User's guide for Model-01 chassis

For etracer PCB revision 1.x

Document revision: 1.2

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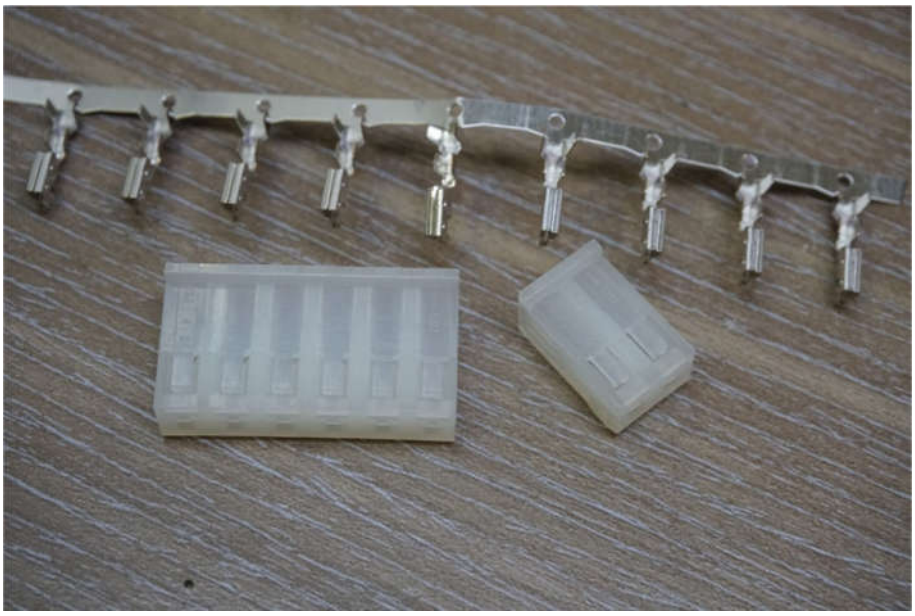
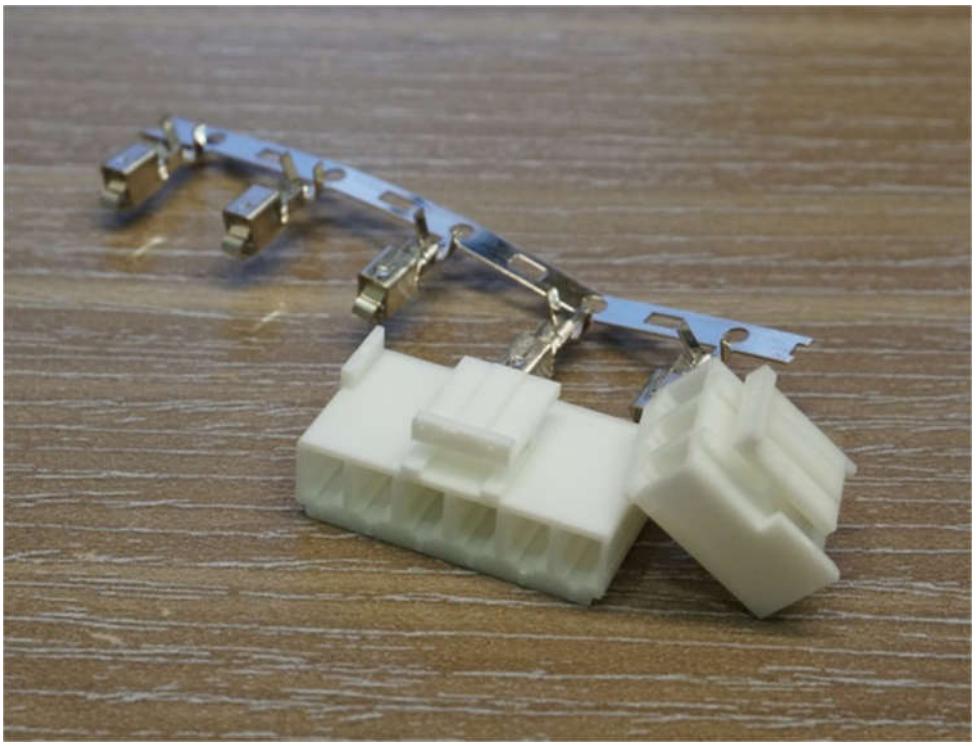
1. Packing list

