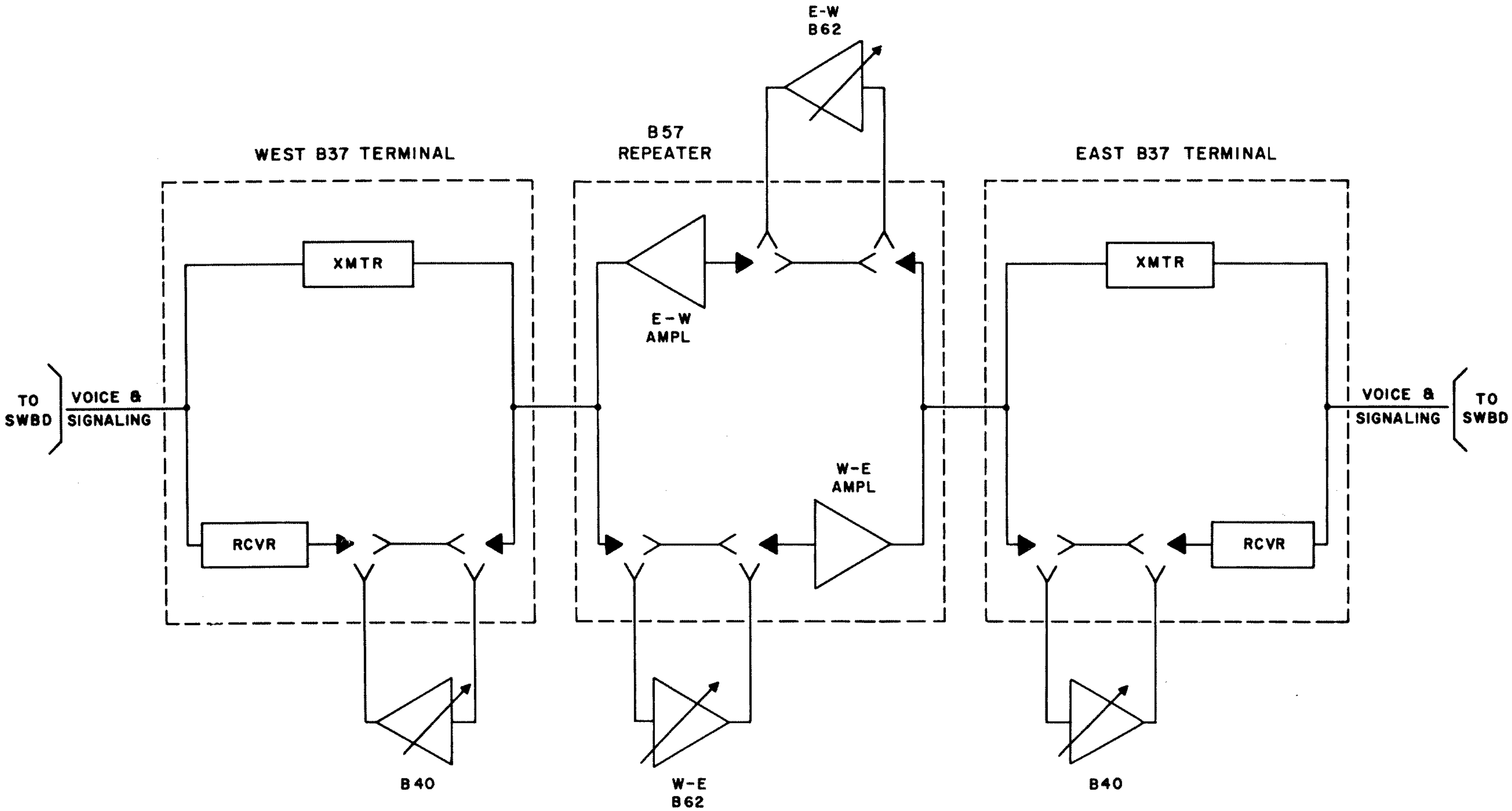
[1] E-W line-up only shown in table. Exchange "W-E" for "E-W" to line up in W-E direction.

[2] Patch cord on E-W and W-E B62 from RF OUT to REP IN jack when indicated.

[3] Transmit from East B37 for E-W B57 and B62 line-up.

[4] Apply 1000 ~, -13 dbm to MOD IN jack for 4-W v-f operation.

Figure 2-9. B57 and B62 Line-up Table.



B37 CHANNEL BLOCK DIAGRAM

FIGURE 3-1

3.1 GENERAL

Figure 3-1 is a block diagram of a B37 channel. Each channel contains a West and East B37 terminal. The B57 repeater is used for systems whose nominal line loss between terminals exceeds 36 db. The B40 terminal regulators and B62 repeater regulators are used if the line loss is subject to wide variations. In some cases, a B40 or B62 is required in one direction of transmission only.

Each B37 channel terminal accepts speech or telegraph signals and dial or ringdown signaling and transmits it at carrier frequency to the far terminal. When receiving, each B37 translates the received carrier frequencies back to the original speech or signaling. The B40 terminal regulator increases or decreases the gain of the receiving branch to compensate for changing weather conditions on the carrier line.

The B57 repeater provides 2-way amplification of the channel signals and provides up to 36 db gain. The B62 repeater regulator increases or decreases the gain of the associated repeater amplifier to compensate for changing weather conditions on the carrier line.

The switchboard and carrier line connections at each terminal may be made on a 4-wire basis as well as the 2-wire basis indicated in figure 3-1.

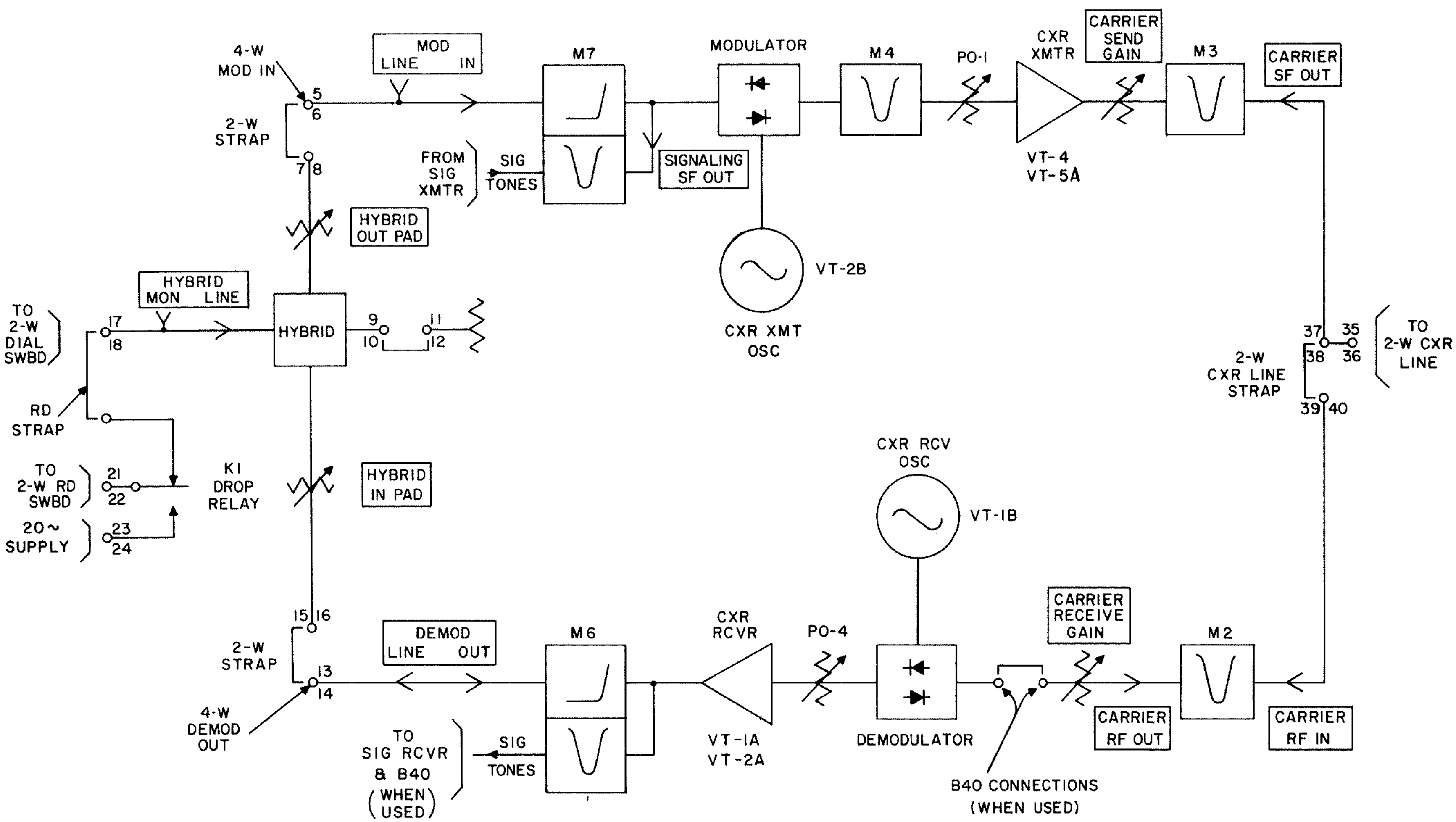
3.2 B37 TERMINAL THEORY OF OPERATION

Refer to schematic diagram B37-14 when reading the following circuit description.

a. Voice Transmitter (fig. 3-2). Voice signals from the local switchboard are applied to the B37 terminal on a 2- or 4-wire basis. The hybrid circuit is used for 2-wire operation to couple the send and receive paths to the switchboard line, while preventing receive signals from entering the send path. The hybrid circuit is provided with an internal compromise termination which works against standard switchboards. An external precision network may be connected in its place when required. The HYBRID OUT PAD is used to set the MOD LINE level to -13 dbm.

The low-pass section of filter M7 freely passes voice signals below 2850~ which are applied to the modulator. The voice signals are modulated to the channel carrier frequency band and amplified by the carrier transmitter amplifier. M4 and M3 at both ends of the amplifier select the single sideband to be transmitted. The CARRIER SEND GAIN control adjusts the transmitter output during line-up. PO-1 at the amplifier input is a factory-set gain adjustment which may be varied to compensate for component aging. The carrier output signals may be connected on a 2- or 4-wire basis to the carrier line.

b. Voice Receiver (fig. 3-2). Channel receive frequencies are selected by filter M2 and applied to the demodulator. If a B40 regulator is used, it is strapped into the receive branch at the demodulator input. The CARRIER RECEIVE GAIN control adjusts the receive branch gain and is used to set the level at the DEMOD OUT jack. PO-4, at the demodulator output, is a factory-set gain adjustment which may be varied to compensate for component aging.



B37, VOICE & CARRIER CIRCUIT, BLOCK DIAGRAM

FIGURE 3-2

The demodulator translates the received carrier frequencies to the voice band. The demodulator output is amplified and frequencies below 2850~ are selected by the low pass section of filter M6 and applied to the 4-wire demod out terminals. For 2-wire operation, the voice signals flow through the receive arm of the hybrid to the 2-wire switchboard line. The HYBRID IN PAD sets the 2-wire net equivalent (receive) gain, measured at the HYBRID LINE jack.

c. Carrier Frequency Oscillators. As indicated in figure 3-2, Carrier Transmit Oscillator VT-2B and Carrier Receive Oscillator VT-1B supply the carrier for the modulator and demodulator respectively. For channels 4 and 5 these oscillators are crystal controlled.

Note. Drawing B37-27 shows that the same carrier is used in both directions of transmission for the channel 1 allocation; therefore for channel 1 only, VT-2B serves the modulator and demodulator and VT-1B is disconnected.

d. Signaling Transmitter, Dial Operation (fig. 3-3). In the on-hook condition, the M-lead is deenergized and the signaling oscillator generates the higher frequency signaling tone. In off-hook, the M-lead voltage energizes the send relay which switches the frequency shift capacitor in the oscillator tank circuit. The signaling oscillator now generates the lower-frequency signaling tone. During dialing, voltage is applied in pulses to the M-lead causing the signaling oscillator to shift frequency according to the dialing pulses. The signaling tones are applied through the band-pass section of filter M7 to the modulator and are transmitted in the same manner as speech signals (a above).

e. Signaling Receiver, Dial Operation (fig. 3-3). The signaling tones are demodulated in the same manner as received speech signals (b above) and are selected by the band-pass section of filter M6. The signaling tones are amplified by the limiter which presents a constant input to the discriminator. During on-hook, the higher-frequency signaling tone is received and causes a positive discriminator output. This drives the DC amplifier into conduction and the receive relay operates to maintain the E- and F-leads open. During off-hook the lower tone is received, the discriminator output is negative, the DC amplifier is cut off, the receive relay releases, and the E- and F-leads are connected. During dialing the shifting frequency tones cause the E- and F-lead connection to be made and broken, which reproduces the dialing pulses sent from the far terminal.

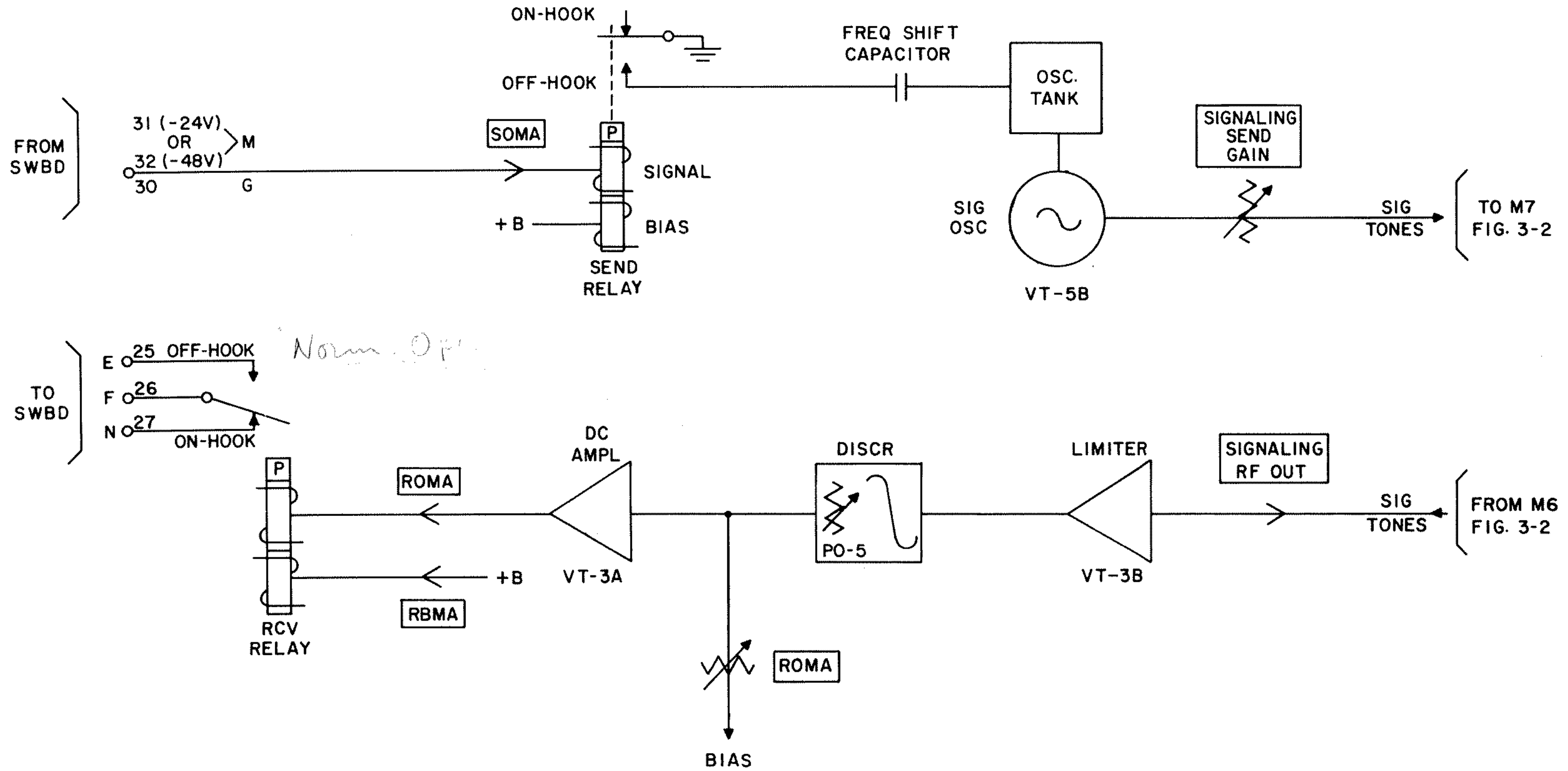
During line-up the bias current of the receive relay is measured at the RBMA (Receive Bias MA) jack. The operate current of the receive is measured at the ROMA (Receive Operate MA) jack and is adjusted with the ROMA control. PO-5, in the discriminator output circuit, is used to obtain minimum dial signaling distortion.

f. Signaling Transmitter, Ringdown Operation (fig. 3-4). In the idle circuit concondition, the send relay is deenergized and the signaling oscillator generates the higher frequency signaling tone. When ringing is applied to the 2-wire drop by the local switchboard, it passes through the normally closed contacts of the drop relay, through choke L1, and energizes the send relay. Choke L1 isolates the send relay from the switchboard line. The operated send relay connects the frequency shift capacitor in the oscillator tank circuit. The signaling oscillator now generates the lower-frequency signaling tone. The signaling tones are applied through the band-pass section of filter M7 to the modulator and are transmitted in the same manner as speech signals (a above). Since the ringing current is AC, the send relay is pulsed at the ringing frequency rate, and the

