Genboard v3
Official build and test guide

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1. Preparations, hints:

First of all, a configuration list should be assembled, containing the information on various options of the board to be assembled. These are as follows:
- primary trigger type (Hall/VR, in most cases it's the prior)
- secondary trigger type (Hall/VR)
- MAP sensor type (250/400 kPa or offboard)
- LCD/PS2 (yes/no , usually one assumes the other, but there are exeptions)
- Flyback type (low voltage or power flyback)
- EGT/knock (yes/no , again, usually one assumes the other, but there migth be exeptions)
- IGBT configuration
- One wire interface (yes/no)

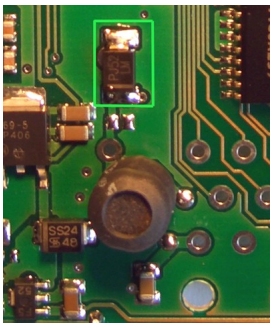
Tools and reqd' parts should be in reach, so you don't need to continiously get them from various places (or even start to look for them, which can consume a lot of time). There should be plenty of light, and it's a good idea to take a short break every now and then.

Tools which you will most likely need:
- soldering iron
- forceps
- combination pliers (for bending the legs of the IGBTs and FETs)
- diagonal pliers (and other pliers)
- FET align tool (a clamping plate with 8 screws driven into it)
- Knife (snap-off blade)
- Screwdriver set (jewelers set)

2 Assembly

2.1 PCB checkup:

Check the following:
- solder remnants (especially near supply chips)
- transient protection diode, pads (because of the incorrect pad design this diode sometimes floats on one side), and orientation (cathode must face towards ecoseal connectors, see image below)



1.

- check the soldering on IC's (pins might be soldered together)
- obivious PCB faults, chrystals, etc…

2.2 General parts

What belongs here:

- EGT/knock
- Supply connection wire for the stepper chip (rigid, blank)
- „Fuse" wire (near the supply connection, this is made from a thin piece of wire)
- The stepper chip (SN754410)
- Filtering inductance
- Trigger jumpers (a solder blob near LM1815, and another jumper)
- Aref
- Flyback wire (though it seems the best time for this to be installed is after the power electronics, and the front plate are soldered in (FETs, and IGBTs)

2.2.1 EGT/knock

The EGT chip (AD597),and the compensation cable connected to it is used to measure exhaust gas temperature. The knock chip is part of the EGT measurement subsystem.

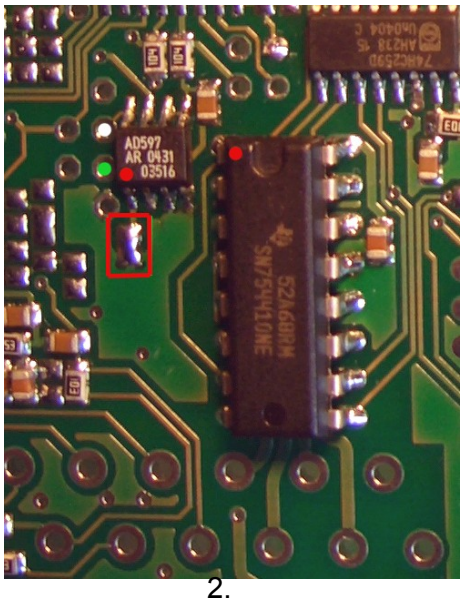
The AD597 is located near pin 1 of the stepper IC. The knock chip is in the upper left corner (with the top side facing you, and the econoseal connections at the bottom).

IMPORTANT:

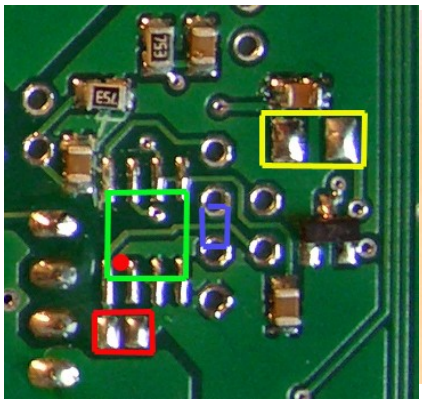
In the images, the first pin of the chips is labeled with a red dot.
The red rectangles show the solder blob that is req'd for the AD597 to function. The green dot shows where the green wire of the compensation cable has to be soldered, and accordingly, the white dot shows the place of the white wire. The cable is installed from the top (soldered from the bottom).
The yellow ractangle in image 3. is the place for the 10 µH SMD inductance, which is also req'd. Above it is a 220 nF cap.
Also in image 3. the place for the second AD597 is shown with a green rectangle. Just flip the PCB , the second EGT's place is right under the first.
(note that the blob labeled in this image is only req'd if there is a second AD597)
The blue rectangle shows the place of the 220 nF filter cap. for the first compensation cable. First, put the blanked ends of the cable into the holes, and solder just the white wire, barely. Then place the cap. there with forceps, while heating the already soldered pad. Then solder the other (green) side of the cap. aswell.
In case of a second EGT, the orientation, and installment of the cable is the same. The green wire goes into the hole right under the first cable's green wire, and the white beside the first one's white. The difference is the use of a throughole cap (100 nF cheramic). This is also soldered from the bottom side.

