Westinghouse

TYPE JY CARRIER TRANSMITTERS
50-150 and 150-300 kc.
100-150, 200-300 v. d-c or 115 v., 50 or 60 cycles a-c

INSTRUCTIONS

CAUTION

Before working on this equipment, turn off the power supply and ground or open circuit the RF lead.

APPLICATION

The Type JY carrier transmitters S#867932 and S#1352338 are used to transmit the intelligence required by many different services using a power line carrier channel. These services include relaying, telemetering, supervisory control, remote tripping, automatic load control, and emergency communication. They are arranged for use with relaying systems using either circuit closing or circuit opening carrier start contacts or with the type HKB relaying system which employs electronic keying. They can be used for the transmission of either audio tone or voice modulation, using either the double sideband or the single sideband system of modulation. The oscillator can be keyed from two separate control circuits.

CONSTRUCTION AND OPERATION

The outline dimensions of these units are shown in Fig. 1. All of the electrical parts are on the rear of the panel, which is ususlly mounted on the swinging rack of a Type JY Power Line Carrier cabinet. The oscillator frequency control dial, the handset and metering jacks are located on the front of the panel. The test pushbutton is operated, and the tubes are inserted and removed from the front of the panel. Variable and removable resistors are conveniently located for ease of adjustment. The necessary electrical shielding, good heat distribution, and accessibility are obtained by the arrangement of the electrical and mechanical components.

The electrical circuits of these units are shown in Fig. 2 for the 50-150 kc unit and also for the 150-300 kc unit. The transmitter consists of a Colpitts oscillator and a six-tube, push-pull parallel, bias-modulated, radio-frequency amplifier. The frequency is adjusted by the oscillator frequency control dial, which controls the setting of the variometer L-1. This variometer, together with capacitors C-1, C-2 and C-3, (Fig. 2) forms the resonant tank circuit for the 50-150 kc transmitter, and the variometer and capacitors C-1, C-2, C-3, C-7 and C-16 forms the resonant tank circuit for the 150-300 kc transmitter. Capacitor C-8 is connected across the tank circuit for frequencies below 80 kilocycles on the 50-150 kc unit.

Resistors R-3 (coarse) and R-5 (fine), serve to adjust the plate voltage of the oscillator tube V-1 to the proper value. Resistors R-4 (coarse) and R-6 (fine), perform a similar function when two separate control circuits are used to control the plate voltage to the oscillator tube.

The amplifier, consisting of tubes V-2 to V-7, is self-biased by means of the current flowing in resistor R-22. This bias is automatically correct for continuous-wave transmission. For modulation, the grid bias developed by the oscillator tube is added to the self bias of the amplifier by an external connection between terminals 28 and 17. This extra bias is varied by the audio voltage in the secondary winding of the modulation transformer T-2. This variation in amplifier bias produces modulated carrier.

The cathode current of each tube, the heater current in two separate circuits, the total amplifier cathode current, and the total amplifier grid current can be metered at jacks on the front of the panel. In each case, the jack sleeve is positive and the tip negative, so that the current will flow from the sleeve to the tip through the meter. The radio-frequency output current is metered at the binding-post jacks which are also on the front of the panel.

A protective gap TP-1, between the plates of the opposite sides of the amplifier (across the full primary winding of the output transformer T-1) prevents damage from lightning or switching surges. A varistor YR-1 across the primary of transformer T-2 prevents over-modulation of the carrier on relaying applications. For other applications it is usually removed. The amplifier screen resistor R-23 is shorted out for all applications except where a 320 volt plate supply is used.

Emergency communication can be effected by using a type JY modulator panel in conjunction with the transmitter. The components on the modulator panel and the modulating transformer T-2 provide the means of modulating the transmitter from a handset microphone plugged into the telephone jacks on the modulator panel.

Alternative components for tubes V-1 to V-7, and resistor R-22 are used for various applications as indicated on the diagram. These are listed in the Accessory Parts List and are covered by the following style numbers:

Accessory Style No.	Application
867933	125 volt supply, for continuous wave
867934	250 volt supply, for continuous wave
1352259	125 volt supply, for 100% modulation
1352260	250 or 320 volt supply for 100% modulation

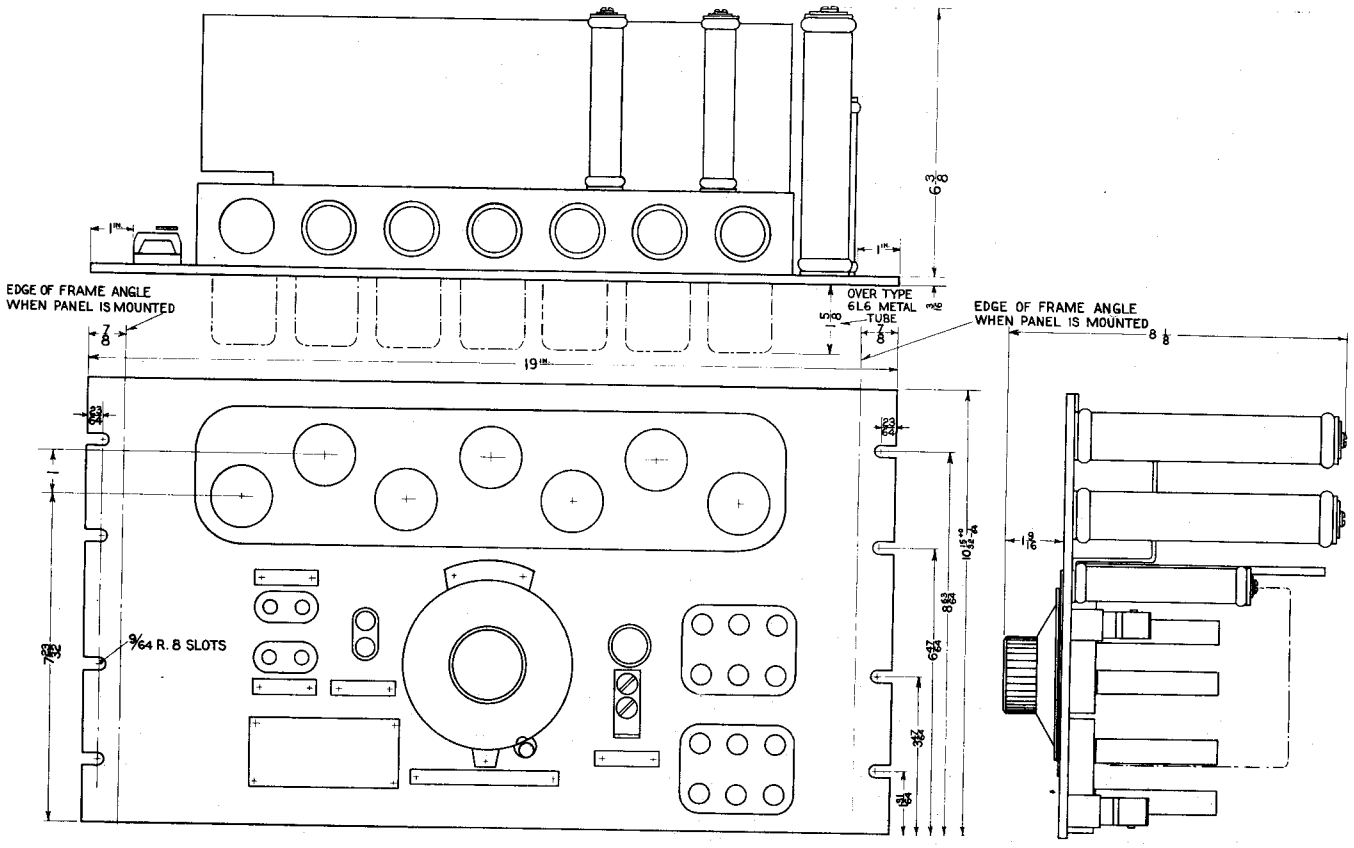


Figure 1
Outline of the Type JY Carrier Transmitters. For Reference Only.

CHARACTERISTICS

The frequency range of these transmitters is either 50 to 150 kc or 150 to 300 kc with a 10% overlap at each end of the frequency range. The carrier output circuits are arranged to feed into one coaxial cable or two cables in parallel. Both transmitters have a continuous wave output of 10 watts on a 125 volt d-c supply, or 30 watts on a 250 volt d-c supply. When arranged for communication and 100% modulation, the carrier output is 2-1/2 watts on a 125 volt d-c supply, 7-1/2 watts on a 250 volt d-c supply, and 10 watts on a 320 volt d-c supply. Adjustments are available so that this Unit can be operated from 100 to 150 or 200 to 300 volts d-c using the proper accessories. The tube heater circuits are arranged so that they can be energized from the d-c supply, or energized by a-c from a suitable transformer. The transformer is usually part of a type JY power supply unit.

Taps on the transmitter output transformer will allow working into a load impedance of 30 or 60 ohms.

INSTALLATION

This Unit is usually supplied as part of a type JY Power Line Carrier Equipment assembly. In these cases it is shipped assembled with the other units in a cabinet, completely wired.