CHAN	SIG TONES	
	ON-HOOK	OFF-HOOK
1	3700	3500
2-5	3350	3150

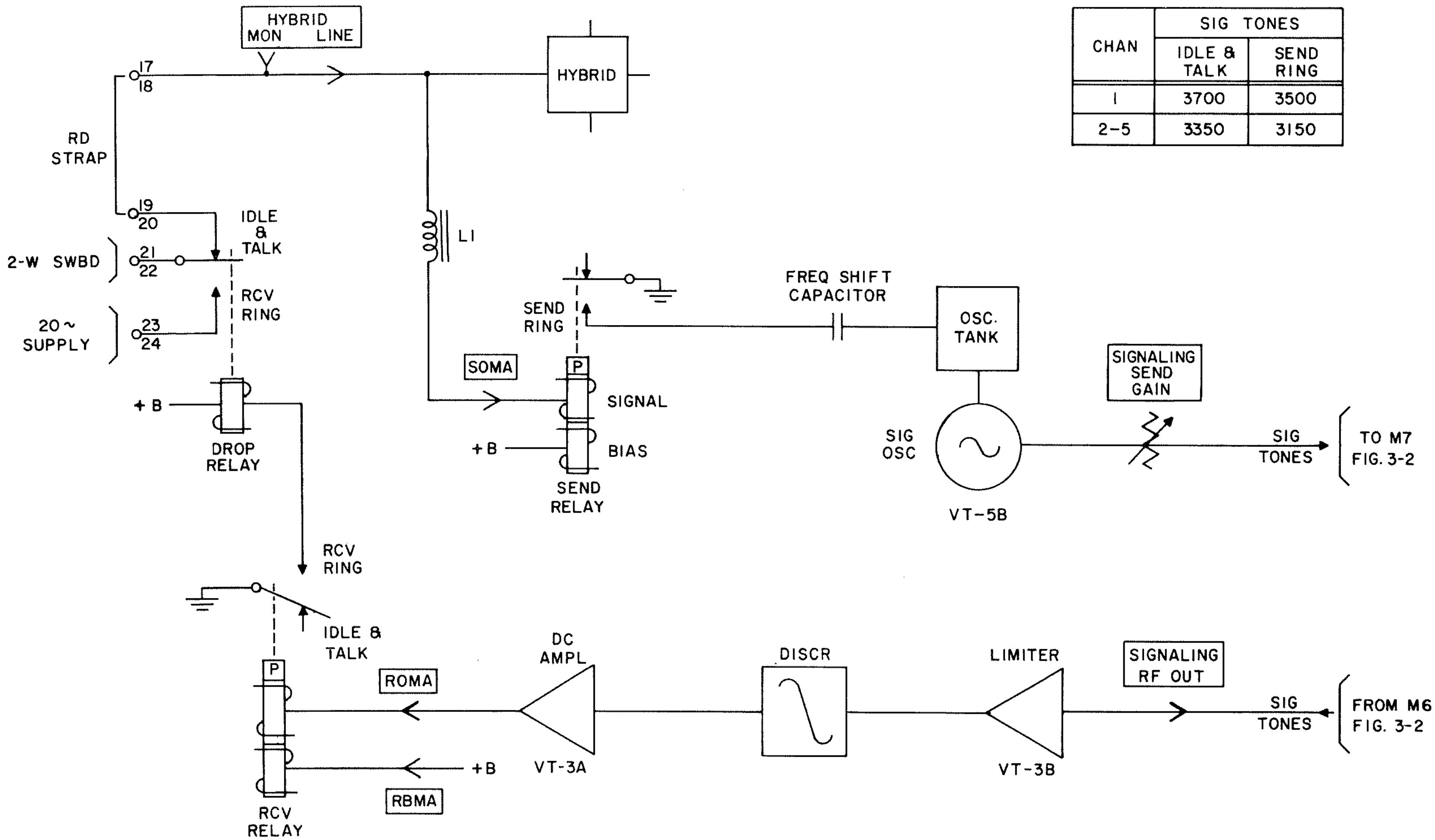
MARK

SPACE



B37 DIAL SIGNALING CIRCUIT BLOCK DIAGRAM

FIGURE 3-3



CHAN	SIG TONES	
	IDLE & TALK	SEND RING
1	3700	3500
2-5	3350	3150

B37 RINGDOWN SIGNALING CIRCUIT BLOCK DIAGRAM

FIGURE 3-4

signaling tones are shifted accordingly during send ringing.

g. Signaling Receiver, Ringdown Operation (fig. 3-4). The signaling tones are demodulated in the same manner as received speech signals (b above) and are selected by the band-pass section of filter M6. The signaling tones are amplified by the limiter which presents a constant input to the discriminator. During idle and talking, the higher frequency signaling tone is received and causes a positive discriminator output. This drives the DC amplifier into conduction and the receive relay operates to maintain the drop relay coil circuit open. During receive ringing the lower tone is received, the discriminator output is negative, the DC amplifier is cut off, the receive relay releases, and the drop relay is energized. When the drop relay operates, it disconnects the voice circuit and connects the switchboard line to the local 20~ supply, so ringing voltage is applied to the line during receive ringing.

Since the signaling tones shift at the send ringing frequency rate (f above) a capacitor is connected across the drop relay to prevent it from releasing during receive ringing periods.

3.3 B40 THEORY OF OPERATION

Refer to schematic diagram B40-3 when reading the following circuit description.

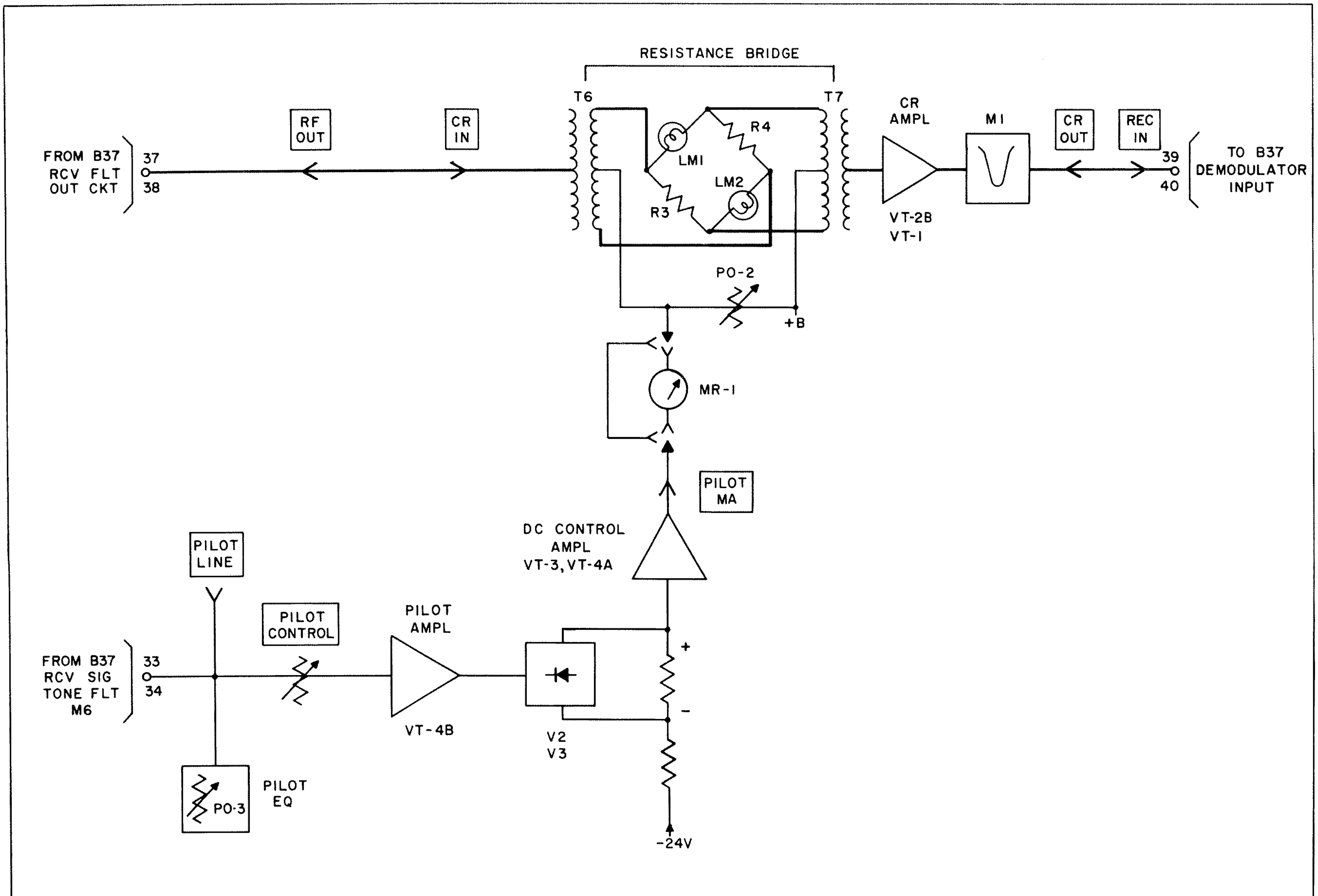
a. General (fig. 3-5). The B40 is normally a zero db gain (no loss or gain) device which is connected in the receive branch of a B37 terminal (fig. 3-2). The B40 consists of a resistance bridge and fixed gain amplifier. Under dry line conditions, the loss of the bridge and the amplifier gain are equal to produce the zero db gain condition.

The loss of the resistance bridge is determined by the level of the received signaling tones in the B37 terminal. If the carrier line loss increases, the signaling tone (pilot) level decreases. This causes the resistance bridge loss to decrease, so the B40 gain increases to offset the increase in carrier line loss and maintains the output of the B37 receiver constant. This action is tabulated below:

(1) Assume that the carrier line loss increases due to wet weather.
(2) The pilot (signaling tone) level received at the B37 terminal decreases.
(3) The resistance bridge loss decreases.
(4) The B40 overall gain increases to compensate for the change in step 1.
(5) The Demod out level of the B37 terminal is virtually unchanged despite the change in weather along the carrier line.

b. Resistance Bridge Operation (fig. 3-5). Channel carrier signals which have been selected by the B37 receive filter (fig. 3-2) are transferred from T6 to T7 through the unbalanced resistance bridge. As the resistance of the lamps is increased, the bridge approaches balance and its impedance increases. As the lamp resistance decreases, the bridge is further unbalanced and its impedance decreases. The resistance of these lamps, and the loss of the bridge depend on the pilot level. The output of T7 is amplified, and passes through filter M1 to the demodulator in the B37 receiver.

The resistance of LM1 and LM2 increases as the DC control current through them increases. The DC control current path extends from ground through the DC control amplifier (both halves of VT-3 in parallel with VT-4A) through LM-1 and LM-2 (in parallel) to B+. PO-2 in parallel with the DC current path through the bridge is used for prelimin-



B40 TERMINAL REGULATOR, BLOCK DIAGRAM

FIGURE 3-5

ary adjustment of the bridge current. The current through the DC amplifier is controlled by the pilot (signaling tone) level received by the B37.

Incoming pilot signals are amplified, rectified and the positive rectified output is applied in series with a negative reference bias. Under dry line conditions, the PILOT CONTROL is adjusted so that the total bias on the DC control amplifier permits enough current through the lamps so that the loss of the resistance bridge just equals the gain of the carrier amplifier. The pilot equalizer permits reduction of the lower frequency signaling tone amplitude if necessary so that the level of both tones is equal at the input to the pilot amplifier. When the carrier line impedance changes, the B40 operates as follows:

(1) A change in weather causes the carrier line loss to increase.
(2) The pilot (signaling tone) level at the B37 receiver drops.
(3) The B40 pilot amplifier output is reduced.
(4) The positive rectifier output is reduced, and the net bias on the DC control amplifier increases.
(5) The DC control current through the lamps decreases, causing the lamp resistances to decrease.
(6) The loss of the resistance bridge decreases, so the net gain of the B40 increases to compensate for the change in step 1.

3.4 B57 THEORY OF OPERATION

Refer to schematic diagram B57-5 when reading the following circuit description. The B57 Repeater contains a WEST-EAST (W-E) and an EAST-WEST (E-W) amplifier to provide amplification in both directions of transmission for one B37 channel.

The block diagram, figure 3-6, indicates that the carrier line connections can be made on a 2- or 4-wire basis. For 4-wire operation, the receive carrier line from the WEST terminal is applied to W-E IN terminals 25-26. For 2-wire operation, the carrier line between the WEST terminal and the B57 is connected to WESTBOUND LINE terminals 21-22. The receive channel frequencies from the WEST terminal are selected by filter M2 and applied through the W-E GAIN control and equalizer S4 (if used) to the W-E carrier amplifier. The W-E GAIN control adjusts the output level of the W-E amplifier. Equalizer S4 is used if it is necessary to equalize the channel response to compensate for the frequency of line filters.

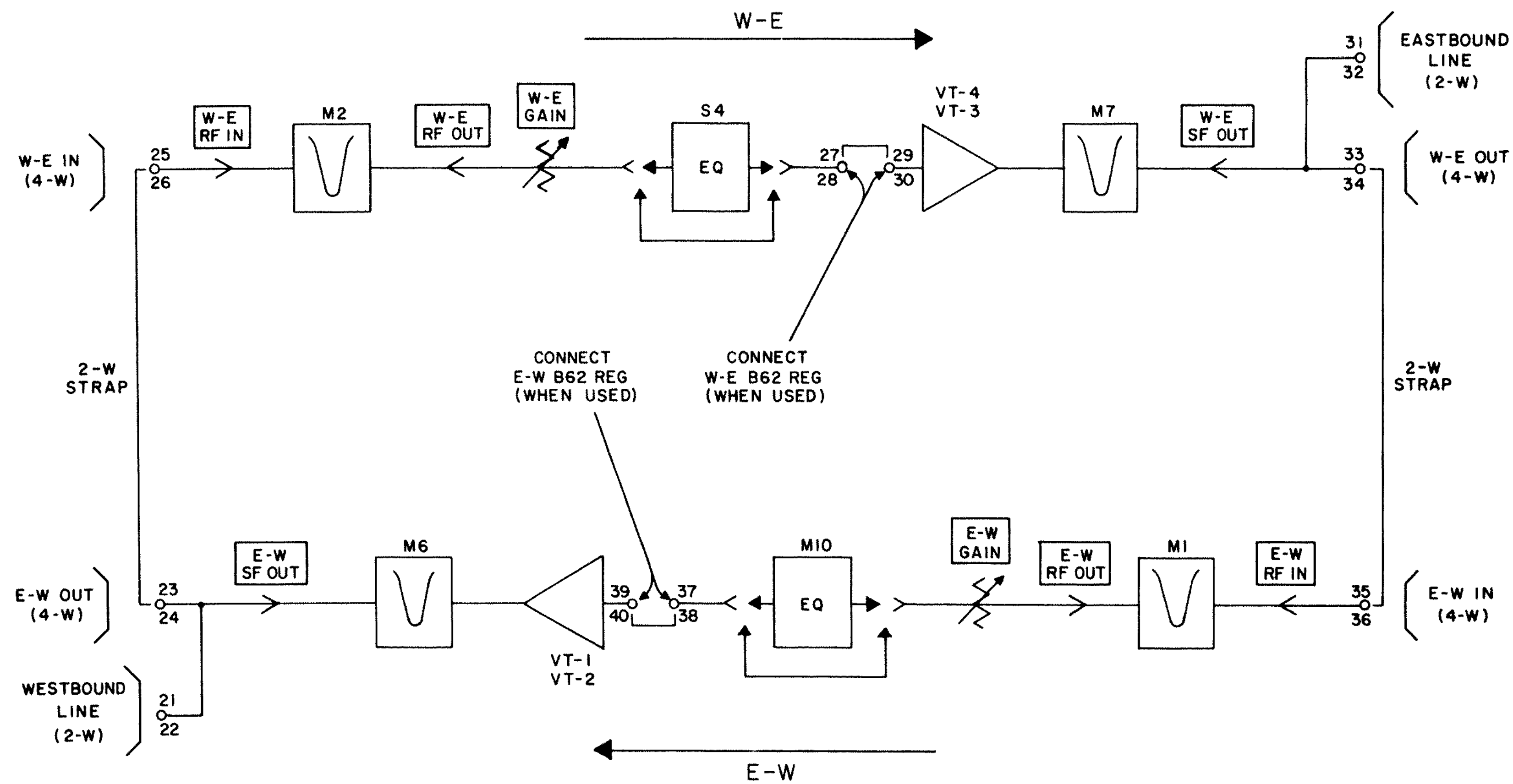
If a B62 is used (section 3.5), it is connected in the W-E path at the input to the carrier amplifier. The amplifier output passes through filter M7, which removes harmonics developed in the amplifier, and appears at the W-E OUT 4-wire terminals which connect to the send carrier line to the EAST terminal. For 2-wire operation, the carrier line connects to EASTBOUND LINE terminals 31-32.

Operation of the E-W amplifier is identical to the W-E amplifier as shown in figure 3-6.

3.5 B62 THEORY OF OPERATION

Refer to schematic diagram B62-2 (channels 2-5) when reading the following circuit description.

a. General (fig. 3-7). The B62 is normally a zero db gain (no loss or gain) device which is connected in one amplifying path of a B57 repeater (fig. 3-1 and 3-6). The B62



B57 REPEATER, BLOCK DIAGRAM

FIGURE 3-6

consists of a resistance bridge and fixed gain amplifier in series, and a pilot control circuit. Under dry line conditions, the loss of the bridge and the amplifier gain are equal to produce the zero gain condition.