Notes:

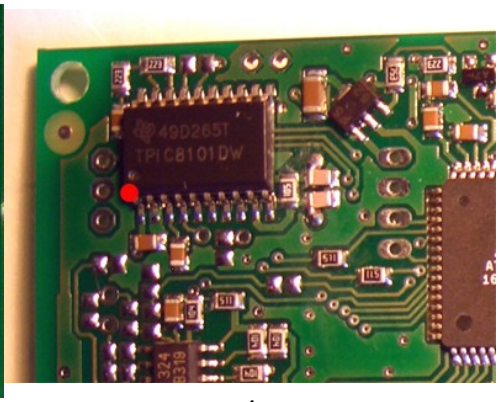
- The top side is where the processor is.
- The green wire of the cable „repels" the solder , blanking it in a way, that the blanked length is about the same as the thickness of the PCB, greatly simplifies soldering!
- Image 4. shows the place of the knock chip.



2.



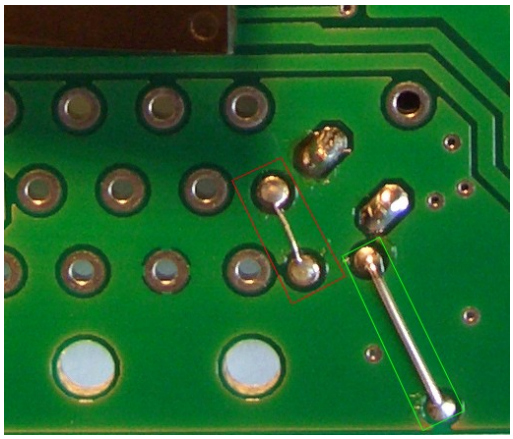
3.



4.

2.2.2 Supply connection, and fuse wire

Next, we solder in the supply connection wire, and the thin fuse wire. In image 5. below, the red rectangle shows the fuse wire, and the green shows the supply connection.



5.

2.2.3 Stepper chip

See image 2. for chip orientation. Throughflow of solder results in better heat transfer, and is a must for the heatsink pins (4,5,12,13).

2.2.4 Filter inductance

This is a 1,5 uH 5,4 A throughhole inductance. In image 1. you can see what it looks like (big cylindrical part). In image 5. , it's pads (already soldered) are visible, right next to the two wires (on the right). This part must be soldered in AFTER step 2.2.2. (otherwise trimming is rather difficult).

2.2.5 Triggers

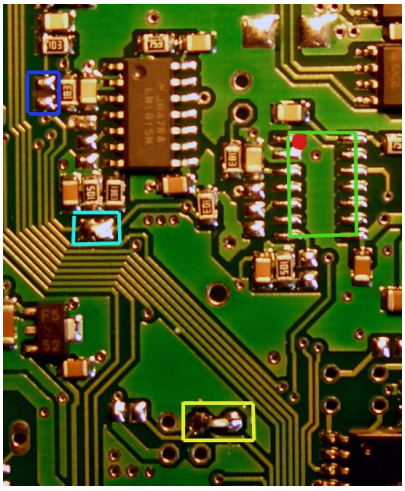
There are two trigger inputs, primary, and secondary. Both can be configured for either Hall or VR use.

In image 6:

- the dark blue rectangle marks , where a solderblob needs to be, if the PRIMARY trigger is HALL
- The cyan rectangle shows, where the solderblob has to be, if the PRIMARY trigger is VR.
- In both cases, there is a jumper, shown by the yellow rectangle.

If the secondary trigger is VR, aka **Auditrigger**:

- The green rectangle shows the place, where the second LM1815 is placed, if the SECONDARY trigger is VR (pin 1 is where the red dot is,it's orientation is the same as the first one's).
- Also, there is a blob on the bottom side of the PCB, when the SECONDARY trigger is configured for VR. See appendix 4.1 on page 18, to see where this blob is and wire is. Both are marked with the color red.



