LVPS Brick v6.5.4.A Reconstruction for Technicians

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05 Mar 2007

INTRODUCTION – LVBOX ASSEMBLY

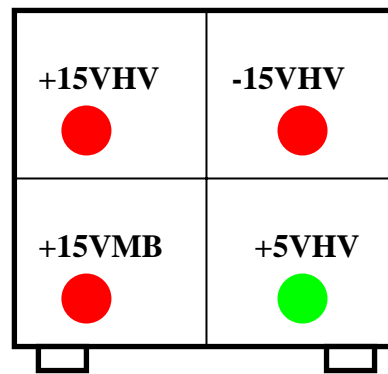**There are 8 DC/DC modules – bricks inside of ATLAS/TileCal low voltage power supply**

(LVBOX):	**1x 3.3V**	**3.3VDIG**	**(blue sticker ⬤)**	**Id: Bxxxx**
	4x 5V	**5VDIG**		
		-5VMB	**(green sticker ⬤)**	**Id: Gxxxx**
		+5VMB		
		+5VHV		
	3x 15V	**15VHV**		
		-15VHV	**(red sticker ⬤)**	**Id: Rxxxx**
		+15VMB		

All bricks follow almost the same reconstruction procedure. The modifications are specifically indicated when the changes are different brick to brick position.

Pic1. Brick positions on water cooling heat sink and their color labeling inside of LVBOX.
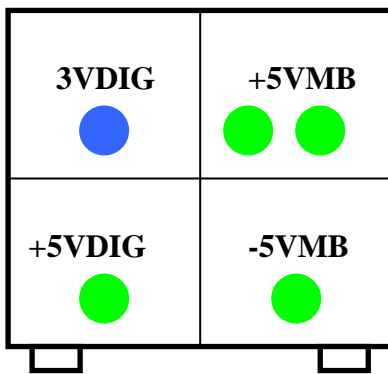
Top side heat sink view   Bottom side heat sink view

CHANGES and NOTICES in brick reconstruction v6.5.4.A

- (1.B) Remove completely the butterfly resistor on bottom side, see Pic2.
- (3.E) Remove components on bottom side, added R33, see Pic10.
- (4.A) Remove C59 (68uF) and D4 diode (LL4148), see Pic11.
- (5.A,B) Solder wire connection, see Pic14.
- (5.C.) Solder components on bottom side, C10 = 2x100nF, see Pic15.
- (6.A) Solder new D4 diode BAT46 with same polarity, see Pic19.
- (7.B) Isense resistor change in 3 bricks, see Table 4.
- (8.B) Improve additional 200V divider, as discussed previously, see Pic26.
- (10.A,B,C) New group shutdown circuit in 3 bricks: **-5VMB, +15VMB, -15VHV**, se Pics 28, 29, 30.

BRICK RECONSTRUCTION v6.5.4.A

1. PCB TRACE CUTS ON BOTTOM SIDE (Pic2):
– **(A) Between test point T15 and pin 1 of U13,**
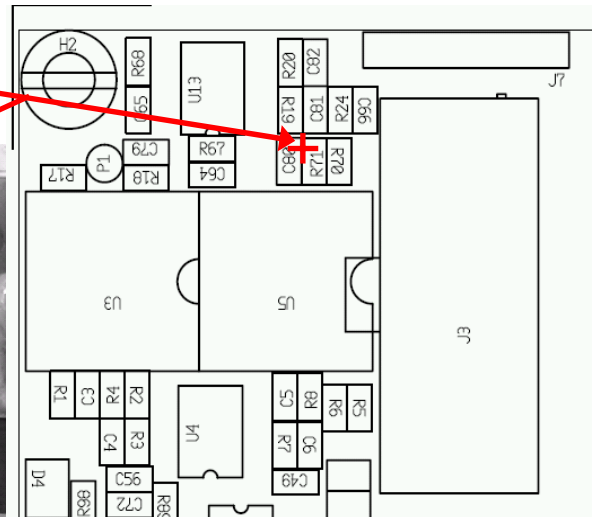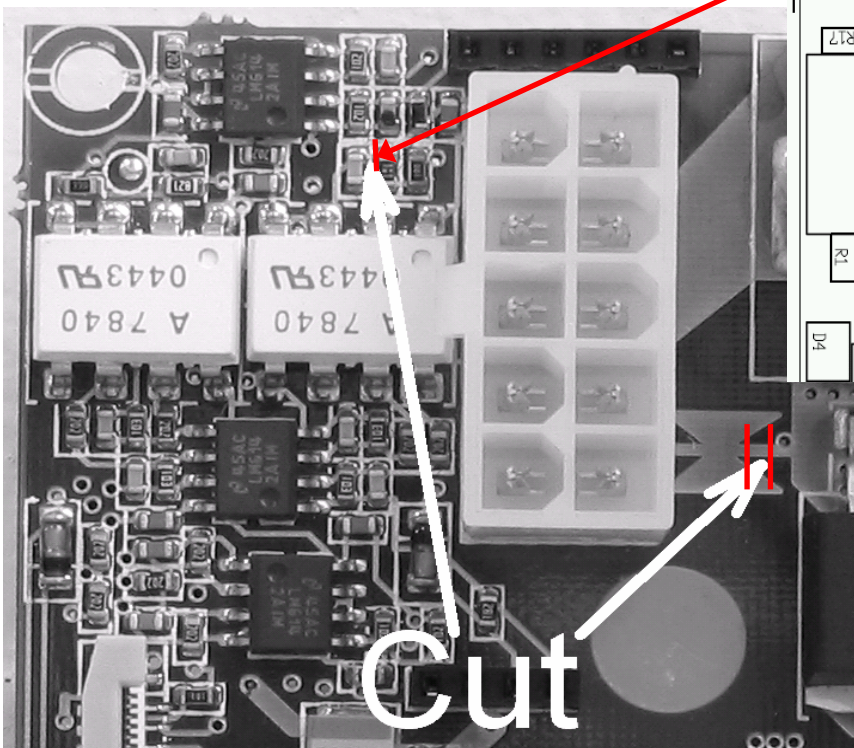– **(B) "Butterfly" Isense resistor on bottom side.**
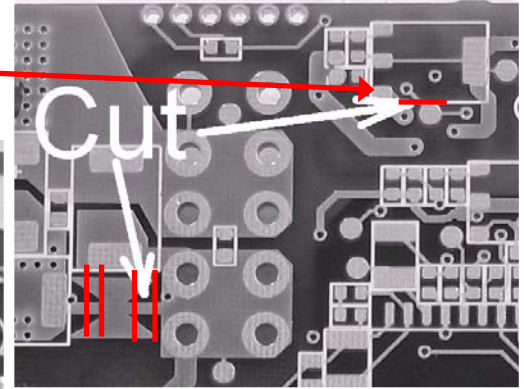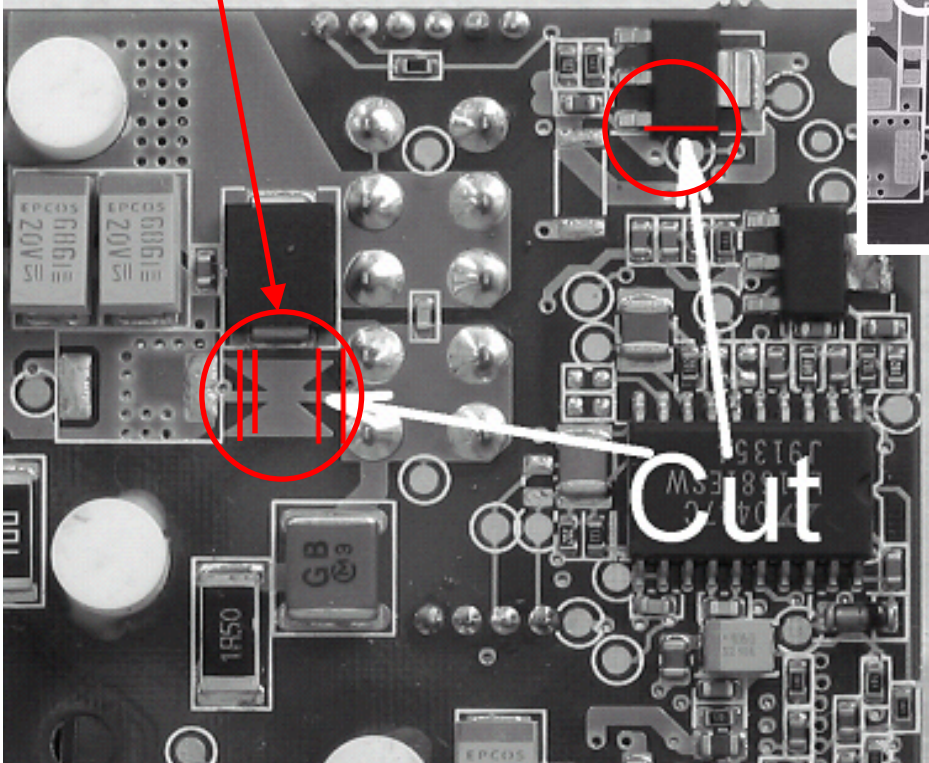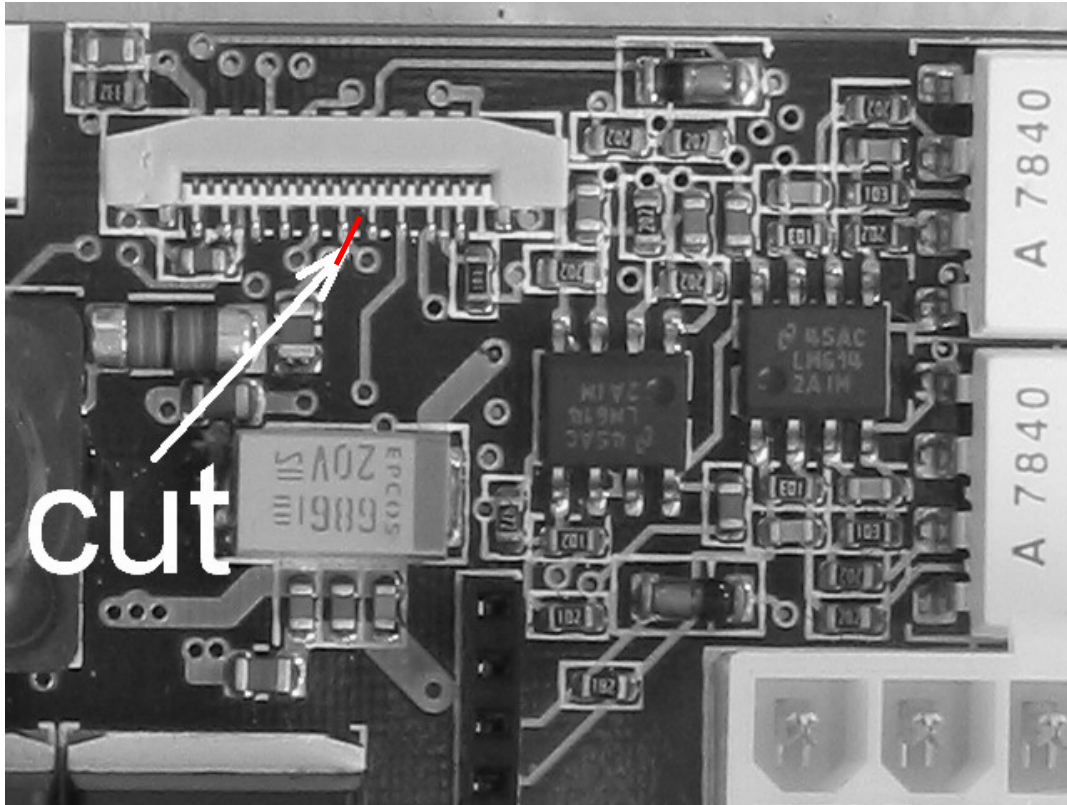