The loss of the resistance bridge is determined by the level of the signaling tones received by the repeater. If the carrier line loss increases, the signaling tone (pilot) level decreases. This causes the resistance bridge loss to decrease, so the B62 gain increases to offset the increase in carrier line loss and maintain the output of the B57 constant. This action is tabulated below:

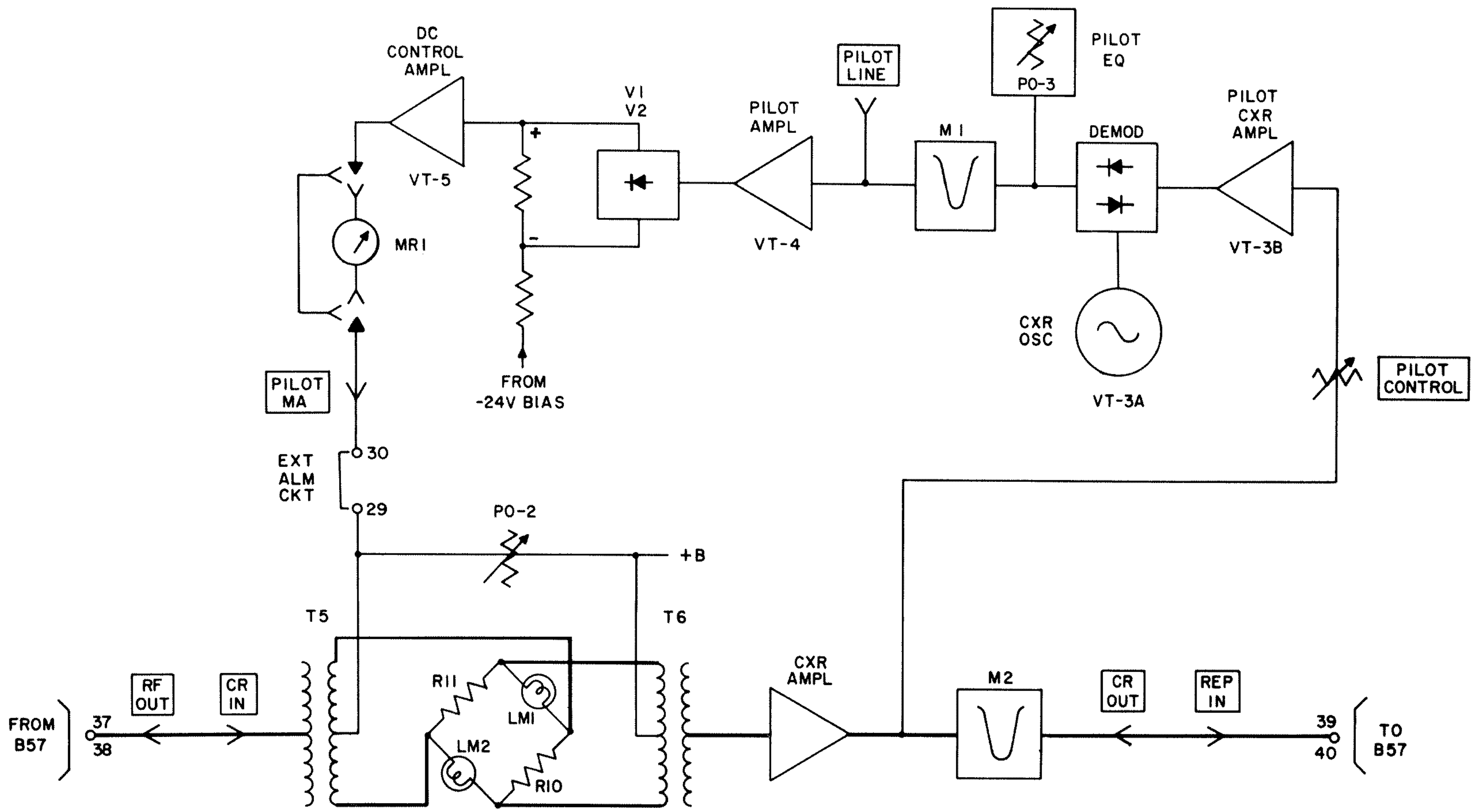
(1) Assume the carrier line loss increases due to wet weather.
(2) The pilot (signaling tone) level received by the B57 repeater decreases.
(3) The resistance bridge loss decreases.
(4) The B62 overall gain increases to compensate for the change in step 1.
(5) The send level of the B57 branch is virtually unchanged despite the change in weather along the carrier line.

b. Resistance Bridge Operation (fig. 3-7). Channel carrier signals which have been selected by the B57 branch filter (figure 3-6) are transferred from T5 to T6 in the B62 through the unbalanced resistance bridge. As the resistance of the lamps is increased the bridge approaches balance and its impedance increases. As the lamp resistance decreases, the bridge is further unbalanced and its impedance decreases. The resistance of these lamps, and the loss of the bridge, depend on the pilot level. The output of T6 is amplified and passes through filter M2 to the amplifier in the B57.

The resistance of LM1 and LM2 increases as the DC control current through them increases. The DC control current path extends from ground, through the DC control amplifier, through LM1 and LM2 (in parallel) to B+. PO-2 in parallel with the DC current path through the bridge is used for preliminary adjustment of the bridge current. The current through the DC control amplifier is controlled by the pilot (signaling tone) level received by the B57.

c. Pilot Demodulator and Control Circuits (fig. 3-7). The output of the B62 carrier amplifier is fed to the pilot carrier amplifier whose output is demodulated. Filter M1 selects the signaling tones from the demodulator output. The pilot equalizer at the M1 input reduces the lower frequency signaling tone amplitude if necessary so that the level of both tones is equal at the input to the pilot amplifier. The pilot amplifier output is fed to a full-wave rectifier and the rectified positive output is applied in series with a negative reference bias. Under dry line conditions, the PILOT CONTROL adjusts the total bias on the DC control amplifier to permit enough current through the lamps so that the loss of the resistance bridge just equals the gain of the carrier amplifier. When the carrier line impedance changes, the B62 operates as follows:

(1) A change in weather causes the carrier line loss to increase.
(2) The pilot (signaling tone) level at the B57 repeater branch input drops.
(3) The B62 pilot amplifier output drops.
(4) The positive rectifier output is reduced, and the net negative bias on the DC control cmplifier increases.
(5) The DC control current through the lamps decreases, causing the lamp resistance to decrease.
(6) The loss of the resistance bridge decreases, so the net gain of the B62 increases to compensate for the change in step 1.



B62, CHANNELS 2-5, BLOCK DIAGRAM

FIGURE 3-7

d. B62 for Channel 1 Only. Refer to schematic diagram B62-11. The version of the B62 used for channel 1 does not contain the demodulator and carrier oscillator shown in figure 3-7. Instead of demodulating the line frequencies to the original signaling tone frequencies, the channel 1 B62 uses filter M1 to select the signaling tones directly from the line signals (after they are amplified). The signaling tones for W-E transmission are centered at 3.6kc, and for E-W transmission at 10.8 kc as shown on drawing B37-27.

APPENDIX A

DEFINITION AND ADJUSTMENT OF TEST TONE

(1) It is necessary to apply a 1000~ test tone to each channel (using the recommended oscillator) during line-up of the v-f and carrier-frequency circuits of a B37 ter-

(2) The level of the test tone and where it is connected depend on the type of connection to the telephone switchboards, 2- or 4-wire. Refer to the table below.

V-f connection to switchboard	Test tone level (dbm)	Plug oscillator into:
2 wire	0	HYBRID LINE jack
4-wire	-13	MOD IN jack

(3) Adjust the oscillator to deliver the test tone as follows:

(a) Terminate the DB meter in 600Ω. Turn the frequency dial on the oscillator to 1000~.

(b) Connect the oscillator to the terminated DB meter. Adjust the oscillator to obtain indication of 0 or -13 db on the DB meter, as required.

(4) Check the output impedance of the oscillator as follows:

(a) Remove the 600Ω termination on the DB meter without disconnecting the oscillator. The indication on the DB meter should increase 6 ± 1 db.

(b) Do not use the oscillator for final adjustment of the B37 equipment if the indication on the DB meter does not increase within the limits given in (a). If the meter reading does not increase as indicated in (a), proceed as follows to determine the internal impedance of the oscillator:

1. Adjust the oscillator to deliver 1000~.
2. Connect an 0 to 10,000Ω variable resistor across the oscillator output terminals. Adjust it for maximum resistance.
3. Connect the DB meter to the oscillator. By trial and error, adjust the variable resistor until the DB meter increases 6 ± 1 db when the resistor only is disconnected from the oscillator terminals.
4. Measure the resistance to which the variable resistor was adjusted in step 3. This value is equal to the internal resistance of the oscillator.
5. If the internal resistance of the oscillator is less than 600Ω, it may be increased to 600Ω by adding suitable resistance in series with the oscillator output terminals. If the internal resistance of the oscillator is greater than 600Ω, it can be corrected to 600Ω by using a repeat coil or transformer of suitable turns ratio or by shunting a suitable resistance across the oscillator output terminals.

APPENDIX B

CORRECTION FACTORS AND METHOD OF READING DB METER

Type of measurement:	If impedance at test point is:	Shunt the meter with a resistor of value:	To adjust meter reading to obtain dbm:
Terminating	150Ω	150Ω	Add +6.0 db
Bridging	150Ω	None	Add +6.0 db
Terminating	600Ω	600Ω	Read directly
Bridging	600Ω	None	Read directly

A DB meter, such as the recommended type, is calibrated to read power in dbm when it is connected across a 600Ω resistor (0 dbm = 1 milliwatt). Since the DB meter is an AC voltmeter, its power (dbm) calibration is correct only when the meter is connected across a 600Ω resistor.

The voltage across a 600Ω resistor which dissipates one milliwatt is 0.774 volts rms. When the DB meter is connected across 150Ω, and it indicates 0 db, the power dissipated is more than 0 dbm because 0.774 volts across 150Ω is 4 milliwatts. This power ratio of 4:1 amounts to 6 db which must be added to the meter reading to obtain the power level in dbm.

To read the meter scale in db, whatever the resistance is at the test-point in the circuit, add the meter reading to the scale switch setting algebraically (considering + and - signs), as indicated in the following examples.

(a) Meter scale switch set to -10, meter reading is -4.
The db reading is -10 + (-4) = -14 db.
If the reading is taken across 600Ω, the power is -14 dbm.
If the reading is taken across 150Ω, the power is -14 + 6 = -8 dbm.

(b) Meter scale switch set to +10, meter reading is 0.
The db reading is +10 + 0 = +10 db.
If the reading is taken across 600Ω, the power is +10 dbm.
If the reading is taken across 150Ω, the power is +10 + 6 = +16 dbm.

(c) Meter scale switch is set to -50, meter reading is +1.
The db reading is -50 + (+1) = -49 db.
If the reading is taken across 600Ω, the power is -49 dbm.
If the reading is taken across 150Ω, the power is -49 + 6 = -43 dbm.

(d) Meter scale switch is set to 0, meter reading is -4.
The db reading is 0 + (-4) = -4 db.
If the reading is taken across 600Ω, the power is -4 dbm.
If the reading is taken across 150Ω, the power is -4 + 6 = +2 dbm.

TYPE B37

CARRIER TELEPHONE TERMINAL

MAINTENANCE PARTS LIST

Note. Sub-assemblies which vary with channel allocation are listed separately on filter schedule, page 5.

Symbol or Item No.	Name and Description	Lynch Part No.
AT-1	ATTENUATOR: 600 ohms	2E0007A-1
AT-2	ATTENUATOR: 600 ohms	2E0007A-1*
AT-2	ATTENUATOR: 150 ohms	2E0010A-1**
AT-3	ATTENUATOR: 600 ohms	2E0007A-1
AT-4	ATTENUATOR: 600 ohms	2E0007A-1*
AT-4	ATTENUATOR: 150 ohms	2E0010A-1**
C1	CAPACITOR, FIXED: .1 mf 600 WVDC	11046B
C2	CAPACITOR, FIXED PAPER: .1 mf 600 WVDC	11046P
C3	CAPACITOR, FIXED: .5 mf 600 WVDC	15046B
C4	CAPACITOR, FIXED SILVERED MICA: .0001 - .001 mf (as required)	
C5	CAPACITOR, FIXED SILVERED MICA: .0001 - .001 mf (as required)	
C6	CAPACITOR, AIR VARIABLE: 10 - 140 mmf	1141AV
C7	NONE	
C8	CAPACITOR, FIXED: .1 mf 600 WVDC	11046B
C9	CAPACITOR, FIXED: .1 mf 600 WVDC	11046B
C10	NONE	
C11	NONE	
C12	NONE	
C13	CAPACITOR, FIXED PAPER: .02 mf 600 WVDC	12036P
C14	CAPACITOR, FIXED SILVERED MICA: .0001 - .001 mf (as required)	
C15	CAPACITOR, AIR VARIABLE: 10 - 140 mmf	1141AV
C16	CAPACITOR, FIXED: .1 mf 600 WVDC	11046B**
C17	CAPACITOR, FIXED: .1 mf 600 WVDC	11046B**
C18	CAPACITOR, FIXED PAPER: .05 mf 200 WVDC	15032P
F1	FUSE, 1-1/2 ampere (AC operation)	500012
F1	FUSE, 2 amperes (Battery operation)	500053
F2	FUSE, 1-1/2 ampere (AC operation)	500012
F2	FUSE, 1/4 ampere (Battery operation)	500054

* Channels 1, 2 and 3 only
** Channels 4 and 5 only

Symbol or Item No.	Name and Description	Lynch Part No.
J1 thru J14	JACK, TELEPHONE	500001-1
L1	CHOKE, TYPE 1619	316190
K1	RELAY, PLUG-IN: 6500 ohms	40007R
K2	RELAY, PLUG-IN: 150 ohms	40017R
K3	RELAY, PLUG-IN: 150 ohms	40017R
M1	ASSEMBLY, HYBRID: Type SA33A	90004A
M5	TRANSFORMER, POWER: Type 1653	316530
M9	ASSEMBLY, CAPACITOR: Type SA30	90003
M10	ASSEMBLY, FILTER CHOKE: Type SA43	90008
PO-1	POTENTIOMETER, VARIABLE, COMPOSITION: 100K ohms, 2W	2104CPJ
PO-2	POTENTIOMETER, VARIABLE, COMPOSITION: 100 ohms, 2W	2101CPJ
PO-3	POTENTIOMETER, VARIABLE, COMPOSITION: 100K ohms, 2W	2104CPJ
PO-4	POTENTIOMETER, VARIABLE, COMPOSITION: 100K ohms, 2W	2104CPJ
PO-5	POTENTIOMETER, VARIABLE, COMPOSITION: 100K ohms, 2W	2104CPJ
R1	NONE	
R2	RESISTOR, FIXED WIREWOUND: 2500 ohms, 10W	22521J
R3	RESISTOR, FIXED COMPOSITION: 56K ohms, ±10%, 2W	25631H
R4	RESISTOR, FIXED COMPOSITION: 100K ohms, ±10%, 2W	21041H
R5	RESISTOR, FIXED COMPOSITION: 680K ohms, ±10%, 2W	26841H*
R6	RESISTOR, FIXED WIREWOUND: 200 ohms, 10W	22011J
R7	RESISTOR, FIXED WIREWOUND: 1000 ohms, 10W	21021J
R8	RESISTOR, FIXED COMPOSITION: 560 ohms, ±10%, 2W	25611H
R9	RESISTOR, FIXED WIREWOUND: 300 ohms, 10W	23011J
R10	RESISTOR, FIXED COMPOSITION: 1500 ohms, ±10%, 2W	21521H
R11	RESISTOR, FIXED COMPOSITION: 3300 ohms, ±10%, 2W	23321H
R12	RESISTOR, FIXED COMPOSITION: 27K ohms, ±10%, 2W	22731H
R13	RESISTOR, FIXED WIREWOUND: 1000 ohms, 10W	21021J
R14	RESISTOR, FIXED WIREWOUND: 600 ohms, 10W	26011J

* Channels 1, 2 and 3 only

Symbol or Item No.	Name and Description	Lynch Part No.
R15	NONE	
R16	RESISTOR, FIXED WIREWOUND: 300 ohms, 10W	23011J
R17	RESISTOR, FIXED COMPOSITION: 3300 ohms, ±10%, 2W	23321H
R18	RESISTOR, FIXED COMPOSITION: 1500 ohms, ±10%, 2W	21521H
R19	RESISTOR, FIXED COMPOSITION: 1500 ohms, ±10%, 2W	21521H
R20	RESISTOR, FIXED COMPOSITION: 100 ohms, ±10%, 2W	21011H
R21	NONE	
R22	RESISTOR, FIXED COMPOSITION: 1000 ohms, ±10%, 1W	21021G**
R22	RESISTOR, FIXED COMPOSITION: 270 ohms, ±10%, 1W (may be omitted)	22711G***
R23	RESISTOR, FIXED COMPOSITION: 8200 ohms, ±5%, 1/2W	28225E
R24	RESISTOR, FIXED COMPOSITION: 8200 ohms, ±5%, 1/2W	28225E
R25	RESISTOR, FIXED COMPOSITION: 100K ohms, ±10%, 1/2W	21041E
R26	RESISTOR, FIXED COMPOSITION: 27K ohms, ±10%, 2W	22731H
R27	RESISTOR, FIXED COMPOSITION: 100K ohms, ±10%, 2W	21041H
	TERMINATION, FILTER: Type H105	H105*
S1	TRANSFORMER, OUTPUT TYPE 1606-1	316061
S2	ASSEMBLY, RECEIVE INTERSTAGE TYPE SA49	90006
S3	TRANSFORMER, OUTPUT TYPE 1629-1	316291
S6	TRANSFORMER, OUTPUT TYPE 1629-1	316291
S7	ASSEMBLY, BIAS FILTER TYPE SA48B	90005B
S8	TRANSFORMER, OUTPUT TYPE 1606-1	316061
S9	TRANSFORMER, REPEAT COIL TYPE 1617-2	316172
S10	ASSEMBLY, HYBRID TERMINATING TYPE SA14A	90001A
S11	ASSEMBLY, CAPACITOR TYPE SA31	90002
S13	TRANSFORMER, OUTPUT TYPE 1609-1	316091
S14	TRANSFORMER, REPEAT COIL TYPE 1621	316210
S17	TRANSFORMER, INPUT TYPE 2610	326100
S18	ASSEMBLY, CAPACITOR TYPE SA31	90002
S19	TRANSFORMER, TYPE 1617-2	316172

* Channel 1 only
** Channels 1, 2 and 3 only
*** Channels 4 and 5 only

Symbol or Item No.	Name and Description	Lynch Part No.
	ASSEMBLY, MODULATOR TYPE SA55	90017
	ASSEMBLY, DEMODULATOR TYPE SA56A	90018A
	ASSEMBLY, DIODE TYPE SA123 (optional)	90113
V1	DIODE, GERMANIUM	40002R
V2	DIODE, GERMANIUM	40002R
V3	DIODE, GERMANIUM	40002R
VT-1	TUBE, TYPE 6SN7/GT **	6SN7/GT**
VT-2	TUBE, TYPE 6SN7/GT **	6SN7/GT**
VT-3	TUBE, TYPE 6SN7/GT **	6SN7/GT**
VT-4	TUBE, TYPE 25L6/GT **	25L6/GT**
VT-5	TUBE, TYPE 6SN7/GT **	6SN7/GT**
VT-6	TUBE, TYPE 5Y3/GT (AC operation)	5Y3/GT
	CRYSTAL, TRANSMIT	41005D-*
	CRYSTAL, RECEIVE	41005D-*

* Add frequency in kc after dash in part number.