- Aluminum alloy plate×7 (top×2, bottom×1, front×1, back×1, left×1, right×1)
- M3 countersunk screw×25
- M3 Philips screw with integrated washer×10 (For mounting etracer PCB and the EPP-200-27 power supply)
- Plastic isolator×4
- M4 screw×4 (For mounting the plastic isolators)
- JEC JR-101-1FRS-04 AC inlet socket×1
- Molex 5197-06 6 circuits housing with crimping terminals×1 (For connector P2 on etracer PCB)
- Molex 5197-02 2 circuits housing with crimping terminals×1 (For connector P1 on etracer PCB)
- JST VHR-3N 3-pin female header with crimping terminals (For AC input of the EPP-200-27 power module)
- JST VHR-6N 6-pin female header with crimping terminals (For DC output of the EPP-200-27 power module)
- 50cm USB type B extension cable×1
- LED with socket×5 (red×2, green×2, yellow×1)
- Molex 2.54mm housing 2×5 with 10 terminal wires (For extending the LEDs) ×1
- Nizing UL10362 600VAC 18AWG Teflon insulated wire (For internal and sockets wirings) ×8 meters
- HV test cable 25cm terminated with 4mm test plugs on both end ×8. (red×2, green×2, black×2, yellow×2)
- 4mm(outer diameter) ×10mm hollow ferrite bead, internal diameter 2mm (For radio frequency suppression for the sockets wirings) × 60
- Banana jack with washer and screw×22(blue×10, red×4, green×4, black×2, yellow×2) with a dedicated mounting tool
- Tube socket with different types×10
- 3mm pre-cut fishpaper (electrical grade vulcanized fibre) with a pre-cut 3M double sided tape to form a tray (the catch-box).

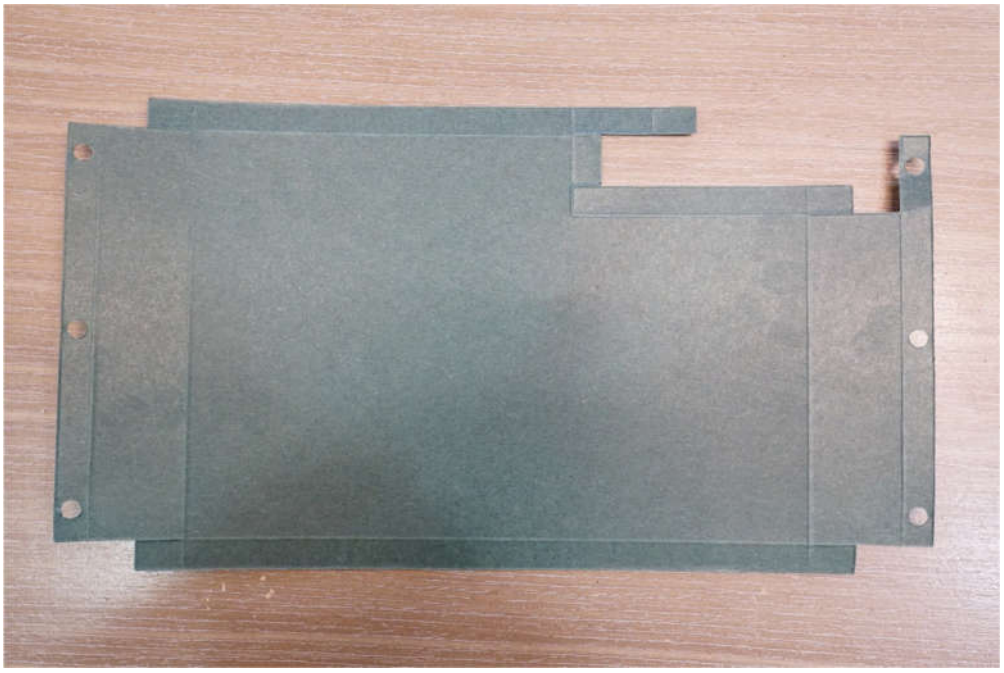
Hollow ferrite bead



Molex 5197 series housings and crimping terminals (Transparent case, For P1 and P2 on the etracer PCB)



JST VHR series housing and crimping terminals (white case, for connecting to the EPP-200-27 power supply)



The catch-box metal scraps collecting tray

⚠ Note: The following items are not included in the chasis kit and should be prepared by the user.

- The screws and nuts for mounting the tube sockets.

- One 5mm×20mm slow blow fuse for AC mains. Current rating 2A for 100VAC~115VAC regions and 1A for 220AC~230AC regions.
- One USB type B male to type A male cable for PC connection.
- One IEC C13 AC power cord for connecting mains.

2. Introduction to the Model-01 chassis

The Model-01 chassis is designed by essues Technologies dedicated for the etracer PCB. The design focuses on compactness and flexibility. With a swappable top-plate (top-B) the user can measure tubes with unlimited socket types by simply using different top-B plates.

The fully assembled Model-01 chassis measures 28cm×19cm×10cm. The material used is 1.5mm thick 5052 Aluminum-Magnesium alloy. It is designed to fit an etracer PCB, an EPP-200-27 SMP (Switching Mode Power) made by MEAN WELL and a 8cm×8cm×2.5cm chassis fan.