Bottom naked pcb view.

Please, remove completely Isense butterfly resistor on bottom side:
- cut both narrow traces (red lines), heat the butterfly trace until it is removed.

### 2. PCB TRACE CUTS ON TOP BRICK SIDE (Pic3):
- (A) between GND pins R71 and C80,
- (B) Second "Butterfly" Isense resistor on top pcb side.

- (C) Cut trace between pin 11 of J2 connector and via hole on top pcb side (Pic4):
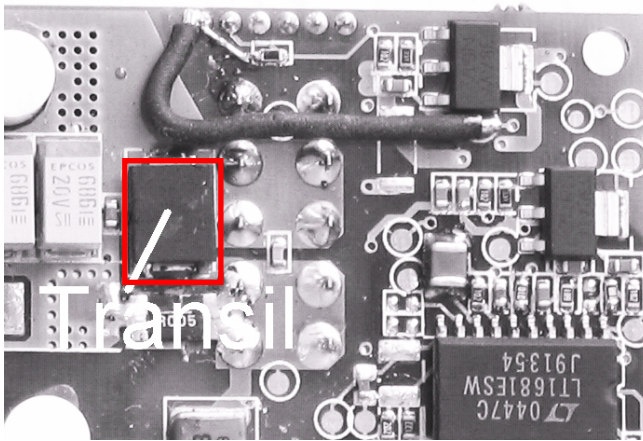

When procedures 1 A, B, and 2 A, B, C are done, check and measure following test pins with an Ohm-meter. There should be non-zero resistance (~100ohm) when measure points 1 and 2 on top side, see in Pic5.
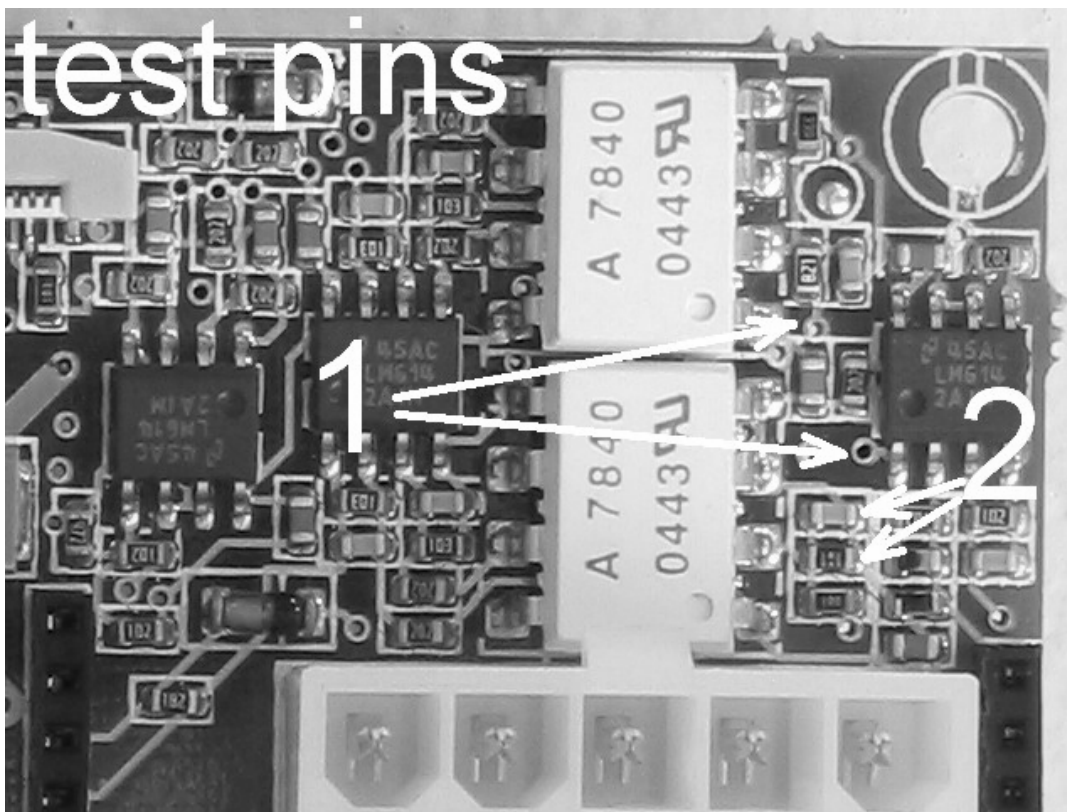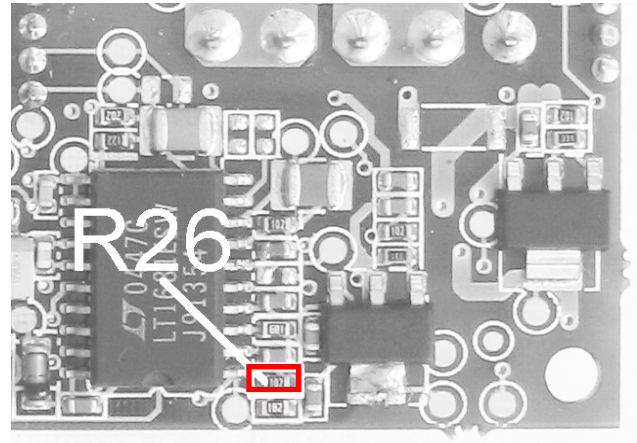

Pic5.

