

# Munich Relay Station

## ISMANNING TRANSMITTER PLANT

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2.38

### INSTRUCTIONS

for  
*Millen Secondary Frequency Standard*  
Cat. No. *90505* Serial No. ....

JAMES MILLEN MFG. CO., INC.  
MALDEN, MASS., U. S. A.

## SECONDARY FREQUENCY STANDARD

Model 90501 - 115-volt - 60 C.P.S.  
Model 90503 - 230-volt - 50-60 C.P.S.

### I. COMPONENT UNITS

1. Secondary Frequency Standard unit with metal cabinet.
2. Type G18 or G51 General Electric 1000 KC quartz crystal oscillator.
3. One complete set of vacuum tubes comprising:
  - 1 - 6K8 - crystal oscillator tube.
  - 2 - 6SN7-GT - multivibrator tubes.
  - 1 - 6V6 - harmonic amplifier tube .
  - 1 - 6SJ7 - mixer tube.
  - 1 - 6J5 - audio oscillator tube.
  - 1 - 5W4 or 5Y3-GT - rectifier tube.
  - 1 - VR150-30 - voltage regulator tube.
4. One Power Cord.
5. One instruction book.
6. Two - 37212 Plugs.

### II. UNPACKING

The carton in which the equipment is shipped should be carefully opened. A careful check should be made to be sure that all component units are located before destroying any of the packing material.

It is not advisable to ship the crystal mounted in its socket inside the cabinet, so it is packed in a separate box.

The crystal is inserted into its socket through an opening on the right side of the cabinet.

### III. OPERATION

#### 1. General

The Secondary Frequency Standard consists of a 6K8 1000 KC crystal oscillator, a 6SN7-GT 100 KC multivibrator, a 6SN7-GT 25 and 10 KC multivibrator, a 6SJ7 mixer, a 6J5 audio oscillator for tone modulation, a 6V6 harmonic amplifier, and a VR150-30 voltage regulator.

#### 2. Crystal Oscillator

The crystal oscillator uses a General Electric type G18 or G51 1000 KC crystal with a frequency-temperature coefficient of less than one cycle per megacycle

per degree centigrade. The crystal is sealed in Helium in a standard metal tube envelope. The oscillator can be set to zero beat with WWV or some other primary frequency standard by means of a screwdriver adjustment on the front panel. The crystal frequency is set at the factory.

### 3. 100 KC Multivibrator

The first 6SN7-GT is used as a 100 KC multivibrator oscillator synchronized with the 1000 KC crystal oscillator.

### 4. 25 and 10 KC Multivibrator

The second 6SN7-GT is used as a multivibrator oscillator synchronized with the 100 KC multivibrator. The frequency determining circuit for this multivibrator is switched by means of the KC. INTERVAL switch on the panel.

### 5. KC. INTERVAL Switch

In the "1000" position of the INTERVAL switch, the output of the 1000 KC crystal oscillator is fed directly into the 6V6 harmonic amplifier grid and the multivibrator tubes are inoperative so that signals at intervals of 1000 KC are available at the output terminal.

In the "100" position of the KC. INTERVAL switch, the output of the oscillator is coupled to the 100 KC multivibrator in order to synchronize the multivibrator with the proper subharmonic of the crystal oscillator. In this position of the switch the first multivibrator operates.

Allow a 10 minute warm-up period before using 10 KC or 25 KC intervals.

In the "25" position of the KC. INTERVAL switch, the output of the oscillator is coupled to the 100 KC Multivibrator, the output of this being coupled to the second multivibrator to synchronize the 25 KC multivibrator with the proper subharmonic of the 100 KC multivibrator. The switch puts the proper resistors for the 25KC operation in the second multivibrator circuit. The output of the second multivibrator is coupled to the harmonic amplifier so that signals at intervals of 25 KC are available at the output terminal.

In the "10" position of the KC. INTERVAL switch, the operation is the same as for the "25" position except that the resistors for the second multi-vibrator are changed for 10 KC operation.

#### 6. Harmonic Amplifier

The output of the oscillators is fed into the 6V6 harmonic amplifier. The harmonic amplifier has a tuned output circuit with coil switching to cover the following ranges: 0-2 Mc., 2-5 MC., 5-11 MC., 10-22 MC., 18-40 MC., and 25-50 Mc. The coil-changing switch is marked BAND.