2.1 Back plate

The back plate has openings for a three-in-one AC inlet, a USB type B female connector and an 8CM chassis fan. The fuse type for the AC inlet shall be 2A/250V slow-blow type for the 100V/115Vac regions and 1A/250V slow-blow type for the 230Vac regions. The etracer PCB and the EPP-200-27 both have a 12Vdc connector that can be used to power the chassis fan. Please note the current rating for the +12Vdc power supply on the etracer PCB is 0.3A maximum. The ventilation holes on the chassis are optimized for cooling efficiency. The air flow of the fan should be

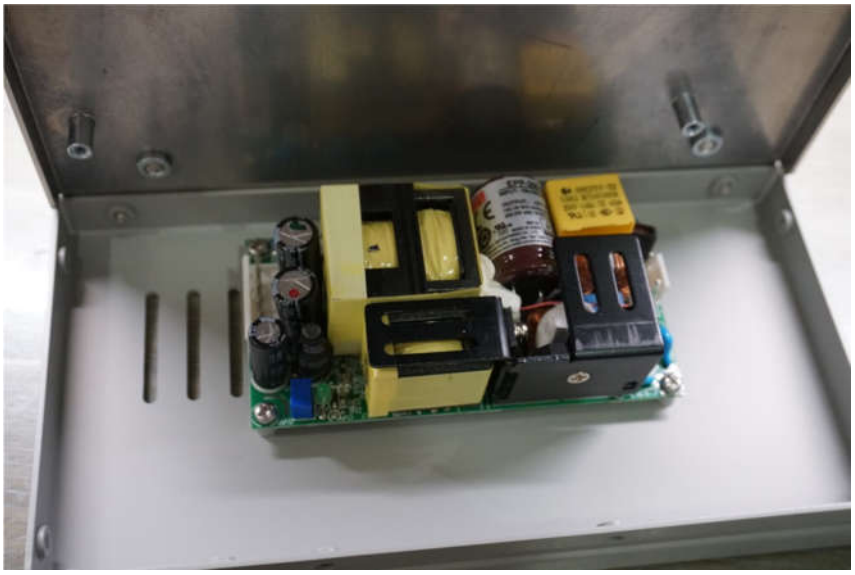
outward (moving air from inside to outside).

Back plate of Model-0

2.2 Right panel

The ventilation holes are located on the right panel only. There are four poles with M3 female threads on the right panel for mounting the EPP-200-27.

Ventilation holes on the right side-panel



EPP-200-27should be mounted on the right side-panel with M3 screws

2.3 Left panel

There is no opening on the left panel. Please note the difference between the top-side and the bottom-side of the left panel when assembling. The top-side has a wider protruding part to support the top plates.

2.4 Top-plates

There are two top-plates for Model-01: a smaller one (Top-A) and a bigger one (Top-B). The top-plates are top-mounted and fastened to the chassis by M3 screws and can be removed easily. Top-A contains openings for two rows of 6 female banana jacks and 5 round openings for 5 LEDs. Top-A is used to connect the banna jacks to the output of etracer PCB and do not need to be swapped under normal operation.

Three flavors of top-B plates are available: A plate Top-B-1 with openings for 10 tube sockets (default), a plate Top-B-2 with openings for 6 tube sockets and a plate Top-B-3 with no opening for tube socket. The latter two types allow users to cut openings to fit other type of tube socket.

Note: Only Top-B-1 and Top-B-3 are available currently.

Top-plates Top-A and Top-B-1(default)

Top-B-3 blank plate

The default Top-B plate, Top-B-1 has a row of 10 openings numbered from 1 to 10 for female banana jacks. The numbered banana jacks shall be connected to the corresponding pins of all vacuum tube sockets. For example, banana jack number one should connect to pin 1s of all vacuum tube sockets. Banana jack number two should connect to pin 2s of all vacuum tube sockets. And so on and so forth.