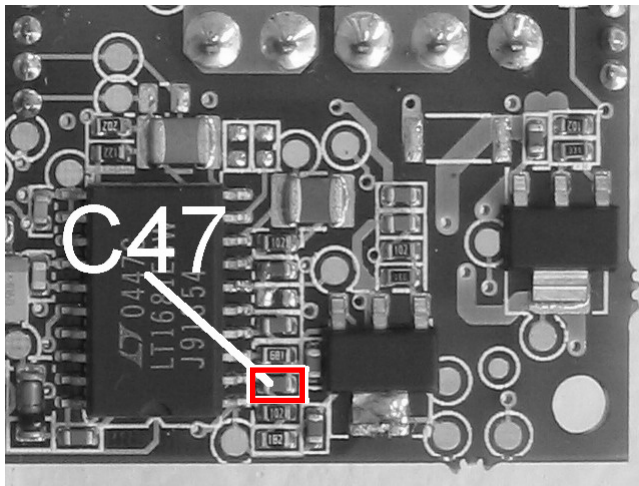## 3. REMOVE COMPONENTS FROM BOTTOM SIDE, on all type of bricks.
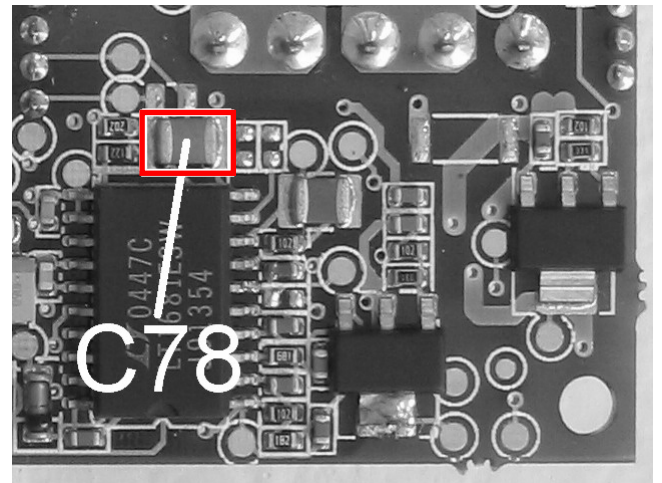
(A). the TRANSIL (diode), Pic6.

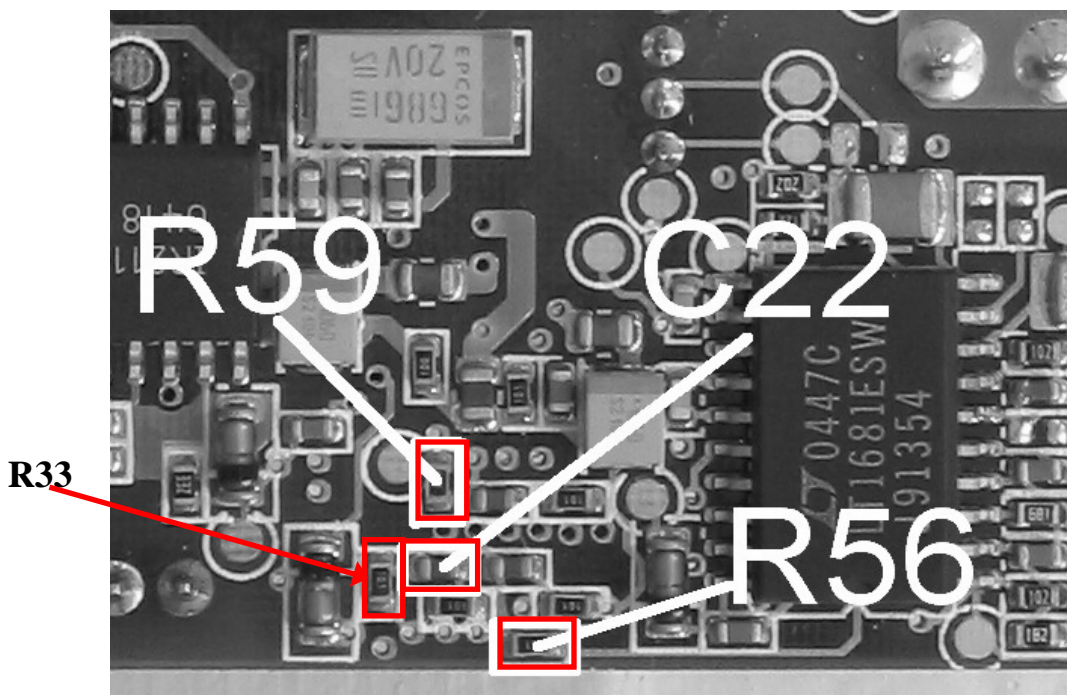**(B)   R26 (1kohm), Pic7.**

(C) Remove capacitor C47 (100nF), Pic8

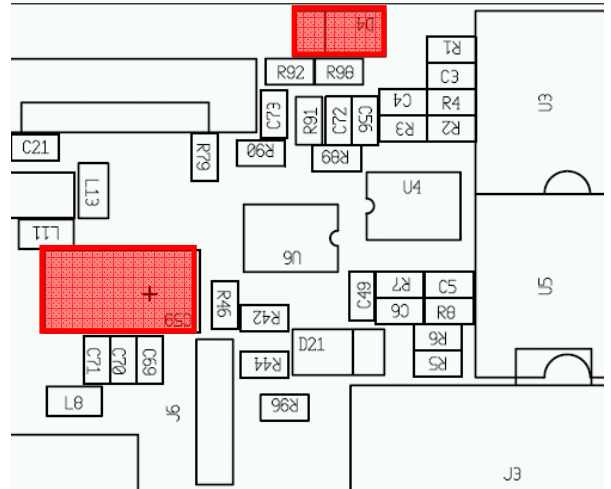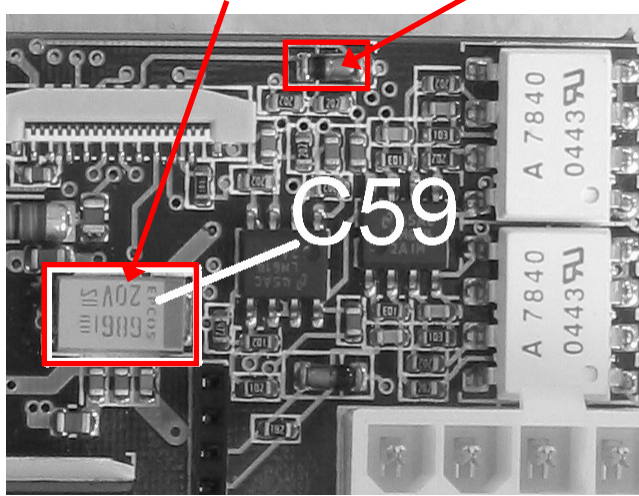**(D) Remove capacitor C78 (100nF), Pic9.**

