

SECTION I

INTRODUCTION

1-1. SCOPE OF MANUAL.

1-2. This instruction manual provides operating and maintenance instructions for the PANORAMIC* Tuning Head, Model RF-8 (hereafter referred to as the Tuning Head) and the PANORAMIC Rack Mounting Assembly, Model MF-8 (hereafter referred to as the Rack Mounting Assembly) manufactured by The Singer Company, Metrics Division. (See figure 1-1.) The Tuning Head is a plug-in unit used with either Main Frame Models MF-2 and MF-50 or the Rack Mounting Assembly. The combination of a Tuning Head and Rack Mounting Assembly is referred to as the Model RF-8R.

1-3. The information contained in this manual refers only to the standard version of the Tuning Head and is current only to the date of publication. Differences in equipment components, specifications and performance resulting from The Singer Company's continuous production improvement program or individual customer design and application requirements are described in addendum sheets.

1-4. PURPOSE AND USE OF EQUIPMENT.

1-5. The Tuning Head is a transistorized VFO (variable frequency oscillator) primarily designed for use with the Model CA-5 Panalyzer in the PANORAMIC Model SSB-50 Single Sideband Spectrum Analyzer. The RF-8 and CA-5 provide r-f spectrum analysis in the frequency range from 2 to 40 MHz. When used with the Rack Mounting Assembly, the Tuning Head is a solid-state replacement for the Model RF-7a Tuning Unit in the PANORAMIC Models SSB-3b and SSB-4 Analyzer. The Rack Mounting Assembly provides the Tuning Head with the necessary mounting enclosure and operating power during rack-mount operation.

1-6. GENERAL DESCRIPTION.

1-7. The Tuning Head is a highly stable continuous tuning oscillator plug-in unit designed to provide injection signals over the frequency range from 2.5 to

40.5 MHz in four bands. (The frequency indicated by the Tuning Head dial is 500 kHz below the Tuning Head output.) It consists mainly of a precision inductance tuned variable frequency oscillator and frequency dividers, and is contained in a completely shielded enclosure. The oscillator frequency stability and low spurious radiation of the Tuning Head make it particularly suitable for use in single-sideband analysis.

1-8. The range of signal frequencies generated by the Tuning Head is divided into four bands. The RANGE selector switch and tuning control provide tuning over the 2 to 40 MHz frequency range. A two-speed tuning drive within the unit facilitates rapid frequency changes while retaining the slow, backlash-free tuning required for the final tuning of the Tuning Head. The output of the Tuning Head is available at a front-panel and a rear BNC connector. The Tuning Head requires an 11-volt regulated dc power source for operation. This voltage is supplied by either the MF-2, MF-50 or the Rack Mounting Assembly.

1-9. The Rack Mounting Assembly is a relay rack mounting unit designed for a standard 19-inch rack. It contains an 11-volt dc power supply which furnishes the Tuning Head with operating power. The Tuning Head fits into an opening in the Rack Mounting Assembly, connecting the Tuning Head to the d-c power source. The Rack Mounting Assembly operates from a 105 to 125 volt, 50 to 400 Hz, a-c power line.

1-10. SPECIFICATIONS.

1-11. Table 1-1 lists the electrical and physical characteristics of the Tuning Head and Rack Mounting Assembly.

1-12. TRANSISTOR, DIODE AND FUSE COMPLEMENT.

1-13. Table 1-2 lists the entire complement of transistors, diodes and fuses used in the Tuning Head and Rack Mounting Assembly.