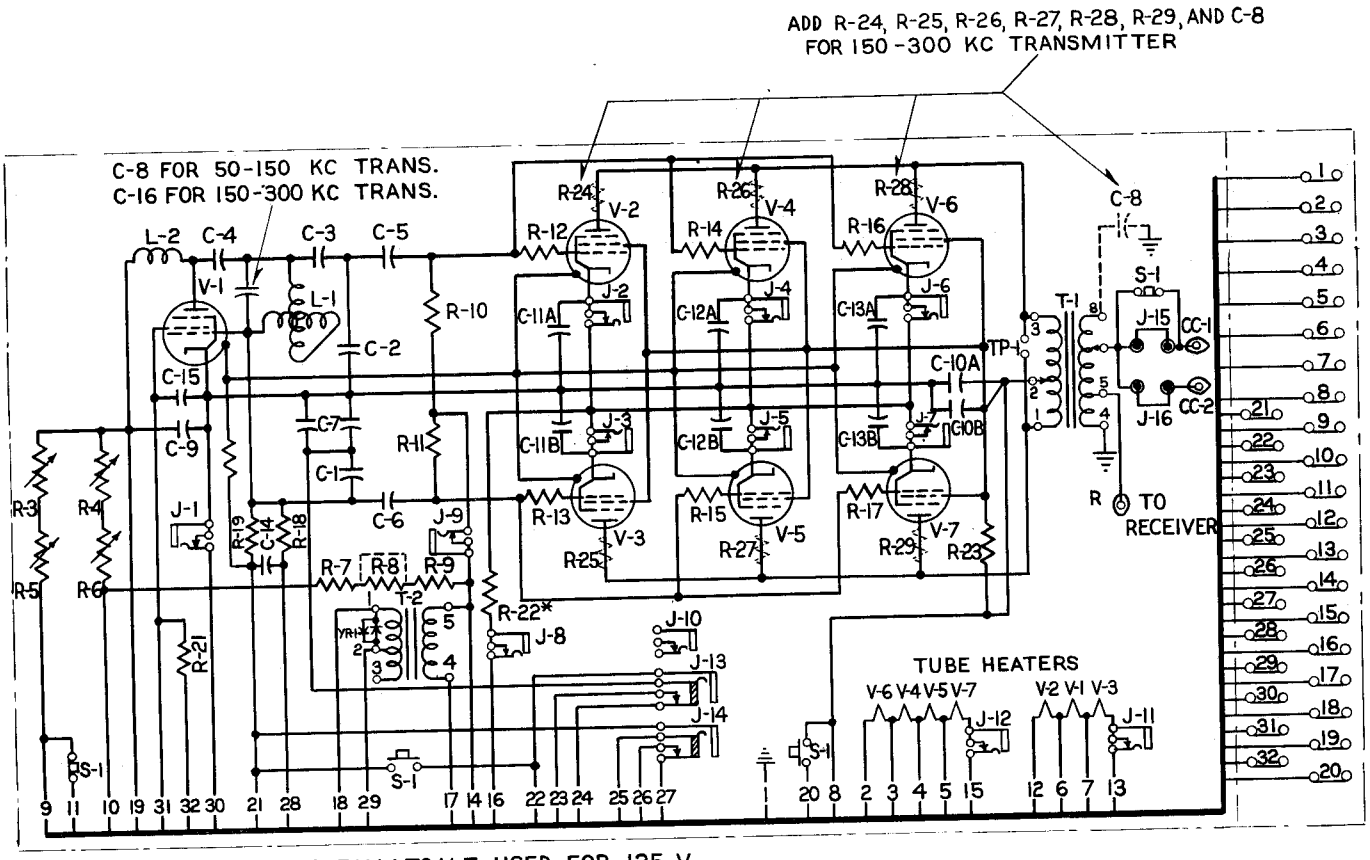
When this Unit is shipped separately, proceed as follows: Unpack the unit and install it on a standard relay rack in the equipment assembly with which it is to be used. The mounting screws are contained in a cloth bag tied to the terminal strip of the Unit. Place the tubes (from the accessory group) in the tube sockets, and the cathode bias resistor in the empty fuse clips on the left side of the Unit looking at the rear. For HKB relaying applications, discard the cathode bias resistor and insert in the fuse clips the metal tube provided with the HKB Control Unit Accessories.

Refer to the interconnection diagram for the equipment assembly of which this unit forms a part, and make connections accordingly. The RF output terminal CC1 is used for the lead to the center conductor of the coaxial cable. If two coaxial cables are used, connect the center conductor of the second one to terminal CC2. Ground the sheath of the coaxial cable and ground terminal #1 of this unit. If a carrier receiver is used with this unit, connect the receiver input to terminal R. Terminals R, CC1, and CC2 are porcelain posts with the marking stencilled near them. All the other terminals are located in the two vertical strips at the right side of the panel looking at the back. Do not connect more than two leads to any one of these terminals. For external connections, #22 gauge wire is ample for any circuit except the tube heater circuits. Use #18 for series connected tube heater circuits and where all the heaters are connected in parallel, use #14 for 25L6 tubes and #12 for 6L6 tubes.

ADJUSTMENTS AND MAINTENANCE

1. First adjust the heater current. The recommended current for the heater of a 25L6 tube is 0.28 ampere, and for a 6L6 tube is 0.85 ampere. This derating from the tube book values is intended to give longer life to the tubes.

   On a-c applications where all the heaters are connected in parallel across a filament transformer, the transformer is designed to give the correct heater current with no adjustment.



NOTE: V-1 TO V-7 USED FOR 125 V.
V-101 TO V-107 USED FOR 250 V.

*NOTE: R-22 USED FOR 125 V. CW.
R-122 USED FOR 250 V. CW. INSTEAD OF R-22
R-222 USED FOR 125 V. 100% MOD. INSTEAD OF R-22
R-322 USED FOR 250 V. 100% MOD. INSTEAD OF R-22

Figure 2
Internal Schematic of the Type JY Carrier Transmitters.

On d-c and a-c applications where the heaters are connected in series, the heater current adjustment is made on a series resistor which is separate from this Unit.

On a 125 volt supply using 25L6 tubes, the heaters of tubes V-1, V-2 and V-3 are in one series circuit, and those of tubes V-4 to V-7 in another series circuit. Each circuit has its own external resistor. Adjust these resistors to give 0.28 ampere measured with a meter plugged into jacks 11 and 12.

On a 250-volt supply using 6L6 tubes, all the tube heaters are in one series circuit with one external series resistor bank. Adjust this resistor to give 0.85 ampere measured at either jacks 11 or 12.

Note that when power is first applied, the heater current will be quite high and will fall to a steady value as the heaters warm up. Adjust for the steady value.

For HKB relaying applications, there is a special heater adjustment which is covered in the Equipment Assembly Instruction Book of which this book forms a part.

2. Next see that the entire resistance of resistors R-3, R-4, R-5 and R-6 are in the circuit by disconnecting any shorting leads across all or part of them. Disconnect any external leads from r-f terminals CC1, CC2, and R, and connect a dummy load consisting of a 60 ohm non-inductive resistor, capable of dissipating about 50 watts, between terminal CC1 and ground. Connect the lead from jacks 15 and 16 to tap 8 on transformer T-1 when using 25L6 tubes, or to tap 7 when using 6L6 tubes. If using a 320-volt plate supply, permanently disconnect the shorting lead across resistor R-23.

Except for double-plate keying relaying applications using a 125-volt plate supply, see that the shorting lead across resistor R-8 is removed.

For all applications using 100% modulation, see that varistor YR-1 is removed from terminals 1 and 2 of transformer T-2.

3. Adjust the oscillator excitation as follows:

(a) For cathode keyed or circuit-opening plate keyed relaying applications, see that all of resistors R-4 and R-6 are unshorted, and that terminal 14 is connected to negative supply through the external circuits. Then adjust resistors R-3 and R-5 until the r-f current measured across jack 15 is 0.41 ampere with 25L6 tubes, or 0.71 ampere with 6L6 tubes.

(b) For double plate keyed relaying ap-

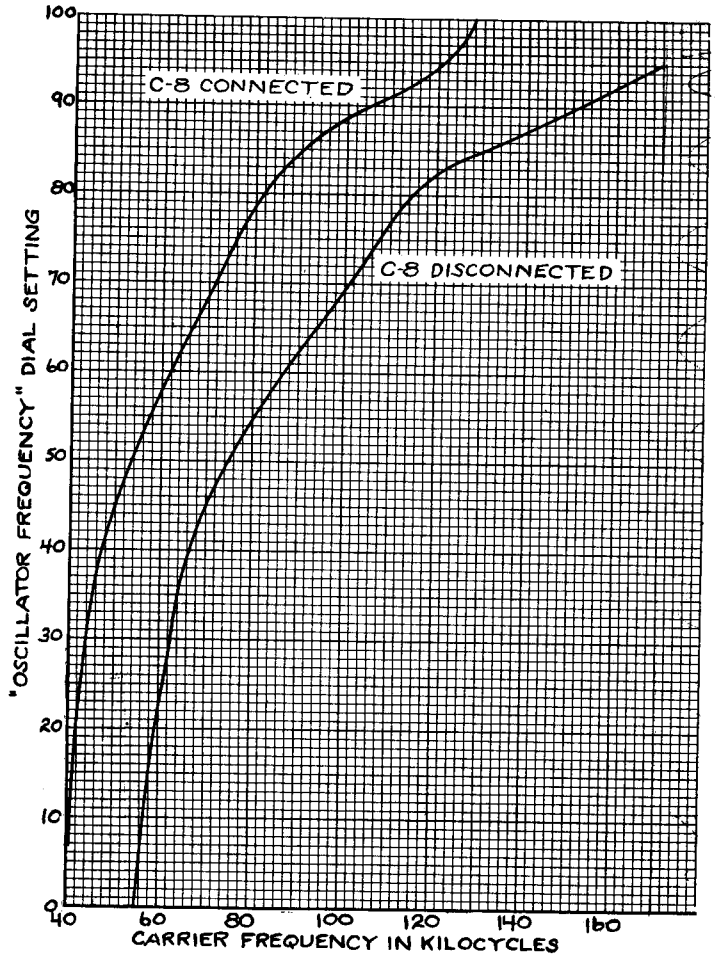


Figure 3
Oscillator Frequency Dial Calibration Curve for the 50-150 Kc S#867932 Type JY Carrier Transmitter.