(E) Remove components R59, R56 (100 ohm), capacitor C22 (47nF), and newly R33 resistor (100ohm), bottom side, Pic10.
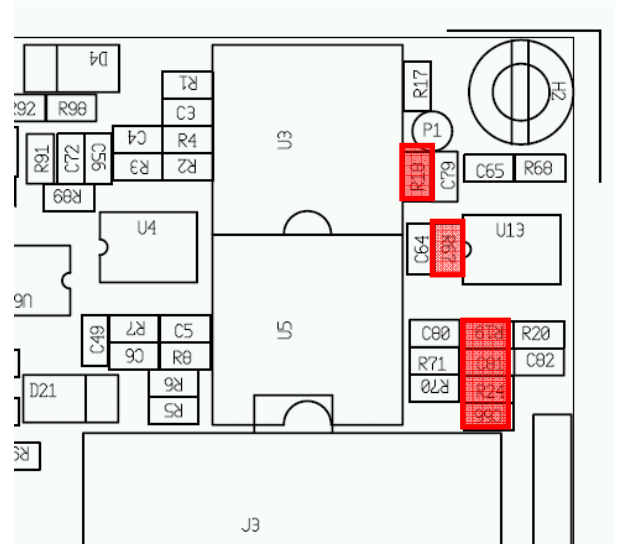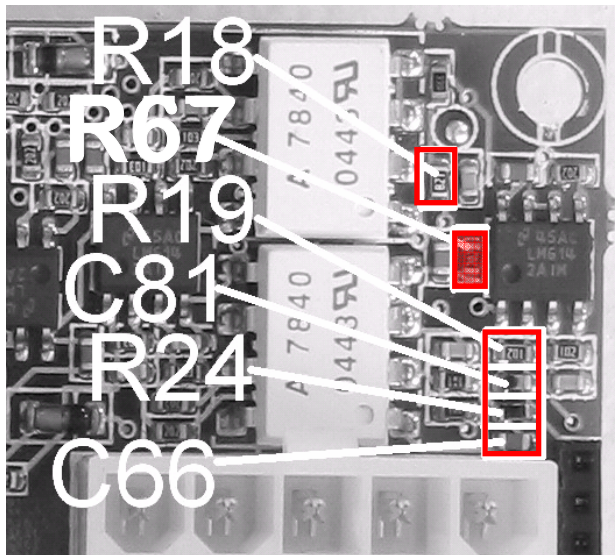
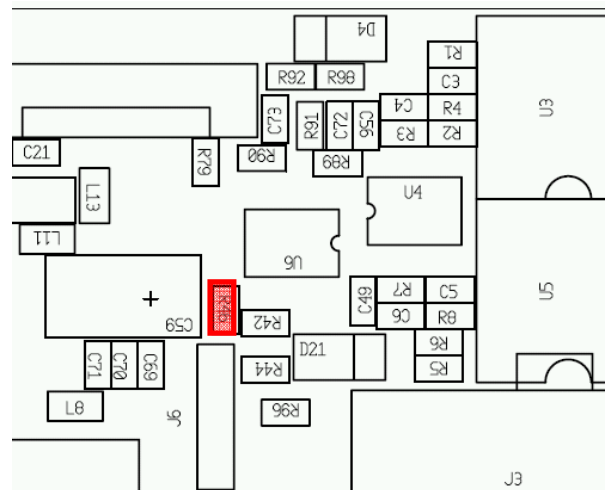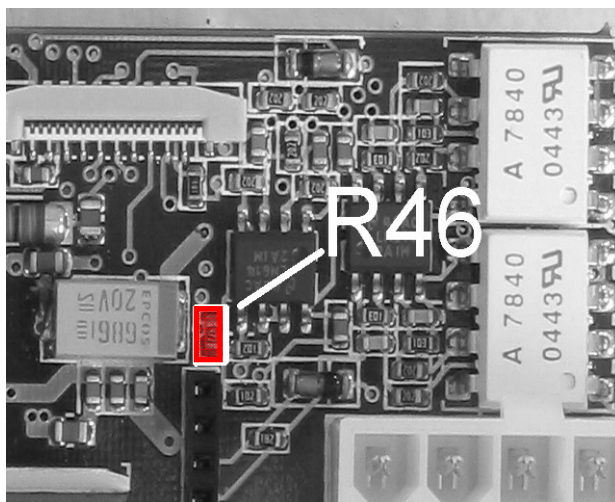## 4. REMOVE COMPONENTS FROM TOP PCB SIDE:

(A) Remove C59 (68uF) and D4 diode (LL4148) for all bricks, see Pic11.

(B) Remove R18, R67, R19, C81, R24, C66, Pic12.

(C) ONLY 15V BRICKS MODIFICATION!!! Remove resistor R46 (4k7), Pic13.

5. SOLDERING ON BOTTOM BRICK SIDE

(A). Prepare 8 pieces of 30 mm wire with isolation.

(B) Solder wire connection between pin6 of J7 connector and measuring point T15 as shown in Pic14.

Pin6 of J7, bottom side

T15 meas. point

The wire can be as short as possible to connect points (Indicated by dashed line).
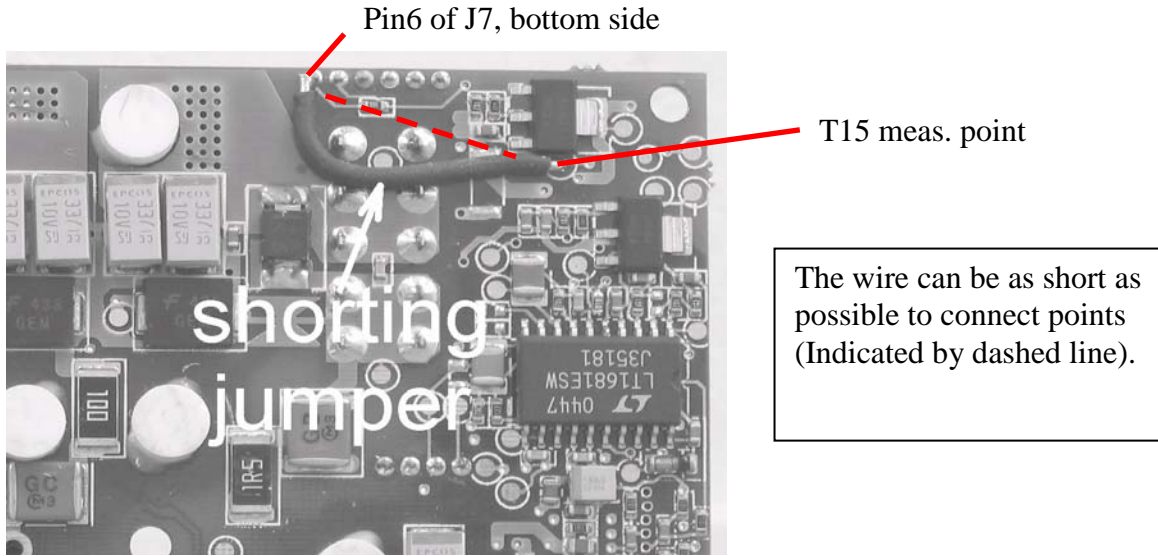
(C) Solder C78= 33nF (size 1210), solder R15= 3k3 size 0603, solder C10 = 2x100nF in parallel (second on top of the first one) size 0603. Capacitor C78 was removed before in procedure 3D. Pic15.