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TABLE 1-1. SPECIFICATIONS

<u>RF-8</u>	
Output Frequency Range:	2.5 to 40.5 MHz minimum
Output Voltage Level:	0.250 to 0.550 volt rms
Output Impedance:	50 ohms
Frequency Modulation Hum:	0.5 Hz at 30MHz maximum
Spurious Signal Level:	-60 dB down from the output level (except those harmonically related).
Operating Voltage Required:	11 ± 0.1 volts dc at 60 ma
Operating Temperature Range:	0 to 55° Centigrade
Physical Characteristics:	
Weight:	3 lbs
Width:	3-3/4 inches
Height:	4 inches
Depth (including handle):	11-3/4 inches
<u>MF-8</u>	
Output Voltage:	11 volts dc at 0.2 amp.
Operating Voltage Required:	105 to 125 volts ac, at 50 to 400Hz
Power Consumption:	4 watts
Operating Temperature Range:	0 to 55° Centigrade
Physical Characteristics:	
Weight:	5 lbs
Width:	19 inches
Height:	5-1/4 inches
Depth:	11-1/4 inches

TABLE 1-2. TRANSISTOR, DIODE AND FUSE COMPLEMENT

Ref. Desig.	Type	Function
<u>RF-8</u>		
A1Q1	2N3646	Colpitts Oscillator
A2Q1	2N3646	Grounded-Base Amplifier
A2Q2	2N3646	Emitter Follower
A3Q1 and Q2	2N3646	Flip-Flop
A3Q3 and Q4	2N3646	Flip-Flop
A3Q5 and Q6	2N3646	Flip-Flop
A3Q7	2N3567	Filter
A3CR1-CR18	1N995	Flip-Flop Diodes
<u>MF-8</u>		
F1	1/32 Amp SLO-BLO	A-c Line Protection

SECTION II

OPERATION

2-1. GENERAL.

2-2. This section contains installation and operating instructions for the Tuning Head and Rack Mounting Assembly. The Tuning Head has been factory tested and aligned and is shipped in a ready-to-operate condition. However, no attempt should be made to install or operate the unit until the operator is thoroughly familiar with the contents of this section. Figures 2-1 and 2-2 are outline dimension drawings of the Rack Mounting Assembly and Tuning Head, respectively.

2-3. INSTALLATION.

2-4. To install the Rack Mounting Assembly in a standard 19-inch relay rack, place the assembly in the position desired and secure the front panel to the vertical members of the rack with four screws. After the Rack Mounting Assembly is installed, connect the power cord to a source of 105 to 125 vac, 50 to 400 Hz power.

2-5. To install a Tuning Head in the Rack Mounting Assembly, install the Tuning Head in the cavity, and

firmly seat the Tuning Head in place. If any resistance is noted while inserting the Tuning Head, withdraw it and examine the connectons on the rear of the Tuning Head and the rear wall of the Rack Mounting Assembly cavity for proper alignment. Tighten the front-panel fastener on the Tuning Head to mechanically secure it to the Rack Mounting Assembly. The procedure for installing a Tuning Head in the Models MF-2 and MF-50 Main Frames is identical.

2-6. OPERATION.

2-7. OPERATING CONTROLS, INDICATORS, AND CONNECTORS. The operating controls, indicators, and connectors for the Tuning Head and Rack Mounting Assembly are described in table 2-1 and shown in figure 2-3.

2-8. OPERATING PROCEDURE. The following procedure describes how to operate the Tuning Head. The procedure assumes that power is applied to the unit.

- a. Set the RANGE switch to the desired frequency range.
- b. Rotate the tuning control until the desired frequency marking of the tuning dial MHz is aligned with the graticule.

TABLE 2-1. OPERATING CONTROLS, INDICATORS AND CONNECTORS

Index No. (Figure 2-3)	Reference Designation	Name	Function
6 2 1	S1	RF-8	
		RANGE	Selects desired output frequency range from 2.5 to 4.5 MHz, 4.5 to 9.5 MHz, 9.5 to 19.5 MHz and 19.5 to 40.5 MHz.
		Tuning Control	Selects desired output frequency within selected range. A FINE tuning feature is selected by pressing in the tuning control. The entire selected frequency range is covered by 24 turns of the control or 384 turns of the control in the FINE mode.
		Tuning Dial, MHz	Indicates the analyzer input frequency to be heterodyned with the selected output frequency. The output frequency is actually 500 kHz above the value indicated on the tuning dial. The yellow band