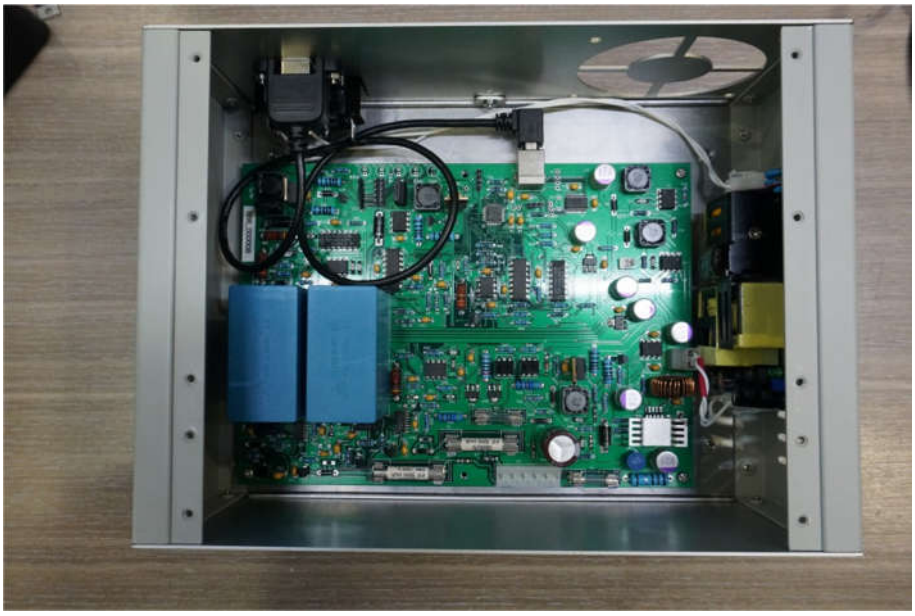
3. Assembling Model -01

Model-01 is constructed by 7 aluminum alloy panels. It can be put together by accompanied M3 Countersunk head screws. Each panel has a distinct appearance and

the user should be able to recognize them easily. The screws for the 4 isolator on the bottom plate are M4 type (included).

4. Internal wiring for Model-01

There are a total of 6 M3 threaded supporting poles for mounting the etracer PCB. The orientation of the PCB is depicted in the following figure:

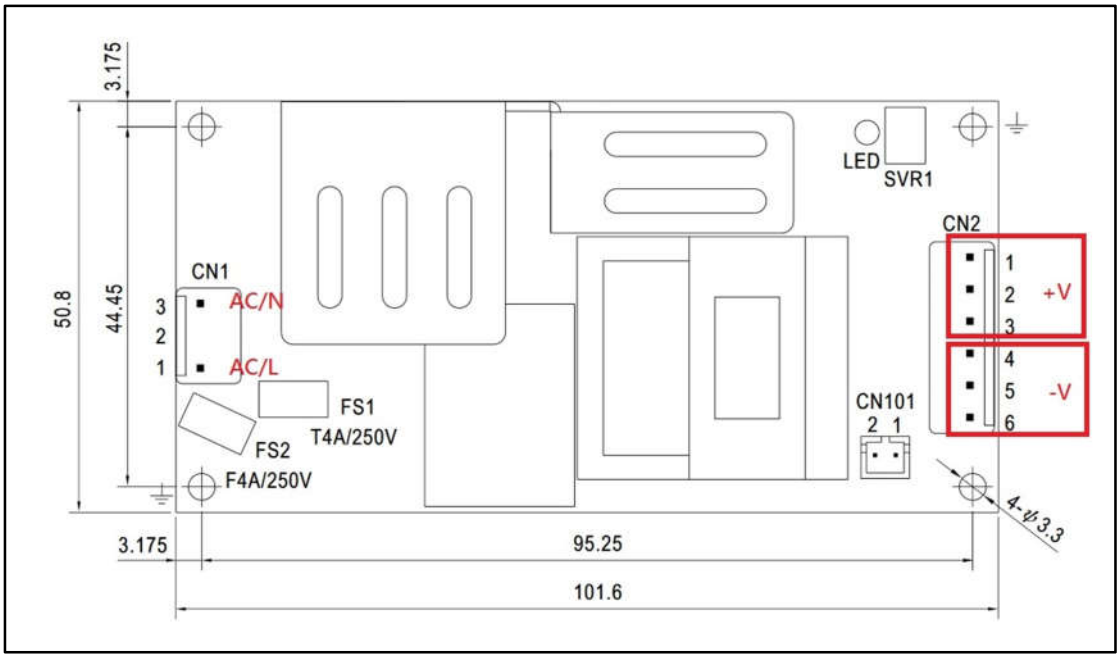


Orientation of the PCB

Model-01 comes with an USB type B extension cable to extend the USB connector to the back plate. The cable comes with dedicated screws. Please use these screws to mount the female connector side of the USB cable to the back plate.

Note: When the USB type B female connector is tightly mounted on the back plate the exposed metal part of the USB connector might contact the back plate and thus short the etracer GND reference point to the chassis. Shorting the USB GND (and hence the PCB GND) to the chassis is not required for the operation of etracer.