R15   C10

C78
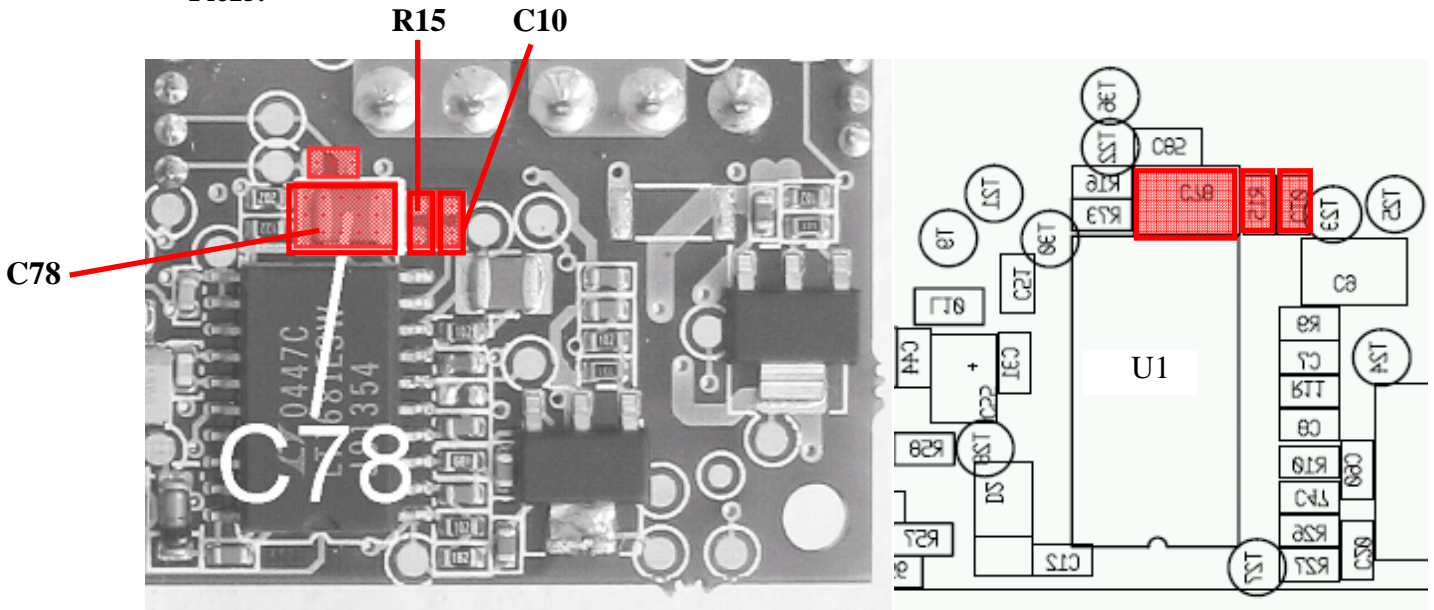
(D) Solder R26, size 0603, 1.5kohm, 1%, Pic 16.

R26
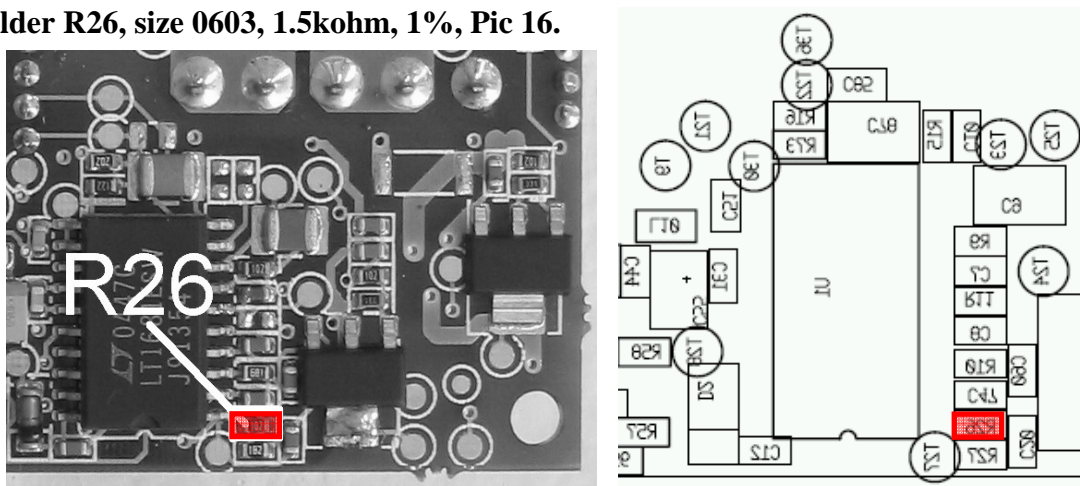
(E) Solder resistors R59 and R56 (size 0603, 1%, value 10kohm), Pic17.
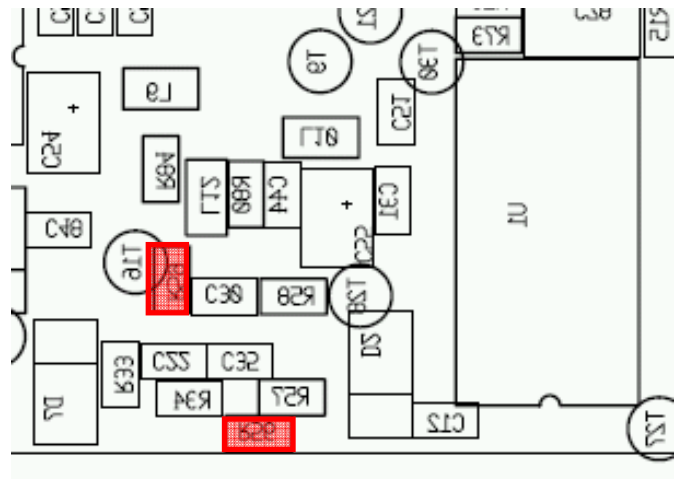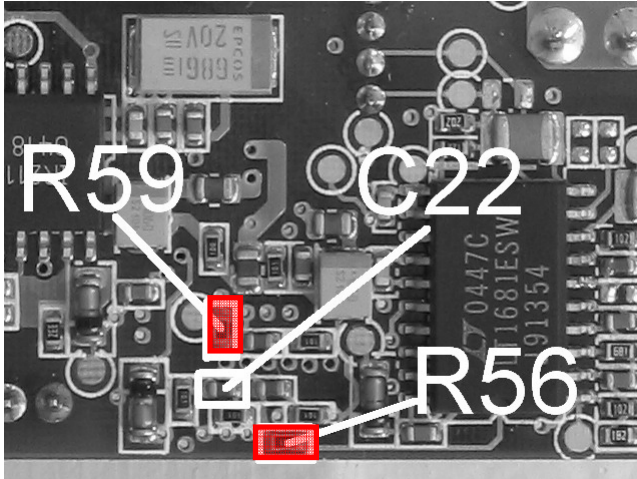
(F) Solder resistor 3.6kohm, 1%, size 0603, in the place of C22 capacitor, bottom pcb side, Pic18.
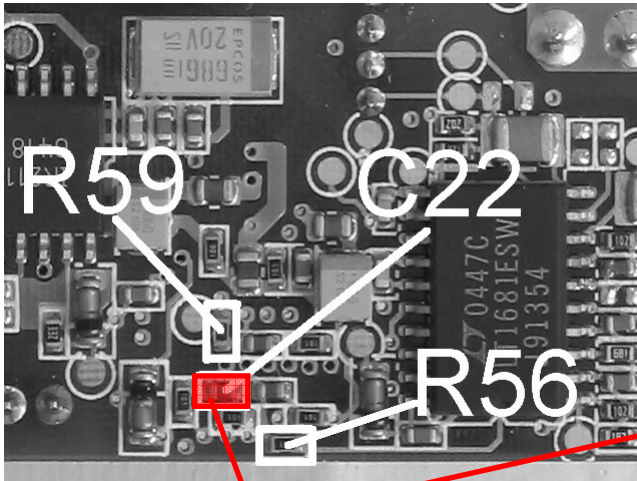
Solder new resistor 3.6kohm, size 0603