** This type is for AC or 24 VDC FIL, operation. For 48 VDC FIL, VT-1 VT-2, VT-3, VT-5 are 12SN7/GT and VT-4 is 50L6/GT.

B-37 FILTER SCHEDULE

CHANNEL	M2(RF-1)	M3(SF-2)	M4(SF-1)	M6(LP-2, BP-2)	M7(LP-1, BP-1)	M8(DN)	S4(CRO)	S5(CTO)	S12(SRF)	S15 TR. EQ.	S16 STO
A1W	F-303-1	F-402	F-302-2	F-304A	F-304A	H6B	G214B	G214B	H5A	SA67	G220B
A1E	F-302-1	F-403	F-303-2	F-304A	F-304A	H6B	G214B	G214B	H5A	SA67	G220B
A2E	F-312-1	F-411	F-311-2	F-300A	F-300A	H7B	G223B	G222B	H3A	SA67	G221B
A2W	F-311-1	F-412	F-312-2	F-300A	F-300A	H7B	G222B	G223B	H3A	SA67	G221B
A3W	F-314-1	F-413	F-313-2	F-300A	F-300A	H7B	G225B	G224B	H3A	SA67	G221B
A3E	F-313-1	F-414	F-314-2	F-300A	F-300A	H7B	G224B	G225B	H3A	SA67	G221B
A4E	F-316-1C	F-415C	F-315-2	F-300A	F-300A	H7B	G227D	G226D	H3A	SA68	G221B
A4W	F-315-1C	F-416C	F-316-2	F-300A	F-300A	H7B	G226D	G227D	H3A	SA68	G221B
A5W	F-318-1C	F-417C	F-317-2	F-300A	F-300A	H7B	G229D	G228D	H3A	SA68	G221B
A5E	F-317-1C	F-418C	F-318-2	F-300A	F-300A	H7B	G228D	G229D	H3A	SA68	G221B
B2E	F-322-1	F-411	F-321-2	F-300A	F-300A	H7B	G232B	G231B	H3A	SA67	G221B
B2W	F-321-1	F-412	F-322-2	F-300A	F-300A	H7B	G231B	G232B	H3A	SA67	G221B
B3W	F-324-1	F-413	F-323-2	F-300A	F-300A	H7B	G234B	G233B	H3A	SA67	G221B
B3E	F-323-1	F-414	F-323-2	F-300A	F-300A	H7B	G233B	G234B	H3A	SA67	G221B
B4E	F-326-1C	F-415C	F-325-2	F-300A	F-300A	H7B	G236D	G235D	H3A	SA68	G221B
B4W	F-325-1C	F-416C	F-326-2	F-300A	F-300A	H7B	G235D	G236D	H3A	SA68	G221B
B5W	F-328-1C	F-417C	F-327-2	F-300A	F-300A	H7B	G238D	G237D	H3A	SA68	G221B
B5E	F-327-1C	F-418C	F-328-2	F-300A	F-300A	H7B	G237D	G238D	H3A	SA68	G221B

Notes:

1. One H105 is used in each Channel 1 unit.
2. Sub-assemblies used on all channels are listed alphabetically on previous pages.

TYPE B40

CARRIER PILOT REGULATOR

MAINTENANCE PARTS LIST

Symbol or Item No.	Name and Description	Lynch Part No.
	EQUALIZER: Type H161	H161*
	EQUALIZER: Type H162	H162**
F1	FUSE: 1 amp (AC operation)	500025
F1	FUSE: 2 amp (battery operation)	500053
F2	FUSE: 1 amp (AC operation)	500025
F2	FUSE: 1/4 amp (battery operation)	500054
J1 thru 16	JACK, TELEPHONE	500001-1
LM-1	LAMP: 6W, 120V } Do not replace individually.	42001L
LM-2	LAMP: 6W, 120V } Replace as a matched set.	42001L
M1	See schedule Page 2	
M2	ASSEMBLY, CAPACITOR: Type SA30	90003
M3	TRANSFORMER: Type 1653	316530
MR-1	METER: 0-50 DC ma. (optional)	42503M
PO-1	POTENTIOMETER, VARIABLE COMPOSITION: 100K ohms, 2W	2104CPJ
PO-2	POTENTIOMETER, VARIABLE WIREWOUND: 600 ohms, 2W	2601WP
PO-3	POTENTIOMETER, VARIABLE COMPOSITION: 500K ohms, 2W	2504CPJ
R1	RESISTOR, FIXED WIREWOUND: 300 ohms, 10W	23011J
R2	RESISTOR, FIXED WIREWOUND: 600 ohms, 10W	26011J
R3	RESISTOR, FIXED DEPOSITED CARBON: 470 ohms, ±1%, 2W	2K0010HH
R4	RESISTOR, FIXED DEPOSITED CARBON: 470 ohms, ±1%, 2W	2K0010HH
R5	RESISTOR, FIXED COMPOSITION: 39K ohms, ±10%, 2W	23931H
R6	RESISTOR, FIXED WIREWOUND: 300 ohms, 10W	23011J
R7	RESISTOR, FIXED COMPOSITION: 47K ohms, ±10%, 2W	24731H

* Channel 1 only
** Channels 2, 3, 4 and 5

Symbol or Item No.	Name and Description	Lynch Part No.
R8	RESISTOR, FIXED WIREWOUND: 300 ohms, 10W	23011J
R9	RESISTOR, FIXED COMPOSITION: ±10%, 2W (factory selected or may be omitted)	
R10	RESISTOR, FIXED WIREWOUND: 500 ohms, 10W	25011J
R11	RESISTOR, FIXED COMPOSITION: 56 ohms, ±10%, 2W	25601H
S1	TRANSFORMER: Type 1619	316190
S2	TRANSFORMER: Type 1619	316190
S3	TRANSFORMER: Type 1609-1	316091
S4	TRANSFORMER: Type 1646	316460
S5	TRANSFORMER: Type 1608-1	316081
S6	ASSEMBLY, BYPASS NETWORK: Type SA47	90046
S7	TRANSFORMER: Type 2613-2	326132
S8	TRANSFORMER: Type 1602	316020
S9	ASSEMBLY, BIAS NETWORK: Type SA46A	90045A
S10	TRANSFORMER: Type 1637	316370
V1	DIODE, GERMANIUM	40002R
V2	DIODE, GERMANIUM	40002R
V3	DIODE, GERMANIUM	40002R
VT-1 thru VT-4	TUBE: Type 6SN7/GT*	6SN7/GT*
VT-5	TUBE: Type 5Y3/GT (AC operation)	5Y3/GT

* This type is for AC or 24 VDC FIL operation. For 48 VDC FIL, VT-1 thru VT-4 are 12SN7/GT.

M1 SCHEDULE

CHANNEL	M1
1W	F405
1E	F404
2W	F411
2E	F412
3W	F414
3E	F413
4W	F420
4E	F421
5W	F423
5E	F422

Type B57

SINGLE CHANNEL CARRIER REPEATER

MAINTENANCE PARTS LIST

Symbol or Item No.	Name and Description	Lynch Part No.
AT-1	ATTENUATOR: 150 ohms	2E0010A-1**
AT-1	ATTENUATOR: 600 ohms	2E0007A-1*
AT-2	ATTENUATOR: 150 ohms	2E0010A-1**
AT-2	ATTENUATOR: 600 ohms	2E0007A-1*
F1	FUSE: 1-1/2 amp (AC operation)	500012
F1	FUSE: 2 amps (battery operation)	500053
F2	FUSE: 1-1/2 amp (AC operation)	500012
F2	FUSE: 1/4 amp (battery operation)	500054
J1 thru J6	JACK, TELEPHONE	500001-1
M3	ASSEMBLY, CHOKE: Type SA43	90008
M4	ASSEMBLY, CHOKE: Type SA43	90008
M5	TRANSFORMER: Type 1653	316530
M8	ASSEMBLY, CAPACITOR: Type SA30	90003
M9	ASSEMBLY, CAPACITOR: Type SA30	90003
M10	EQUALIZER	***
PO-1	POTENTIOMETER, VARIABLE COMPOSITION: 100K ohms, 2W	2104CPJ
PO-2	POTENTIOMETER, VARIABLE COMPOSITION: 100K ohms, 2W	2104CPJ
R1	RESISTOR, FIXED WIREWOUND: 10 ohms, 10W	21001J
R2	RESISTOR, FIXED WIREWOUND: 10 ohms, 10W	21001J
R3	RESISTOR, FIXED COMPOSITION: 560 ohms, ±10%, 2W	25611H*
R3	RESISTOR, FIXED COMPOSITION: 150 ohms, ±10%, 2W	21511H**
R4	RESISTOR, FIXED WIREWOUND: 300 ohms, 10W	23011J
R5	RESISTOR, FIXED COMPOSITION: 560 ohms, ±10%, 2W	25611H*
R5	RESISTOR, FIXED COMPOSITION: 150 ohms, ±10%, 2W	21511H**

* For channels 1, 2 & 3 only
** For channels 4 & 5 only
*** Optional - Line filter equalizer as needed for

Symbol or Item No.	Name and Description	Lynch Part No.
R6	RESISTOR, FIXED WIREWOUND: 300 ohms, 10W	23011J
R7	RESISTOR, FIXED COMPOSITION: 22K ohms, ±10%, 2W	22231H
R8	RESISTOR, FIXED COMPOSITION: 22K ohms, ±10%, 2W	22231H
S1	ASSEMBLY, NETWORK INTERSTAGE: Type SA44	90058
S2	ASSEMBLY, NETWORK INTERSTAGE: Type SA45	90059
S3	TRANSFORMER: Type 1609-1	316091
S4	EQUALIZER	*
S5	TRANSFORMER, Type 1609-1	316091
S6	ASSEMBLY, INTERSTAGE NETWORK: Type SA45	90059
S7	ASSEMBLY, INTERSTAGE NETWORK: Type SA44	90058
	TERMINATION, FILTER: Type H105	**
VT-1	TUBE, Type 6SN7/GT ***	6SN7/GT
VT-2	TUBE, Type 25L6/GT ***	25L6/GT
VT-3	TUBE, Type 25L6/GT ***	25L6/GT
VT-4	TUBE, Type 6SN7/GT***	6SN7/GT
VT-5	TUBE, Type 5Y3/GT (AC operation)	5Y3/GT

* Optional - Line filter equalizer as needed for installation

** For channel 1 only: 2 required per channel

*** This type is for AC or 24 VDC FIL operation. For 48 VDC FIL, VT-1, VT-4 are 12SN7/GT and VT-2, VT-3 are 50L6/GT.

B57 FILTER SCHEDULE

CHANNEL	M1	M6	S8	M2	M7	S9
1	F403	F403	H152	F402	F402	H151
2	F411B	F411B	H153	F412B	F412B	H154
3	F414B	F414B	H156	F413B	F413B	H155
4	F420B	F420B	H157	F421B	F421B	H158
5	F423B	F423B	H160	F422B	F422B	H159

LYNCH CARRIER SYSTEMS INC.
695 Bryant Street
San Francisco 7, California

Type B62

SINGLE CHANNEL PILOT REGULATOR

MAINTENANCE PARTS LIST

Symbol or Item No.	Name and Description	Lynch Part No.
C1 C2 C3	NONE	
C4	CAPACITOR, FIXED SILVERED MICA: (as required)	*
C4	CAPACITOR, AIR VARIABLE: 10-140 mmf	1141AV**
F1	FUSE: 1-1/2 amps (AC operation)	500012
F1	FUSE: 2 amps (battery operation)	500053
F2	FUSE: 1-1/2 amps (AC operation)	500012
F2	FUSE: 1/4 amps (battery operation)	500054
J1 thru J6	JACK, TELEPHONE	500001-1
LM-1	LAMP, 6W, 120V } Do not replace individually.	500051
LM-2	LAMP, 6W, 120V } Replace as a matched set.	500051
M3	ASSEMBLY, FILTER CHOKE: Type SA43	90008
M4	ASSEMBLY, CAPACITOR: Type SA30	90003
M5	TRANSFORMER: Type 1653	316530
MR-1	METER: 0-50 DC ma	42503M***
PO-1	POTENTIOMETER, VARIABLE COMPOSITION: 100K ohms, 2W	2104CPJ
PO-2	POTENTIOMETER, VARIABLE WIREWOUND: 600 ohms, 2W	2601WP
PO-3	POTENTIOMETER, VARIABLE COMPOSITION: 500K ohms, 2W	2504CPJ
R1	NONE	
R2	RESISTOR, FIXED WIREWOUND: 600 ohms, 10W	26011J
R3	RESISTOR, FIXED WIREWOUND: 5K ohms, 10W	25021J
R4	RESISTOR, FIXED COMPOSITION: 6800 ohms, ±10%, 2W	26821H
R5	RESISTOR, FIXED COMPOSITION: 470 ohms, ±10%, 2W	24711H

* Channel 1 only
** Channels 2 thru 5 only
*** Optional

Symbol or Item No.	Name and Description	Lynch Part No.
R5	RESISTOR, FIXED COMPOSITION: 100 ohms, ±10%, 2W	21011H**
R6	RESISTOR, FIXED COMPOSITION: 470 ohms, ±10%, 2W	24711H*
R6	RESISTOR, FIXED COMPOSITION: 270 ohms, ±10%, 2W	22711H**
R7	RESISTOR, FIXED COMPOSITION: 180 ohms, ±10%, 2W	21811H*
R7	RESISTOR, FIXED COMPOSITION: 270 ohms, ±10%, 2W	22711H**
R8	RESISTOR, FIXED WIREWOUND: 1000 ohms, 10W	21021J
R9	RESISTOR, FIXED COMPOSITION: 100K ohms, ±10%, 2W	21041H
R10	RESISTOR, FIXED DEPOSITED CARBON: 470 ohms, ±1%, 2W	2K0010HH
R11	RESISTOR, FIXED DEPOSITED CARBON: 470 ohms, ±1%, 2W	2K0010HH
R12	RESISTOR, FIXED COMPOSITION: 39K ohms, ±10%, 2W	23931H
R13	RESISTOR, FIXED WIREWOUND: 300 ohms, 10W	23011J
R14	RESISTOR, FIXED COMPOSITION: 47K ohms, ±10%, 2W	24731H
R15	RESISTOR, FIXED WIREWOUND: 300 ohms, 10W	23011J
R16	RESISTOR, FIXED COMPOSITION: 10K ohms, ±10%, 2W	21031H
R17	RESISTOR, FIXED COMPOSITION: 12K ohms, ±10%, 1W	21231G
R18	RESISTOR, FIXED COMPOSITION: 4700 ohms, ±10%, 1W	24721G
R19	RESISTOR, FIXED WIREWOUND: 1500 ohms, 10W	21521J
R20	RESISTOR, FIXED WIREWOUND: 1500 ohms, 10W	21521J
R21	RESISTOR, FIXED COMPOSITION: 56 ohms, ±10%, 2W	25601H
R22	RESISTOR, FIXED COMPOSITION: 100 ohms, ±10%, 2W	21011H**
R23	RESISTOR, FIXED WIREWOUND: 200 ohms, 10W	22011J
S1	TRANSFORMER, TYPE 1646	316460
S2	TRANSFORMER, TYPE 1609-1	316091
S3	TRANSFORMER, TYPE 1609-1	316091