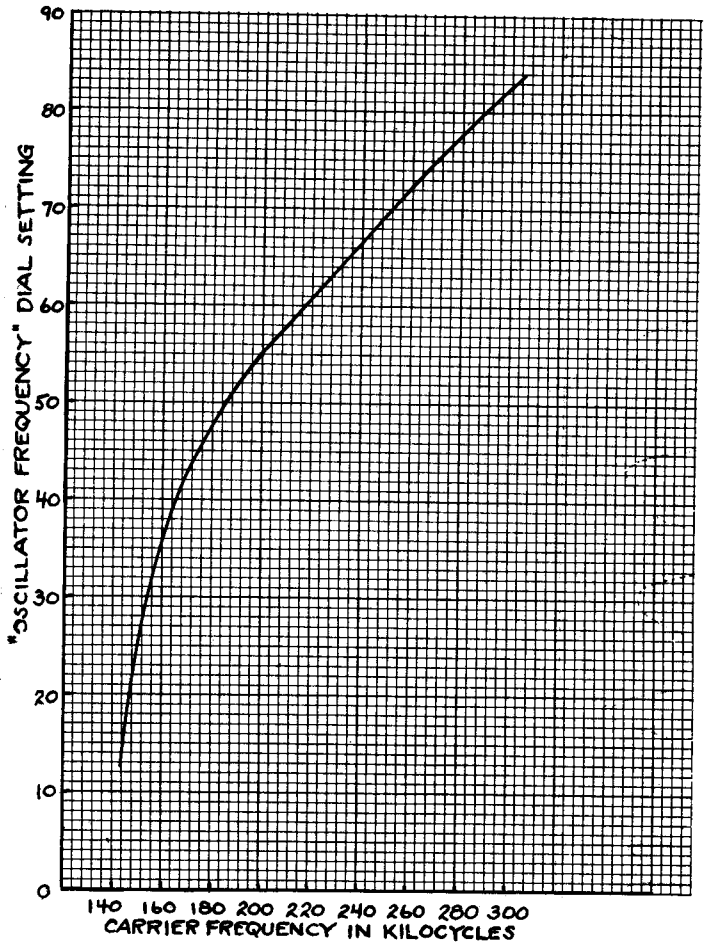


Figure 4
Oscillator Frequency Dial Calibration Curve for the 150-300 Kc S#1352338 Type JY Carrier Transmitter.

plications, first close the relay contacts (or push button) supplying the oscillator through terminal 10, leaving the supply through terminal 9 disconnected. Then adjust resistors R-4 and R-6 until the r-f current measured across jack 15 is 0.41 ampere with 25L6 tubes, or 0.71 ampere with 6L6 tubes. Then open the plate supply through terminal 10 (if necessary disconnect the external lead to terminal 20 so that the TEST button can be kept closed to read the meter), and close the plate supply through terminal 9. If this is done by closing the relay on the Modulator Unit, temporarily connect a jumper between carrier transmitter terminal 14 and negative supply to retain normal grid bias on the amplifier tubes. Then adjust resistors R-3 and R-5 to give the same values of r-f output current as above. Be sure all the external switchboard relay circuits are normal during this adjustment. After the adjustment is made, restore all temporary connections to normal.

(c) For HKB relaying applications (See the instruction book on the HKB Control Unit), first adjust resistors R-4 and R-6 to have a total value of approximately 9500 ohms. Then cause Thyratron V-1 in the HKB Control Unit [illegible]re continuously, leave open the plate supply to the oscillator through terminal 9, and adjust resistors R-1 and R-2 in the HKB Control Unit to give an r-f output current measured at carrier transmitter jack 15 of 0.41 ampere with 25L6 tubes, or 0.71 ampere with 6L6 tubes. Then extinguish Thyratron V-1 in the HKB Control Unit, and close the oscillator plate supply through terminal 9. If this is done by closing the relay on the Modulator Unit, temporarily connect a jumper between carrier transmitter terminal 14 and HKB Control Unit terminal 7 to retain normal grid bias on the amplifier tubes. Then adjust resistors R-3 and R-5 to give the same values of r-f output current as above. After the adjustment is made, restore all temporary connections to normal.

(d) For applications using the continuous wave accessories where this Unit is permanently connected for modulated carrier, see that all of resistors R-4 and R-6 are unshorted. Then adjust resistors R-3 and R-5 until the r-f current measured at jack 15 is 0.32 ampere with 25L6 tubes, or 0.5 ampere with 6L6 tubes. Do not apply any audio for this adjustment.

(e) For applications using 100% modulation, see that all of resistors R-4 and R-6 are unshorted. Then adjust resistors

R-3 and R-5 until the r-f current measured at jack 15 is 0.24 ampere with 25L6 tubes, or 0.375 ampere with 6L6 tubes on a 250 volt plate supply, or 0.425 ampere with 6L6 tubes on a 320 volt plate supply. Do not apply any audio for this adjustment.

4. Select the carrier frequency desired by referring to curve Fig. 3 or Fig. 4, and adjust the OSCILLATOR FREQUENCY control dial to the setting given by the curve. For frequencies above 80 kilocycles, disconnect capacitor C-8. The frequency setting from the curve is approximate and for installations where no carrier channels have yet been established, will be sufficiently accurate. To get an exact setting, use a precision wavemeter, or use a standard signal generator and an oscilloscope, connecting the signal generator across the horizontal plates and the transmitter output across the vertical plates, to obtain a circular figure. Alternately, use a receiver and zero-beat the transmitter output with a signal generator.

   Remove the snorting link across jack 15, and connect an r-f ammeter, (1 ampere full scale) across its binding posts. Apply plate voltage to the oscillator and amplifier by closing the external power supply switch and pressing TEST button S-1.

   If no current can be read, short out a portion of resistor R-3 or R-4 whichever is in the feed to the oscillator plate, (depending on the external connections), until current can be read on the meter. Always press the TEST button to read current at jack 15. A latch is provided on the front of the panel to hold the pushbutton closed.

5. For applications using the continuous wave accessories (see table under Electrical Description) varistor YR-1 across the primary of the modulation transformer automatically limits the modulation to the capabilities of the amplifier. The equipment Assembly Instruction Book, of which this book forms a part, will give instructions for adjusting the audio input voltage at the source, such as a Type JY Tone Transmitter. For applications using 100% modulation, if the modulation transformer T-2 is connected to match a 600 ohm input, the type 25L6 tubes will require an input of 0.6 to 0.8 volts r.m.s., and the type 6L6 tubes an input of 1.0 to 1.4 volts r.m.s. For further details refer to the Equipment Assembly Instruction Book.

6. After the above adjustments are complete, switch off the plate voltage supply, and remove the 60-ohm resistor between terminal CC1 and ground. Reconnect terminals CC1, CC2 and R to any external leads. If both CC1 and CC2 are used, as with two coaxial cables, connect the lead from jacks 15 and 16 to tap 7 on transformer T-1 when using 25L6 tubes, or to tap 6 when using 6L6 tubes. When the apparatus at the far end of the coaxial cable or cables has been adjusted, recheck the r-f output currents. These should be within 10% of the values obtained with the dummy load. In the case of two coaxial cables, the figures will vary more than this, and the normal values for this condition measured at either jack 15 or 16 are given in the adjustment table. After all r-f measurements are complete, remove the meter from jack 15 and replace the shorting link across the binding posts.

   Check the cathode current of each tube and the total amplifier cathode and grid current at jacks 1 to 9 with the adjustment tables. Also measure the oscillator plate volts with a d-c voltmeter having a resistance of at least 1000 ohms per volt.

   For oscillator screen keying applications, the oscillator plate volts will be somewhat higher, and the oscillator screen volts, measured across terminals 31 and 30, somewhat lower than the plate voltage values given in the tables. Record both quantities.

   If the supply voltage is different from the nominal values, the adjustment values will also vary. The unit will operate from a supply between 100 and 150 volts using 25L6 tubes, and between 200 and 320 volts using 6L6 tubes, but for any voltage above 270 volts, remove the short from across amplifier screen resistor R-23. If the supply volts are above the nominal, the oscillator plate voltage and cathode current will be below, and the amplifier cathode currents above, the table values for the same r-f output current and power. The amplifier grid current must not exceed the table values. Always maintain the table values for the heater currents. If the supply volts are below the nominal, it may not be possible to obtain the rated power output without excessive distortion. In this case, adjust the oscillator plate volts as high as possible, but do not exceed the table values for the amplifier grid current. All the other values will then be somewhat below the table values, except the heater currents which must be maintained.