6. SOLDERING ON TOP PCB SIDE (All Bricks)

(A). Solder short connection between pins 7,6 and 2 of the U13 opamp, see Pic19. Solder new D4 diode BAT46 with same polarity, Pic19
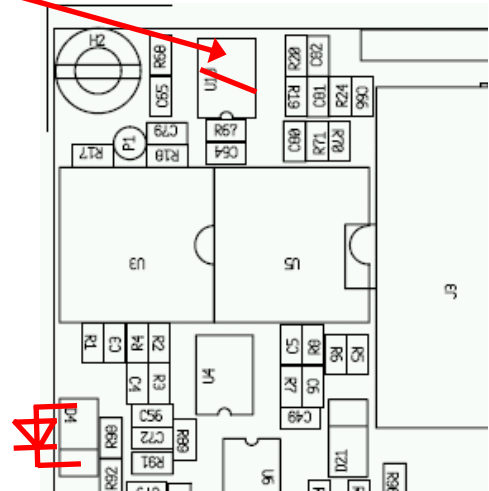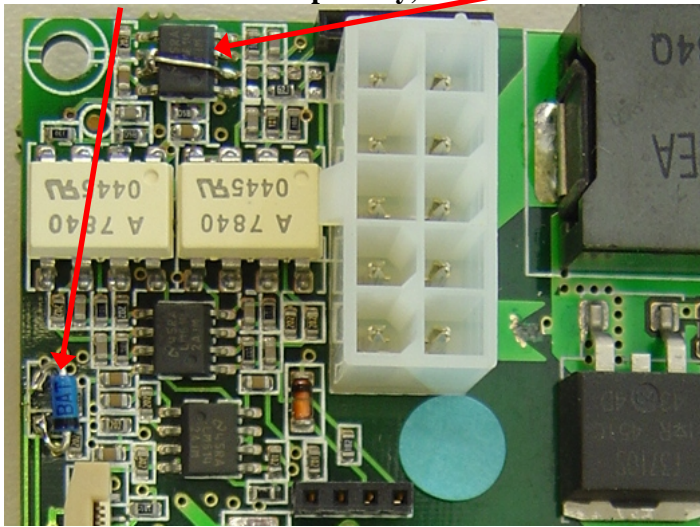
(B) Solder one new resistor in the place indicated in Pic20, 620 ohm resistor, 1%, 0603.
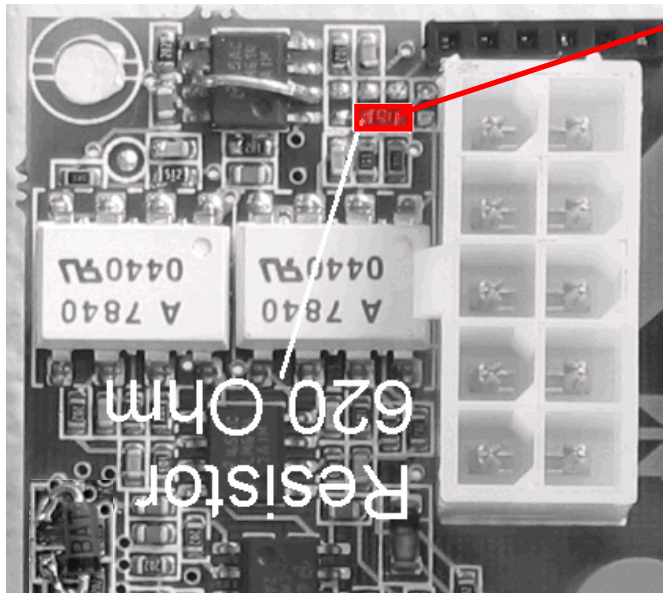
(C) Solder new resistors R18 from Table1 and R67 from Table2 on top pcb side, Pic21.
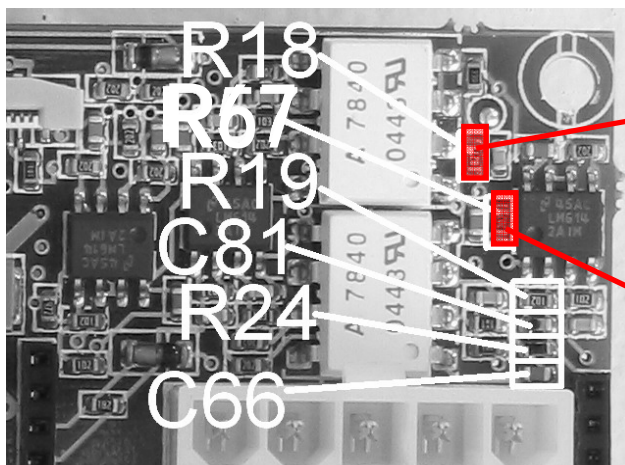
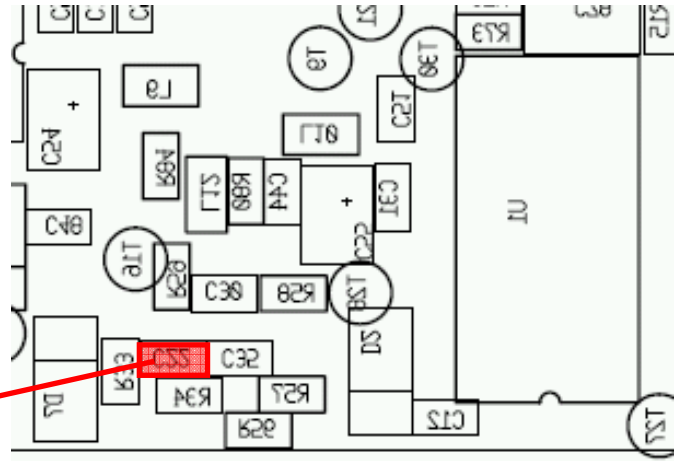**Table1.**

Brick's type		R18(new value)
1x	3.3V	1.1k
4x	5V	1.8k
3x	15V	5.1k

Table2.

Brick's type		R67(new value)
1x	3.3V	1.1k
4x	5V	1.3k
3x	15V	1.8k

(D) 15V BRICKS MODIFICATION ONLY: Solder new resistor R46 – 7.5kohm, 1%, 0603, Pic22.
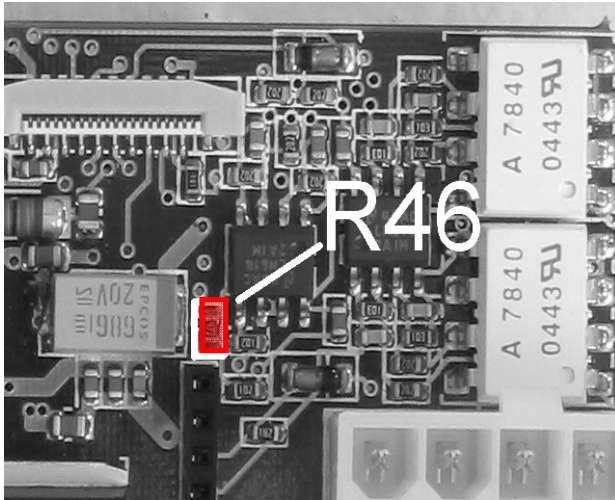
7. START UP SEQUENCE AND OverCurrent Protection (OCP) of bricks.

(A) Change C9 SMD capacitor on bottom side by value from Table3, Pic23:
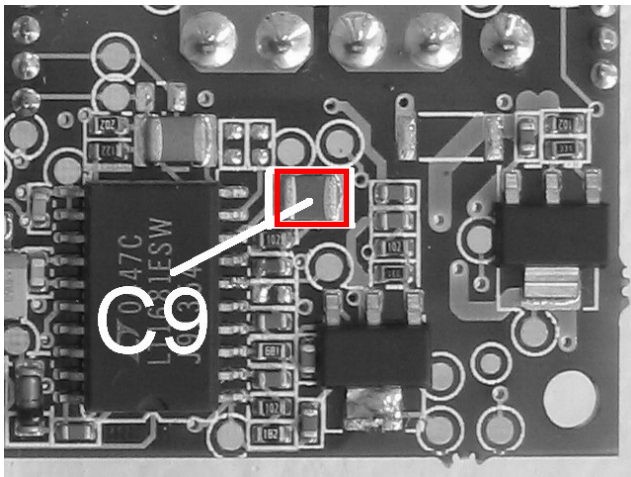
Table3.