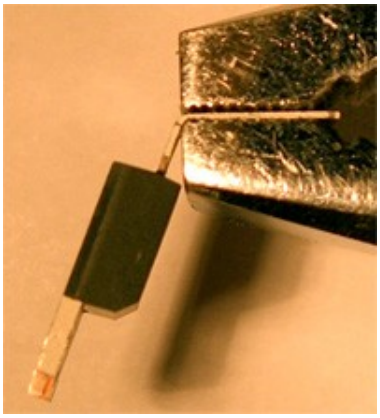
6.

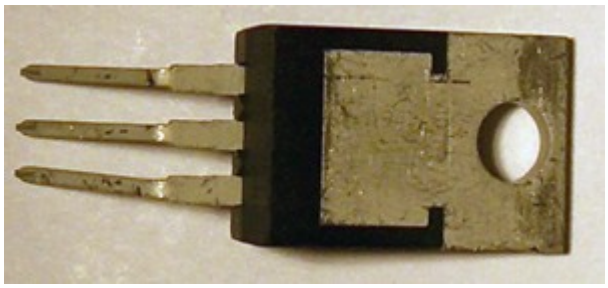
2.3 One-wire interface

This is an additional chip located next to pin 12 of the smaller econoseal connector, on the top side of the PCB. Pin 1 of the chip is on the GND pad.

2.4 FETs, IGBTs, IGBT configurations

When installing the IGBTs and FETs, use the FET align tool.The legs of the IGBTs and FETs are bent using combination pliers. See the photo below, for an aid:

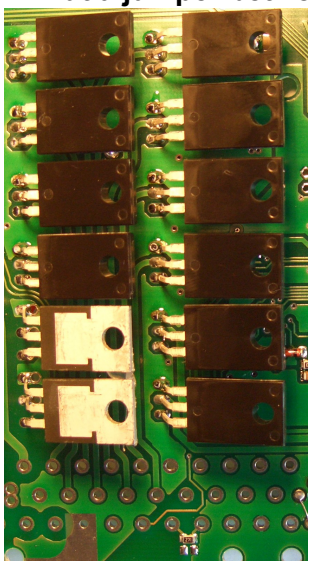




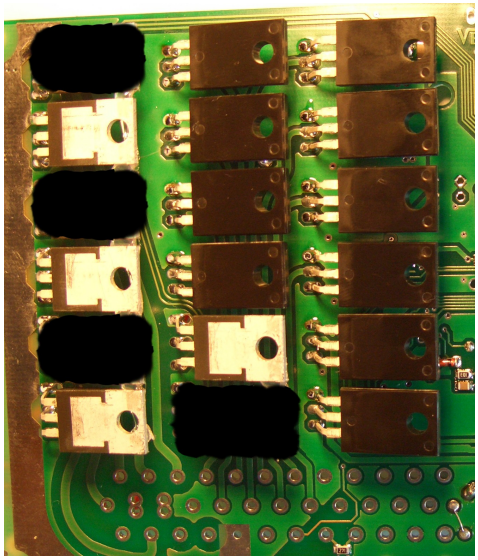
The legs are bent in a way that the housing of the FET/IGBT meets the plier. In the other image (to the right) above it's clearly visible, that the legs are bent where their width slightly increases.
Start with the first row (all IGBTs).
There are five basic IGBT configurations, as follows, the first number represents the number of IGBTs, obiviously the second is the number of logic level outputs, which are also shown here (Econoseal pins):

- 0
- 2+6 (image 7)
- 4+4 (image 8)
- 6+2 (image 9)
- 8

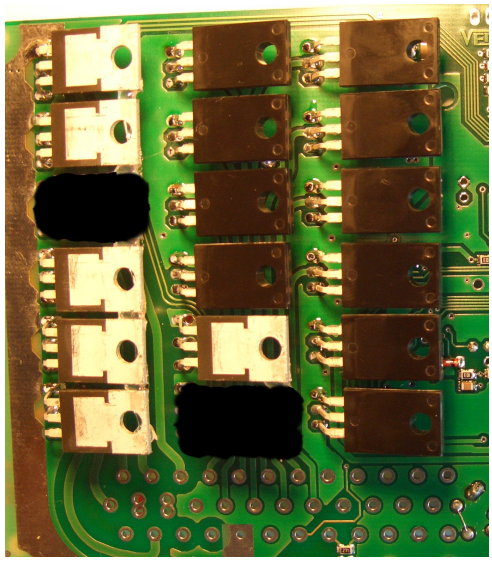
Note: Plug in the hotmelt gun, if the IGBT configuration is either 2+6, 6+2, or 8.
Put a jumper between the gate and the econoseal connection of each IGBT not installed!!