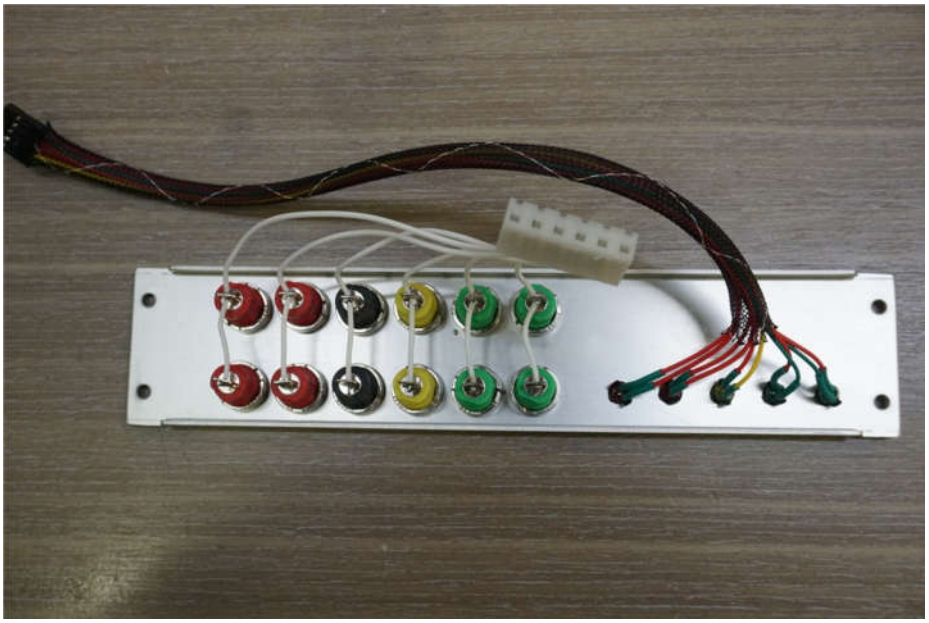
The EPP-200-27 power module shall be mounted on the right panel with four M3 screws. The AC mains (100V to 230V) input shall be connected to CN1. The output of EPP-200-27 (CN2) shall be connected to the power input (P1) of the etracer PCB. Please make sure the polarity is correct when making the connection cable. CN101 on EPP-200-27 is a 12 Vdc output. It can be used to power a chassis fan. Pin 1 is negative and pin 2 is positive on CN101. The output voltage on EPP-200-27 can be adjusted by trimming SVR1. Please rotate the potentiometer SVR1 clockwise all the way to set the highest output voltage (about 28.5 Vdc).



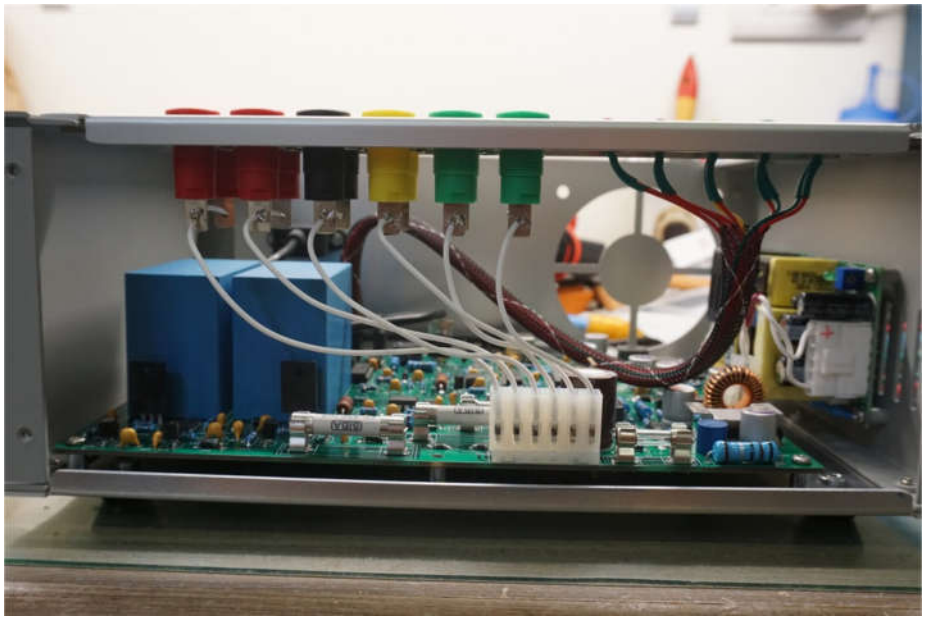
Connectors on EPP-200-27

The test header P2 on the etracer PCB has a total of 6 pins: HV1, HV2, GND, NEGV, HEATER1 and HEATER2. These signals need to be brought to the banana jacks on top-plate Top-A. Please use the included 600VAC 18AWG Teflon insulated wires to make the connections. The LEDs on the PCB can be moved to Top-A through J3. Please refer to the etracer PCB user's manual for the pins assignments of J3.
Note the pin-order on J3 is different than the order of the LEDs on the PCB or the order of the LEDs on the top-plate. Please make sure the correct pin-assignments are made for the cable.

When making the connection cables it might be convenient with the front panel removed. The window provides an easy access to the banana jacks and the pins on the PCB.