The output of the harmonic amplifier can be varied by a gain control on the front panel of the Frequency Standard. The output is available at a terminal marked OUTPUT.

Using an ordinary communication receiver, the Frequency Standard can be heard up to 50 megacycles at 1000 KC and 100 KC intervals, up to 42 megacycles at 25 KC intervals, and up to 39 megacycles 10 KC intervals. The output of the Frequency Standard in the vicinity of 13 MC is: 700 microvolts at 1000 KC intervals, 200 microvolts at 100 KC intervals, 35 microvolts at 25 KC intervals, and 20 microvolts at 10 KC intervals.

The harmonic amplifier, when properly tuned, greatly increases the usefulness of the Frequency Standard.

#### 7. Mixer

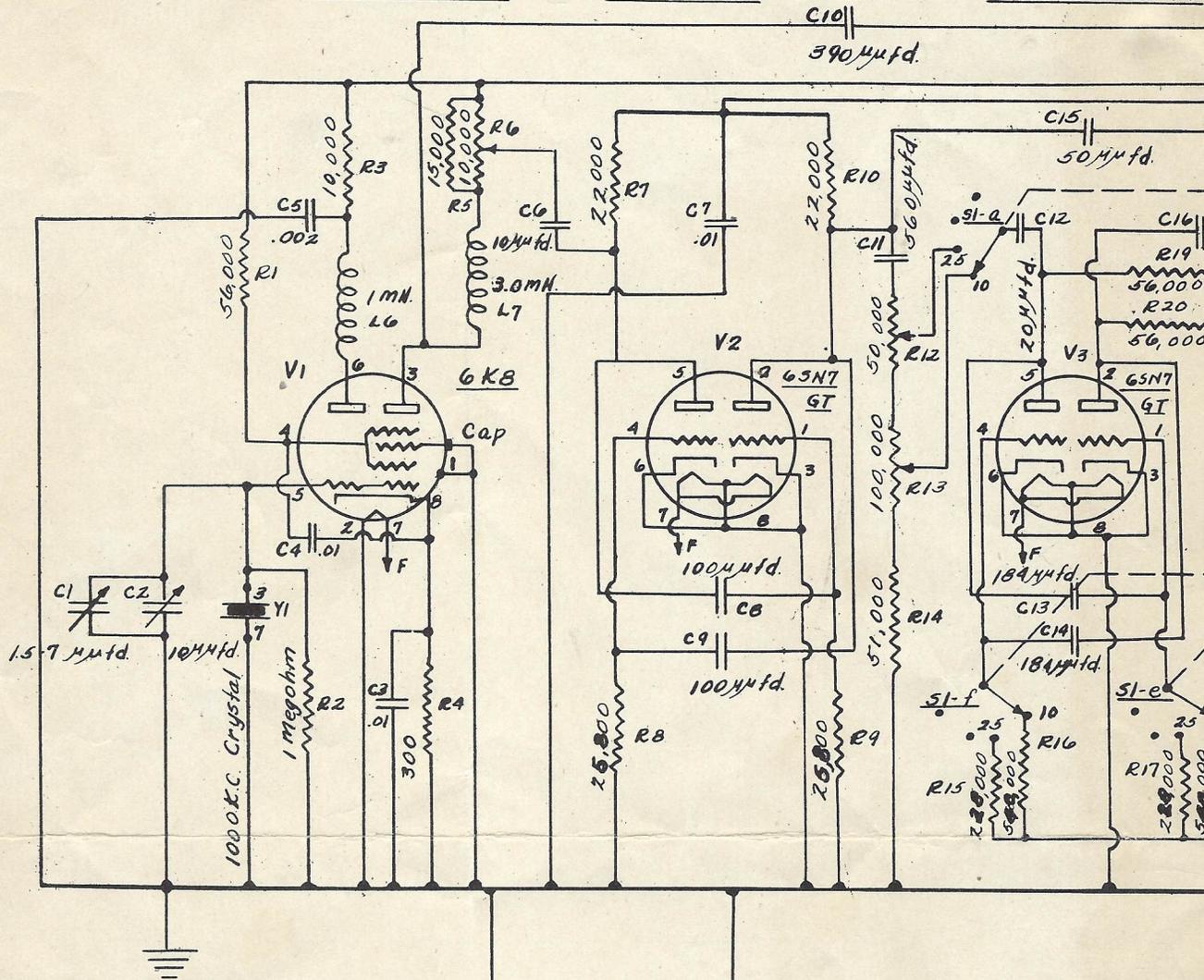
The output of the harmonic amplifier is fed into the control grid of a 6SJ7 mixer. This grid is also coupled to the terminal marked INPUT. The audio output of the mixer is available at a phone jack marked PHONE.