* Channel 1 only
** Channels 2 thru 5 only

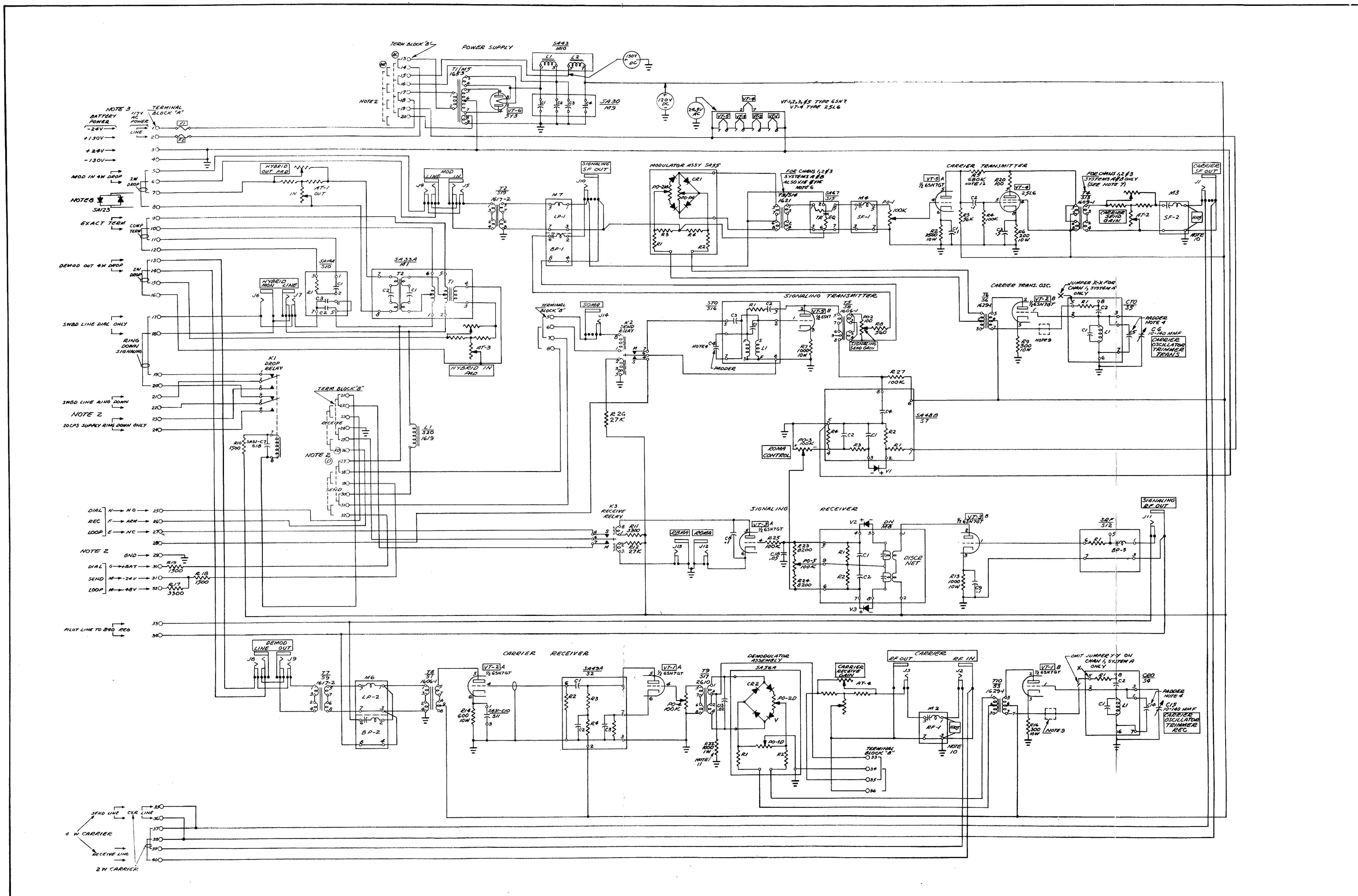
Symbol or Item No.	Name and Description	Lynch Part No.
S4	TRANSFORMER, TYPE 1629-1	316291**
S5	TRANSFORMER, TYPE 2613-2	326132
S6	ASSEMBLY, BIAS NETWORK TYPE SA52	90055
S7	ASSEMBLY, INTERSTAGE NETWORK TYPE SA49	90006
S8	TRANSFORMER, TYPE 1608-1	316081
S9	ASSEMBLY, BIAS NETWORK TYPE SA46A	90045A
S10	ASSEMBLY, CAPACITOR TYPE SA31	90002*
S11	TRANSFORMER, TYPE 1637	316370
V1 V2 V3	DIODE, GERMANIUM	40002R
V4 V5 V6 V7	DIODE, GERMANIUM	40002R**
VT-1	TUBE, TYPE 6SN7/GT ***	6SN7/GT
VT-2	TUBE, TYPE 6SN7/GT ***	6SN7/GT
VT-3	TUBE, TYPE 6SN7/GT ***	6SN7/GT
VT-4	TUBE, TYPE 6SN7/GT ***	6SN7/GT
VT-5	TUBE, TYPE 25L6/GT ***	25L6/GT
VT-6	TUBE, TYPE 5Y3/GT (AC operation)	5Y3/GT

* Channel 1 only ** Channels 2 thru 5 only.

*** This type is for AC or 24 VDC FIL operation. For 48 VDC FIL, VT-1 thru VT-4 are 12SN7/GT and VT-5 is 50L6/GT.

B62 FILTER SCHEDULE

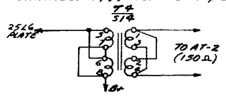
CHANNEL	M2	S10	M1	EQ
A1WE	F449	NOT REQ'D	F306	H163
A1EW	F450	NOT REQ'D	F307	H164
A2EW	F451	G322	F305A	H162
A2WE	F452	G323	F305A	H162
A3WE	F453	G324	F305A	H162
A3EW	F454	G325	F305A	H162
A4EW	F455	G326	F305A	H162
A4WE	F456	G327	F305A	H162
A5WE	F457	G328	F305A	H162
A5EW	F458	G329	F305A	H162
B1WE	F449	NOT REQ'D	F306	H163
B1EW	F450	NOT REQ'D	F307	H164
B2EW	F451	G331	F305A	H162
B2WE	F452	G332	F305A	H162
B3WE	F453	G333	F305A	H162
B3EW	F454	G334	F305A	H162
B4EW	F455	G335	F305A	H162
B4WE	F456	G336	F305A	H162
B5WE	F457	G337	F305A	H162
B5EW	F458	G338	F305A	H1´2



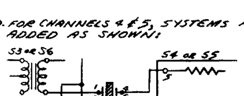
NOTES:

1. LEADS WITH ARROWHEADS PROVIDED BY INSTALLER AS REQUIRED.
2. EQUIPMENT SUPPLIED FOR AC POWER AND RINGDOWN SIGNALING, OTHER OPTIONS MUST BE ARRANGED BY INSTALLER.
3. FOR PROPER POWER SOURCE, CHECK HOOK-UP ON BOTH "A" AND "B" TERMINAL BLOCKS, BEFORE CONNECTING POWER.
4. FOR DETAILS OF COMPONENTS, SEE PARTS LIST.
5. "S" AND "M" NUMBERS INDICATE SMALL & MEDIUM CONTAINER POSITIONS, SEE PARTS LOCATION DIAGRAM.
6. FOR CHANNELS 4 & 5, SYSTEMS A & B:

7. FOR CHANNELS 4 & 5, SYSTEMS A & B:



8. OPTIONAL DIODES (SA123) CONNECT ACROSS REAR TERMINALS 7 & 8 FOR 2W OPERATION.
9. FOR CHANNELS 4 & 5, SYSTEMS A & B, XTAL IS ADDED AS SHOWN:



10. FILTER TERMINATION H105 CONNECT TO PINS 1 & 3 OF:
    SF-2 (M3) - A1W ONLY
    RF-1 (M2) - A1E ONLY
11. VALUE OF R22:
    1K, 1W, FOR CHANNELS 1, 2 & 3.
    270, 1W, FOR CHANNELS 4 & 5, OR MAY BE OMITTED.
12. OMIT ON CHANNELS 4 & 5.
13. TUBES SHOWN FOR AC & 24 VDC FIL. OPERATION. 48 VDC FIL TUBES ARE:
    VT-1, VT-2, VT-3, VT-5: 12SN7
    VT4: 50L6

APPR. BY	START SERIAL NO.	DESCRIPTION OF CHANGE	C. O. NO.	DATE	ISSUE
MR	371538	R26, R27 added (were in SA48A). S7 was SA48A. S10 was SA14.	G1843	10-17-58	P5
MR	371526	C18, PO-5, R23, R24 & R25 added. M8 was H6A (CH 1) & H7A (CH 2-5).	G1830	9-26-58	P4
MR	371483	Crystal oscillator resistors R15 & R21 deleted.	G1779	6-19-58	P3
MR	371371	Relays K1, K2, K3 connections changed.	G1448	9-17-57	P2
MR	37709	ORIGINAL	539	2-25-55	P1

TITLE:

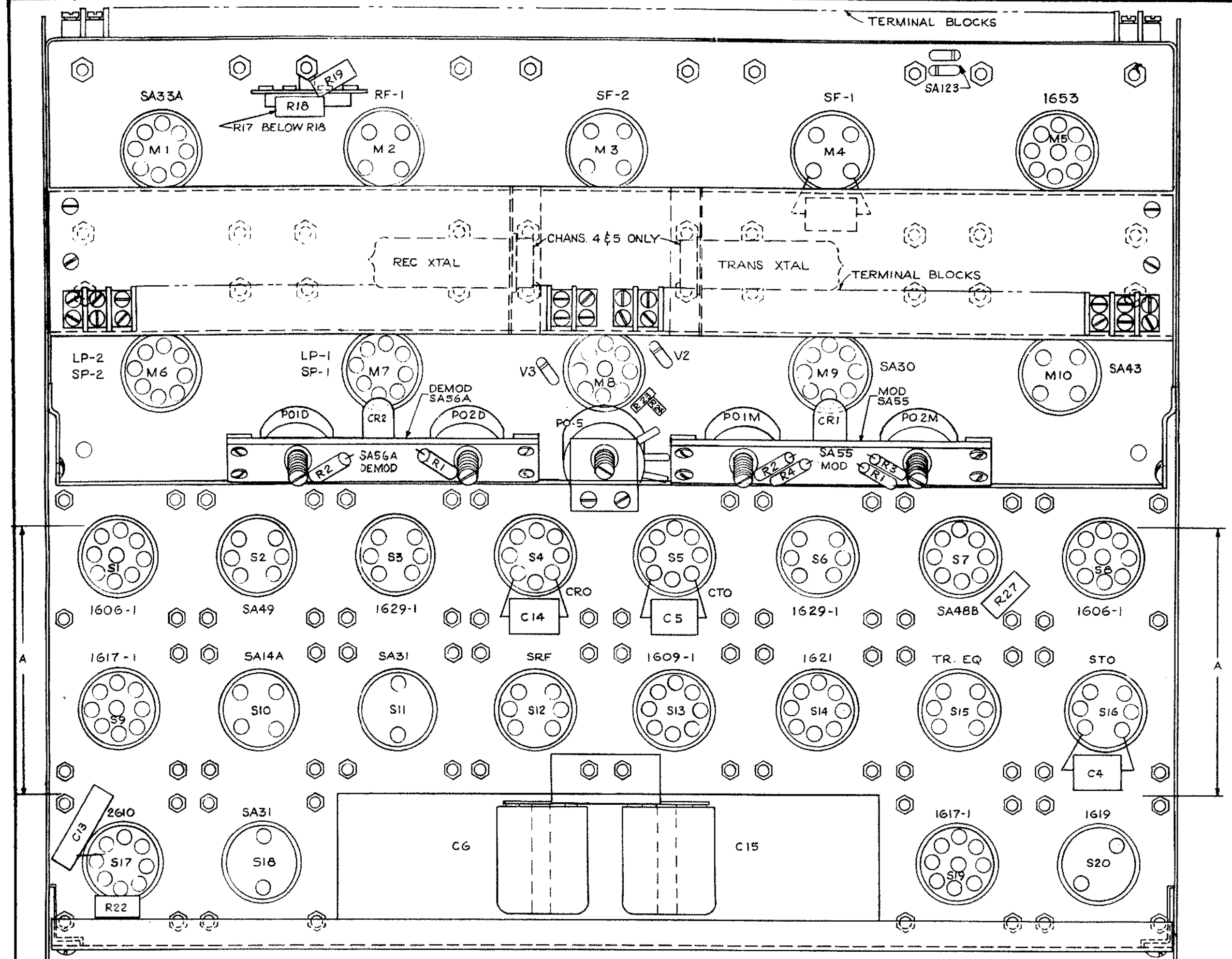
CARRIER TELEPHONE TERMINAL TYPE B37 SCHEMATIC

Lynch TELEPHONE SYSTEMS

LYNCH CARRIER SYSTEMS INC
695 BRYANT ST. SAN FRANCISCO

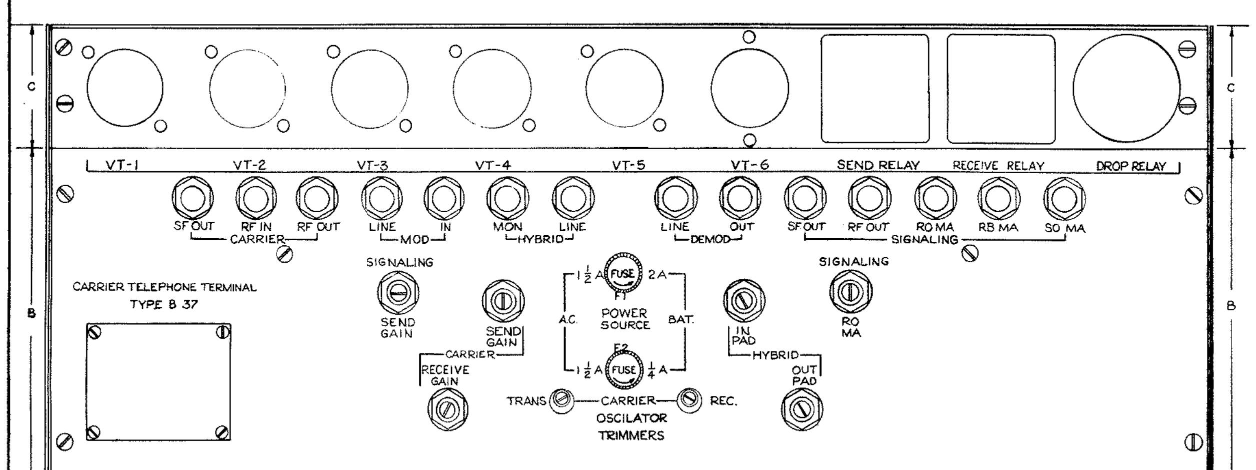
DRAWING NO. B37-14

ISSUE P4

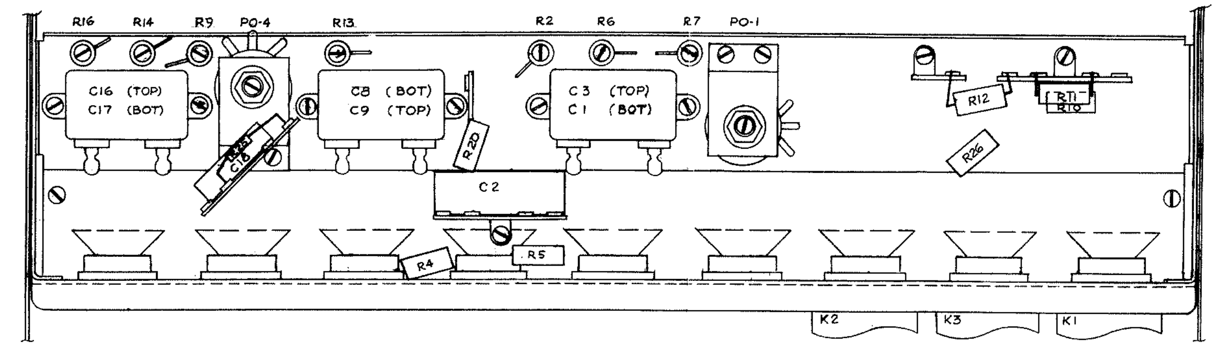


TOP VIEW

(SHOWN REMOVED FROM CABINET)
(WITH TUBE ROW OMITTED)

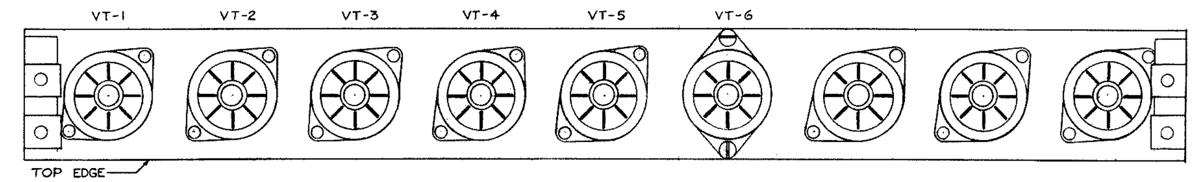


FRONT VIEW

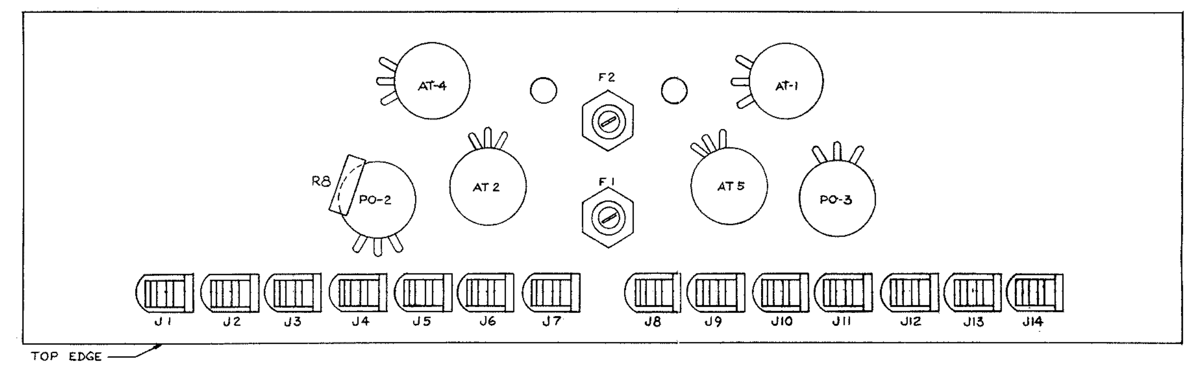


A - A
TOP VIEW

TUBE ROW



C - C
REAR VIEW



B - B
REAR VIEW

NOTES

1. C16 & C17 ARE OMITTED ON CHANNELS 1, 2, 3.

NOTES UNLESS OTHERWISE SPECIFIED

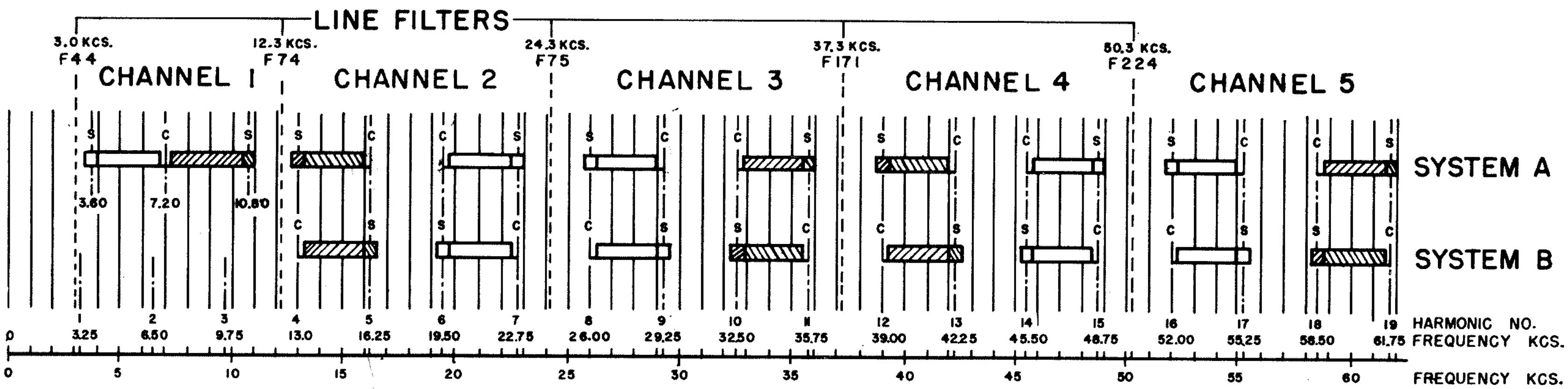
APPR. BY	START SERIAL NO.	DESCRIPTION OF CHANGE	C.O. NO.	DATE	ISSUE
mar	371538	Add R26 & R27 S7 was SA48A S10 was SA14.	G1843	10-17-58	P4
mar	371526	C18, PO-5, R23, R24 & R25 added.	G1830	9-26-58	P3
mar	371371	Relays K1, K2, K3 were on chassis behind tube row. R15 & R21 deleted.	G1448	9-17-57	P2
mar	37709	ORIGINAL	539	2-25-55	P1

TITLE:
CARRIER
TELEPHONE TERMINAL
TYPE B37
PARTS LOCATION

Q

Lynch TELEPHONE SYSTEMS
LYNCH CARRIER SYSTEMS INC.
695 BRYANT ST. SAN FRANCISCO, CALIF.