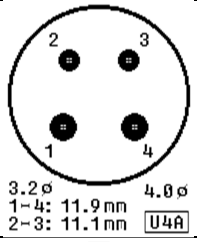
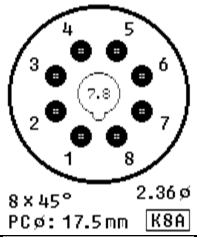
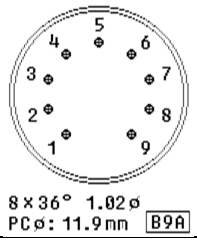
Fully wired Top-A plate

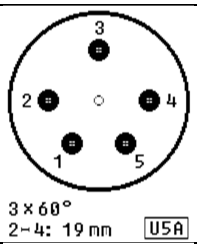
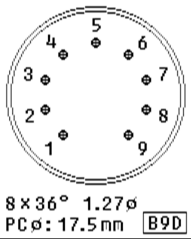
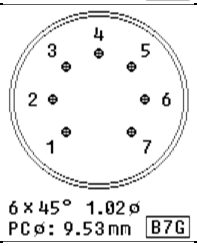
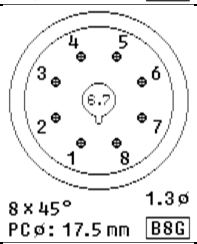
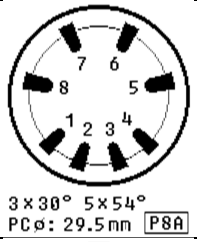
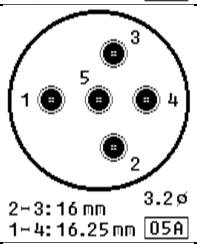
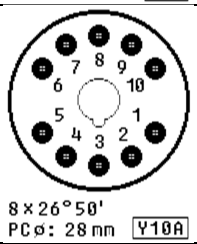


With the front panel removed it’s easy to access P2 to measure the cable length.

Wiring for the top-plate Top-B-1 requires a little effort. The first step is mounting all tube sockets to it. The following figure shows the sockets names with a number from 1 to 10 assigned to each of them.

The following table shows the pin-assignment with a short description for each numbered socket:

number	name	Drawing (bottom view)	Description
1	U4A		Also known as UX-4. Commonly found in US tubes such as 2A3 or 300B.
2	K8A		Also known as Octal. Commonly found in US and European tubes such as 6L6, 6SN7 and KT88.
3	B9A		Also known as miniature-9. Commonly found in US and European tubes such as 12AX7 and 6DJ8

4	U5A		Also known as UX-5. Commonly found in US tubes such as 807.
5	B9D		Used for tubes such as WE437.
6	B7G		Also known as miniature-7. Commonly found in US and European tubes such as 6C4.
7	B8G		Also known as Loctal. Used in European tubes such as 3A/167M.
8	P8A		Used in European tubes such as AZ1. Please know the pin-order is counter-clockwise.
9	O5A		Commonly found in European tubes such as PX4. Please note the pin-assignment has no special order. Also there is a 4-pin variation for this socket where pin-5 is left unused.
10	Y10A		Commonly found in German tubes such as EL156.

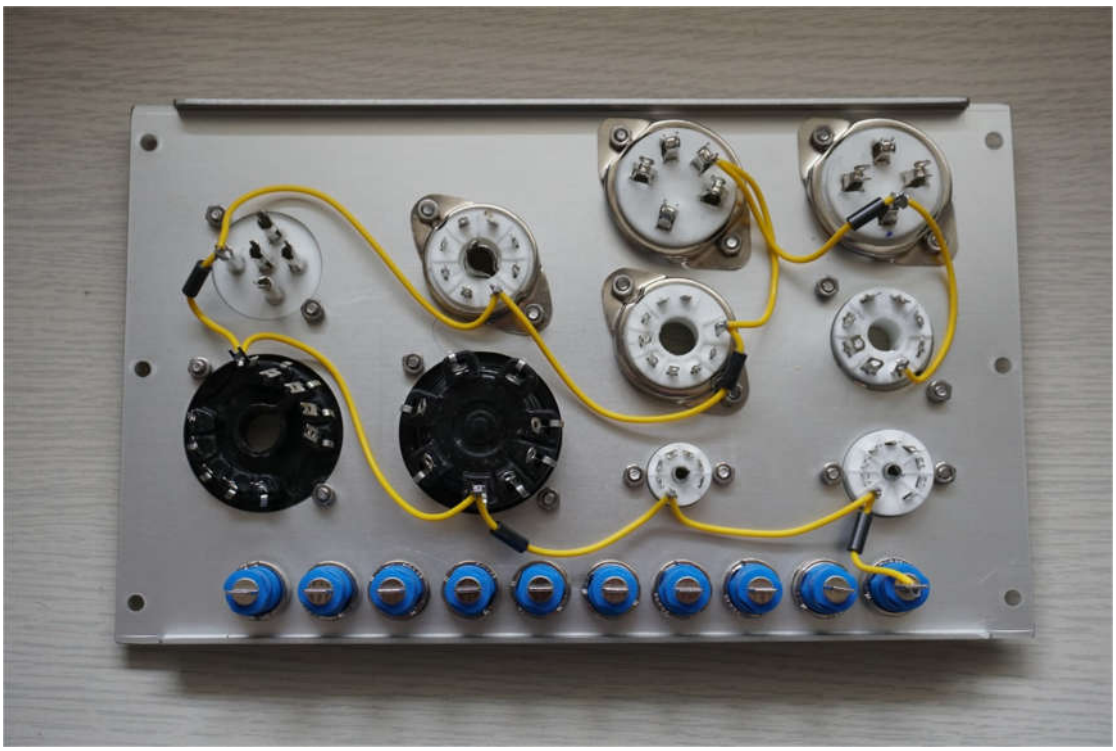
The drawings in the table are obtained by courtesy of Mr. Franz Hamberger. Source: http://www.dl7avf.info/charts/roehren/index.html