(Cont'd)

TABLE 2-1. OPERATING CONTROLS, INDICATORS AND CONNECTORS (Cont'd)

Index No. (Figure 2-3)	Reference Designation	Name	Function
1 (Cont'd)			(calibrated from 0 to 2 MHz) on the 2.0 to 4.5 MHz portion of the MHz tuning dial is for use with the Model REC-2 Range Extending Converter. Refer to the REC-2 manual.
3	P1	OUTPUT 50 Ω	Provides the unit output to a BNC connector. A second output is available at the rear of the unit.
4	S1	MF-8	Applies primary power to the Rack Mounting Assembly.
		POWER	
5	DS1	Power Indicator Light	Illuminates to indicate that power is applied to the Rack Mounting Assembly.

2-9. PACKAGING INSTRUCTIONS.

2-10. The following packaging instructions provide information for short term and long term storage and shipping of the Tuning Head and Rack Mounting Assembly.

2-11. **SHORT-TERM PACKAGING.** For short-term packaging, the Tuning Head or Rack Mounting Assembly

should be enclosed in a polyethylene bag and placed in a suitable carton for protection. The carton should be stored in a clean and moisture-free area. All accessories and literature should be securely fastened to the equipment in order to prevent loss.

2-12. **LONG-TERM PACKAGING AND PACKAGING FOR SHIPMENT.** Figure 2-4 and 2-5 illustrate the packaging procedure for the Tuning Head and Rack Mounting Assembly, respectively.

SECTION III

THEORY OF OPERATION

3-1. GENERAL.

3-2. This section contains the theory of operation for the Tuning Head and Rack Mounting Assembly. The Tuning Head is basically a tunable oscillator-divider unit that provides injection signals in the frequency range from 2.5 to 40.5 MHz. Operating power for the Tuning Head is provided by either the Models MF-2 and MF-50 Main Frames or the Rack Mounting Assembly.

3-3. SIMPLIFIED BLOCK DIAGRAM ANALYSIS.

3-4. The Tuning Head (figure 3-1) contains a tunable oscillator that is inductively tuned over a frequency range of 20 to 40.5 MHz by the front panel tuning control. (Tuning Head dial indication is 500 kHz below the oscillator frequency.) The oscillator output is then amplified before being applied to a three stage flip-flop frequency divider and the OUTPUT 50 Ω connector (when RANGE switch S1 is in the 19.5-40.0 position). Within the frequency divider the oscillator output frequency (20 to 40.5 MHz) is divided by 1/2, 1/4, and 1/8, providing an output in the frequency ranges of 10 to 20 MHz, 5 to 10 MHz and 2.5 to 5 MHz, respectively, for the 9.5-19.5, 4.5-9.5 and 2.0-4.5 positions of RANGE switch S1. A filter is provided in the Tuning Head to provide a filtered d-c voltage to the oscillator.

3-5. The Rack Mounting Assembly consists of an 11-volt regulated dc power supply and related circuitry.

The power supply furnishes the Tuning Head with the necessary operating voltage.

3-6. DETAILED THEORY OF OPERATION.

3-7. The Tuning Head (figure 5-1) consists of three major electronic assemblies: The Oscillator (A1), the Amplifier (A2) and the Divider/Regulator (A3). The oscillator is of the Colpitt-Clapp type and is inductively tuned by inductuner L2, which is mechanically ganged to the front panel tuning control. The amplifier consists of grounded-base buffer amplifier A2Q1 and emitter follower A2Q2. The oscillator output applied directly to RANGE switch S1 is taken from a point in the emitter circuit of A2Q2 which provides correct output impedance of 50 ohms. The oscillator output applied to the frequency divider is provided at a lower output impedance. The divider consists of three conventional flip-flops. Stage A3Q7 provides cancellation of power supply ripple and transients.