Brick type	Value C9	Start group
-5V MB	1.0uF	1
+15V MB	4.7uF	2
+5V MB	10uF *	3
+3.3V DIG	4.7uF	2
+5V DIG	10uF *	3
-15V HV	1.0uF	1
+15V HV	4.7uF	2
+5V HV	10uF *	3

* original value, does not need to be changed   .
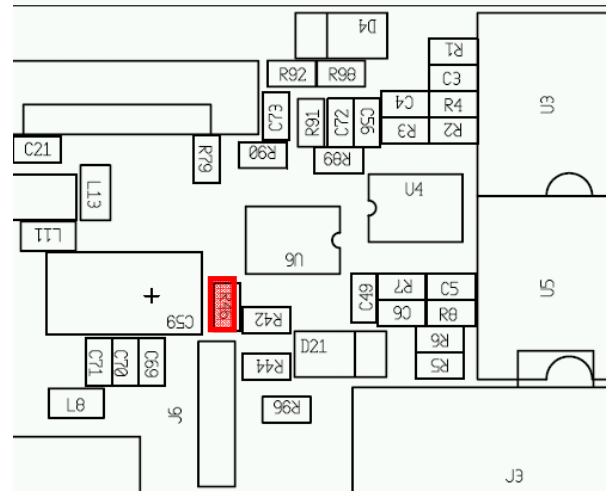
(B) Solder new Isense-resistor (instead of "Butterfly" pcb trace on the bottom pcb side) by Table 4, SMD type, 2512 size, 1%, Pic24:
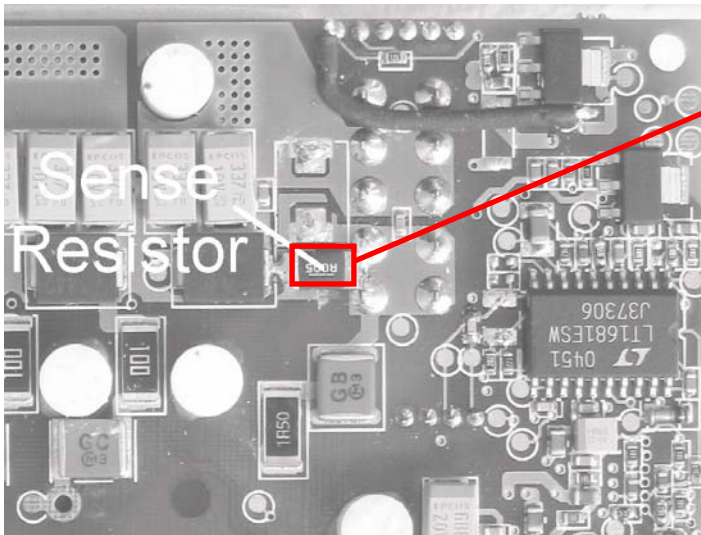
Table 4. v6.5.4. brick's Isense resistors

Brick type	Isense-resistor	OCP [A]
-5V MB	3mOhm	13
+15V MB*	10mOhm*	4.5
+5V MB	2mOhm	18
+3.3V DIG	3mOhm	13
+5V DIG	3mOhm	13
-15V HV	10mOhm	4.5
+15V HV*	10mOhm*	4.5
+5V HV*	10mOhm*	4.5

8. <u>Additional 200V divider for V input (200Vdc) brick measurements:</u>

(A) R33 resistor (100R) on bottom pcb side was already removed in (3.E).

(B) Solder new wired resistor of 680kohm (rated for 250Vdc min, 1%, 0.25W) between +200Vdc inputs (bottom side of connector J1) and a pad of unsoldered R33, see Pic25 or Pic26.
For reasons of reliability of connection, 680kohm resistor has to be soldered on pad of unsoldered R33 and also partially soldered together with new resistor 3.6kohm (proc. 5.F)

Pic25. Bottom side photo.

Pic26.

9. L4 inductor change in 3x15V and 5VHV bricks, top side pcb

(A) Unsolder SMD power inductor L4 on top side in all 15V bricks and 5VHV brick, Pic27.

L4

Unsoldered L4 on 15V brick.

(B) Solder new L4 value for 3x 15V brick and +5VHV according to the Table5.

Table 5. New inductor L4 values.

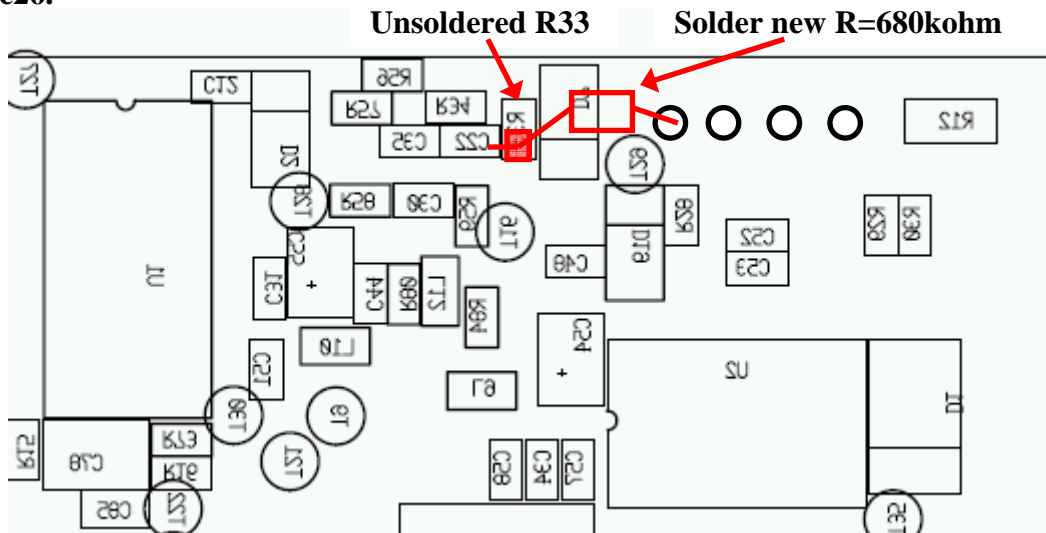| Brick	L4 [uH]
3VDIG	stay same
5VDIG	stay same
5VMB	stay same
-5VMB	stay same
5VHV	47
15VHV	150
15VMB	150
-15VHV	150

10. Additional Group Shutdown circuit in 3bricks : ONLY -5VMB, +15VMB, -15VHV

(A) Reminder, SMD diode D4 (LL4148) was already removed in step (4.A) on top pcb side, and new diode D4 BAT46 was soldered in step (6.A), see following Pic28.

(B) FOR ONLY -5VMB, +15VMB, -15VHV Bricks: Solder new wired resistor 470ohm (1%, 0.25W) between pins 5 and 8 of U3, see Pic29.
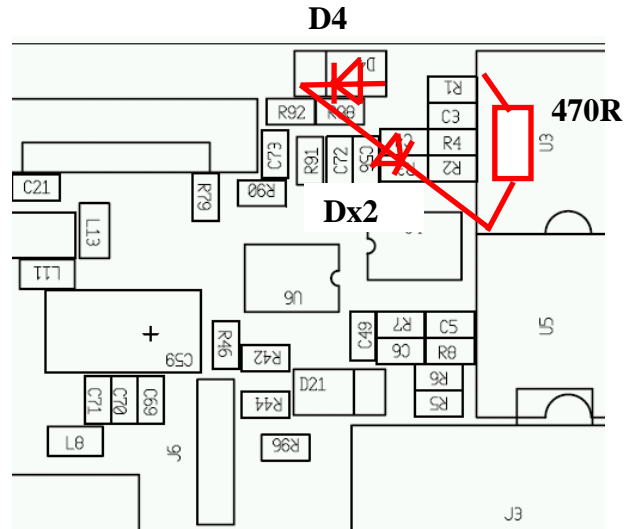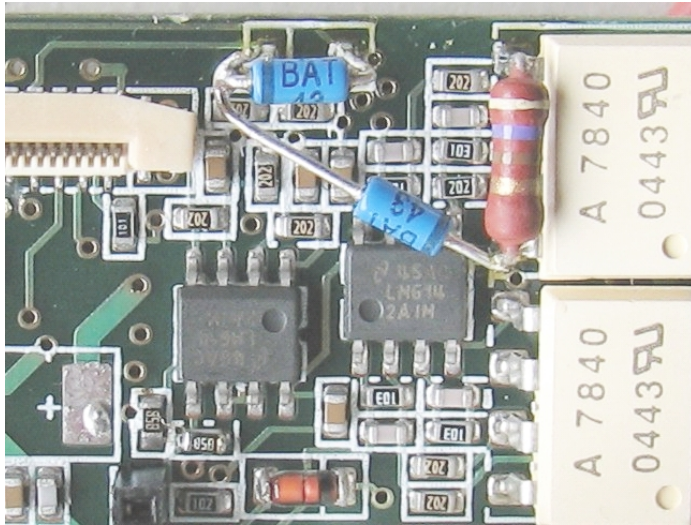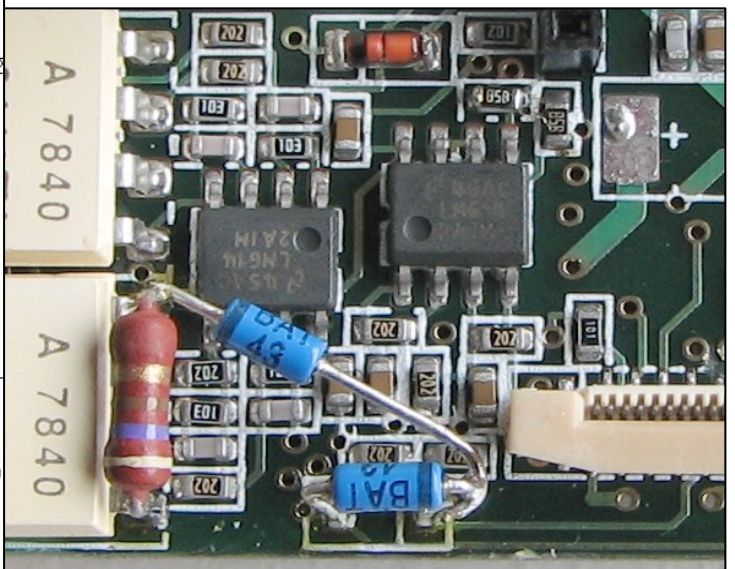