7.



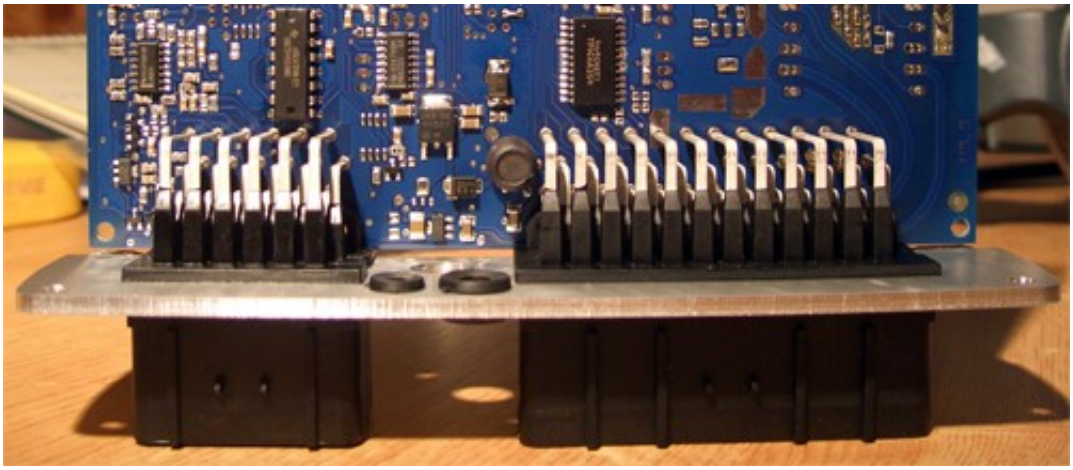
8.

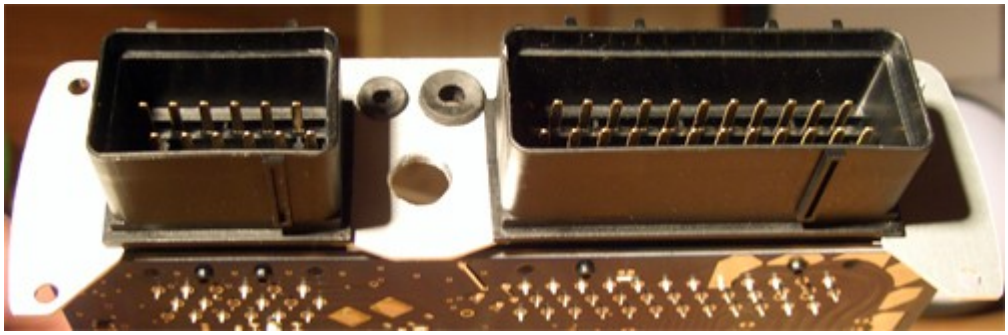


9.

2.5 Econoseal connectors and frontplates

Two large connectors connect the computer to the outside world (along with other optional connections). These are situated on the frontplate of the controller. In the to images below, you can see how the frontplate is installed with the connectors in it (in these images they are not yet soldered in).





There are several types of frontplates. In the previous images you can see one with three holes drilled into it. This is called a 7,10,8 type. These numbers refer to the diameter of the hole (in mm). If there is an onboard MAP sensor, there is always a large, 10 mm hole on the frontplate. The two other holes depend on other configuration options, such as LCD/PS2, and EGT. PS2 and EGT wires go through the 7 mm hole, while the LCD cable uses the 8 mm hole. In any case, rubber rings are placed into 7, and 8 mm holes (4 and 6 mm innger diameter rings, respectively). The PS2 wire usually goes through the endplate. Frontplate/endplate configuration depends on what options are ordered and in what combination.
IMPORTANT! Pin 14, and 15 of the larger (36 pin) need to be slightly bent towards the connector, so they go into the holes on the board, closer to the frontplate.

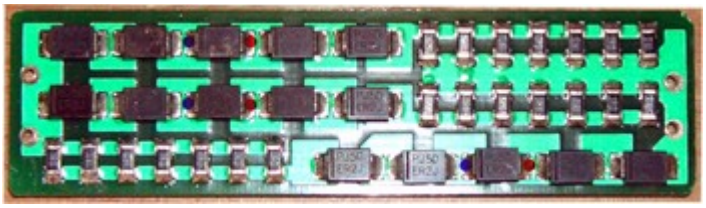
Notes:

- Most of the time it's not possible to insert the 36 pin connector into the frontplate, due to manufacturing issues. It seems the best, and fastest way to force the connetor in, is to use a hammer, while placing the frontplate on thick paper on a firm surface (floor). Be careful not to damage the frontplate! Another way (may be safer for beginners), is to use a blade and take some material off of the grooves on the connectors, from their inside, so they can more easily accomodate the frontplate. The latter method is rather time consuming.