3-8. The Rack Mounting Assembly (figure 5-2) consists of the 11-volt dc regulated power supply and associated input circuitry. When POWER switch S1 is placed to the up (on) position, the 105 to 125-volt a-c input is applied to the 11-volt dc power supply, resulting in the supply output of 11 volts dc. The 11-volt dc supply voltage is coupled to the Tuning Head via pins 7 and 8 of connector J1. Fuse F1 protects the circuitry of the power supply, and indicator DS1 illuminates when a-c power is energizing the unit.

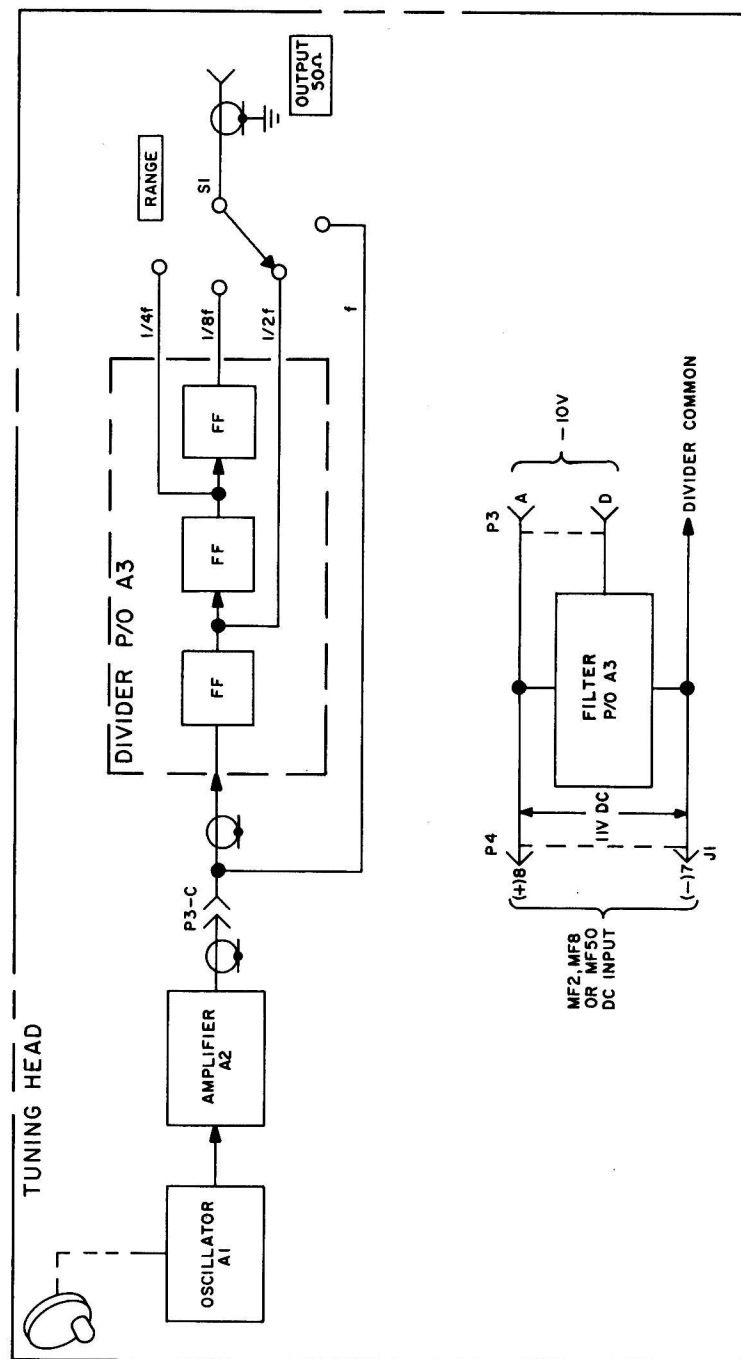
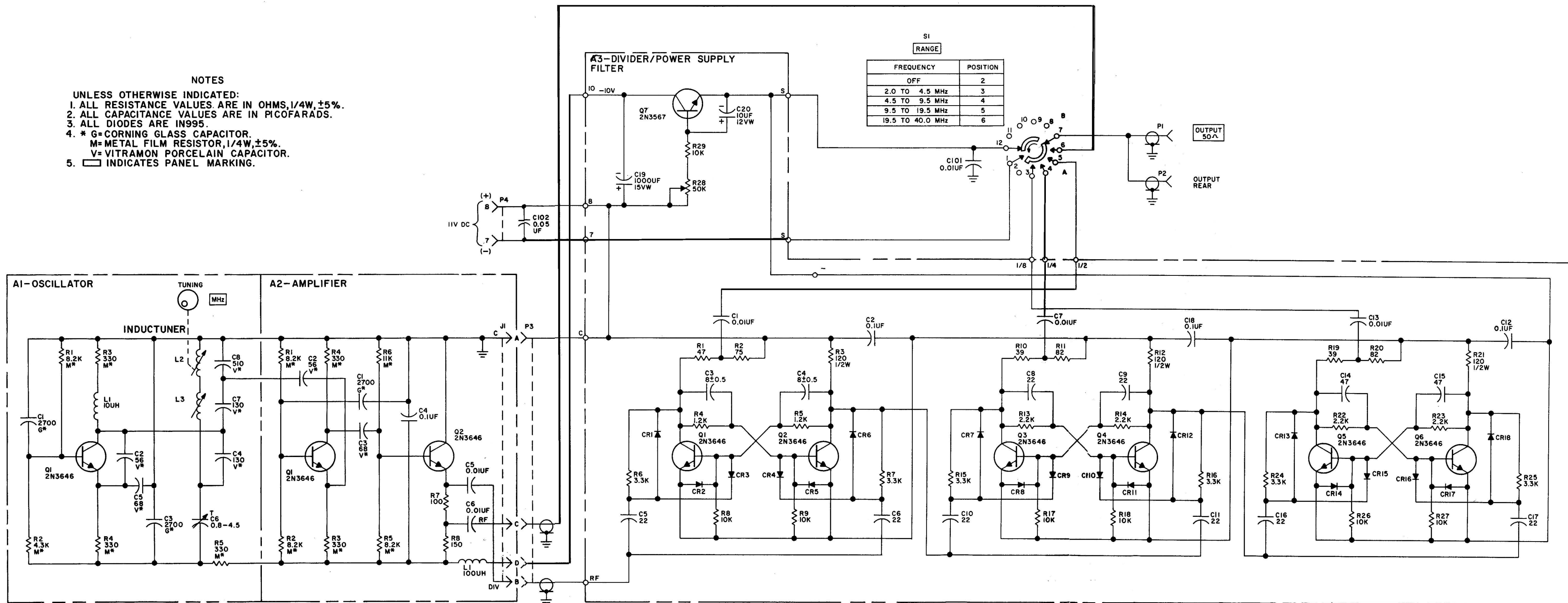