⚠ Please note the pin-ordering for socket types O5A and P8A are different from other sockets where pins are ordered clockwise.

⚠ O5A might have different pin number assignments for different tube types. Always consult the datasheet before testing a new tube type with an O5A base.

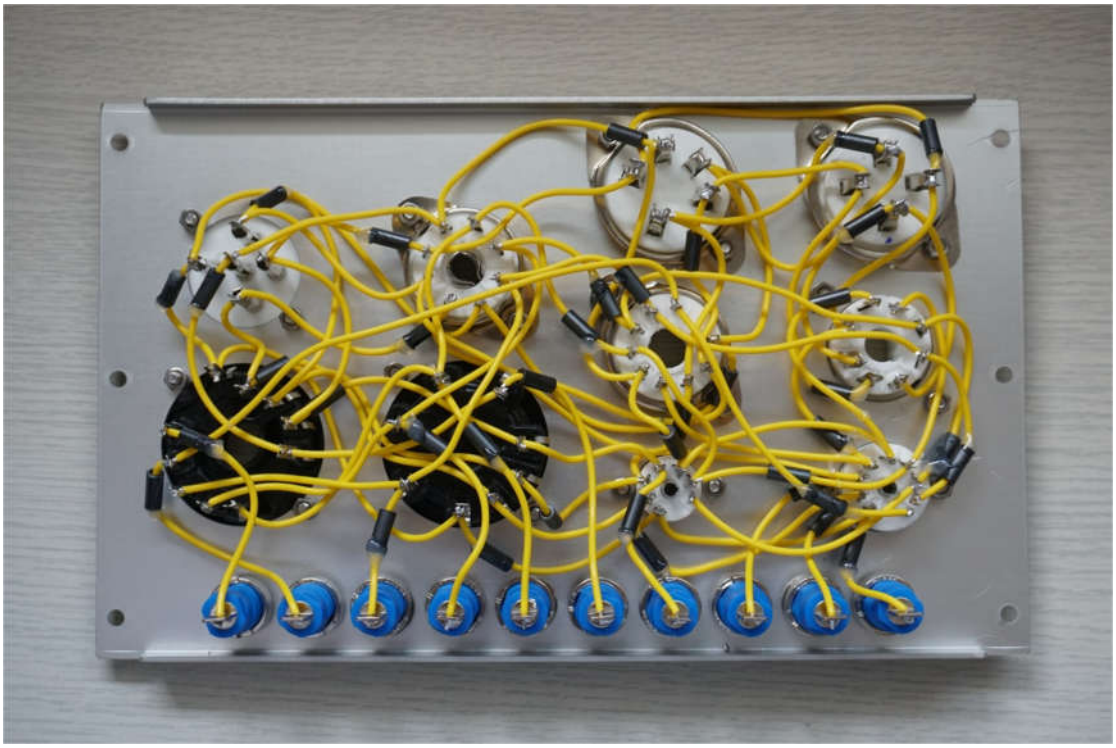
The orientation of the sockets is not important. For the big 9-pin socket there might be a gap between the metal frame of the socket and the top plate. This gap can be filled by inserting two washers as shown in the circled region in the following figure.

The second step is connecting the pins on the sockets following the rule: Pins number 1 on all tube sockets should be serially connected and connect to the banana jack number 1. Please mount a hollow ferrite bead to the wire every two or three wires to prevent high-frequency oscillation. The same rule applies to pin number 2, 3, etc. Please note that ferrite beads are conductive material and it is advisable to glue the beads to the wires to prevent short-circuit. The following figure shows the result of connecting all pin 1s.



Pin 1 on all sockets serially connected and connects to banana jack #1

The following figure shows a complete wiring of Top-B-1.