2.6 Flyback (conventional and power)

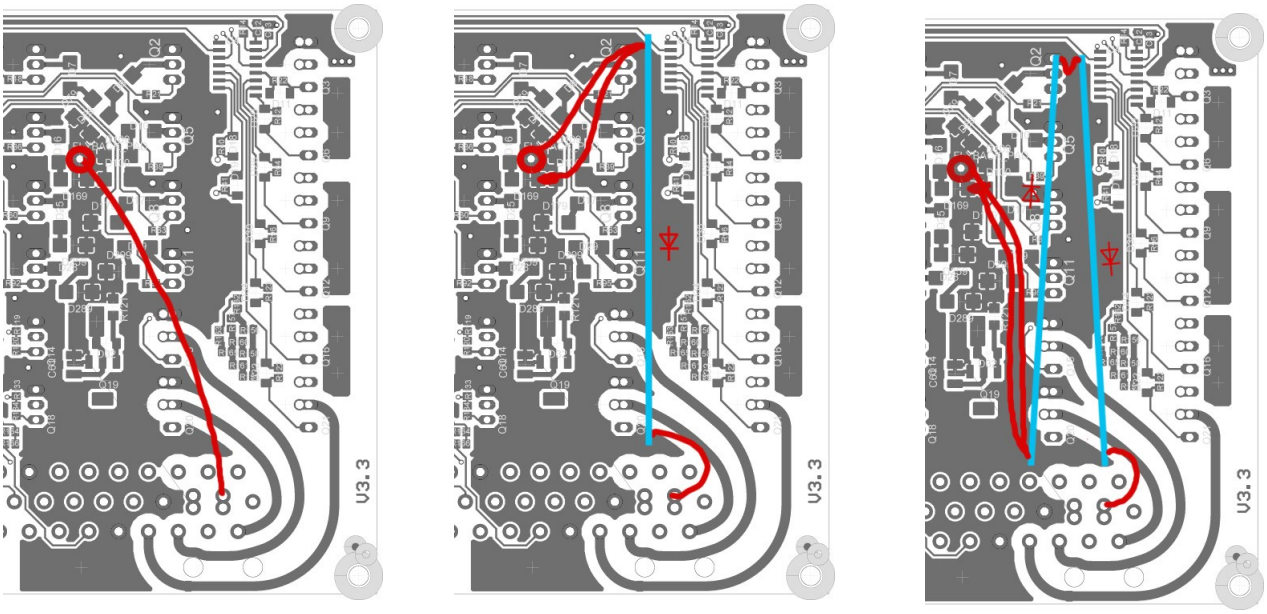
2.6.1Testing the pwr. flyback

Before installing the power flyback, it must be tested. In the photo below, the cathodes of the diodes are to the left. There are two solder holes at the left end of the board and two on the right. Simply put the GND of the DM to the cathode end of the board, and measure the points marked with a red dot. When finished, put the positive (hot) lead of the DM to the anode end of the board, and measure the points marked with a blue dot. Repeat this on the other side of the board. The measured voltage should be around 1,2 V.



2.6.2 Installing the flyback / pwr. flyback:

See the top PCB layout in appendix 4.2 for the location of the flyback connection on the PCB. Either a wire or a PCB fitted with a number of diodes (this is called a power flyback) goes to ECO36 pin 23. The power flyback can be single or dual. The cathode of the diodes must face the frontplate, while the anodes are connected to the PCB (quite obivious , since the diodes on the board are cathodewise to the solder hole). Below are the various flyback types (from left to right): Simple flyback wire, single pwr. flyback, dual pwr. flyback (the blue line represents the PCB, wihch is positoned perpendicular to the main board). When there is no pwr. flyback, the flyback wire's length is about 72 mm. For a sinlge pwr.flyback the two wires at the anode end, are around 40 mm, and the wire at the cathode is about 30 mm. For a dual configuration, the anode wires are 60 mm, the cathode wire is the same length as before. There are also two very short wires connecting the two pwr.flyback boards, these should be no longer than 15 mm.



Note: In some very rare cases this flyback connection is tottally left out. Always refer to the configuration sheet. Pay attention to the polarity!!