The initial adjustment values should be recorded for future reference. If the recorded current readings show a progressive departure from their original values, it is probable that one or more tubes need replacement. The best check for a faulty tube is to exchange it with the oscillator tube and compare the power output obtained with that originally recorded. If all the tubes in the unit are suspected, replace all the amplifier tubes with new ones, and then test each of the tubes removed in the oscillator socket as described above. If the power output is not within 20% of the originally recorded value, replace the tube.

CAUTION

Do not push the TEST button unless either the shorting link or the ammeter is in place across binding post jack 15, because the resulting open circuit may cause incorrect operation with carrier relays.

The heater current should be readjusted if necessary during maintenance, to the value listed in the adjustment table.

RENEWAL PARTS

When ordering renewal parts for this unit, include the following data from the nameplate:

(1) The name of the unit.

(2) The Style or DL number.

(3) The serial number.

TABLE I

ADJUSTMENT DATA USING 25L6 TUBES

	A	B	C
Nominal Supply voltage	125	125	125
Heater current (J-11 and J-12) amperes	0.28	0.28	0.28
Oscillator plate voltage (terminals 19 & 20)	30	25	36
Oscillator cathode current (J-1) milliamperes	12	8	13
Amplifier cathode currents each tube (J-2 thru J-7) milliamperes	60	37	20
Amplifier cathode current total (J-8) milliamperes	360	220	120
Amplifier grid current total (J-9) milliamperes	0.2	0	0
RF output current, single coaxial cable (J-15) amperes	0.41	0.32	0.24
RF output watts, current squared x 60, watts	10	6	3.45
RF output current, each of 2 coaxial cables (J-15 & J-16) amperes	0.29	0.32	0.17

Column A is for continuous wave operation

Column B is for modulated operation using continuous wave accessories and no audio applied.

Column C is for modulated operation using accessories for 100% modulation and no audio applied.

TABLE II

ADJUSTMENT DATA USING 6L6 TUBES

	A	B	C	D
Nominal Supply voltage	250	250	250	320
Heater current (J-11 and J-12) amperes	0.85	0.85	0.85	0.85
Oscillator plate voltage (terminals 19 & 20)	65	60	73	85
Oscillator cathode current (J-1) milliamperes	20	14	15	18
Amplifier cathode currents each tube (J-2 thru J-7) milliamperes	60	37	20	27
Amplifier cathode current total (J-8) milliamperes	360	220	120	160
Amplifier grid current total (J-9) milliamperes	0.2	0	0	0
RF output current, single coaxial cable (J-15) amperes	0.72	0.5	0.375	0.425
RF output watts, current squared x 60, watts	30	15	8.4	11
RF output current, each of 2 coaxial cables (J-15 & J-16) amperes	0.5	0.35	0.265	0.30

Column A is for continuous wave operation

Column B is for modulated operation using continuous wave accessories and no audio applied.

Column C is for modulated operation using accessories for 100% modulation and no audio applied.

Column D is for modulated operation on 320 volts using accessories for 100% modulation and no audio applied.

TRANSMITTER PARTS LIST

DIAGRAM SYMBOL 50-150 KC.	REQ'D.	DIAGRAM SYMBOL 150-300 KC.	REQ'D.	FUNCTION	RATING
				CAPACITORS	
C-1	1			Oscillator Tank	0.015 MFD. 2500 V. d-c Mica
		C-1	1	" "	0.0068 " " " " "
C-2	1			" "	0.015 " " " " "
		C-2	1	" "	0.0068 " " " " "
C-3	1			" "	0.015 " " " " "
		C-3	1	" "	0.0068 " " " " "
C-4	1	C-4	1	" Plate	0.027 " 600 " " "
		C-4	1	" "	0.0015 " 2500 " " "
C-5	1	C-5	1	Amplifier Grid	0.00027 " " " " "
C-6	1	C-6	1	" "	0.00027 " " " " "
C-7	2			Oscillator Tank	0.1 " 600 " " Paper
		C-7	2	" "	0.015 " " " " "
C-8	1			" "	0.0051 " 2500 " " Mica
		C-8	1	Output Tuning	0.0015 " " " " "
C-9	1	C-9	1	Oscillator Plate By Pass	0.024 " "
C-10	1	C-10	1	Amplifier Plate-Screen By Pass	0.25 + 0.25 MFD. 600 V. d-c Paper
C-11	2	C-11	2	Amplifier Cathode By Pass	0.015 + .015 MFD. 600 V. d-c Paper
C-12	2	C-12	2	" " " "	0.015 + .015 " " " " " "
C-13	2	C-13	2	" " " "	0.015 + .015 " " " " " "
C-14	1	C-14	1	Bias Filter	0.015 + .015 " " " " " "
C-15	1	C-15	1	Oscillator Screen By Pass	0.024 MFD. Mica
		C-16	1	Oscillator Tank	0.00056 MFD. 2500 V. d-c Mica
				JACKS	
J-1	1	J-1	1	Oscillator Cathode Current	One Circuit Opening
J-2	1	J-2	1	Amplifier Cathode Current	" " "
J-3	1	J-3	1	" " "	" " "
J-4	1	J-4	1	" " "	" " "
J-5	1	J-5	1	" " "	" " "
J-6	1	J-6	1	" " "	" " "
J-7	1	J-7	1	" " "	" " "
J-8	1	J-8	1	" " "	" " "
J-9	1	J-9	1	" Grid "	" " "
J-10	1	J-10	1	Spare	" " "
J-11	1	J-11	1	Heater Current	" " "
J-12	1	J-12	1	" "	" " "
J-13	1	J-13	1	Communication	One Circuit-1 Break, 4 Terminal
J-14	1	J-14	1	"	" " " " " "
J-15	1	J-15	1	R.F. Current	2 Binding Post
J-16	1	J-16	1	" "	" " "
				COILS	
L-1	1			Oscillator Variometer	0.17 to 1.7 Millihenries
		L-1	1	" "	0.053 to .575 Millihenries
L-2	1			Oscillator Plate	75 Millihenries
		L-2	1	" "	12 "
				RESISTORS	
R-3	1	R-3	1	Oscillator Plate	16,000 Ohms
R-4	1	R-4	1	" "	" "
R-5	1	R-5	1	" "	2000 Ohms 1 Adjustment Band
R-6	1	R-6	1	" "	" " " " "
R-7	1	R-7	1	Bias Balancing	82,000 Ohms 1 Watt
R-8	1	R-8	1	" "	56,000 " " "
R-9	1	R-9	1	" "	82,000 " " "
R-10	1	R-10	1	Amplifier Grid Leak	24,000 " " "
R-11	1	R-11	1	" " "	" " " "
R-12	1	R-12	1	Parasite Suppressor	1000 " " "
R-13	1	R-13	1	" "	" " " "
R-14	1	R-14	1	" "	" " " "
R-15	1	R-15	1	" "	" " " "
R-16	1	R-16	1	" "	" " " "
R-17	1	R-17	1	" "	" " " "
R-18	1	R-18	1	Oscillator Grid Leak	10,000 " " "
R-19	1	R-19	1	" " "	" " " "
R-20	1	R-20	1	Static Leak	0.27 Megohms One Watt
R-21	1	R-21	1	Oscillator Screen	16,000 Ohms
R-23	1	R-23	1	Amplifier Screen	2500 Ohms
		R-24	1	Parasite Suppressor	56 Ohms - 1 Watt
		R-25	1	" "	" " " "
		R-26	1	" "	" " " "

TRANSMITTER PARTS LIST

DIAGRAM SYMBOL 50-150 KC.	REQ'D.	DIAGRAM SYMBOL 150-300 KC.	REQ'D.	FUNCTION	RATING
				RESISTORS (Con't.)	
		R-27	1	Parasite Suppressor	56 Ohms - 1 Watt
		R-28	1	" "	" " " "
		R-29	1	" "	" " " "
				SWITCHES	
S-1	1	S-1	1	Test Push Button	3/16" TK. Panel Mtg.
				SPARK GAPS	
TP-1	1	TP-1	1	Output Transformer	Type RVS Arrester
				TRANSFORMERS	
T-1	1	T-1	1	R.F. Output	275/120 V.
T-2	1	T-2	1	Modulation	
				TUBE SOCKETS	
X-1 To X-7	1	X-1 To X-7	1	V1, V2, V3, V4, V5, V6, V7 or V101, V102, V103, V104, V105, V106, V107.	Ceramic Octal Wafer
				LIMITER	
YR-1	1	YR-1	1	Voltage	Rectox S#1269512

FROM DWGS. T-7613949 AND T-7613950

ACCESSORY PARTS LIST

DIAGRAM SYMBOL	S#867933	S#867934	S#1352259	S#1352260	FUNCTION	RATING
					RESISTORS	
R-22	1				Amplifier Cathode Bias	20 Ohms for 125 V. d-c Trans.
R-122		1			" " "	40 " " 250 V. " "
R-222			1		" " "	
R-322				1	" " "	
					TUBES	
V-1	1		1		Oscillator	25L6 for 125 V. d-c Trans..
V-2	1		1		Amplifier	" " " " " "
V-3	1		1		"	" " " " " "
V-4	1		1		"	" " " " " "
V-5	1		1		"	" " " " " "
V-6	1		1		"	" " " " " "
V-7	1		1		"	" " " " " "
V-101		1		1	Oscillator	6L6 for 250 V. d-c Trans.
V-102		1		1	Amplifier	" " " " " "
V-103		1		1	"	" " " " " "
V-104		1		1	"	" " " " " "
V-105		1		1	"	" " " " " "
V-106		1		1	"	" " " " " "
V-107		1		1	"	" " " " " "

FROM DWGS. T-7613949 AND T-7613950

INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE JY CARRIER TRANSMITTERS

50-150 and 150-300 KC.