(C) FOR ONLY -5VMB, +15VMB, -15VHV Bricks: Solder new shottky diode Dx2, type BAT46 (BAT43), Dx2 solder between Cathode of new D4 and pin 8 of U3 optocoupler (HCPL7840), cathode towards pin 8 of U3, see also Pic29.

Part of brick scheme and another detailed photo with group shdn is shown in Pic30.
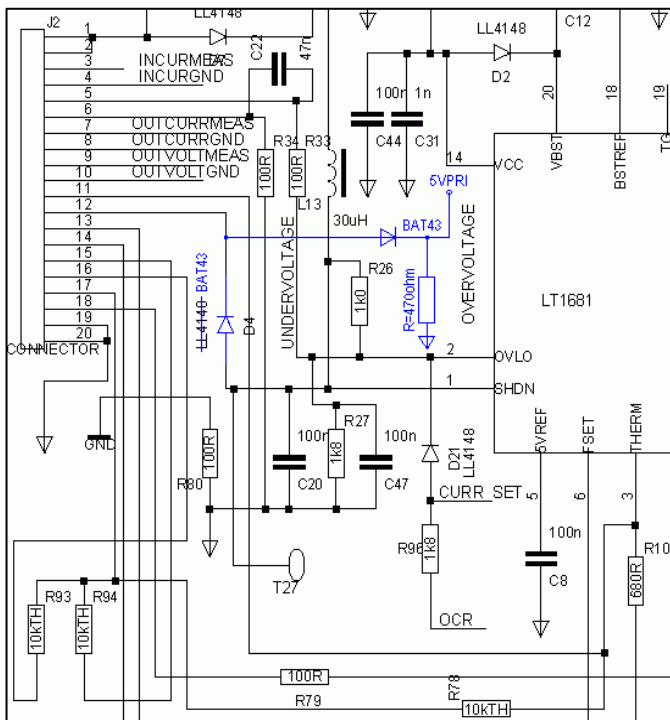
11.   <u>Resistive Preloads for 3x15V and 5VHV bricks inside LVBOX (done at Cern)</u>

(A) This procedure is made when all modifications described previously in this document are finished, bricks are tested and ready for assembly inside of LVBOX.

(B)   Preload resistors are connected directly on Vout connector between positive and return pins. All resistors have the same value of 47ohm, power resistor in TO220 package, rated for 20Watts, see Table 6, Pic31.

Table 6. Preload resistors for 15V and 5VHV bricks.

Pic31.

| Brick	Iout_range [A]	Preload [Ohm]
3VDIG	1.7 - 5.6	No
5VDIG	3.3 - 6.7	No
5VMB	6.6 - 13.3	No
-5VMB	3.3 - 6.7	No
5VHV	0.1 - 0.3	47
15VHV	0.15 - 0.4	47
15VMB	0.2 - 0.6	47
-15VHV	0.15 - 1.9	47

(C) Resistors are mounted on the front of the cooling plate (heat sink) where 4 new screw holes are prepared. See naked heat sink in Pic32, and assembled LVBOX (front side view) with 4 new preloads in Pic 33.

Pic32.

Top front side, 4 new holes, M3
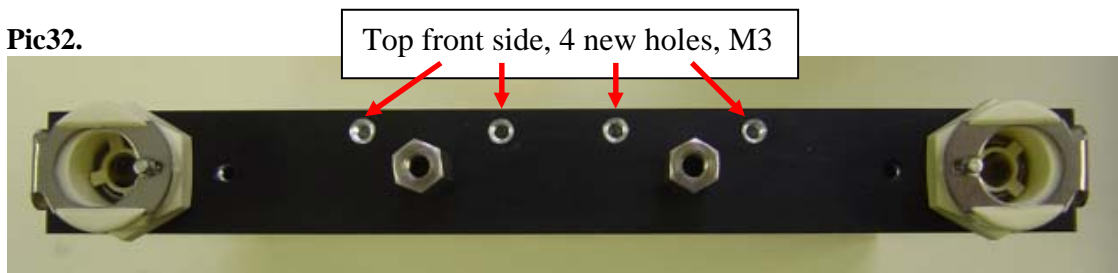
Pic33. Assembled LVBOX with 4 new R preloads for 3x15V and 5VHV bricks.
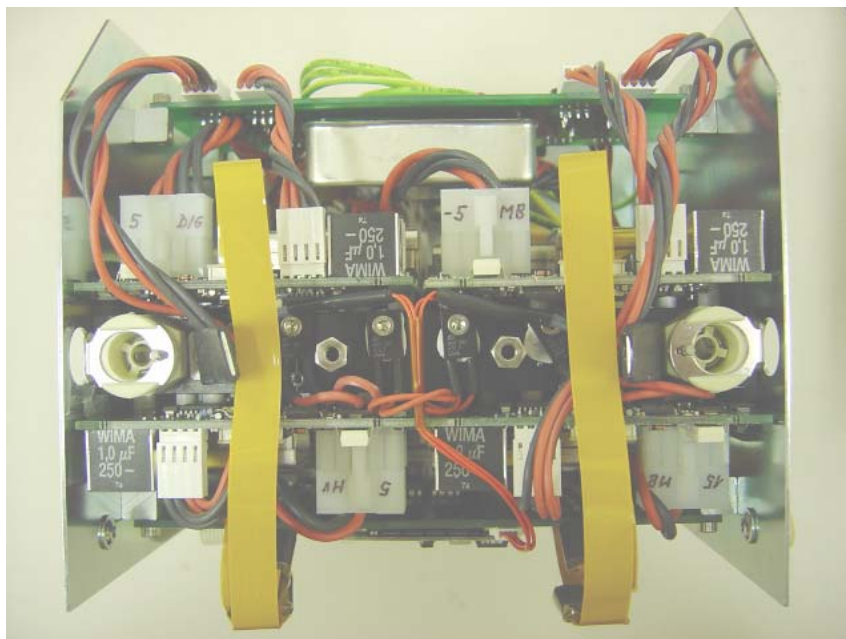
Comments are welcome to bpalan@cern.ch.

Appendix 1. Top and bottom side brick v6.5 components placement:

Top side brick components view.

Bottom side view: Attention! Picture is flipped horizontally.