2.8 On-board insulated wireing

See appendix 4.1 for reference. The colors represent the following connections:

Red (58 mm): Secondary trigger VR (bottom side solder blob is also shown)
Blue (46 mm): Secondary trigger HALL
Light green: MAP connection offboard
Yellow (34 mm): MAP onboard
Orange (79 and 72 mm): The two knock connections
Pink (43 mm): When there is no one wire interface, we apply this wire
Cyan (40 and 34 mm): RS232 connections
Brown: GND reinforcement (be SURE that you solder this in AFTER the flyback has been installed)

The two dark green wires are the supply wires (see 2.2.2).
When such a wire goes to an econoseal pin, be sure to bare the end of the wire (which will be soldered to the pin) just slightly (1-1,5 mm). The other and, which usually goes through a hole, can be bared a bit longer (2-3 mm). For the secondary trigger connections , the end that will be soldered onto the large pads, should be bared to about 5-7 mm.

2.9 LCD and PS2 connections

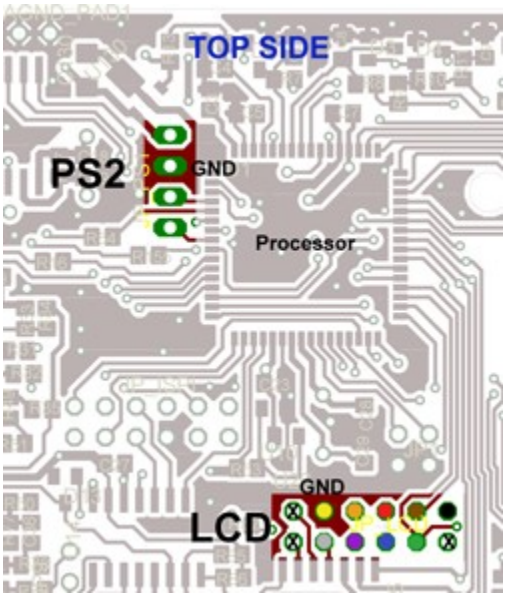
If there is an LCD/PS2 option (they are usually together, but there are exeptions), an LCD and PS2 wire needs to be soldered in. The LCD wire is a 10 pole wire, which of we only use 9.

LCD pinout:

1 Black: VCC
2 Brown: Enable
3 Red: Data 4
4 Orange: Data 6
5 Yellow: GND
6 Green: RW
7 Blue: Data 5
8 Purple: Data 7
9 Gray: RS

PS2 pinout:

