Contents

1 Introduction

The PentaVac is a conventional, complete and compact tubetester with extended performance. Its presentation in a case ensures reliable protection and easy transport.

A filing pocket located in the lid allows you to store mains & connecting cords as well as documents. Some tubes can be also slipped into the residual space.

A fast microprocessor manages an operating mode that allows you to perform measurements at very high plate current (up to 500 mA) while minimizing volume, weight, consumption and cost.

Integrated power supplies make it possible to test all audio tubes as well that a very large majority of radio tubes, magic eyes, regulators, diodes and valves under all heating voltages from 1.2 V to 60 V.

Refer to the manufacturer's sheets for specific tube measurement conditions.

The adjustment of the grid voltage 1 is carried out in a flexible and precise manner by a 10-turn potentiometer and is displayed to the nearest decimal between +20 V and - 20 V.

All circuits are protected against overloads and connection errors, however a connection error can be destructive for a tube so it is recommended to be careful.

2 Safety information

The PentaVac works with high voltages, for your safety and to avoid damaging the device, follow the procedures indicated in this manual and ensure you have the skills to use it.

If not, seek the assistance of an experienced person.

This device is not a toy, so keep it out of the reach of a child.

Before inserting a tube correctly preset the test values (by pressing the TEST button but without the tube inserted) and make sure you have achieved the correct ones electrode connections to the test stand.

Always connect the cables of the interconnection matrix before pressing the TEST button.

Never touch the contacts of the sockets or the end of the interconnection plugs when the device is powered on.

Do not insert anything other than electron tubes in the holders and use adapters for tubes other than noval or octal.

Do not short circuit or overload the EXT heating outputs.

Avoid using the device with wet hands, this increases the risk of electric shock.

Replace the mains fuse only with a fuse of the same type: 250V / 2A fast.

Observe the mains supply voltage according to the model delivered.

If the power cord or interconnection matrix cords are damaged, replace them identically (available as spare parts).

The tubes can get very hot during the measurements, use a cloth or woolen glove to handle them.

There is no useful circuit for the user inside the device and any opening and / or intervention will void the warranty.

3 Control panel

- An octal socket + 2 noval socket dedicated to common tubes.

- A VT2 octal socket connected via the interconnection matrix (terminals 1 to 8)

- A noval VT1 socket connected via the interconnection matrix (terminals 1 to 9)

- A row (terminals 1 to 9) which correspond to the VT1 & VT2 sockets pins.

- A row of active terminals:

- Plate: Plate supply voltage

- G3: Grid 3 supply voltage

- G2: Grid 2 supply voltage

- G1: Grid 1 supply voltage

- K: Cathode input

- F: Filament supply voltage (negative terminal)

- F +: Filament supply voltage (positive terminal)

- Overload: Plate supply overload indicator.

- Plate Fuse: Plate supply fuse. (500 mA fast)

- EXT: Heating power supply output terminals

- Vplate: Plate voltage adjustment potentiometer

- Vg1: Grid 1 voltage adjustment potentiometer

- Vg2: Grid 2 voltage adjustment potentiometer

- Vg3: Grid 3 voltage adjustment potentiometer

- Iplate: Plate current sensitivity selection - I> 50 mA, I <=50 mA

- Vf <14 V / Vf> 14 V: Selection of the heating voltage range

- Vf: Fine adjustment of the heating voltage.

- TEST: For adjusting tube test values & Tube test button.

- Vacuum: Vacuum test

- Triode1 / 2: Selection of Triode 1 or 2 for the support dedicated to 12AT / AU / AX7, etc ...

- ON / OFF: General switch

- MAINS: Mains connector fitted with a 2A fast fuse

4 Preparation & setup

Make sure that no tube is present on either of the sockets.

Almost all tube datasheets are listed and accessible on the internet via this link:

http://www.tubedata.org

Make the appropriate connections on the test matrix using the leads.

Caution: If you are using one of the dedicated sockets remove all cords.

Press the TEST button.

Preset the voltages Vplate (Plate), Vg1 (grid 1), Vg2 (screen or grid 2),
Vg3 (grid 3) and the heating voltage according to the characteristics of the tube to be tested.

All these voltages are visible on the display if the TEST button is pressed.

Select the Iplate measurement range> 50mA or <50mA depending on the expected plate current.

Release the TEST button.

Plug in the tube and let it heat up for about a minute.

Press TEST again and slightly adjust the previous settings if necessary.

The display indicates the different currents.

If the Overload LED illuminates immediately release the TEST button, the tube is defective or the settings are not correct.

Release the button, the test is finished.

More complete measurements: transconductance, internal resistance and gain are possible and simple, these measures are described in the next chapter.

5 Advanced tests

The cathodic flow rate of a tube is an important data which makes it possible to determine its state of wear and to perform pairing.

