

1. EEZ PSU H24005 Building Instructions

1.1. PCB assembly

The PSU has four PCBs where [SMT](#) parts are used to the greatest extent. Only connectors and few specialized parts (e.g. power resistor, PCB mounted AC/DC adapter, post-regulator's power mosfet, etc.) are [THT](#).

SMT parts are selected to be easily mounted with hand soldering and assistance of magnifying glass with light or low magnification microscope. In general, a magnification of x8 to x10 should be more than appropriate for this task. Almost all passive components are of 0805 size and never smaller than 0603. Selected IC packages are SOIC, TSOP, TSSOP and similar that have exposed pins (i.e. no QFN or BGA package are selected).

Only two ICs (IC4, IC16) that has exposed power tab cannot be simply mounted with soldering iron and need hot air soldering station. That requires different skills but one can find many useful videos on the Internet with instructions how to do that efficiently at home without use of e.g. stencil and [reflow oven](#).

1.1.1. Required tools

- Soldering iron with conical sloped tip [example](#)
- Hot air soldering station [example](#)
- Solder wire 0.25 mm [example](#), and 0.7 mm [example](#) (optionally solder paste, for ICs with exposed power tabs but take into account that its shelf life is very limited even when refrigerated, therefore use small package, [example](#))
- Solder wick / desoldering braid [example](#)
- Flux [example](#)
- Magnifying glass with light (desktop magnifier with backlight) [example](#) or microscope [example](#)
- Self-locking tweezers [example](#)
- Set of tweezers [example1](#), [example2](#)
- Isopropyl alcohol [example](#) and paper wipes [example](#)
- PCB holder [example](#)

1.1.2. Where to start?

The total number of parts that have to be soldered is almost 800. On the first sight that can easily discourage many, but it's not so bad. First, two most demanding PCBs for power boards are identical and you can try to assemble it side by side following steps mentioned below. The AUX PS is the simplest one but also has AC mains section that require additional care when operating. Finally, physically the biggest one – Arduino Shield is modestly populated but also carry extra parts such as TFT display, Arduino board, binding posts, etc. that dictate some other set of assembling rules.

A good start could be to check that all parts from the BOM list are available and sorted by type and values and can be easily accessible. As you have probably already learned, simple SMT parts with 2-3 terminals (passives, diode, transistors) can be easily lost even if you have well arranged and clean benchtop. Therefore instead of crying for lost one, simply order few parts more and take another one when previously selected was just gone. That issue is present with both self-locking and regular tweezers.

There is a few methods of storing and sorting SMT parts like small part snapboxes, envelopes etc. Each of them is valuable as far as it can reduce possibility of replacing one part mistakenly with another. That is especially important for ceramic capacitors (MLCCs) that do not carry value marks.

A discipline of selecting a single value at the time (even in larger quantity) and placing them on proper places is of a paramount importance to ensure that PCBs are assembled correctly and will work properly.

When needed tools, bare PCBs and SMT parts are on disposal, one important task still remain before we can start with PCB assembling – it's how to identify part value since PCB's silkscreens (top and bottom) only carry reference designators (i.e. R..., C..., IC..., etc.).

If you are using Eagle then open **.brd** file and when populating top layer make sure that among other layers 21, 25, and 27 are visible (see *Top assembly selected layers.png*). For assembling bottom layer

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set layers 22, 26, and 28 as visible (see *Bottom assembly selected layers.png*).

The freeware edition of Eagle also allows you to open .brd file and switch layers on and off.

When installation of the Eagle is not an option, you can use the following images:

- *AUX PS r5B9 assembly (top layer).png*
- *AUX PS r5B9 assembly (bottom layer).png*
- *Arduino shield r3B4 assembly (top layer).png*
- *Arduino shield r3B4 assembly (bottom layer).png*
- *Power board r5B9 assembly (top layer).png*
- *Power board r5B9 assembly (bottom layer).png*

Above mentioned order of PCBs is not mandatory for assembling process but represents a logical sequence since AUX PS is required for powering Arduino shield and Arduino shield is required for controlling Power boards. Suggested order is also sorted by PCB complexity starting with the simplest one.

If not otherwise specified, we'd like to recommend that parts are soldered in the following order on the same layer:

- Small SMT parts (e.g. passives, diodes, transistors, etc.)
- SMT ICs
- Bulk SMT parts (elco capacitors, power inductors, mosfets and diodes) and
- THT parts (connectors, switches, chokes, etc.)

1.1.3. AUX PS r5B9 assembling

We'd like to recommend the following steps for assembling this board:

- +5 V power supply built around IC16
- Fan control (Q22, X6)
- AC input terminal and protection
- Soft start/stand-by (Q20, Q21, OK1, OK2)
- AC/DC module (TR2) and
- Ethernet and USB terminals (X7, X11)

The IC16 is one of the few parts that require hot air soldering because of exposed power tab placed beneath its plastic body. It has to be mounted in that way to establish a solid electrical and thermal bond with exposed copper on the PCB's top layer. Otherwise, a permanent damage may occur or erratic operation. Due to that this part should be mounted first. When that is done we can proceed with completion of +5 V power supply section. The X5 connector has to be mounted *after* surrounding SMT parts (D21, R130, R131) otherwise it could be difficult to mount them without damaging X5 by touching it unintentionally with soldering iron body or tip.

When this section is finished and ready for testing do *not* solder TR2 since it's huge and could make mounting of surrounding parts afterwards almost impossible. Instead, use external regulated 12 V supply and connect it properly on its terminal 9- and +7. If everything is soldered correctly, a regulated +5 V will appear on X5 pin 10 (+) and 9 (-).

Now we can proceed with fan control. Keep in mind to mount THT part at the end (X6). Testing of this section has to be postponed until Arduino Shield is assembled. Also, it will require preparation of fan cable which comes without connector.

AC input terminal and protection section contains only THT parts that can be carefully soldered on the bottom layer.

Soft start/stand-by triacs Q20 and Q21 are sharing the same heatsink KK1 mounted on its opposite sides using single screw and nut. They can be mounted on before soldering. Another possibility is to solder heatsink first and then mount on each side a triac and then solder their terminals. Take care that power resistor R107 is of proper type (wirewound) and power rating.

Finally, place TR2 as the latest part on the top PCB layer. Now it's possible to test once again +5 V power supply by carefully applied AC mains on the X4 pin 1, 2 and 5.

On the bottom layer only two parts have to be mounted – Ethernet and USB terminals. If you got custom enclosure with pre-drilled holes on its rear panel, we recommend to mount the PCB on the rear panel first (using 14 mm spacers) and then solder that terminals. That will insure that everything fits perfectly.

1.1.4. Arduino Shield r3B4 assembling

1.1.5. Power board r5B9 assembling

Work in progress