100-150, 200-300 V. D-C or 115 V., 50 or 60 cycles A-C

CAUTION Before working on this equipment, turn off the power supply and ground or open circuit the RF lead.

APPLICATION

The Type JY carrier transmitters S#867932B and S#1352338B are used to transmit the intelligence required by many different services using a power line carrier channel. These services include relaying, telemetering, supervisory control, remote tripping, automatic load control, and emergency communication. They are arranged for use with relaying systems using either circuit closing or circuit opening carrier start contacts or with the Type HKB relaying system which employs electronic keying. They can be used for the transmission of either audio tone or voice modulation, using either the double sideband or the single sideband system of modulation. The oscillator can be keyed from two separate control circuits.

CONSTRUCTION AND OPERATION

The outline dimensions of these units are shown in Fig. 1. All of the electrical parts are on the rear of the panel, which is usually mounted on the swinging rack of a Type JY Power Line Carrier cabinet. The oscillator frequency control dial, the handset and metering jacks are located on the front of the panel. The test pushbutton is operated, and the tubes are inserted and removed from the front of the panel. Variable and removable resistors are conveniently located for ease of adjustment. The necessary electrical shielding, good heat distribution, and accessibility are obtained by the arrangement of the electrical and mechanical components.

The electrical circuits of these units are shown in Fig. 2 for the 50-150 kc unit and also for the 150-300 kc unit. The transmitter consists of a Colpitts oscillator and a six-tube, push-pull parallel, bias-modulated, radio-frequency amplifier. The frequency is adjusted by the oscillator frequency control dial, which controls the setting of the variometer L-1. This variometer, together with capacitors C-1, C-2 and C-3, (Fig. 2) forms the resonant tank circuit for the 50-150 kc transmitter, and the variometer and capacitors C-1, C-2, C-3, C-7 and C-16 forms the resonant tank circuit for the 150-300 kc transmitter. Capacitor C-8 is connected across the tank circuit for frequencies below 80 kilocycles on the 50-150 kc unit.

Resistors R-3 (coarse) and R-5 (fine), serve to adjust the plate voltage of the oscillator tube V-1 to the proper value. Resistors R-4 (coarse) and R-6 (fine), perform a similar function when two separate control circuits are used to control the plate voltage to the oscillator tube.

The amplifier, consisting of tubes V-2 to V-7, is self-biased by means of the current flowing in resistor R-22. This bias is automatically correct for continuous-wave transmission. For modulation, the grid bias developed by the oscillator tube is added to the self bias of the amplifier by an external connection between terminals 28 and 17. This extra bias is varied by the audio voltage in the secondary winding of the modulation transformer T-2. This variation in amplifier bias produces modulated carrier.

The cathode current of each tube, the heater current in two separate circuits, the total amplifier cathode current, and the total amplifier grid current can be metered at jacks on the front of the panel. In each case, the jack sleeve is positive and the tip negative,

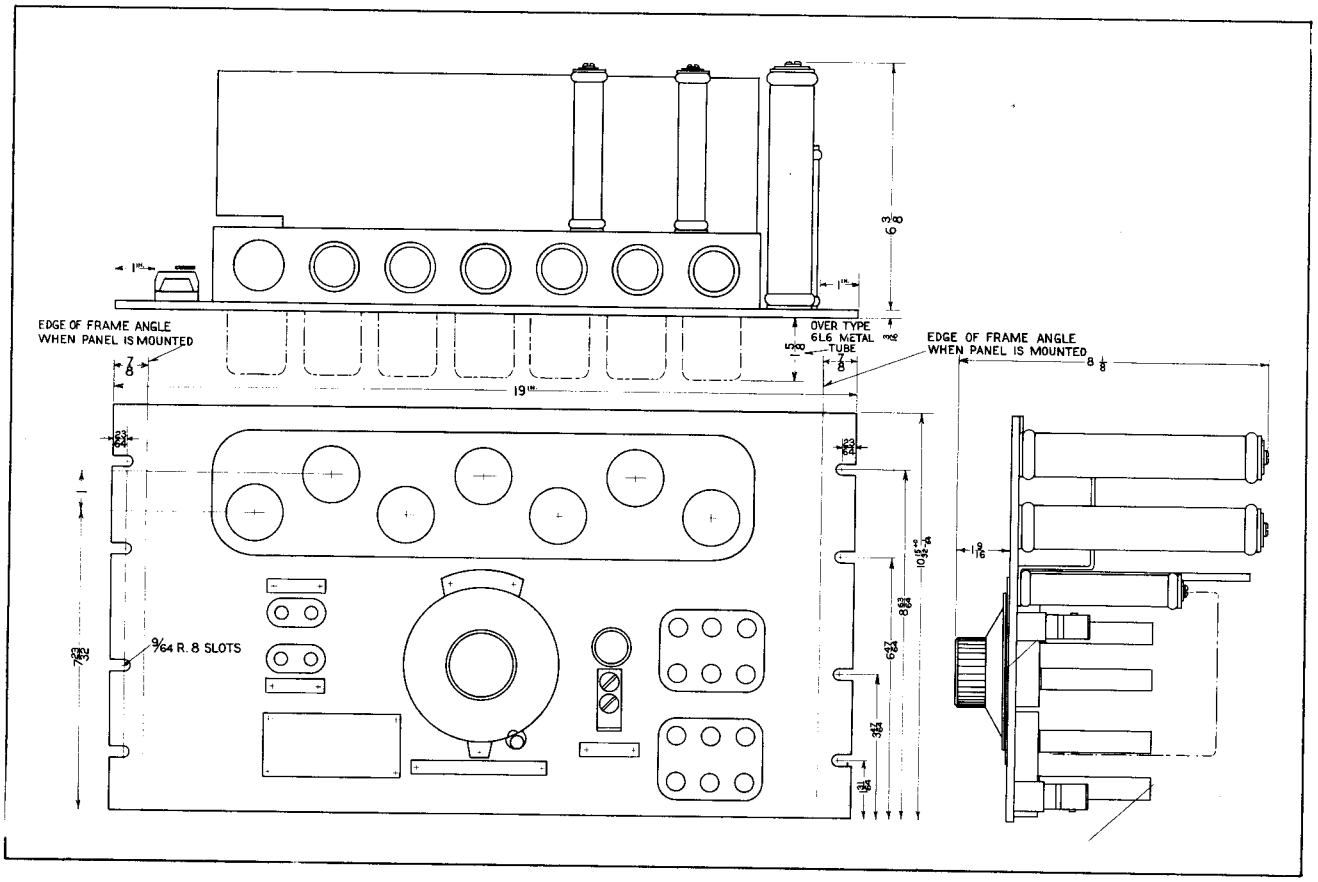


Fig. 1—Outline of the Type JY Carrier Transmitters. For Reference Only.

so that the current will flow from the sleeve to the tip through the meter. The radio-frequency output current is metered at the binding post jacks which are also on the front of the panel.

A protective gap TP-1, between the plates of the opposite sides of the amplifier (across the full primary winding of the output transformer T-1) prevents damage from lightning or switching surges. A varistor YR-1 across the primary of transformer T-2 prevents overmodulation of the carrier on relaying applications. For other applications it is usually removed. The amplifier screen resistor R-23 is shorted out for all applications except where a 320 volt plate supply is used.

Emergency communication can be effected by using a type JY modulator panel in conjunction with the transmitter. The components on the modulator panel and the modulating transformer T-2 provide the means of modulating the transmitter from a handset microphone plugged into the telephone jacks on the modulator panel.

Alternative components for tubes V-1 to V-7, and resistor R-22 are used for various applications as indicated on the diagram. These are listed in the Accessory Parts List and are covered by the following style numbers:

Accessory Style No.	Application
867933	125 volt supply, for continuous wave
867934	250 volt supply, for continuous wave
1352259	125 volt supply, for 100% modulation
1352260	250 or 320 volt supply for 100% modulation.