DRAWING NO. B37-20 | ISSUE P4



NOTES:

"S" INDICATES — MEAN SIGNALLING FREQUENCY

"C" " — CARRIER FREQUENCY

SHADED AREAS INDICATE — EAST TO WEST TRANSMISSION

APPR. BY	START SERIAL NO.	DESCRIPTION OF CHANGE	C. O. NO.	DATE	ISSUE
WAR	37001	ORIGINAL	---	4/52	P1

TITLE:

FREQUENCY ALLOCATION
TYPE B37
CARRIER TELEPHONE
SYSTEM

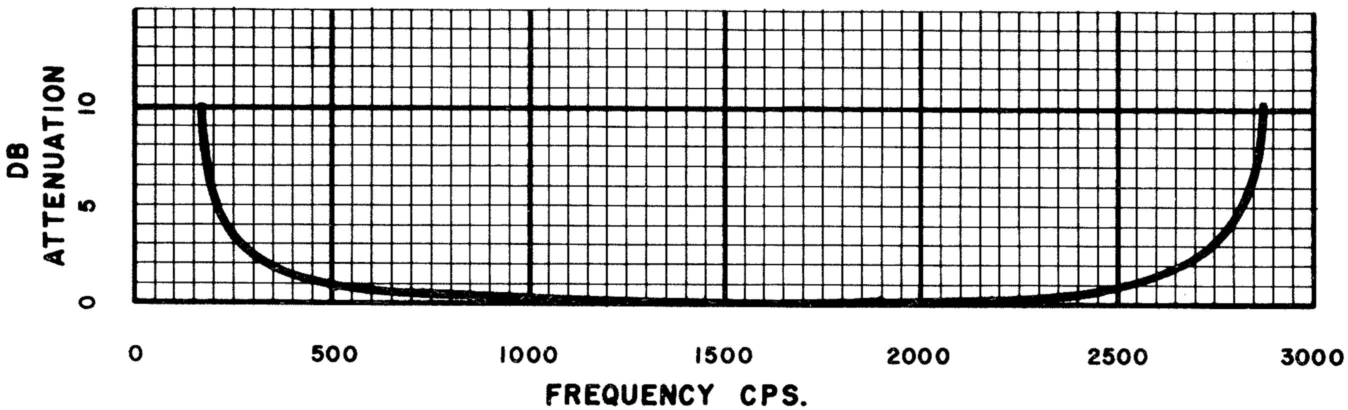
D

Lynch TELEPHONE SYSTEMS

LYNCH CARRIER SYSTEMS INC.
695 BRYANT ST. SAN FRANCISCO, CALIF.

DRAWING NO. B37-27

ISSUE P1



APPR. BY	START SERIAL NO.	DESCRIPTION OF CHANGE	C. O. NO.	DATE	ISSUE
MCR	---	ORIGINAL	---	8/51	P1

TITLE:

TYPICAL
OVERALL RESPONSE CURVE
SWITCHBOARD TO SWITCHBOARD
TYPE B37
CARRIER TELEPHONE SYSTEM

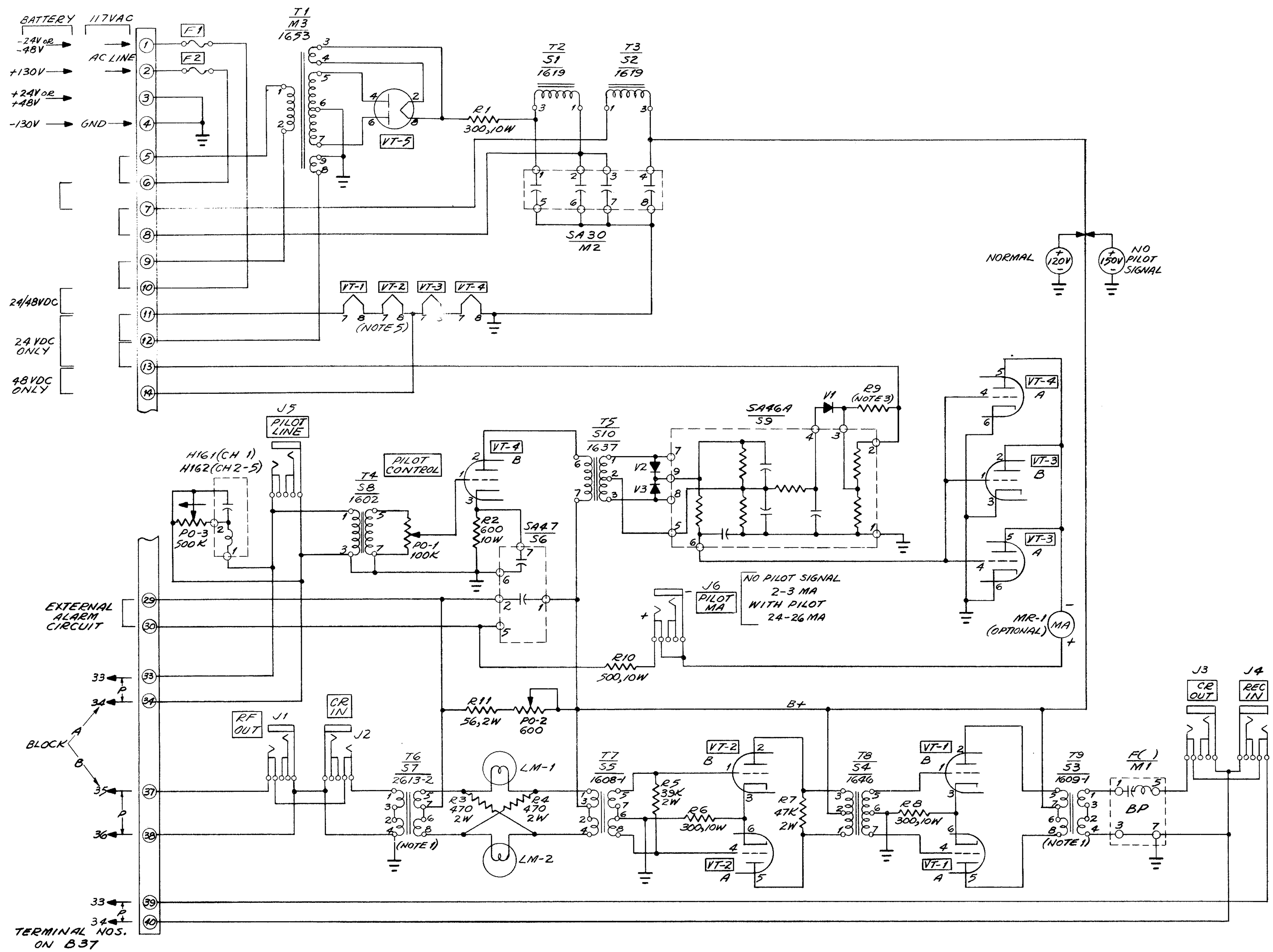
A

Lynch TELEPHONE SYSTEMS

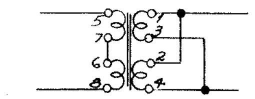
LYNCH CARRIER SYSTEMS INC.
695 BRYANT ST. SAN FRANCISCO, CALIF.

DRAWING NO. B37-29

ISSUE P1



NOTES:

1. 

CIRCUIT SCHEMATIC SHOWS T6 & T9 STRAPPED FOR CHANNELS 1, 2 & 3. FOR CHANNELS 4 & 5, STRAP BOTH T6 & T9 AS SHOWN ABOVE.

2. LEADS WITH ARROWHEADS PROVIDED BY INSTALLER, AS REQUIRED.
3. R9 IS FACTORY SELECTED (2W, 10%), OR MAY BE OMITTED AS REQUIRED.
4. ENCLOSED DESIGNATIONS APPEAR ON FRONT PANEL.
5. TUBE TYPES ARE LISTED BELOW:

	VT-1 THRU VT-4	VT-5
AC SUPPLY	6SN7/GT	5Y3/GT
24VDC FIL	6SN7/GT	NOT REQD
48 VDC FIL	12SN7/GT	NOT REQD

APPR. BY	START SERIAL NO.	DESCRIPTION OF CHANGE	C. O. NO.	DATE	ISSUE
wh	40575	Wiring for optional 48V battery operation added.	G1895	12-10-58	P2
wh	40403	ORIGINAL	996	5-7-56	P1

TITLE:

CARRIER PILOT REGULATOR TYPE B40 SCHEMATIC

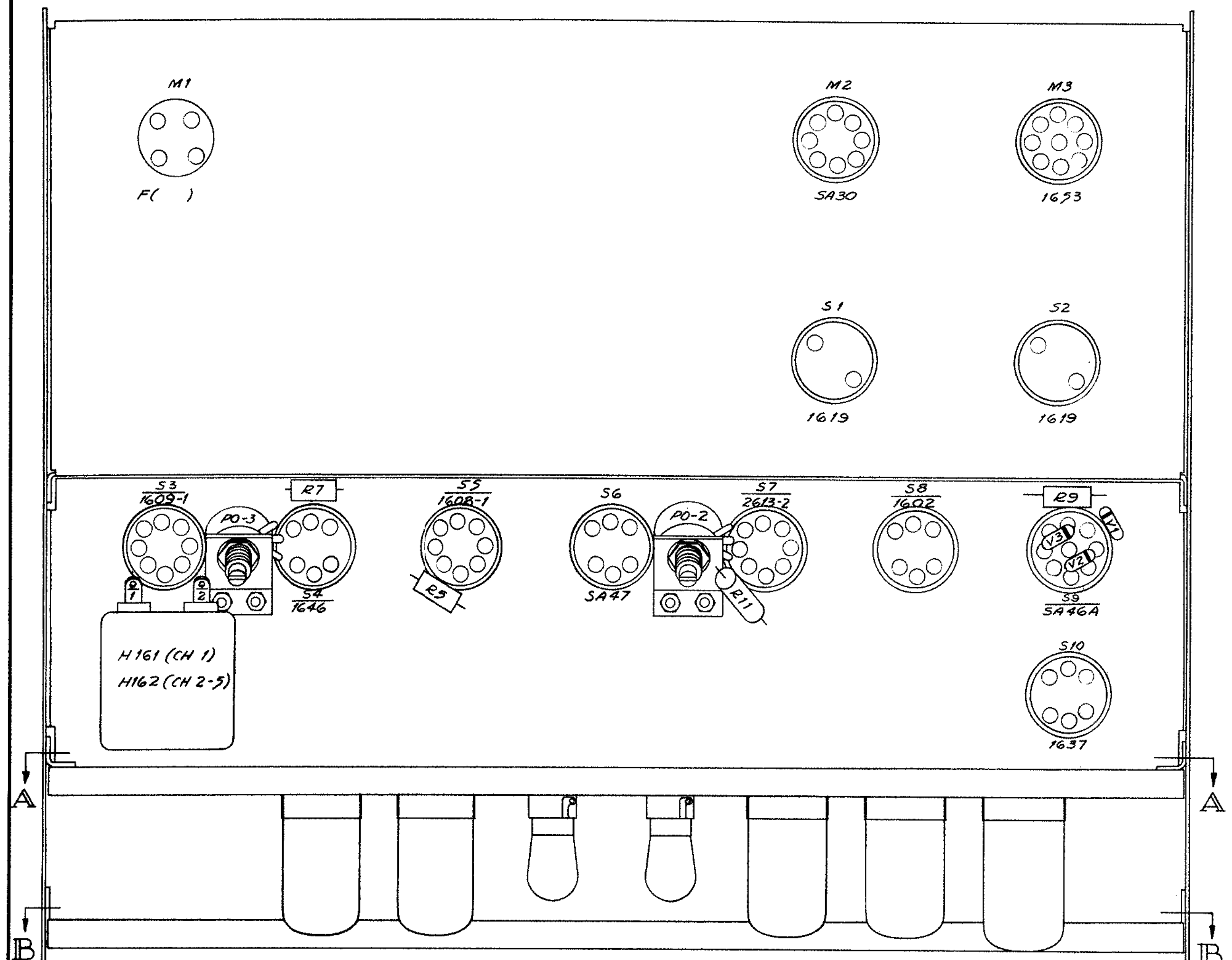
2

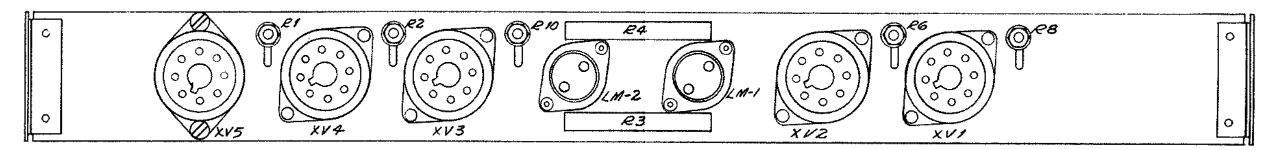
Lynch TELEPHONE SYSTEMS

LYNCH CARRIER SYSTEMS INC. 695 BRYANT ST. SAN FRANCISCO, CALIF.

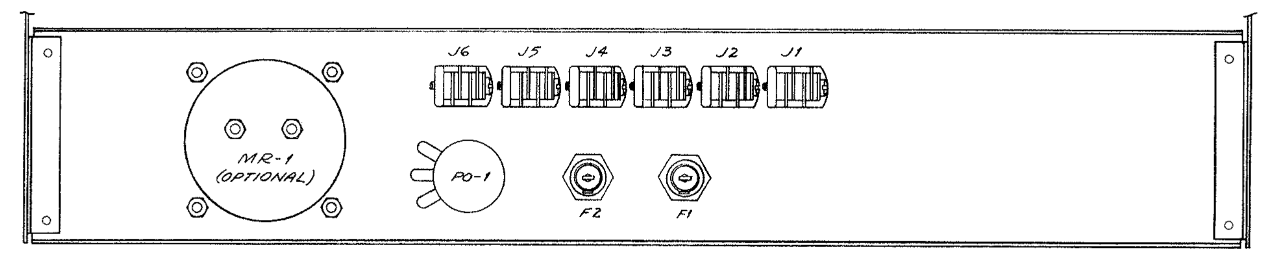
DRAWING NO. B40-3

ISSUE P1

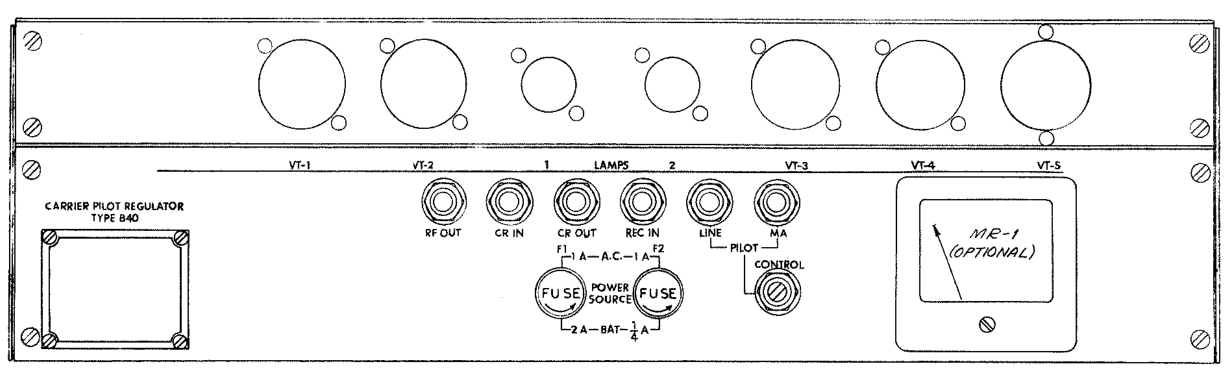




VIEW "A-A"



VIEW "B-B"