Figure 3-1. Tuning Head and Rack Mounting Assembly, Simplified Block Diagram

UNLESS OTHERWISE INDICATED:

1. ALL RESISTANCE VALUES ARE IN OHMS, 1/4W, $\pm 5\%$.
2. ALL CAPACITANCE VALUES ARE IN PICO FARADS.
3. ALL DIODES ARE IN995.
4. * G= CORNING GLASS CAPACITOR.
M= METAL FILM RESISTOR, 1/4W, $\pm 5\%$.
V= VITRAMON PORCELAIN CAPACITOR.
5.  INDICATES PANEL MARKING.

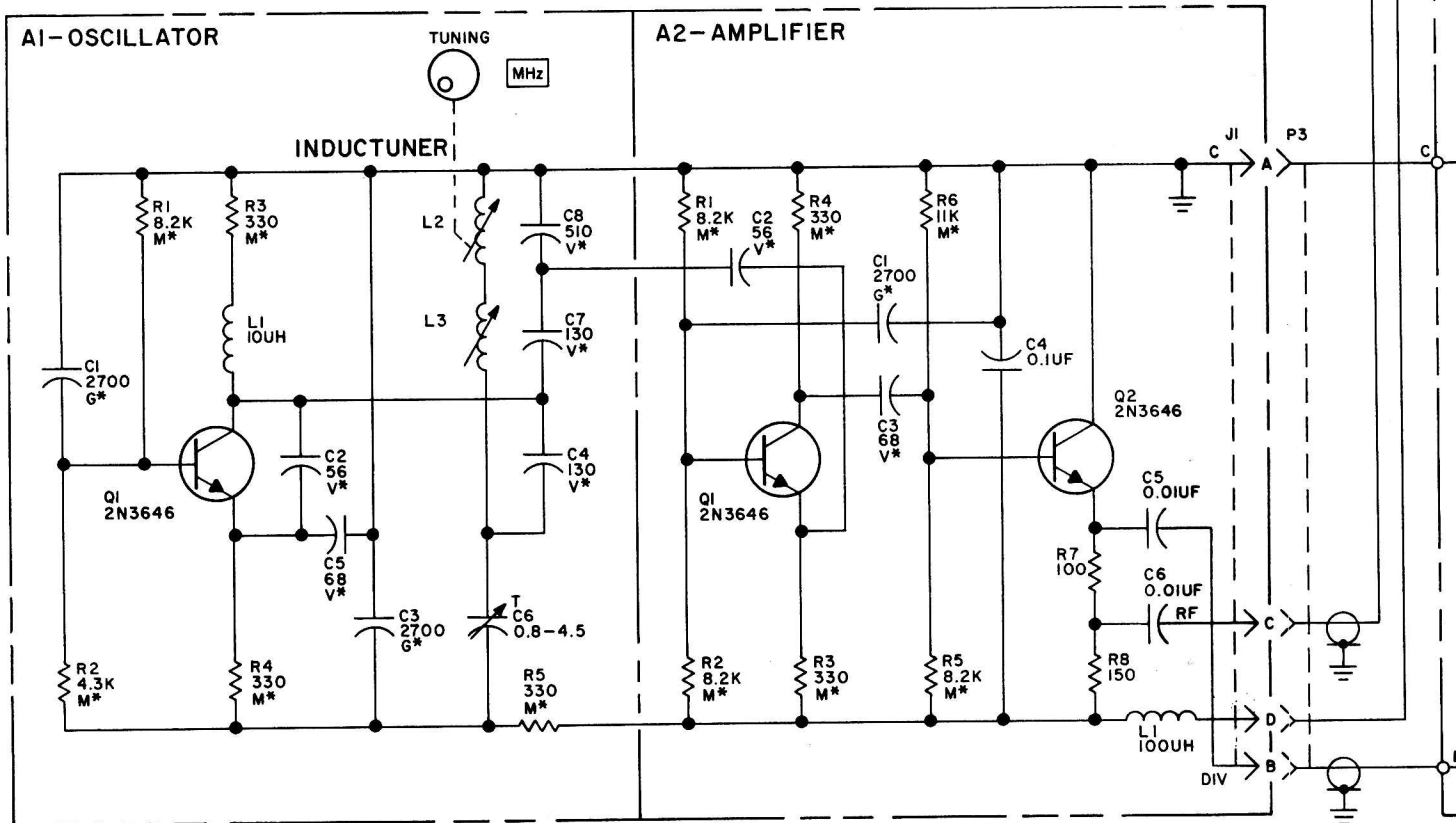


**Figure 5-1. Tuning Head,
Schematic Diagram**

NOTES

UNLESS OTHERWISE INDICATED:

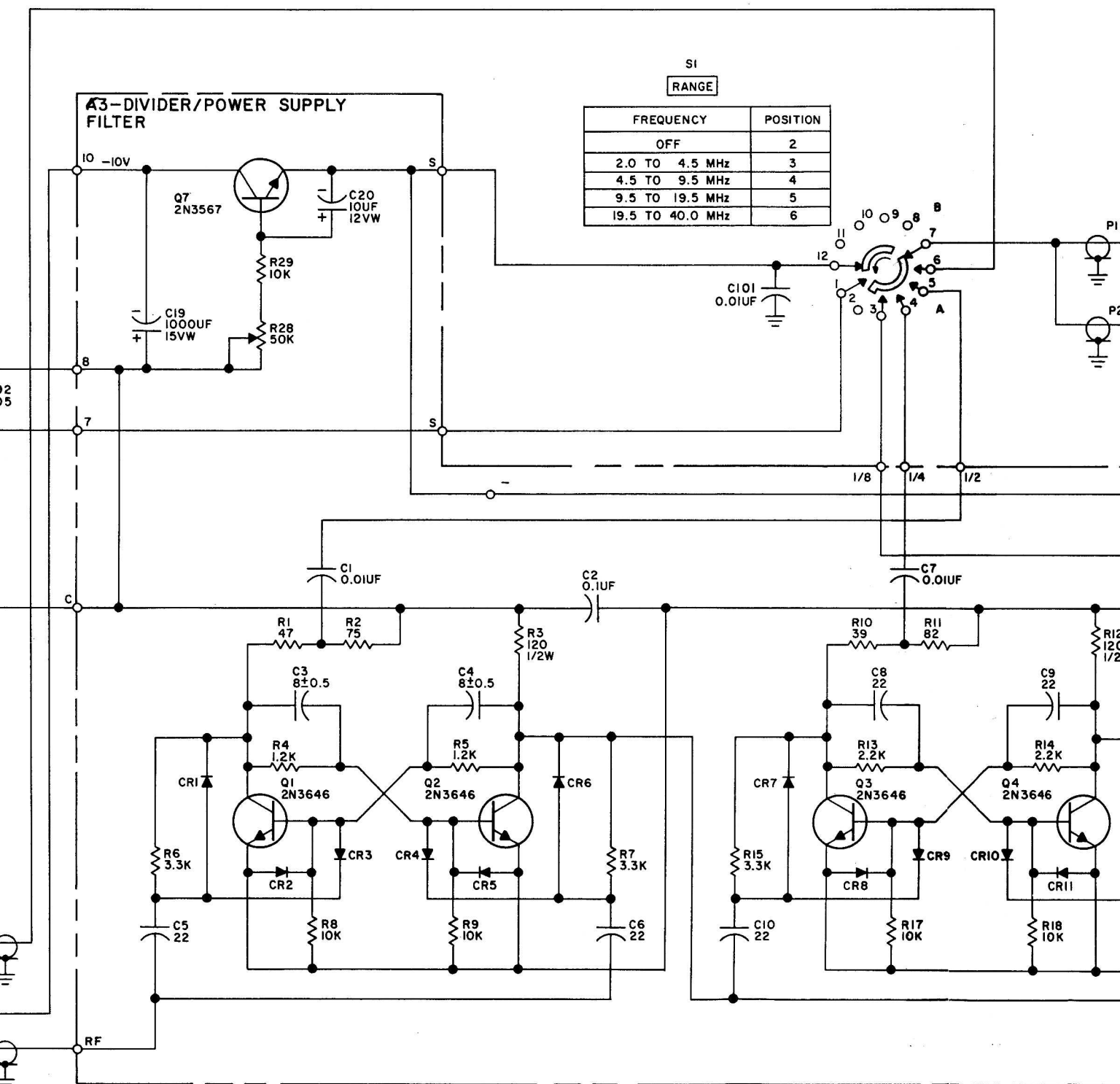
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V= VITRAMON PORCELAIN CAPACITOR.
5. INDICATES PANEL MARKING.