CHARACTERISTICS

The frequency range of these transmitters is either 50 or 150 kc or 150 to 300 kc with a

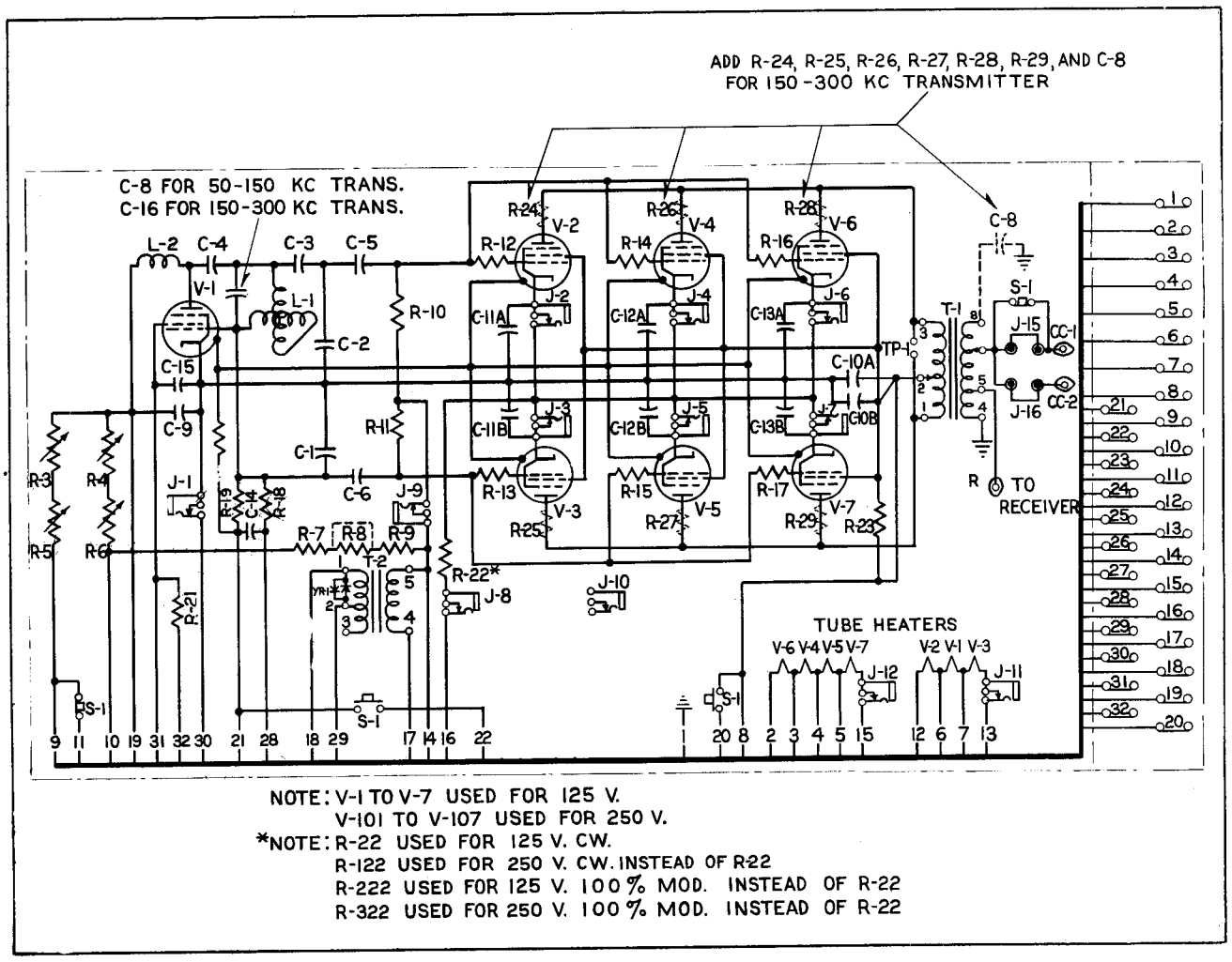


Fig. 2—Internal Schematic of the Type JY Carrier Transmitters.

10% overlap at each end of the frequency range. The carrier output circuits are arranged to feed into one coaxial cable or two cables in parallel. Both transmitters have continuous wave output of 10 watts on a 125 volt d-c supply, or 30 watts on a 250 volt d-c supply. When arranged for communication and 100% modulation, the carrier output is 2-1/2 watts on a 125 volt d-c supply, 7-1/2 watts on a 250 volt d-c supply, and 10 watts on a 320 volt d-c supply. Adjustments are available so that this Unit can be operated from 100 to 150 or 200 to 300 volts d-c using the proper accessories. The tube heater circuits are arranged so that they can be energized from the d-c supply, or energized by a-c from a suitable transformer. The transformer is usually part of a type JY power supply unit.

Modulation transformer T2 has primary taps for 50 or 600 ohm input. The unit is wired with taps 1 and 2 brought out to terminals 18 and 29 for 50 ohm input, such as a telephone handset microphone. For special applications requiring a 600 ohm input circuit, the lead on tap 2 can be disconnected, and taps 1 and 3 used instead.

INSTALLATION

This Unit is usually supplied as part of a type JY Power Line Carrier Equipment assembly. In these cases it is shipped assembled with the other units in a cabinet, completely wired.

When this Unit is shipped separately, proceed as follows: Unpack the unit and install it on a standard relay rack in the equipment

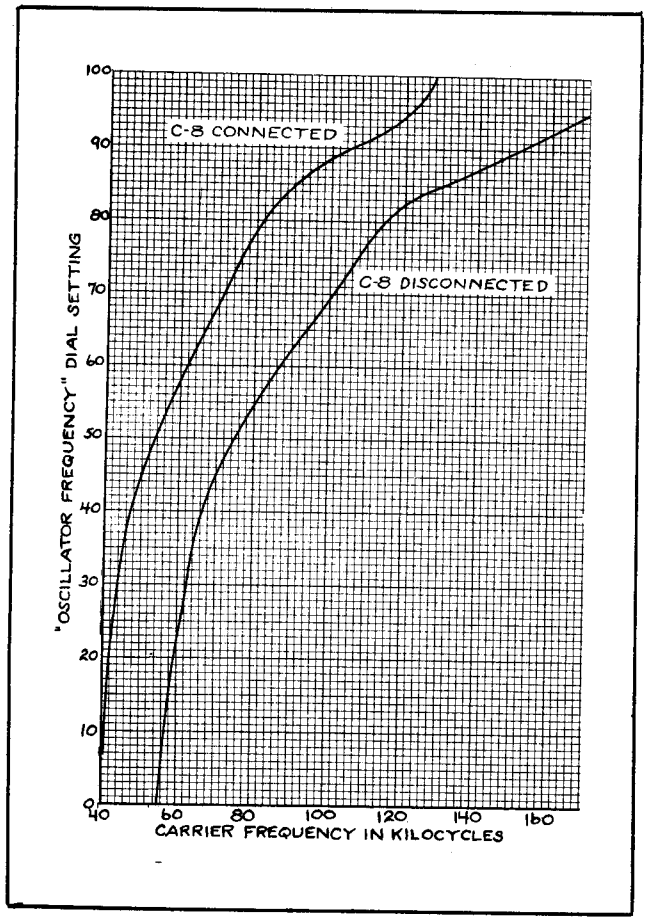


Fig. 3—Oscillator Frequency Dial Calibration Curve for the 50-150 Kc S#867932 Type JY Carrier Transmitter.

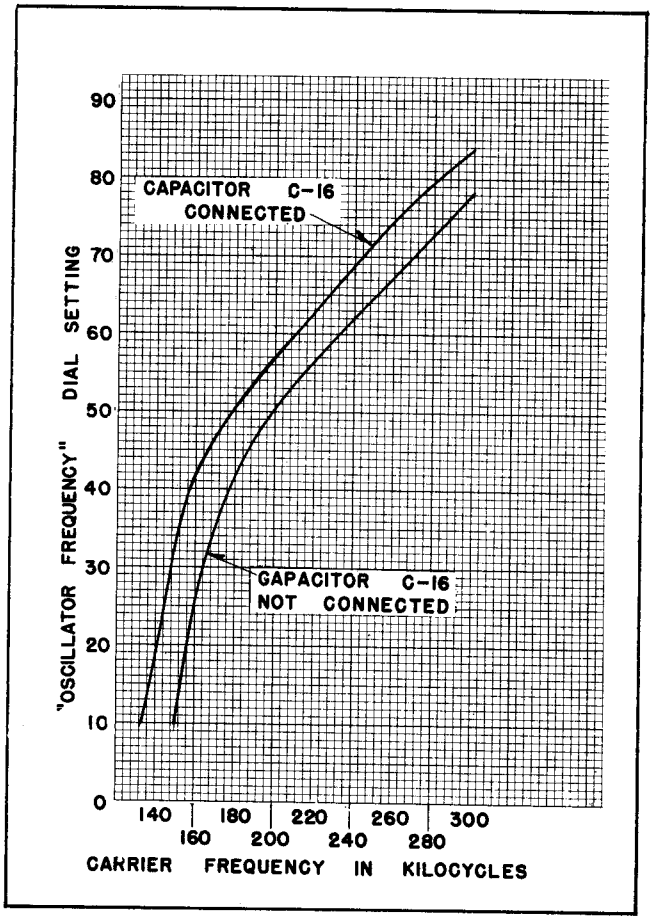


Fig. 4—Oscillator Frequency Dial Calibration Curve for the 150-300 Kc S#1352338 Type JY Carrier Transmitter.

assembly with which it is to be used. The mounting screws are contained in a cloth bag tied to the terminal strip of the Unit. Place the tubes (from the accessory group) in the tube sockets, and the cathode bias resistor in the empty fuse clips on the left side of the Unit looking at the rear. For HKB relaying applications, discard the cathode bias resistor and insert in the fuse clips the metal tube provided with the HKB Control Unit Accessories.

Refer to the interconnection diagram for the equipment assembly of which this unit forms a part, and make connections accordingly. The RF output terminal CC1 is used for the lead to the center conductor of the coaxial cable. If two coaxial cables are used, connect the center conductor of the second one to Terminal CC2. Ground the sheath of the coaxial cable and ground terminal #1 of this Unit. If a carrier receiver is used with this unit, connect the receiver input to Terminal R. Terminals R, CC1, and CC2 are porcelain posts with the marking stencilled near them. All the other terminals are located in the two vertical strips at the right side of the panel looking at the back. Do not connect more than two leads to any one of these terminals. For external connections, #22 gauge wire is ample for any circuit except the tube heater circuits. Use #18 for series connected tube heater circuits and where all the heaters are connected in parallel, use #14 for 25L6 tubes and #12 for 6L6 tubes.