	40403	ORIGINAL	996	5-7-56	P1
APPR. BY	START SERIAL NO.	DESCRIPTION OF CHANGE	C.O. NO.	DATE	ISSUE

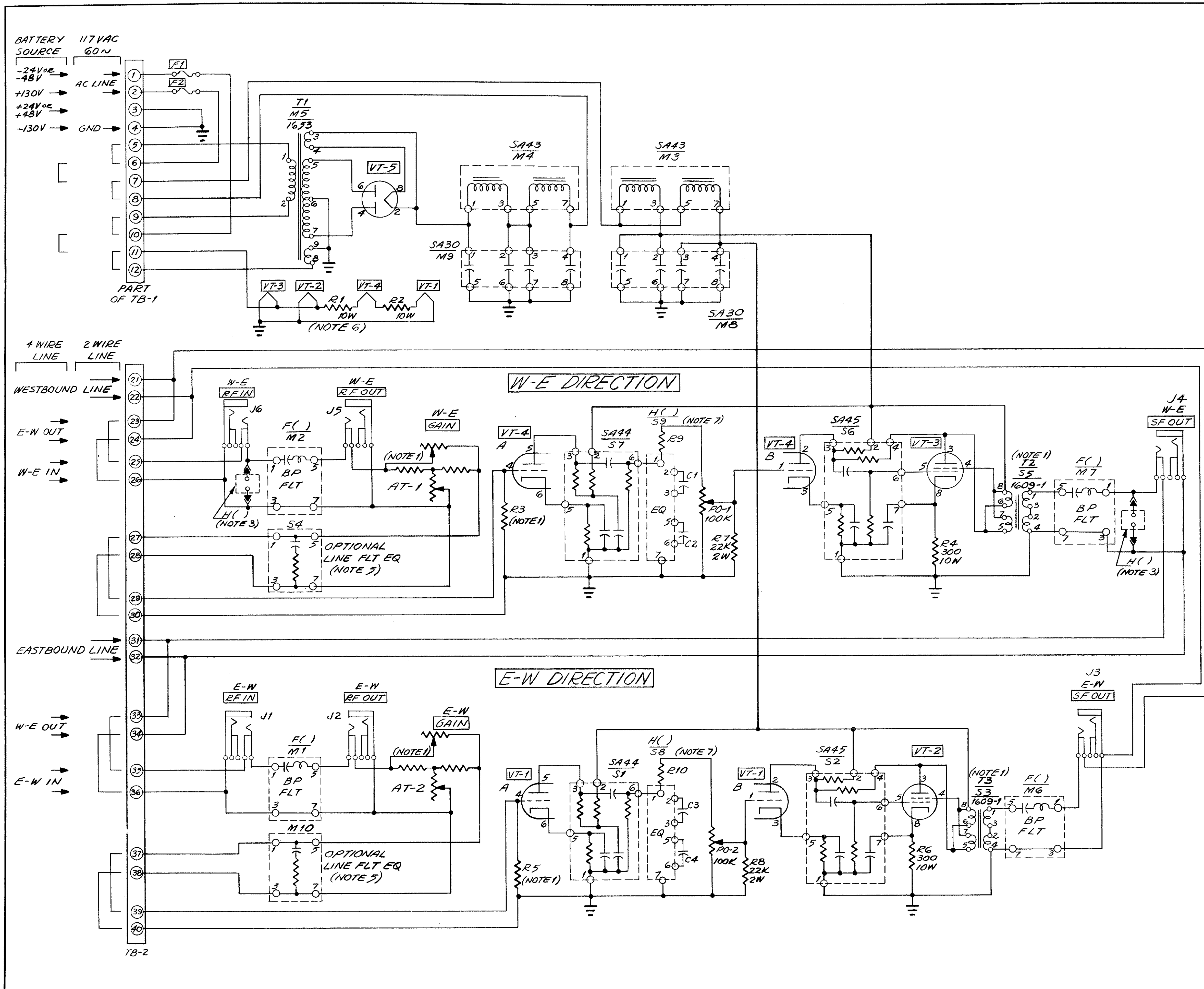
TITLE:

CARRIER
PILOT REGULATOR
TYPE B40
PARTS LOCATION

2

Lynch
TELEPHONE SYSTEMS
LYNCH CARRIER SYSTEMS INC.
695 BRYANT ST. SAN FRANCISCO, CALIF.

DRAWING NO. B40-4 | ISSUE P1



NOTES:

1.

	FOR CHANNELS 1, 2 & 3	FOR CHANNELS 4 & 5
AT-1, AT-2	600Ω	150Ω
R3, R5	560Ω, 2W, COMP	150Ω, 2W, COMP
ALL JACK IMPEDANCES	600Ω	150Ω
T2, T3	STRAP AS SHOWN	STRAP

2. LEADS WITH ARROWHEADS ARE PROVIDED BY INSTALLER.

3. BAND PASS FILTER TERMINATIONS ARE USED IN CHANNEL 1 ONLY.

4. ENCLOSED DESIGNATIONS APPEAR ON FRONT PANEL.

5. LINE FILTER EQUALIZERS INCLUDED ONLY IF REQD.

6.

FILAMENT VOLTAGE	VALUE R1 & R2	TUBE TYPES				
		VT-1	VT-2	VT-3	VT-4	VT-5
AC SUPPLY	10Ω	6SN7/GT	25L6/GT	25L6/GT	6SN7/GT	5Y3/GT
24V FIL						NOT REQD
48V FIL	40Ω	12SN7/GT	50L6/GT	50L6/GT	12SN7/GT	NOT REQD

7. VALUES OF C1, C2, C3, C4, R9 & R10 SELECTED TO PROVIDE FLAT OVERALL RESPONSE. MAY BE OMITTED IF NOT REQUIRED. FOR CHAN 1, C1 OR C3 CONNECTS TO PINS 3 & 5 OF EQUALIZER. C2 & C4 ARE OMITTED.

APPR. BY	START SERIAL NO.	DESCRIPTION OF CHANGE	C. O. NO.	DATE	ISSUE
wR	57145	AT-1 & AT-2 changed to bridged T-pads.	1276	12-18-57	P2
wR	57104	ORIGINAL	571	4-18-55	P1

TITLE:

SINGLE CHANNEL REPEATER TYPE B57 SCHEMATIC

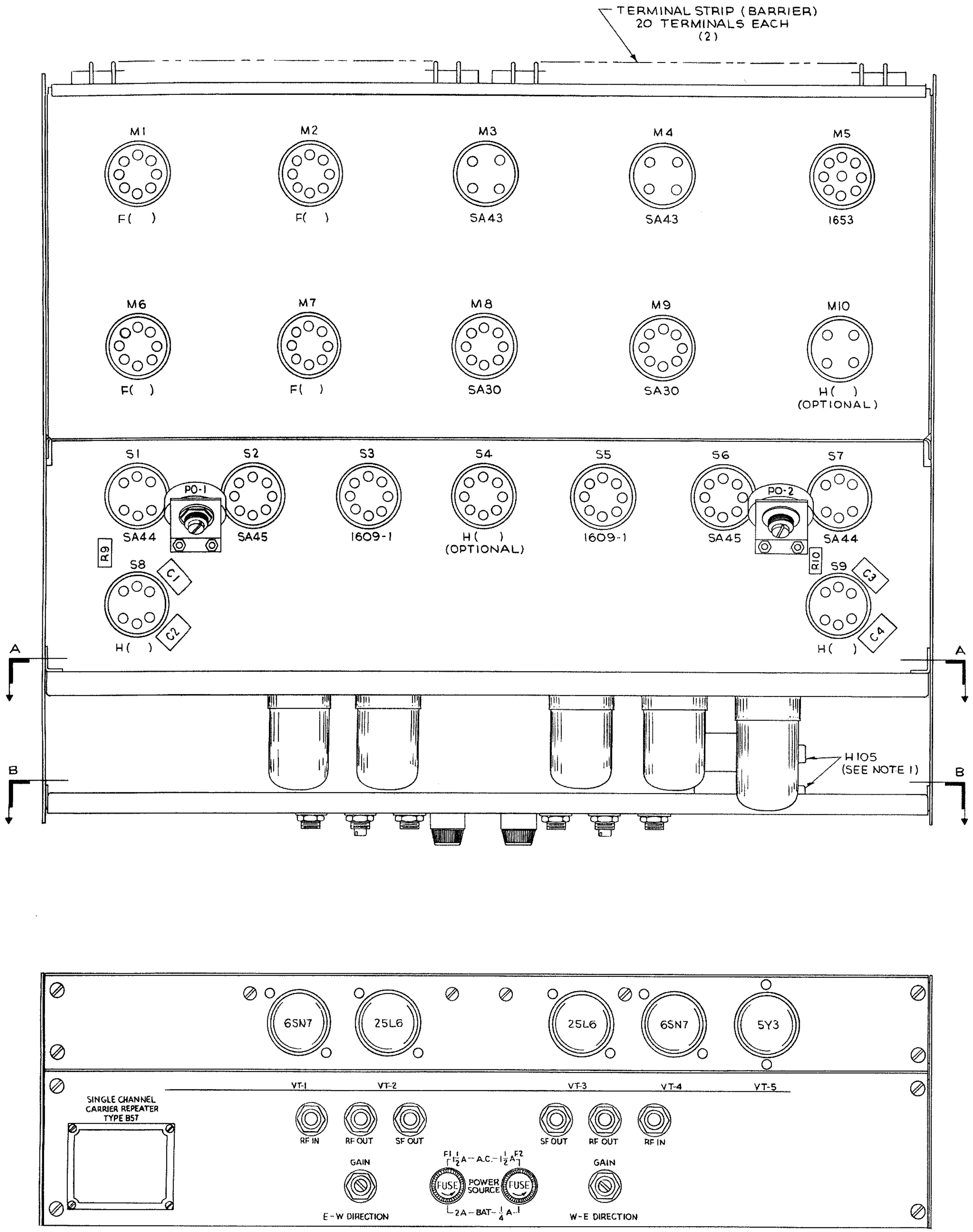
2

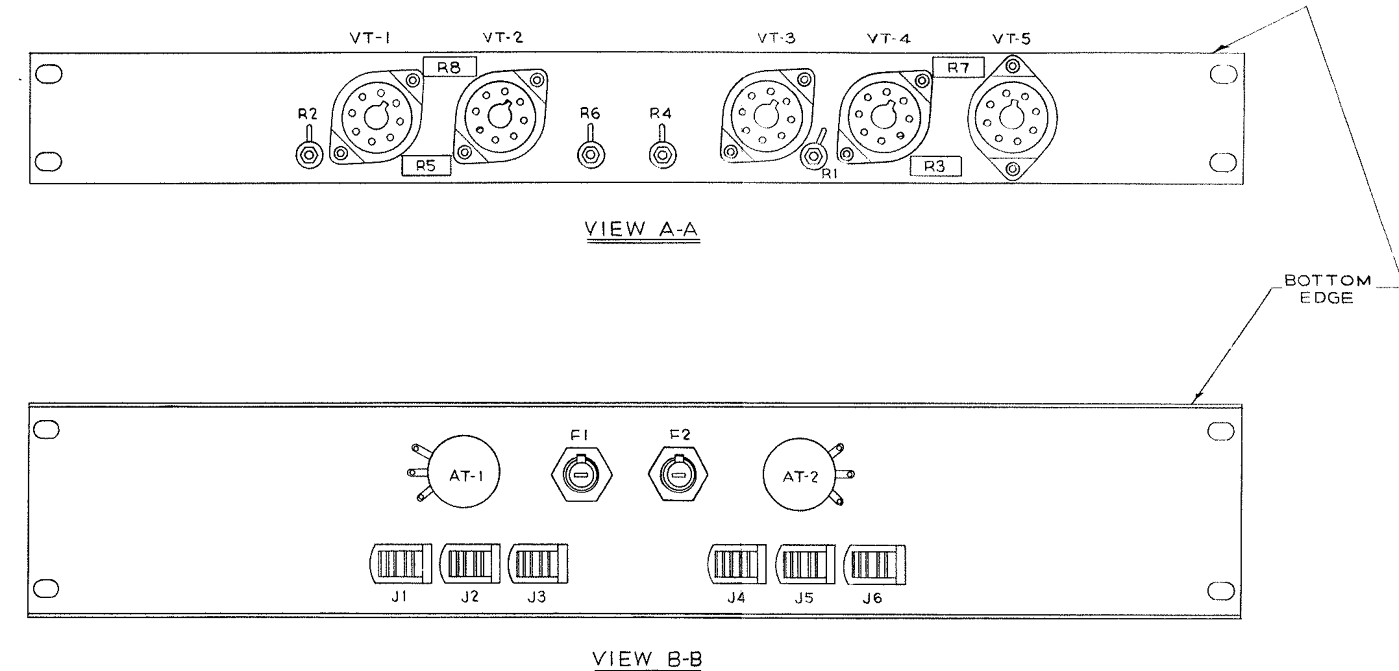
Lynch TELEPHONE SYSTEMS

LYNCH CARRIER SYSTEMS INC. 695 BRYANT ST. SAN FRANCISCO, CALIF.

DRAWING NO. B57 - 5

ISSUE P2





NOTES:
1. H105 IS USED IN CHANNEL 1 ONLY.

APPR. BY	START SERIAL NO.	DESCRIPTION OF CHANGE	C. O. NO.	DATE	ISSUE
	57104	ORIGINAL	571	4-18-55	P1

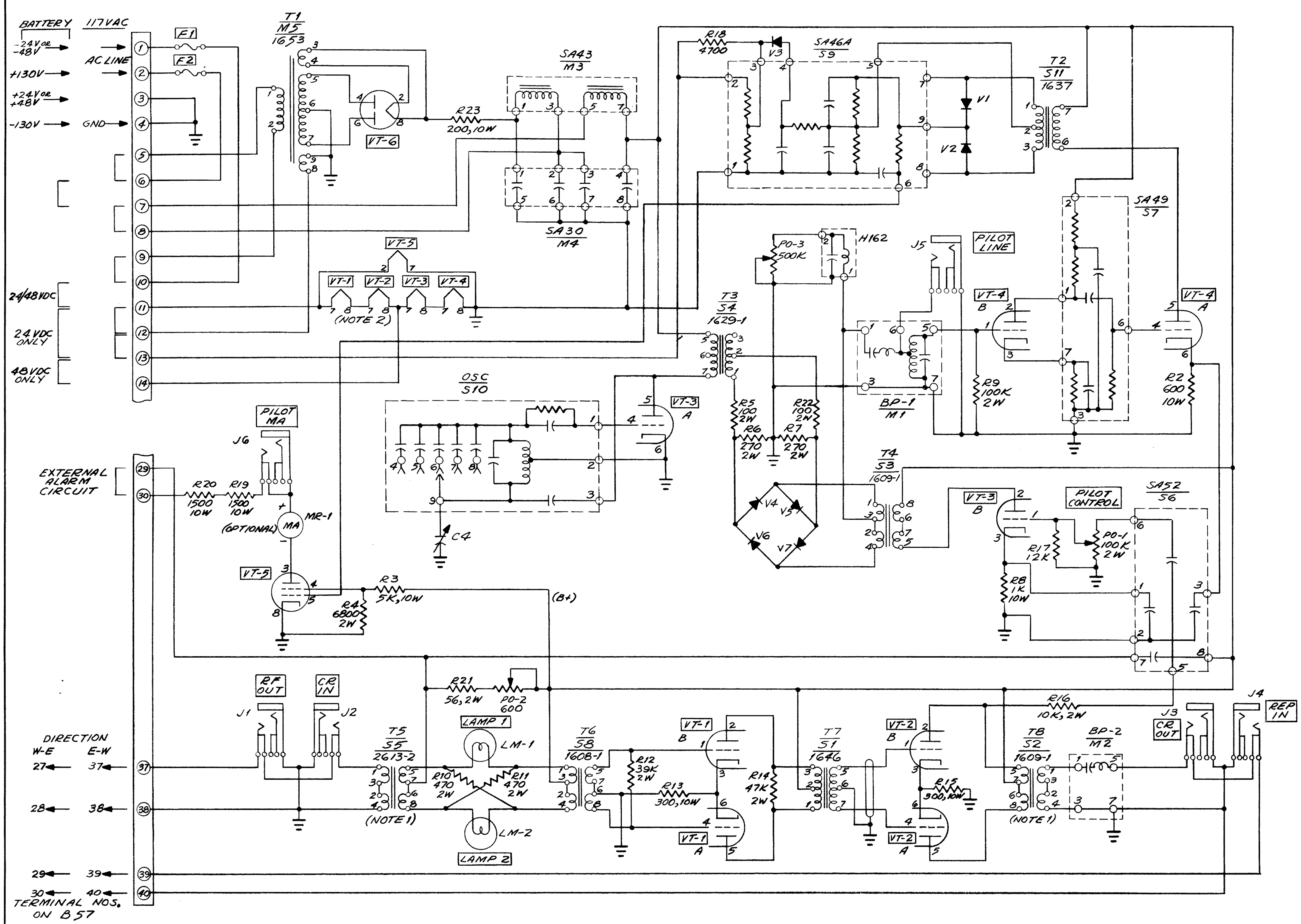
TITLE:

SINGLE CHANNEL
REPEATER
TYPE B57
PARTS LOCATION

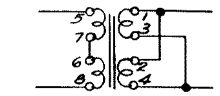
Lynch
TELEPHONE SYSTEMS
LYNCH CARRIER SYSTEMS INC.
695 BRYANT ST. SAN FRANCISCO, CALIF.

DRAWING NO. B57-6 ISSUE P1

2



NOTES:

1. 

CIRCUIT SCHEMATIC SHOWS T5 & T8 STRAPPED FOR CHANNELS 2 & 3. FOR CHANNELS 4 & 5, STRAP BOTH T5 & T8 AS SHOWN ABOVE.