However, this parameter only gives an overview of all the performances of which the tube is capable, with the PentaVac you will be able to carry out 3 other very complementary measurements, these are:

- The slope or transconductance Gm: expressed in mA / V, µS or µmhos.

- Internal resistance Rp: expressed in Ohms.

- The gain µ which is the product of the 2 previous values.

Slope measurement:

Carry out a first measurement, note the corresponding current Ia1.

Without touching the other settings, increase or decrease the grid 1 voltage by 1 volt (Vg1) and note the new current Ia2.

The slope Gm is the difference between the currents Ia1 and Ia2 expressed in mA / V or in µS or µmhos by multiplying the value by 1000: 1mA / V = 1000 µS = 1000 µmhos.

This characteristic, taken at several points, allows to know the linearity of a tube.

Internal resistance measurement:

Carry out a first measurement, note the plate voltage Vp1 and the corresponding current Ia1.

Without touching the other settings increase or decrease the Plate voltage (Vplate) until causing a significant change in current, note the new value of the plate voltage Vp2 and the new current Ia2.

The internal resistance Rp is the difference of the plate voltages divided by the difference of the corresponding currents: Vp1 +/- Vp2 div. Ia1 +/- Ia2, value expressed in Ohms.

Calculation of the gain:

As specified above, the gain µ is equal to Gm (in mA / V) x Rp

All the characteristics of the tube are then known and extremely precise matching can be achieved.

6 Testing common tubes

In order to facilitate the tests, a set of measurement conditions for the most common tubes is summarized here:

6SL7 - 6SN7 - 6SU7 - 5691 - 5692 – 6188:

G1 terminal to terminal 1 and terminal 4
K Terminal to terminal 3 and terminal 6
F Terminal to terminal 7
F+ Terminal to terminal 8

The test of one or the other of the internal triodes is carried out by connecting the Plate terminal to terminal 2 or terminal 5.

Tube	Vf / If	Vplate	Vg2	Vg1	Ik
6SL7	6,3V / 0,3 A	300 V	-	- 2,0 V	3,2 mA
6SN7	6,3V / 0,6 A	300 V	-	- 8,0 V	15 mA
6SU7	6,3V / 0,3 A	300 V	-	- 1,0 V	5,5 mA
5692	6,3V / 0,6 A	200 V	-	- 4,0 V	13 mA
6188	6,3V / 0,3 A	300 V	-	- 1,0 V	5,5 mA

ECC81 / 12AT7 – ECC82 / 12AU7 – ECC83 / 12AX7 – ECC99 – 12BH7 - 5963 :

G1 terminal to terminal 2 and terminal 7
K terminal to terminal 3 and terminal 8
F terminal to terminal 4 and terminal 5
F+ terminal to terminal 9

The test of one or the other of the internal triodes is carried out by connecting the Plate terminal to terminal 1 or terminal 6.

Continued on next page....

Testing common tubes../…

Tube	Vf / If	Vplate	Vg2	Vg1	Ik
ECC81	6,3V / 0,3 A	300 V	-	- 2,0 V	15 mA
ECC82	6,3V / 0,3 A	200 V	-	- 5,0 V	15 mA
ECC83	6,3V / 0,3 A	200 V	-	- 0,5 V	3,2 mA
ECC99	6,3V / 0,8 A	200 V	-	- 4,0 V	42 mA
12BH7	6,3V / 0,6 A	200 V	-	- 5,0 V	18 mA
5963	6,3V / 0,3 A	200 V	-	- 4,0 V	15 mA

ECC85 – ECC88 – E88CC - E188CC – 6DJ8 – 6N1P – 6922 :

G1 terminal to terminal 2 and terminal 7
K terminal to terminal 3 and terminal 8
F terminal to terminal 4
F+ terminal to terminal 5

The test of one or the other of the internal triodes is carried out by connecting the Plate terminal to terminal 1 or terminal 6

Tube	Vf / If	Vplate	Vg2	Vg1	Ik
ECC85	6,3V / 0,3 A	250 V	-	- 2,0 V	15 mA
ECC88	6,3V / 0,4 A	250 V	-	- 4,0 V	58 mA
E88CC	6,3V / 0,3 A	250 V	-	- 4,0 V	50 mA
E188CC	6,3V / 0,3 A	150 V	-	- 3,0 V	16 mA
6DJ8	6,3V / 0,4 A	250 V	-	- 4,0 V	58 mA
6N1P	6,3V / 0,6 A	300 V	-	- 2,0 V	28 mA
6922	6,3V / 0,4 A	250 V	-	- 4,0 V	58 mA

Testing common tubes../…

EL84 – 6BQ5 – 6P14P - 7189 :

G1 terminal to terminal 2
K terminal to terminal 3
F terminal to terminal 4
F+ terminal to terminal 5
Plate terminal to terminal 7
G2 terminal to terminal 9