1 VCC
2 GND
3 DATA
4 CLK

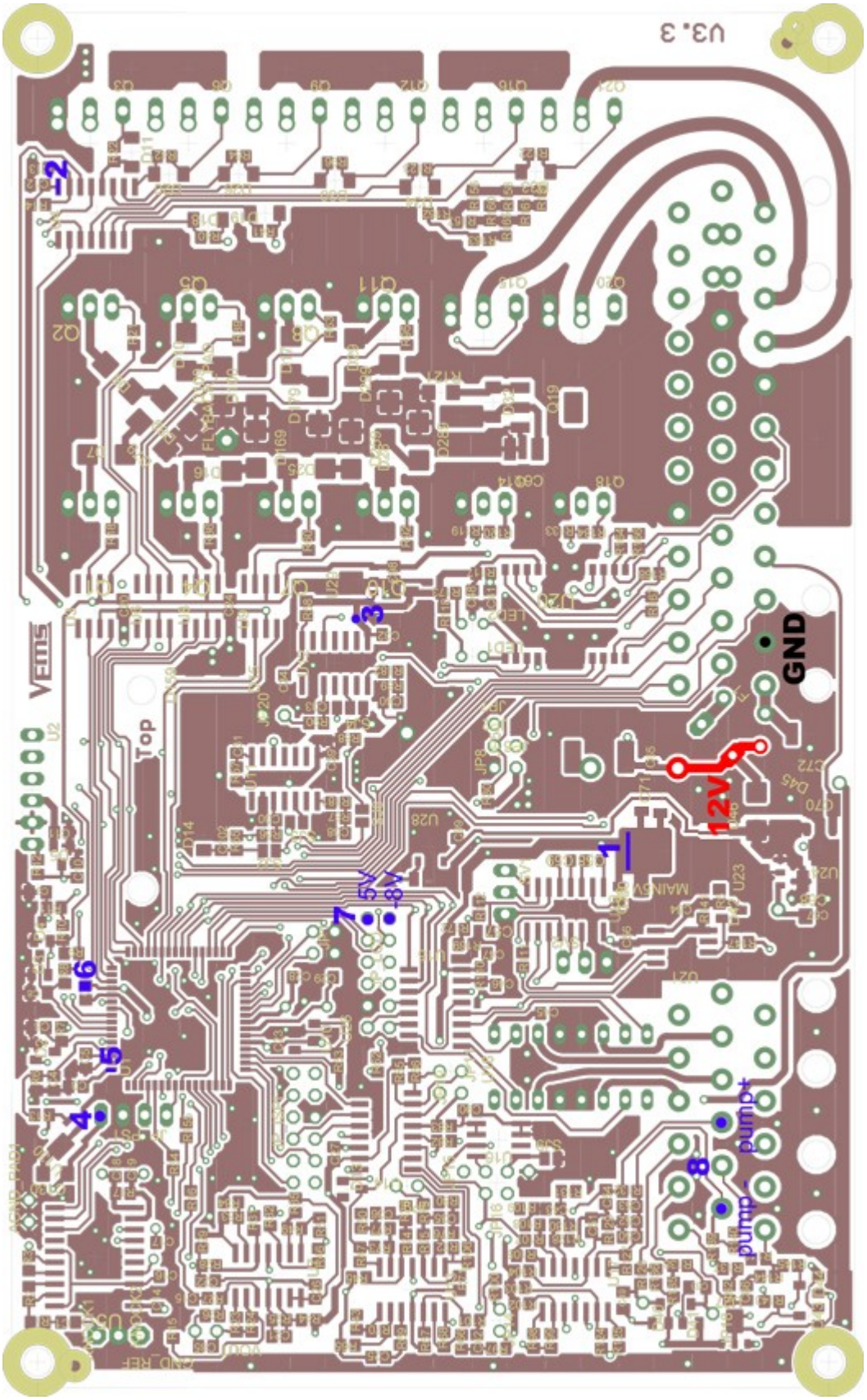


3.1 pre-board test:

1. Check the PCB for any obivious flaws, and errors. Pay special attention to the PJ52 diode, and the quartz chrystals (if there is a knock chip, there is a second 4 MHz quartz). Also , if there is an AD597 chip (EGT option), see if the 10 uH inductance is soldered in.
2. Give the board an ID, and connect the ISP, and then turn on the power supply. Measure the voltages at the measurement points below (see the diagram on the next page!):
   - **1** 5V Main regulator
   - **2** 5,6V Supply voltage of the IGBT drive chip
   - **3** 5V The otput of the regulator near the place of the second LM1815
   - **4** 5V PS2 supply voltage
   - **5** Aref voltage
   - **6** 5V Processor supply voltage (pin 52)
   - **7** LCD supply voltages, -8 V and 5 V
   - **8** pump- and pump+

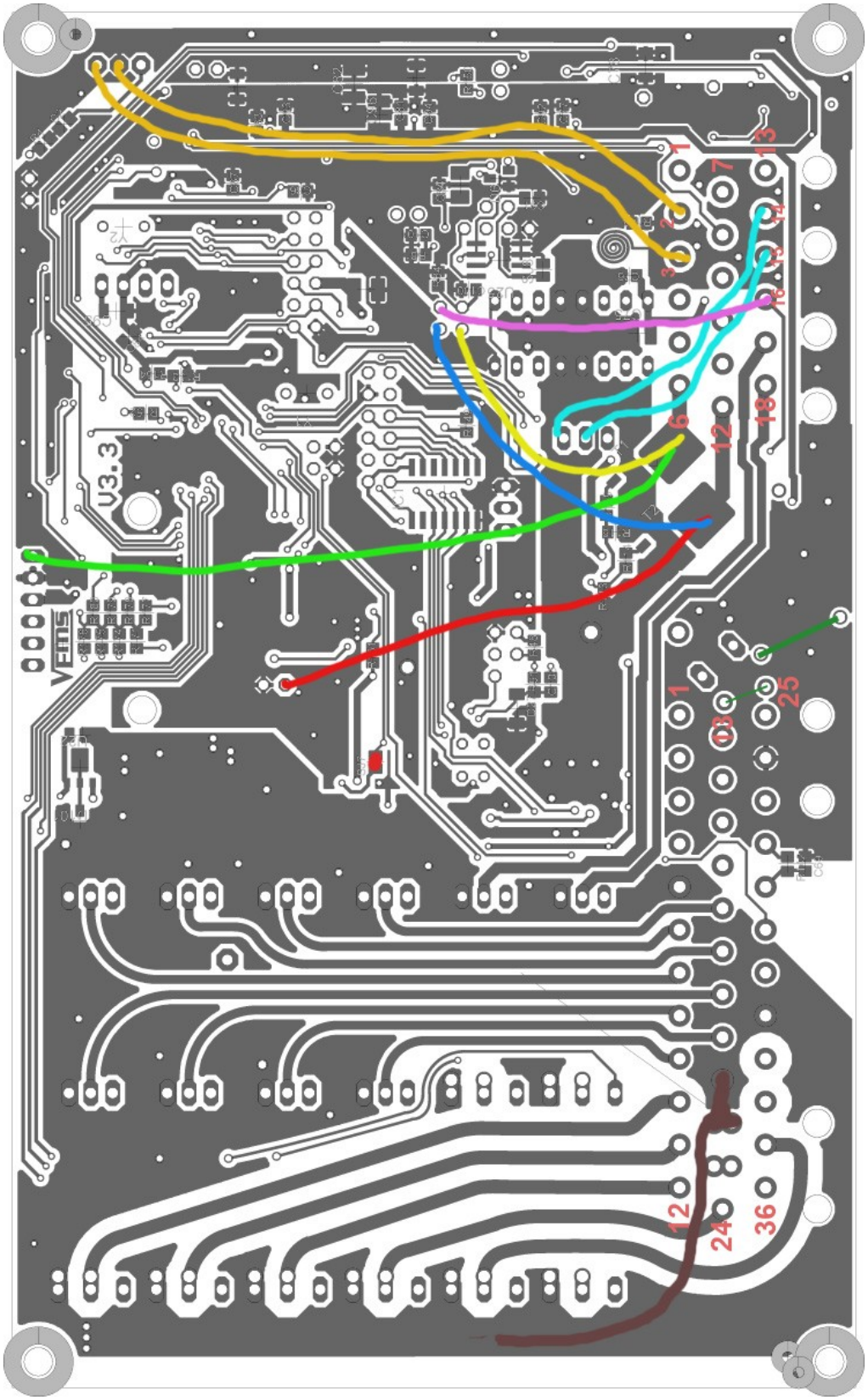
   If any of the above voltages exceed the given reference by more then 3 %, the board is considered faulty. Everything must be clearly documented!.