ADJUSTMENTS AND MAINTENANCE

1. First adjust the heater current. The recommended current for the heater of a 25L6 tube is 0.28 ampere, and for a 6L6

tube is 0.85 ampere. The derating from the tube book values is intended to give longer life to the tubes.

On a-c applications where all the heaters are connected in parallel across a filament transformer, the transformer is designed to give the correct heater current with no adjustment.

On d-c and a-c applications where the heaters are connected in series, the heater current adjustment is made on a series resistor which is separate from this Unit.

On a 125 volt supply using 25L6 tubes, the heaters of tubes V-1, V-2 and V-3 are in one series circuit, and those of tubes V-4 to V-7 in another series circuit. Each circuit has its own external resistor. Adjust these resistors to give 0.28 ampere measured with a meter plugged into jacks 11 and 12.

On a 250-volt supply using 6L6 tubes, all the tube heaters are in one series circuit with one external series resistor bank. Adjust this resistor to give 0.85 ampere measured at either jacks 11 or 12.

Note that when power is first applied, the heater current will be quite high and will fall to a steady value as the heaters warm up. Adjust for the steady value.

For HKB relaying applications, there is a special heater adjustment which is covered in the Equipment Assembly Instruction Book of which this book forms a part.

2. Next see that the entire resistance of resistors R-3, R-4, R-5 and R-6 are in the circuit by disconnecting any shorting leads across all or part of them. Disconnect any external leads from r-f terminals CC1, CC2, and R, and connect a dummy load consisting of a 60 ohm non-inductive resistor, capable of dissipating about 50 watts, between terminal CC1 and ground. Connect the lead from jacks 15 and 16 to tap 8 on transformer T-1 when using 25L6 tubes, or to tap 7 when using 6L6 tubes. If using a 320-volt plate supply, permanently disconnect the shorting lead across resistor R-23.

Except for double-plate keying relaying applications using a 125-volt plate supply, see that the shorting lead across resistor R-8 is removed.

For all applications using 100% modulation, see that varistor YR-1 is removed from terminals 1 and 2 of transformer T-2.

3. Adjust the oscillator excitation as follows:

(a) For cathode keyed or circuit-opening plate keyed relaying applications, see that all of resistors R-4 and R-6 are unshorted, and that terminal 14 is connected to negative supply through the external circuits. Then adjust resistors R-3 and R-5 until the r-f current measured across jack 15 is 0.41 ampere with 25L6 tubes, or 0.71 ampere with 6L6 tubes.

(b) For double plate keyed relaying applications, first close the relay contacts (or push button) supplying the oscillator through terminal 10, leaving the supply through terminal 9 disconnected. Then adjust resistors R-4 and R-6 until the r-f current measured across jack 15 is 0.41 ampere with 25L6 tubes, or 0.71 ampere with 6L6 tubes. Then open the plate supply through terminal 10 (if necessary disconnect the external lead to terminal 20 so that the TEST button can be kept closed to read the meter), and close the plate supply through terminal 9. If this is done by closing the relay on the Modulator Unit, temporarily connect a jumper between carrier transmitter terminal 14 and negative supply to retain

normal grid bias on the amplifier tubes. Then adjust resistors R-3 and R-5 to give the same values of r-f. output current as above. Be sure all the external switchboard relay circuits are normal during this adjustment. After the adjustment is made, restore all temporary connections to normal.

(c) For HKB relaying applications (See the instruction book on the HKB Control Unit), first adjust resistors R-4 and R-6 to have a total value of approximately 9500 ohms. Then cause Thyratron V-1 in the HKB Control Unit to fire continuously, leave open the plate supply to the oscillator through terminal 9, and adjust resistors R-1 and R-2 in the HKB Control Unit to give an r-f output current measured at carrier transmitter jack 15 to 0.41 ampere with 25L6 tubes, or 0.71 ampere with 6L6 tubes. Then extinguish Thyratron V-1 in the HKB Control Unit, and close the oscillator plate supply through terminal 9. If this is done by closing the relay on the Modulator Unit, temporarily connect a jumper between carrier transmitter terminal 14 and HKB Control Unit terminal 7 to retain normal grid bias on the amplifier tubes. Then adjust resistors R-3 and R-5 to give the same values of r-f output current as above. After the adjustment is made, restore all temporary connections to normal.

(d) For applications using the continuous wave accessories where this Unit is permanently connected for modulated carrier, see that all of resistors R-4 and R-6 are unshorted. Then adjust resistors R-3 and R-5 until the r-f current measured at jack 15 is 0.32 ampere with 25L6 tubes, or 0.5 ampere with 6L6 tubes. Do not apply any audio for this adjustment.

(e) For application using 100% modulation, see that all of resistors R-4 and R-6 are unshorted. Then adjust resistors R-3 and R-5 until the r-f current measured at jack 15 is 0.24 ampere with 25L6 tubes, or 0.375 ampere with 6L6 tubes on a 250 volt plate supply, or 0.425 ampere with 6L6 tubes on 320 volt supply. Do not apply any audio for this adjustment.

4. Select the carrier frequency desired by referring to curve Fig. 3 or Fig. 4, and adjust the OSCILLATOR FREQUENCY control dial to the setting given by the curve. For frequencies above 80 kilocycles, disconnect capacitor C-8. The frequency setting from the curve is approximate and for installations where no carrier channels have yet been established, will be sufficiently accurate. To get an exact setting, use a precision wavemeter, or use a standard signal generator and an oscilloscope, connecting the signal generator across the horizontal plates and the transmitter output across the vertical plates, to obtain a circular figure. Alternately, use a receiver and zero-beat the transmitter output with a signal generator.

Remove the shorting link across jack 15, and connect an r-f ammeter, (1 ampere full scale) across its binding posts. Apply plate voltage to the oscillator and amplifier by closing the external power supply switch and pressing TEST button S-1.

If no current can be read, short out a portion of resistor R-3 or R-4 whichever is in the feed to the oscillator plate, (depending on the external connections), until current can be read on the meter. Always press the TEST button to read current at jack 15. A latch is provided on the front of the panel to hold the pushbutton closed.

5. For applications using the continuous wave accessories (See table under Electrical Description) varistor YR-1 across the primary of the modulation transformer automatically limits the modulation to the capabilities of the amplifier. The Equipment Assembly Instruction Book, of which this book forms a part, will give instructions for adjusting the audio input voltage at the source, such as a Type JY Tone Transmitter. For applications using 100% modulation, if the modulation transformer T-2 is connected to match a 600 ohm input, the type 25L6 tubes will require an input of 0.6 to 0.8 volts r.m.s., and the type 6L6 tubes an input of 1.0 to 1.4 r.m.s. For further details refer to the Equipment Assembly Instruction Book.

6. After the above adjustments are complete, switch off the plate voltage supply, and remove the 60-ohm resistor between terminal CC1 and ground. Reconnect terminals CC1, CC2 and R to any external leads. If both CC1 and CC2 are used, as with two coaxial cables, connect the lead from jacks 15 and 16 to tap 7 on transformer T-1 when using 25L6 tubes, or to tap 6 when using 6L6 tubes. When the apparatus at the far end of the coaxial cable or cables has been adjusted, recheck the r-f output currents. These should be within 10% of the values obtained with the dummy load. In the case of two coaxial cables, the figures will vary more than this, and the normal values for this condition, measured at either jack 15 or 16 are given in the adjustment table. After all r-f measurements are complete, remove the meter from jack 15 and replace the shorting link across the binding posts.

Check the cathode current of each tube and the total amplifier cathode and grid current at jacks 1 to 9 with the adjustment tables. Also measure the oscillator plate volts with a d-c voltmeter having a resistance of at least 1000 ohms per volt.

For oscillator screen keying applications, the oscillator plate volts will be somewhat higher, and the oscillator screen volts, measured across terminals 31 and 30, somewhat lower than the plate voltage values given in the tables. Record both quantities.

If the supply voltage is different from the nominal values, the adjustment values will also vary. The unit will operate from a supply between 100 and 150 volts using 25L6 tubes, and between 200 and 320 volts using 6L6 tubes, but for any voltage above 270 volts, remove the short from across amplifier screen resistor R-23. If the supply volts are above nominal, the oscillator plate voltage and cathode current will be below, and the amplifier cathode currents above, the table values for the same r-f output current and power. The amplifier grid current must not exceed the table values. Always maintain the table values for the heater currents. If the supply volts are below the nominal, it may not be possible to obtain the rated power output without excessive distortion. In this case, adjust the oscillator plate volts as high as possible, but do not exceed the table values for the amplifier grid current. All the other values will then be somewhat below the table values, except the heater currents which must be maintained.

The initial adjustment values should be recorded for future reference. If the recorded current readings show a progressive departure from their original values, it is probable that one or more tubes need replacement. The best check for a faulty tube is to exchange it with the oscillator tube and compare the power output obtained with that originally recorded. If all the tubes in the unit are suspected, replace all the amplifier tubes with new ones, and then test each of the tubes removed in the oscillator socket as described above. If the power output is not within 20% of the originally recorded value, replace the tube.