2. TUBE TYPES ARE LISTED BELOW:

	VT-1 THRU VT-4	VT-5	VT-6
AC SUPPLY	6SN7/GT	25L6/GT	5Y3/GT
24VDC FIL	6SN7/GT	25L6/GT	NOT REQD
48VDC FIL	12SN7/GT	50L6/GT	NOT REQD

3. ENCLOSED DESIGNATIONS APPEAR ON FRONT PANEL.

APPR. BY	START SERIAL NO.	DESCRIPTION OF CHANGE	C. O. NO.	DATE	ISSUE
[illegible]	62173	Wiring for optional 48V battery operation added.	G1897A	12-10-58	P2
[illegible]	62077	ORIGINAL	647	8-2-55	P1

TITLE:

SINGLE CHANNEL PILOT REGULATOR TYPE B62 (CHANNELS 2 THRU 5) SCHEMATIC

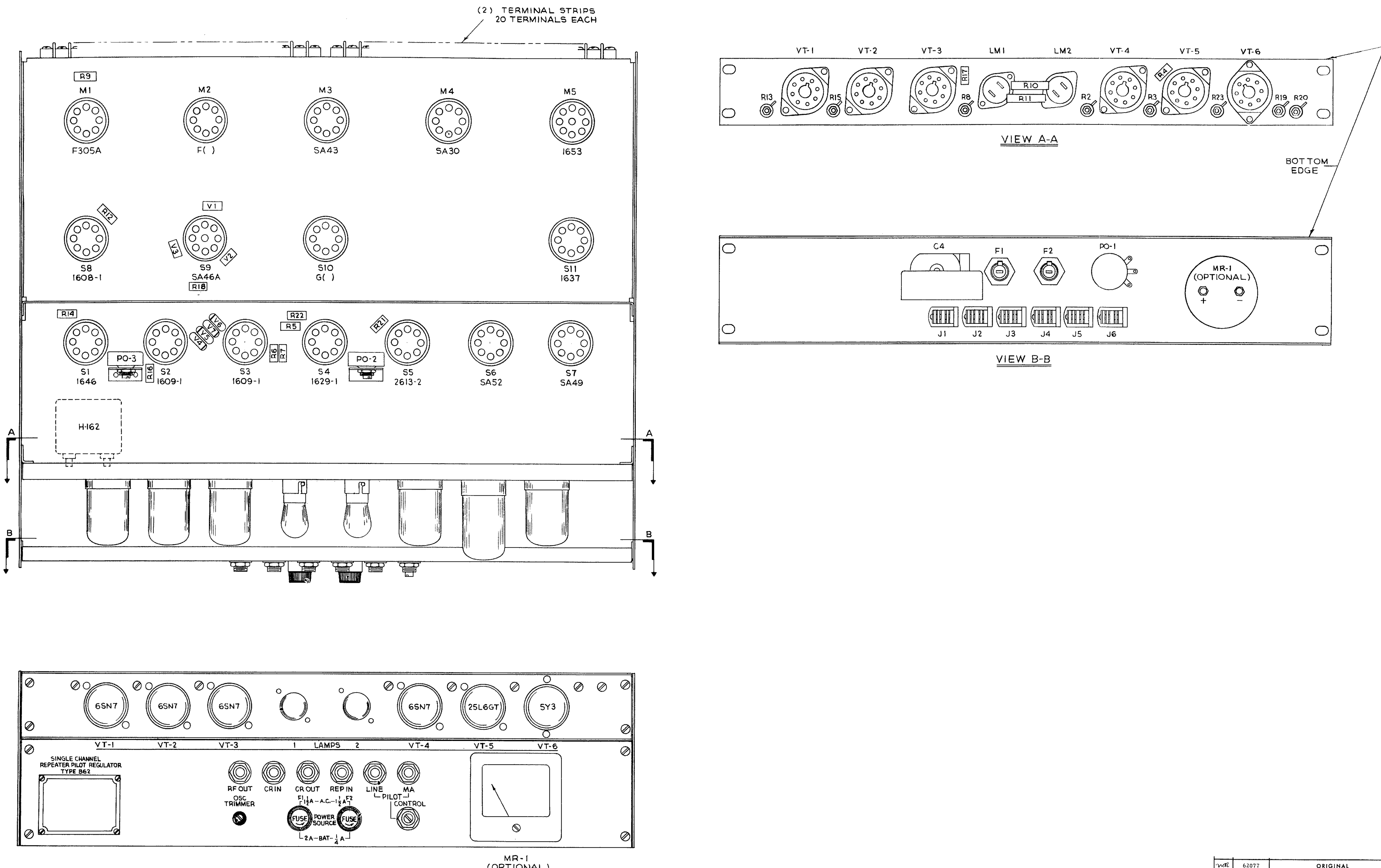
2

Lynch TELEPHONE SYSTEMS

LYNCH CARRIER SYSTEMS INC. 695 BRYANT ST. SAN FRANCISCO, CALIF.

DRAWING NO. B62-2

ISSUE P1



VM	62077	ORIGINAL	552	4-1-55	P1
APPR. BY	START SERIAL NO.	DESCRIPTION OF CHANGE	C.O. NO.	DATE	ISSUE

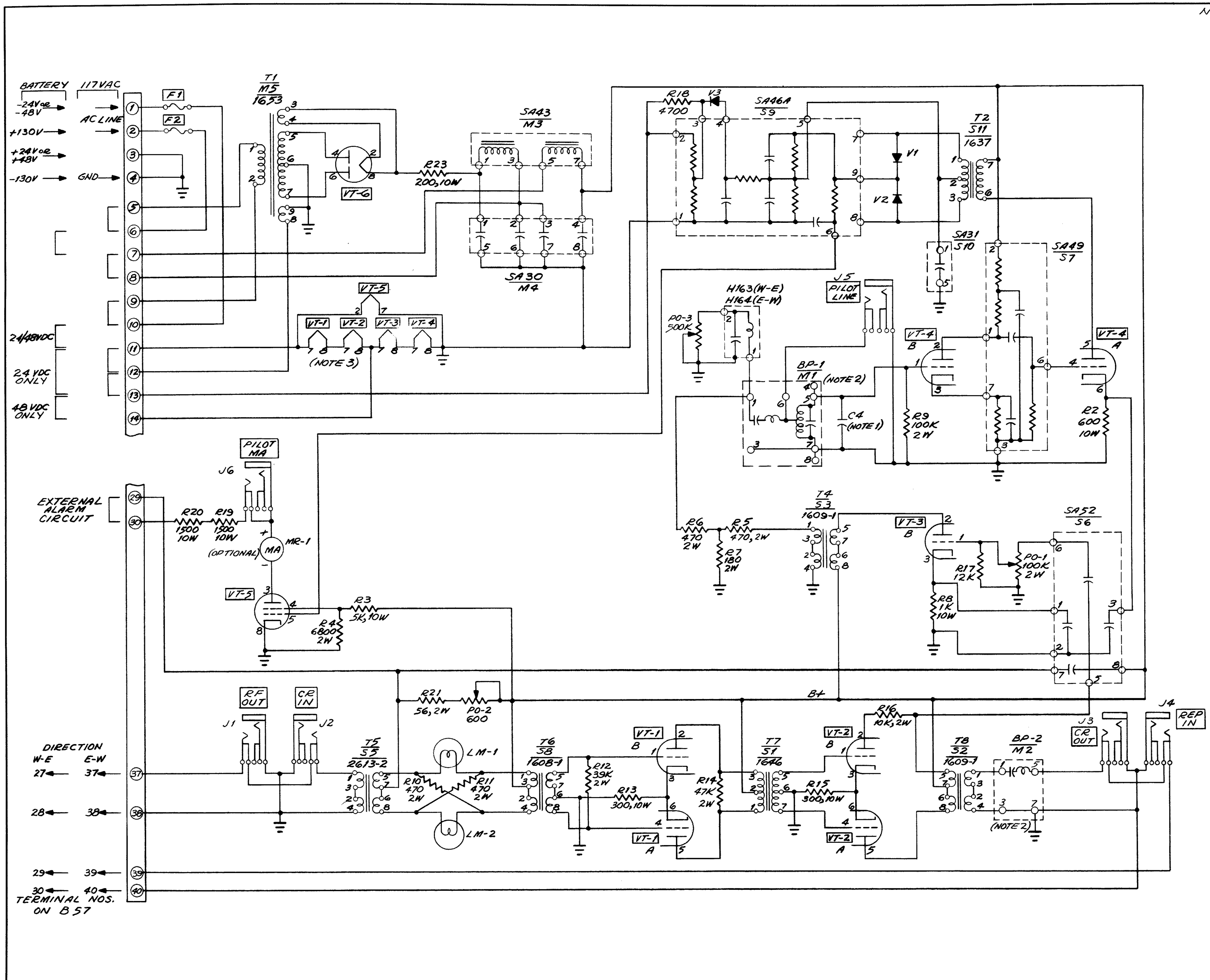
TITLE:

SINGLE CHANNEL
PILOT REGULATOR
TYPE B62
(CHANNELS -2 THRU 5)
PARTS LOCATION

Lynch TELEPHONE SYSTEMS
LYNCH CARRIER SYSTEMS INC.
695 BRYANT ST. SAN FRANCISCO, CALIF.

DRAWING NO. B62-3 ISSUE P1

2



NOTES:
1. C4 REQD FOR CHAN 1, E-W (F307) ONLY.
2. M2 IS F449 FOR W-E, & F450 FOR E-W.
M1 IS F306 FOR W-E, & F307 FOR E-W.
3. TUBE TYPES ARE LISTED BELOW:

	VT-1 THRU VT-4	VT-5	VT-6
AC SUPPLY	6SN7/GT	25L6/GT	5Y3/GT
24 VDC FIL	6SN7/GT	25L6/GT	NOT REQD
48 VDC FIL	12SN7/GT	50L6/GT	NOT REQD

4. ENCLOSED DESIGNATIONS APPEAR ON FRONT PANEL.

APPR. BY	START SERIAL NO.	DESCRIPTION OF CHANGE	C. O. NO.	DATE	ISSUE
	62173	Wiring for optional 48V battery operation added.	G1897A	12-10-58	P2
	62080	ORIGINAL	673	9-15-55	P1

TITLE:

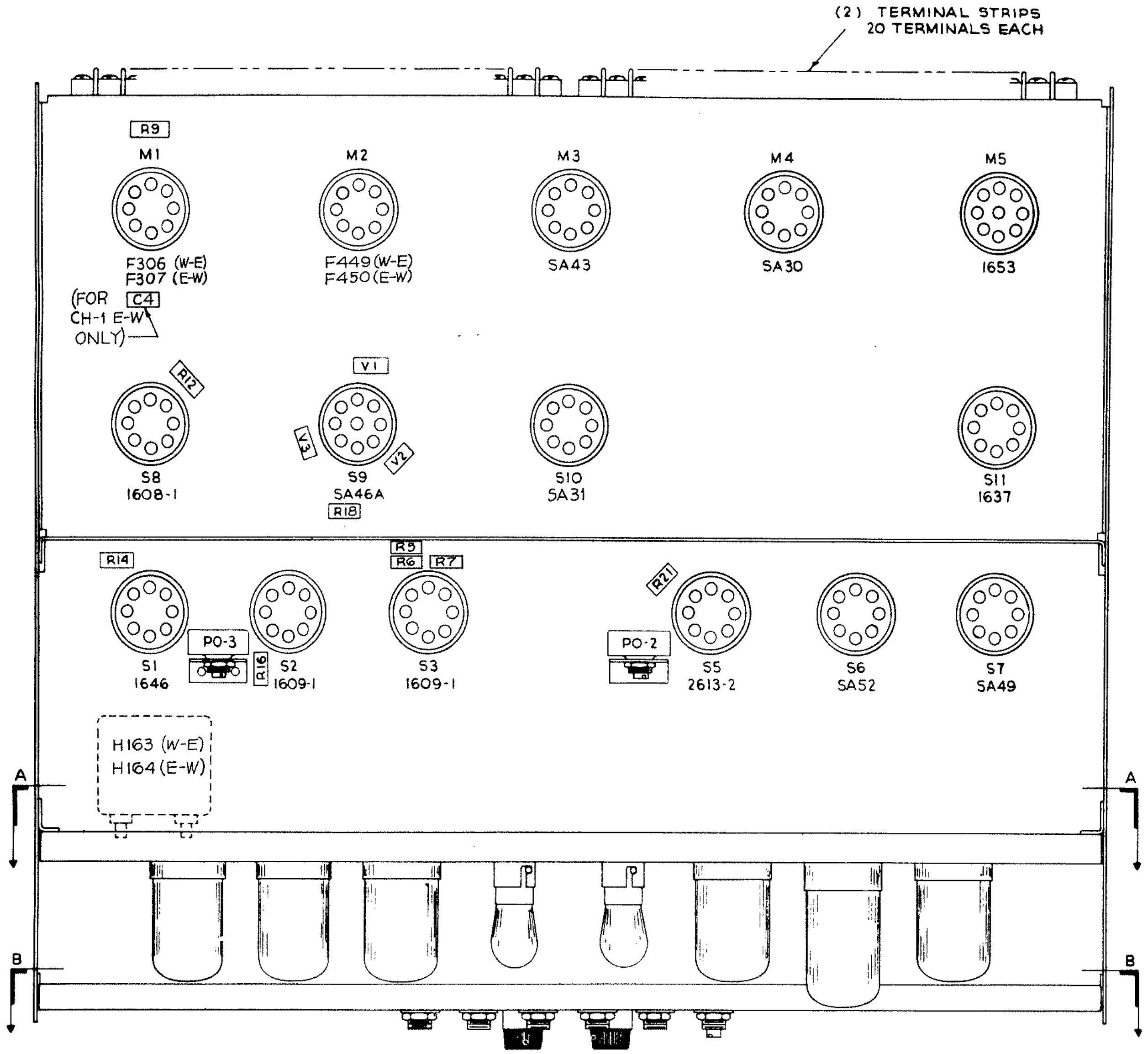
SINGLE CHANNEL PILOT REGULATOR TYPE B62 (CHANNEL 1 ONLY) SCHEMATIC

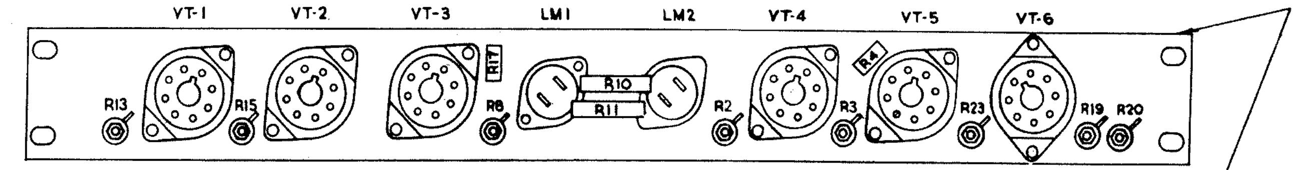
2

Lynch TELEPHONE SYSTEMS

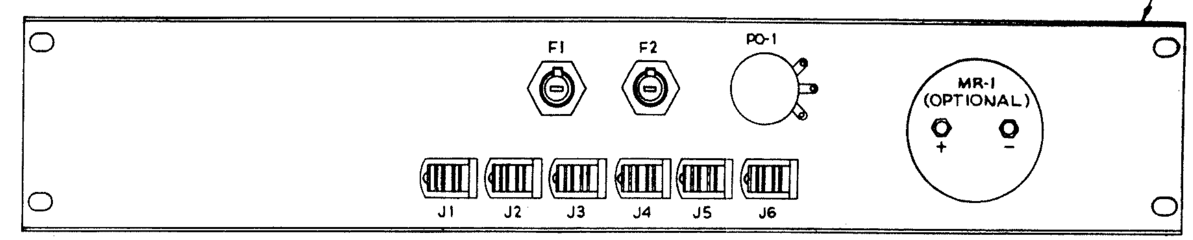
LYNCH CARRIER SYSTEMS INC. 695 BRYANT ST. SAN FRANCISCO, CALIF.

DRAWING NO. B62-11 ISSUE P1

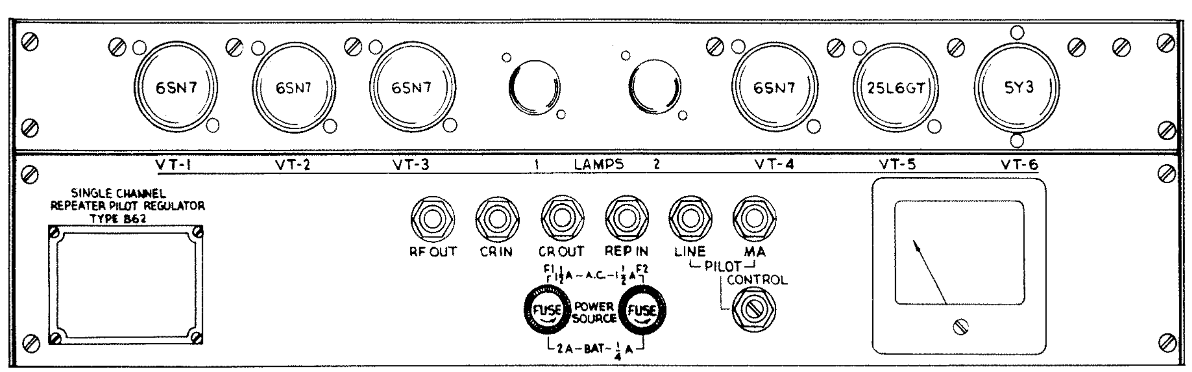




VIEW A-A



VIEW B-B



MR-1
(OPTIONAL)

APPR. BY	START SERIAL NO.	DESCRIPTION OF CHANGE	C. O. NO.	DATE	ISSUE
vsa	62080	ORIGINAL	673	9-15-55	P1

TITLE:

SINGLE CHANNEL
PILOT REGULATOR
TYPE B62
(CHANNEL 1 ONLY)
PARTS LOCATION

Lynch TELEPHONE SYSTEMS
LYNCH CARRIER SYSTEMS INC
695 BRYANT ST SAN FRANCISCO, CALIF

2

DRAWING NO. B62-12
ISSUE P1