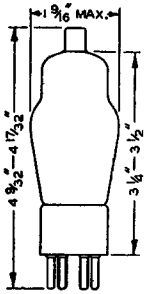
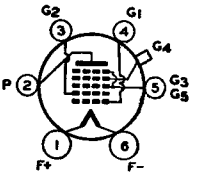


RCA-1A6

PENTAGRID CONVERTER



The 1A6 is a multi-electrode type of vacuum tube designed to perform simultaneously the function of a mixer tube and of an oscillator tube in superheterodyne circuits. Through its use, the independent control of each function is made possible within a single tube. The 1A6 is designed especially for use in battery-operated receivers. In such service, this tube replaces the two tubes required in conventional circuits and gives improved performance. For general discussion of pentagrid types, see Frequency Conversion, page 31.

CHARACTERISTICS

Filament Voltage (D. C.)	2.0	Volts
Filament Current	0.060	Ampere
Direct Interelectrode Capacitances (Approx.)		
Grid No. 4 to Plate (With shield-can)	0.25	μμf
Grid No. 4 to Grid No. 2 (With shield-can)	0.2	μμf
Grid No. 4 to Grid No. 1 (With shield-can)	0.1	μμf
Grid No. 1 to Grid No. 2	0.8	μμf
Grid No. 4 to All Other Electrodes (R-F Input)	10.5	μμf
Grid No. 2 to All Other Electrodes (Osc. Output)	6	μμf
Grid No. 1 to All Other Electrodes (Osc. Input)	5	μμf
Plate to All Other Electrodes (Mixer Output)	9	μμf
Bulb		ST-12
Cap		Small Metal
Base		Small 6-Pin

Converter Service

Plate Voltage		180 *max.*	Volts
Screen Voltage (Grids No. 3 and 5)		67.5 *max.*	Volts
Anode-Grid Voltage (Grid No. 2)		135 *max.*	Volts
Anode-Grid Voltage Supply*		180 *max.*	Volts
Control-Grid Voltage (Grid No. 4)		−3 *min.*	Volts
Total Cathode Current		9 *max.*	Milliamperes
Typical Operation			
Plate Voltage	135	180	Volts
Screen Voltage	67.5	67.5	Volts
Anode-Grid Voltage	135	135	Volts
Anode-Grid Voltage Supply	135	180*	Volts
Control-Grid Voltage	−3	−3	Volts
Oscillator-Grid Resistor (Grid No. 1)	50000	50000	Ohms
Plate Current	1.2	1.3	Milliamperes
Screen Current	2.5	2.4	Milliamperes
Anode-Grid Current	2.3	2.3	Milliamperes
Oscillator-Grid Current	0.2	0.2	Milliampere
Total Cathode Current	6.2	6.2	Milliamperes
Plate Resistance	0.4	0.5	Megohm
Conversion Conductance	275	300	Micromhos
Conversion Conductance (At −22.5 volts on Grid No. 4)	4	4	Micromhos

* Applied through 20000-ohm dropping resistor, by-passed by 0.1 μf condenser.

The transconductance of the oscillator portion (not oscillating) of the 1A6 is 425 micromhos under the following conditions: Plate voltage, 135 to 180 volts; screen voltage, 67.5 volts; anode-grid voltage (no voltage-dropping resistor), 135 volts; and zero oscillator grid volts. Under these same conditions the anode-grid current is 2.3 milliamperes.

INSTALLATION

The **base** pins of the 1A6 require the use of a standard six-contact socket which should be installed to hold the tube in a vertical position.

The coated **filament** of the 1A6 may be operated conveniently from dry-cells, from a single lead storage-cell, or from an air-cell battery. For dry-cell operation, a filament rheostat may be used together with a permanently installed voltmeter to insure the proper filament voltage. For operation from a 2-volt lead storage-cell, the 1A6 requires no filament resistor. Operation from an air-cell battery requires a fixed resistor in the filament circuit. This resistor should have a value such that with a new air-cell battery, the voltage applied across the filament terminals will not initially exceed 2.15 volts.

Series operation of the filament of the 1A6 with those of other two-volt battery types is permissible provided certain precautions are observed. It is essential that shunt resistors be employed across certain filaments to carry the plate current returning from other tubes through these filaments. The shunt resistors should be adjusted to maintain the filament voltage of each tube at its rated value of 2.0 volts under operating conditions. It is obvious that the shunt resistor can also be used to adjust for a difference in filament current ratings. Series-parallel operation of two-volt types is not recommended because failure of one tube may cause excessive voltage across other tubes. Socket terminal No. 1 (see socket connections) should be connected to the positive battery terminal.

Complete **shielding** of the 1A6 is generally necessary to prevent intercoupling between its circuit and those of other stages.

APPLICATION

As a **frequency converter** in superheterodyne circuits, the 1A6 can supply the local oscillator frequency and at the same time mix it with the radio-input frequency to provide the desired intermediate frequency. For this service, design information is given under CHARACTERISTICS. It is important to note that the anode-grid voltage and the plate voltage must each be higher than the screen voltage.

For the oscillator circuit, the coils may be constructed according to conventional design, since the tube is not particularly critical for frequencies up to 10 megacycles. For higher frequencies the 1C6 should be used. However, it should be noted that the 1C6 requires additional filament current. The voltage applied to the anode-grid (No. 2) of the 1A6 should not exceed the maximum value of 135 volts, but should always be higher than the screen (grids No. 3 and No. 5) voltage. The anode-grid voltage may be obtained from a suitable tap on the B battery or from the plate-supply tap through a voltage-dropping resistor of 20000 ohms shunted by a by-pass condenser of 0.1 μf. The size of the resistor in the grid circuit of the oscillator is not critical but requires design adjustment, depending upon the values of the anode-grid voltage and of the screen voltage. Adjustment of the circuit should be such that the cathode current is approximately 6 milliamperes. *Under no condition of adjustment should the cathode current exceed the recommended maximum value of 9 milliamperes.*

The bias voltage applied to grid No. 4 can be varied over relatively wide limits to control the translation gain of the tube. For example, with 67.5 volts on the screen (grids No. 3 and No. 5), the bias voltage may be varied from −3 to plate current cut-off (approximately −25 volts). With lower screen voltages, the cut-off point is proportionately less. The extended cut-off feature of the 1A6 in combination with the similar characteristics of super-control tubes can be utilized advantageously to adjust receiver sensitivity.

Since the capacity between grid No. 4 and plate is in a parallel path with the capacity and inductance of the plate load, it is important to use a load capacity of sufficient size to limit the magnitude of the r-f voltage built up across the load. If this is not done, r-f voltage feed-back will occur between plate and grid No. 4 to produce degenerative effects. For this reason, the size of the load condenser in the plate circuit should be not less than 50 $\mu\mu$f.

Converter circuits employing the 1A6 may easily be designed to have a translation gain of approximately 40. A typical circuit which provides exceptionally uniform oscillator output over the entire grid-bias range is shown under type 1C6. For details of oscillator coil assemblies, refer to type 2A7.