Tube	Vf / If	Vplate	Vg2	Vg1	Ik
EL84	6,3V / 0,76 A	300 V	300 V	- 2,0 V	180 mA
6BQ5	6,3V / 0,76 A	300 V	300 V	- 2,0 V	170 mA
6P14P	6,3V / 0,76 A	300 V	300 V	- 2,0 V	180 mA
7189	6,3V / 0,76 A	300 V	300 V	- 2,0 V	165 mA

EL34 – 6CA7 – KT66/77/88/90/100 – 6L6 – 6V6 – 5881 – 6550:

G3 terminal to terminal 1
F terminal to terminal 2
Plate terminal to terminal 3
G2 terminal to terminal 4
G1 terminal to terminal 5
F+ terminal to terminal 7
K terminal to terminal 8

Tube	Vf / If	Vplate	Vg2	Vg1	Ik
EL34	6,3V / 1,5 A	300 V	250 V	- 5,0 V	200 mA
6CA7	6,3V / 1,5 A	300 V	250 V	- 5,0 V	200 mA
KT66	6,3V / 1,3 A	300 V	250 V	- 5,0 V	170 mA
KT77	6,3V / 1,4 A	300 V	250 V	- 5,0 V	230 mA
KT88	6,3V / 1,6 A	300 V	250 V	- 5,0 V	230 mA
KT90	6,3V / 1,6 A	300 V	250 V	- 5,0 V	280 mA
6L6	6,3V / 0,9 A	300 V	250 V	- 5,0 V	120 mA
6V6	6,3V / 0,45 A	300 V	250 V	- 5,0 V	80 mA
5881	6,3V / 0,9 A	300 V	250 V	- 5,0 V	120 mA
6550	6,3V / 1,6 A	300 V	250 V	- 5,0 V	260 mA

7 Diodes, Valves, regulators & cathodic indicators

The PentaVac allows the testing of particular tubes such as diodes, rectifier valves, gas regulators and cathodic indicators.

Diodes:

These very low power tubes can be tested, with care so as not to destroy them, to their maximum flow rate with the PentaVac internal power supply.

Before inserting the tube, position the Vplate potentiometer fully anti-clockwise and wait for the plate voltage to drop to 3 or 4 V.

The connection is made like the other tubes: terminal K to the cathode and terminal Plate to the plate (s) .

When the tube is hot press TEST and very gently turn the Vplate potentiometer observing the current growth and comparing it to the curve shown in the tube specifications.

It is safer to install a limiting resistors in series with the plate(s).

Valves:

Valves or rectifier tubes can also be tested with the PentaVac internal plate power supply

The connection and the test sequence are identical to the diodes.

Gas regulators:

The test of these tubes will be carried out with an appropriate limiting resistor in series with the anode in order to limit the current, the starting voltage will be read directly from the display. Connections between terminal K and Plate.

Cathodic indicators:

The eye brightness test can be done simply by connecting its electrodes to the appropriate terminals and adding, according to the diagram in the instructions, the resistance (s) for the plates.

The eye opening closing command can be carried out with G1.

8 Technical characteristics

Size : 425 x 285 x 200 mm

Weight : 8,2 kgs

Mains supply : 220V – 230V / 50-60 Hz (115 V on request) ou 12V through a DC – ac converter

Consommation : 60 à 250 VA maxi

Mains fuse : 3 A slow 5 x 20 mm

Measurement mode: continuous dissipation, managed by 8-bit microcomputer clocked at 20 MHz

Adc sampling: 10 bits monotone (1024 points)

Measurement accuracy: better than 5% +/- 1 digit

Heating voltages *: 1.2 V to 60 V in 2 ranges

Heating current: 3.5 A maximum

Heating voltage accuracy: better than 5% and regulated

Plate voltage: 4 to 600 volts minimum

Grid 1 voltage: + 20 V to - 100 volts minimum

Grid 2 voltage: 0 to 350 volts minimum

Grid 3 voltage: 0 to - 60 V minimum

Maximum measurable plate current: 400 mA

Maximum measurable screen current: 50 mA

Grid 1 voltage display resolution: 0.1 V +/- 1 digit between + 20 V and - 20 V then 1 V between - 20 V and - 100 V

Grid 2 voltage display resolution: 1 V +/- 1 digit

Grid voltage display resolution 3: 1 V +/- 1 digit

Plate voltage display resolution: 1 V +/- 1 digit

Plate current display resolution: 1 mA +/- 1 digit

Short-circuit and connection error protection by current limiting circuits.

*: Floating voltage, directly heated tubes can be tested.

9 Views of instrument and display

Front panel, display, connectors and controls.

Screen detail

9 ../… Views of instrument and display

General view of the device