All wirings in place

If the user plan to use the heater supply on the etracer PCB to test tubes with a heater

rating more than 20 Watts a chassis fan is required. The ventilation system in Model-01 is carefully designed and with a chassis fan the temperature on the EPP-200-27 and the heater supply IC can be effectively reduced. A spec of 15 CFM for the chassis fan is good enough. This type of fan typically draws a current of less than 0.2A. A more powerful fan can be used to reduce the heat at a cost of increased fan noise.

5. Building and installing the catch-box metal scraps collecting tray

The catch-box is a new addition to the Model-01 chassis kit starting from November 2019. The catch-box is made of 3mm-thick fishpaper that forms a tray underneath the Top-B-x plate where the tube sockets are mounted. It keeps the metal particles caused by inserting tubes into or removing tubes from tubes sockets from reaching the etracer PCB.

The fishpaper is pre-cut with pre-formed fold-lines. It is straightforward to build the catch-box by folding along the fold-lines and use glue, kapton tape or stapler to fasten the side-walls together. An optional pre-cut 3M double-sided tape is also supplied in the kit. This tape is used to keep the particles from moving freely in the tray.

Built catch-box with 3M double-sided tape installed

The catch-box can be installed by dropping it directly into the Model-01 chassis with the Top-B-x sockets plate removed as depicted in the following figure. Please make sure the side-wall of the catch-box close to the chassis fan stays perfectly vertical to prevent it from touching the rotating fan and causes unwanted noises.

Catch-box installed on the Model-01 chassis

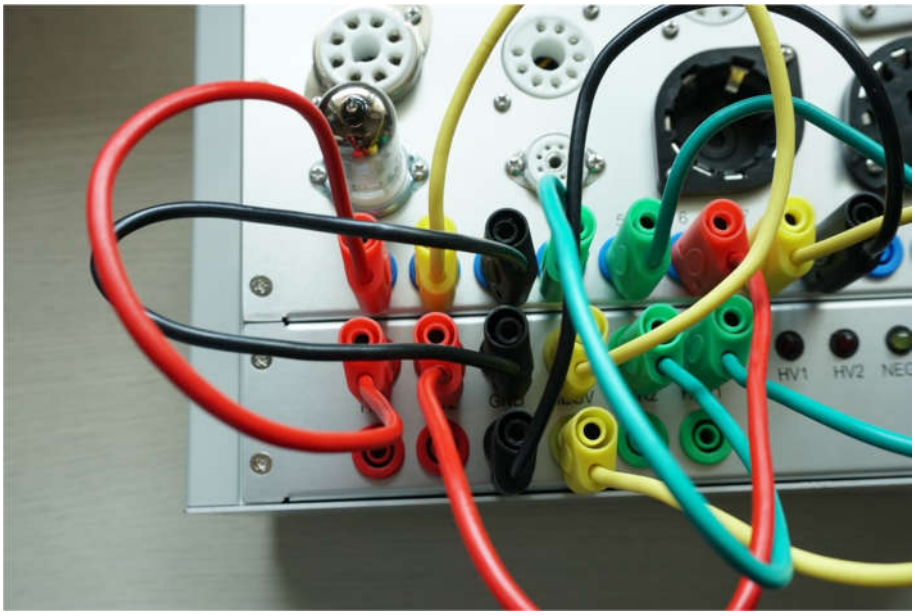
Although the air-flow of the chassis fan is partially blocked by the catch-box the actually cooling-effect of the chassis fan is better with a catch-box installed.

6. Equipment grounding

As described in previous sections etracer does not need any grounding arrangement. For safety consideration the E (Earth) terminal of the AC inlet can be shorted to the chassis by a wire to make sure the chassis is always at the same potential as the earth. Note a 3-prone connector and a properly grounded mains is required for equipment grounding to work.

7. Testing with Model -01

Testing tubes with Model-01 is achieved by connecting the signals on Top-A to the pins of the DUT (Device Under Test) on Top-B. The connection is done by wires with banana plugs on both ends. Please refer to the etracer PCB user's manual for connections for testing different types of tube.



A wiring example. Testing a 12AX7 tube

8. Maintenance

⚠For Model-01 chassis without a catch-box installed it is very important to inspect the etracer PCB regularly especially for heavy users (eg. every 6 months) and make sure no metal particle accumulates on the etracer PCB surface. These particles might come from the scuffed pins of the DUTs during plug/unplug because the tubes sockets are right on top of the etracer PCB. Another source of dusts might be caused by the chassis fan by moving air into the chassis. An air blower or a brush is good enough to get the job done. Fail in doing so might create a short on the PCB trace and lead to severe damage to the etracer PCB.

The components on the etracer PCB are carefully selected and will give the users many years of service if the above maintenance procedure is observed.