S1

RANGE

FREQUENCY	POSITION
OFF	2
2.0 TO 4.5 MHz	3
4.5 TO 9.5 MHz	4
9.5 TO 19.5 MHz	5
19.5 TO 40.0 MHz	6

A3-DIVIDER/POWER SUPPLY
FILTER

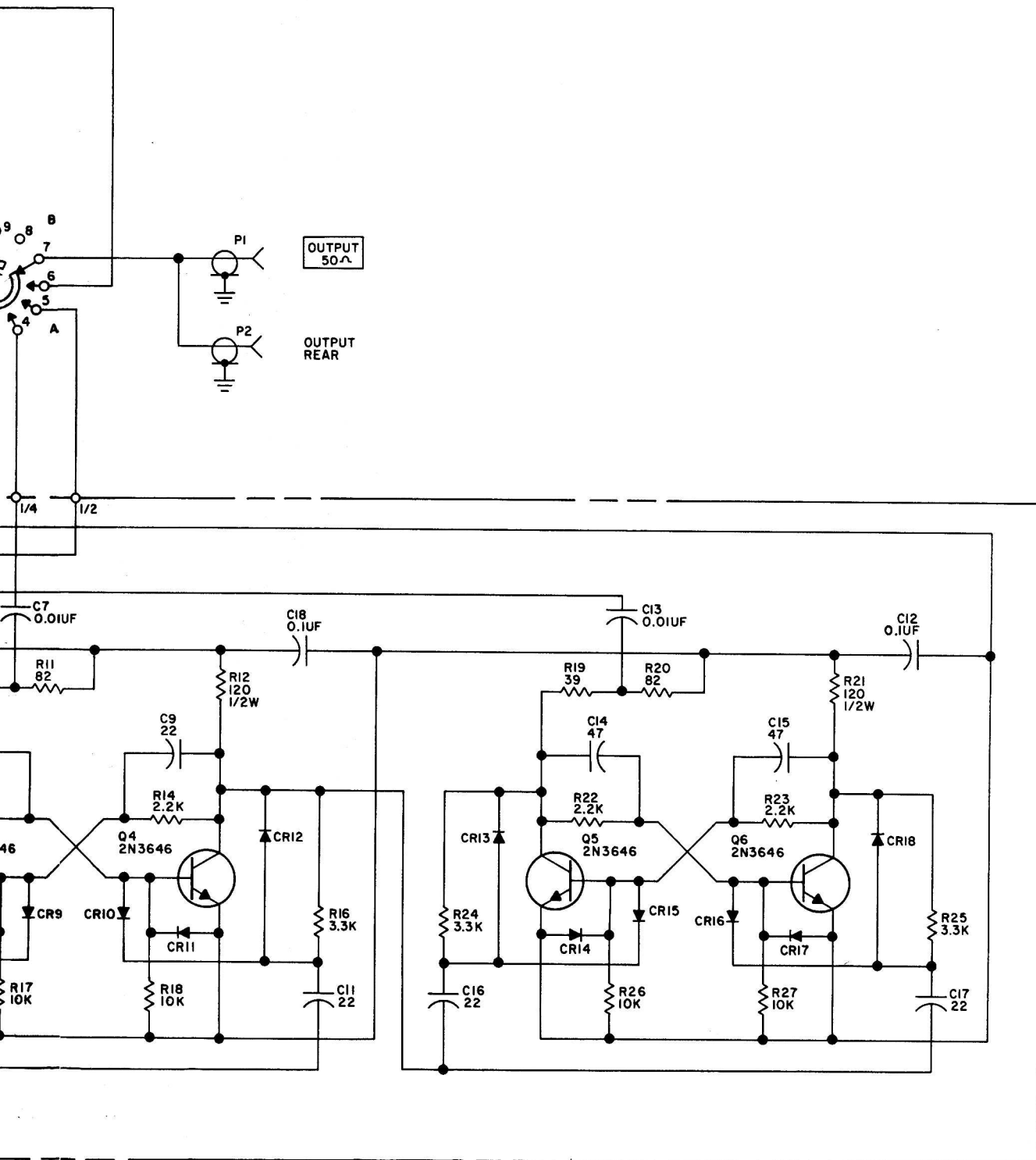


Figure 5-1. Tuning Head,
Schematic Diagram