CAUTION Do not push the TEST button unless either the shorting link or the ammeter is in place across binding post jack 15, because the resulting open circuit may cause incorrect operation with carrier relays.

The heater current should be readjusted if necessary during maintenance, to the value listed in the adjustment table.

RENEWAL PARTS

When ordering renewal parts for this unit, include the following data from the nameplate:

(1) The name of the unit.

(2) The Style or DL number.

(3) The serial number.

TABLE I

ADJUSTMENT DATA USING 25L6 TUBES

	A	B	C
Nominal Supply voltage	125	125	125
Heater current (J-11 and J-12) amperes	0.28	0.28	0.28
Oscillator plate voltage (terminals 19 & 30)	30	25	36
Oscillator cathode current (J-1) milliamperes	12	8	13
Amplifier cathode currents each tube (J-2 thru J-7) milliamperes	60	37	20
Amplifier cathode current total (J-8) milliamperes	360	220	120
Amplifier grid current total (J-9) milliamperes	0.2	0	0
RF output current, single coaxial cable (J-15) amperes	0.41	0.32	0.24
RF output watts, current squared x 60, watts	10	6	3.45
RF output current, each of 2 coaxial cables (J-15 & J-16) amperes	0.29	0.22	0.17

Column A is for continuous wave operation.

Column B is for modulated operation with a maximum of 30% modulation using continuous wave accessories and no audio applied.

Column C is for modulated operation using accessories for 100% modulation and no audio applied.

TABLE II

ADJUSTMENT DATA USING 6L6 TUBES

	A	B	C	D
Nominal Supply voltage	250	250	250	320
Heater current (J-11 and J-12) amperes	0.85	0.85	0.85	0.85
Oscillator plate voltage (terminals 19 & 20)	65	60	73	85
Oscillator cathode current (J-1) milliamperes	20	14	15	18
Amplifier cathode currents each tube (J-2 thru J-7) milliamperes	60	37	20	27
Amplifier cathode current total (J-8) milliamperes	360	220	120	160
Amplifier grid current total (J-9) milliamperes	0.2	0	0	0
RF output current, single coaxial cable (J-15) amperes	0.72	0.5	0.375	0.425
RF output watts, current squared x 60, watts	30	15	8.4	11
RF output current, each of 2 coaxial cables (J-15 & J-16) amperes	0.5	0.35	0.265	0.30

Column A is for continuous wave operation.

Column B is for modulated operation with a maximum of 30% modulation using continuous wave accessories and no audio applied.

Column C is for modulated operation using accessories for 100% modulation and no audio applied.

Column D is for modulated operation on 320 volts using accessories for 100% modulation and no audio applied.

TRANSMITTER PARTS LIST

DIAGRAM SYMBOL 50-150 KC.	REQ'D.	DIAGRAM SYMBOL 150-300 KC.	REQ'D.	FUNCTION	RATING
				CAPACITORS	
C-1	1			Oscillator Tank	0.015 MFD. 2500 V. d-c Mica
		C-1	1	" "	0.0068 " " " " "
C-2	1			" "	0.015 " " " " "
		C-2	1	" "	0.0068 " " " " "
C-3	1			" "	0.015 " " " " "
		C-3	1	" "	0.0068 " " " " "
C-4	1	C-4	1	" Plate	0.027 " 600 " " "
		C-4	1	" "	0.0015 " 2500 " " "
C-5	1	C-5	1	Amplifier Grid	0.00027 " " " " "
C-6	1	C-6	1	" "	0.00027 " " " " "
C-8	1			Oscillator Tank	0.0051 " 2500 " " Mica
		C-8	1	Output Tuning	0.0015 " " " " "
C-9	1	C-9	1	Oscillator Plate By Pass	0.024 " "
C-10	1	C-10	1	Amplifier Plate-Screen By Pass	0.25 + 0.25 MFD. 600 V. d-c Paper
C-11	2	C-11	2	Amplifier Cathode By Pass	0.015 + .015 MFD. 600 V. d-c Paper
C-12	2	C-12	2	" " " "	0.015 + .015 " " " " "
C-13	2	C-13	2	" " " "	0.015 + .015 " " " " "
C-14	1	C-14	1	Bias Filter	0.015 + .015 " " " " "
C-15	1	C-15	1	Oscillator Screen By Pass	0.024 MFD. Mica
		C-16	1	Oscillator Tank	0.00056 MFD. 2500 V. d-c Mica
				JACKS	
J-1	1	J-1	1	Oscillator Cathode Current	One Circuit Opening--Western Electric #232-A
J-2	1	J-2	1	Amplifier Cathode Current	" " " or
J-3	1	J-3	1	" " "	" " " Cook Electric #JK-24
J-4	1	J-4	1	" " "	" " "
J-5	1	J-5	1	" " "	" " "
J-6	1	J-6	1	" " "	" " "
J-7	1	J-7	1	" " "	" " "
J-8	1	J-8	1	" " "	" " "
J-9	1	J-9	1	" Grid "	" " "
J-10	1	J-10	1	Spare	" " "
J-11	1	J-11	1	Heater Current	" " "
J-12	1	J-12	1	" "	" " "
J-15	1	J-15	1	R.F. Current	2 Binding Post
J-16	1	J-16	1	" "	" " "
				COILS	
L-1	1			Oscillator Variometer	0.17 to 1.7 Millihenries
		L-1	1	" "	0.053 to .575 Millihenries
L-2	1			Oscillator Plate	75 Millihenries
		L-2	1	" "	12 "
				RESISTORS	
R-3	1	R-3	1	Oscillator Plate	16,000 Ohms
R-4	1	R-4	1	" "	" "
R-5	1	R-5	1	" "	2000 Ohms 1 Adjustment Band
R-6	1	R-6	1	" "	" " " " "
R-7	1	R-7	1	Bias Balancing	82,000 Ohms 1 Watt

TRANSMITTER PARTS LIST

DIAGRAM SYMBOL 50-150 KC.	REQ'D.	DIAGRAM SYMBOL 150-300 KC.	REQ'D.	FUNCTION	RATING
				RESISTORS (Con't.)	
R-8	1	R-8	1	Bias Balancing	56,000 Ohms One Watt
R-9	1	R-9	1	" "	82,000 " " "
R-10	1	R-10	1	Amplifier Grid Leak	24,000 " " "
R-11	1	R-11	1	" " "	" " " "
R-12	1	R-12	1	Parasite Suppressor	1000 " " "
R-13	1	R-13	1	" "	" " " "
R-14	1	R-14	1	" "	" " " "
R-15	1	R-15	1	" "	" " " "
R-16	1	R-16	1	" "	" " " "
R-17	1	R-17	1	" "	" " " "
R-18	1	R-18	1	Oscillator Grid Leak	10,000 " " "
R-19	1	R-19	1	" " "	" " " "
R-20	1	R-20	1	Static Leak	0.27 Megohms One Watt
R-21	1	R-21	1	Oscillator Screen	16,000 Ohms
R-23	1	R-23	1	Amplifier Screen	2500 Ohms
		R-24	1	Parasite Suppressor	56 Ohms - 1 Watt
		R-25	1	" "	" " " "
		R-26	1	" "	" " " "
		R-27	11	" "	" " " "
		R-28	1	" "	" " " "
		R-29	1	" "	" " " "
				SWITCHES	
S-1	1	S-1	1	Test Push Button	3/16" TK. Panel Mtg.
				SPARK GAPS	
TP-1	1	TP-1	1	Output Transformer	Type RVS Arrester
				TRANSFORMERS	
T-1	1	T-1	1	R.F. Output	275/120 V.
T-2	1	T-2	1	Modulation	
				TUBE SOCKETS	
X-1		X-1		V1, V2, V3, V4, V5, V6, V7, or	
To	1	To	1	V101, V102, V103, V104, V105,	Ceramic Octal Wafer
X-7		X-7		V106, V107.	Amphenal M1P8T
				LIMITER	
YR-1	1	YR-1	1	Voltage	Rectox S#1269512

FROM DWGS. T-7613949 AND T-7613950

ACCESSORY PARTS LIST

DIAGRAM SYMBOL	S#867933	S#867934	S#1352259	S#1352260	FUNCTION	RATING
					RESISTORS	
R-22	1				Amplifier Cathode Bias	20 Ohms for 125 V. d-c Trans.
R-122		1			" " "	40 " " 250 V. " "
R-222			1		" " "	
R-322				1	" " "	
					TUBES	
V-1	1		1		Oscillator	25L6 for 125 V. d-c Trans.
V-2	1		1		Amplifier	" " " " " "
V-3	1		1		"	" " " " " "
V-4	1		1		"	" " " " " "
V-5	1		1		"	" " " " " "
V-6	1		1		"	" " " " " "
V-7	1		1		"	" " " " " "
V-101		1		1	Oscillator	6L6 for 250 V. d-c Trans.
V-102		1		1	Amplifier	" " " " " "
V-103		1		1	"	" " " " " "
V-104		1		1	"	" " " " " "
V-105		1		1	"	" " " " " "
V-106		1		1	"	" " " " " "
V-107		1		1	"	" " " " " "

FROM DWGS. T-7613949 AND T-763950

WESTINGHOUSE ELECTRIC CORPORATION

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