Since the mixer grid circuit is untuned, a fairly high input level is required. The use of the built-in mixer greatly simplifies many calibrations.

Oscillator Buffer

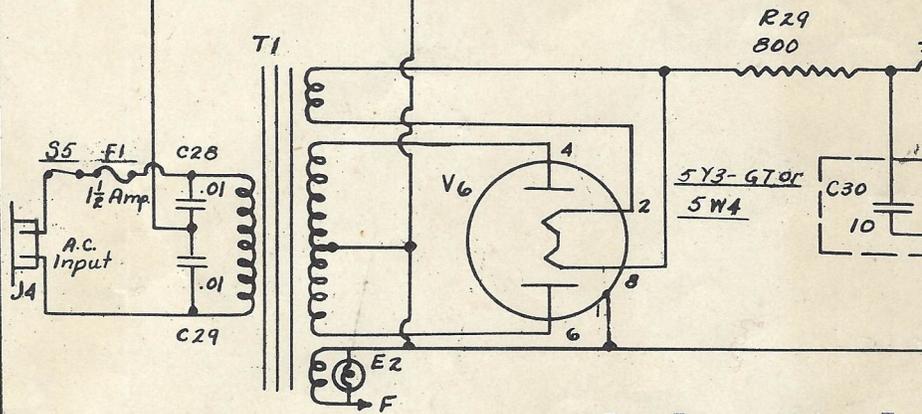
100K.C. M.V.

THIRD ANGLE  
10 & 25 K.C. M.V.



Note - Interval Switch

- SI-a. 10-Sync. Voltage for 10K.C. Multivibrator
- 25-Sync. Voltage for 25K.C. Multivibrator
- SI-b. 10 & 25-Output of 10K.C. + 25K.C. Multivibrator to grid of 6V6 Harmonic Amp.
- 100-Output of 100K.C. Multivibrator to grid of 6V6 Harmonic Amp.
- 1000-Output of 1000K.C. Oscillator - Buffer to grid of 6V6 Harmonic Amp.
- SI-c. 10 & 25-B Voltage on for 10K.C. + 25K.C.
- SI-d. 10, 25, 100-B Voltage on for 100K.C.
- SI-e, f. 10-Switching of grid resistors for 10K.C. Multivibrator
- 25-Switching of grid resistors for 25K.C. Multivibrator