3. Upload the boot loader, via the steps below
   1. Upload: /tmp/STABLE1_0/mintest w xxx xxx: ID in decimal form
   2. Fuse upload: /tmp/STABLE1_0/mintest f xxx xxx: ID in decimal form
   3. Verification: /tmp/STABLE1_0/mintest vf xxx xxx: ID in decimal form
4. Turn off the power supply, and take the ISP off. Then connect the RS-232. Turn on the power supply.
5. Measure the pump (-) voltage, and document it. Then connect the GND of the DM to pump (-) and the hot wire to pump (+), measure the voltage and document it.
6. Check the firmware using the following command line:
   /tmp/STABLE1_0/mintest/firmvare1_0_38/perl prog.pl vems.hex :*serial port* Et This step also sets up serial communication.
7. If the verification fails, use the command line above, but with an Etw switch instead of Et.
   If the verification has been successful, upload tables.mtt, using the terminal (send fájl button), then upload config-65.mtt from the etc folder. As soon as you see „Bye” in the terminal, disconnect, and reboot the V3, using a firmware verification.
8. The maximum difference between pump(-) and (+) is ± 4 mV. This voltage can be set by changing the pump_pw_zero parameter. In the etc folder the file names have the following format: config-XX.mtt, where XX represents the pump_pw_zero value which will be set ,by sending the file to the computer. Document the pump_pw_zero value, and the voltages.
9. If all the above is done, and everything is in order, put a small q in the documentation below the ID of the board, and put the board in the box labeled with a large Q.


V3.3
Top
VEMS
GND
12V
pump-
pump+
1
2
3
4
5
6
7
8
5V
8V

Appendix 4.1

Bottom side wireing



Appendix 4.3

Quick checklist

1. PCB checkup
    1.1 Transient diode check
2. EGT chip (if needed)
3. Supply connection, fuse wire
4. Stepper chip
5. Trigger jumpers (if there is an EGT chip, then be sure to place a solder blob to pin 1)
6. One wire chip (if needed)
7. Second LM1815 (if the secondary trigger is VR (a.k.a. auditrigger))
8. Inductance (1,5 uH 5,4 A)
9. IGBTs, FETs (check the soldering, it should flow through)
10. Frontplate with connectors AND rubber rings
    10.1Cut the pins (meaning, the small pin ends sticking out of the PCB AFTER soldering) of the eco 36 connector in the row closest to the
11. IGBTs/FETs
12. Power flyback (check polarity)
13. MAP sensor (fasten the nuts; in case of the 250 kPa sensor, only solder in the sensor itself after the nuts have been fastened)
14. EGT wire (and ofcourse the cap)
15. Insulated wireing (and GND reinforcement)
16. LCD and PS2