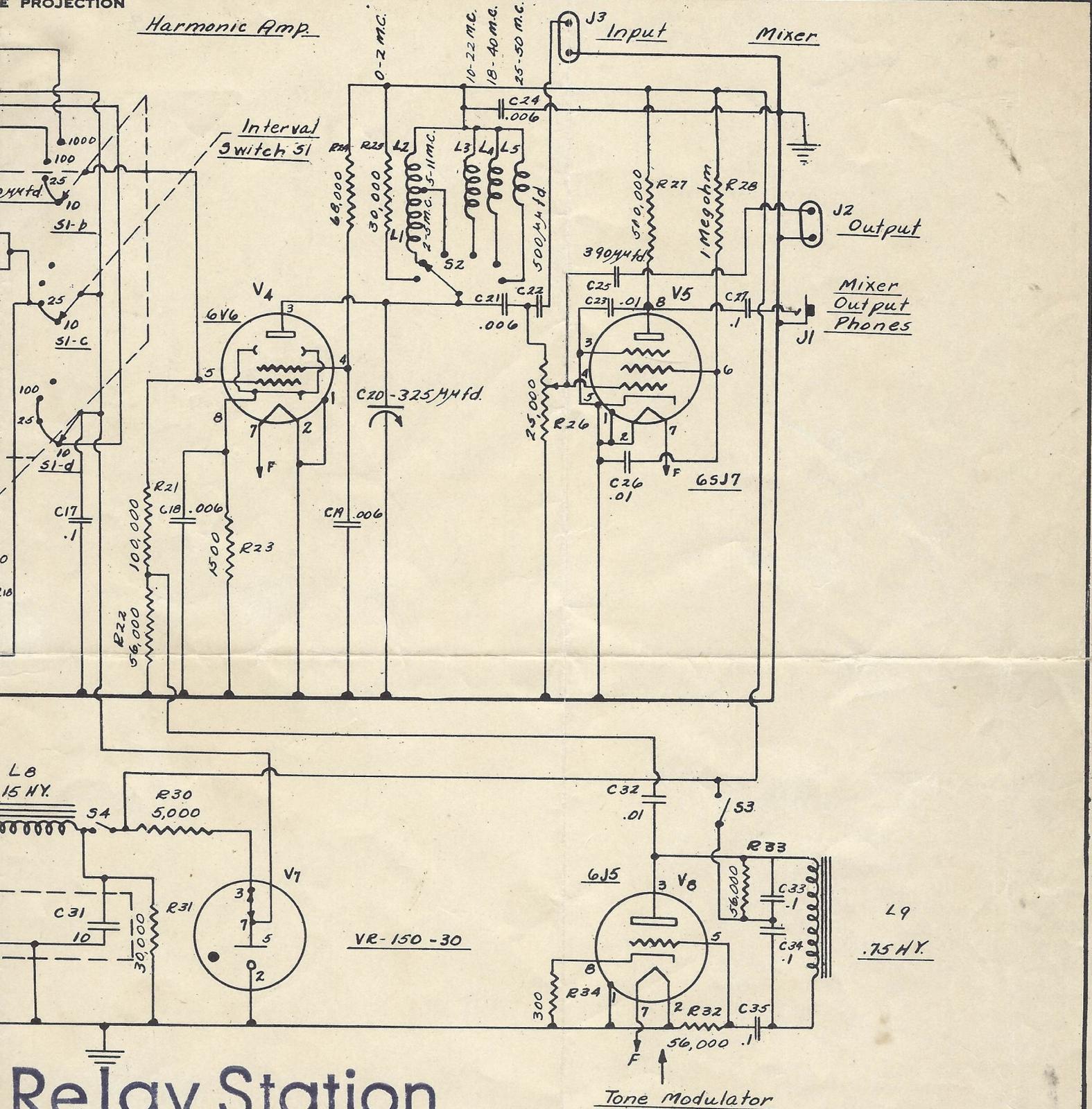
Munich

90501 - 115 VOLT STANDARD LESS TUBES  
 90505 - 115 VOLT STANDARD WITH TUBES  
 90507 - 230 VOLT STANDARD WITH TUBES

ISMANING TRANSMITTER

C-35  
R-34

Harmonic Amp.



# Relay Station

ALL DIMENSIONS UNLESS OTHERWISE NOTED MUST BE HELD TO A TOLERANCE OF

5-9-49	(A)	R8 & R9 wds 26,100 R15 & R17 were 235,000 R4 & R8 550,000
9-27-45	(B)	Eliminated 115V. at J4-Gnd. Shocks chg. L7 from 2.5 mh to 3.0 mh H.S. added mtg on voltage
2-21-45	(7)	C1 made Permanent - chg R14 to 51,000 chg R27 to 510,000 - Label Crystal Y1
1-15-45	(6)	Redrawn - No chgs. H.I.
1-12-45	(5)	R8 & R9 were 26,300 R15 & R16 were 225,000 chg. of C24 on schematic

## CIRCUIT DIAGRAM

FIRST MADE FOR 90505 FREQUENCY STANDARD

DESIGNED BY <u>R.W.C.</u>	CHECKED BY <u>R.W.C.</u>
DRAWN BY <u>C.W.S.</u>	APPROVED <u>N.W.S.</u>

**JAMES MILLEN MFG. CO., INC.**  
MALDEN, MASS., U.S.A.

DATE  
**M90505-A**    **A-5-44**

PLANT