

# LVPS Brick v.6.5 modifications for version 6.5.2.rev.

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**Summary:** This document describes the component changes on LVPS brick (3.3V, 5V, or 15V versions) from produced version 6.5 into version 6.5.2. All mentioned component names and values are referring to the scheme components designed by Ivan Hruska of version 6.5 (or 6.4 as seen in this document on page 3). Previously described brick version 6.5.1 (19 Oct 2006) follows the same changes except that discussed points No.16 (Start-up Sequence), No.17 (Max Current Protection), and No.20 are different.

## OverVoltageProtection (OVP) on brick board:

1. Cutting PCB wires:
  - (a) between T15 and pin 1 of U13
  - (b) between GND pins R71 and C80
  - (c) "Butterfly" on top and bottom side.
2. Providing two wired short cuts:
  - (a) Connecting the Divider R17, R18 to the output filter.(30 mm piece of wire with isolation)
  - (b) Provide reference between pins 7, 6 and 2 of the U13 for the comparator.
3. Unsoldering R19, R24, C81 and C66.
4. Changing the value of the resistor R18 by table 1:

| Brick type | R18(new value) |
|------------|----------------|
| 3.3V       | 1.1k           |
| 5.0V       | 1.8k           |
| 15.0V      | 5.1k           |

5. Changing the value of the resistor R67 by table 2:

| Brick type | R67(new value) |
|------------|----------------|
| 3.3V       | 1.1k           |
| 5.0V       | 1.3k           |
| 15.0V      | 1.8k           |

6. Soldering one 620 ohm resistor between U13 (pin 1) and R71 (to provide comparator function through the current feedback).
7. Unsoldering C47 (to speedup the OVP reaction.)

## Changes for reason of safety, stability and reliability:

8. Remove TRANSIL from output of the Brick.
9. Unsoldering and removing C59.
10. Changing the value of the resistor R11 = 62kOhm (switching frequency 300 kHz) to 100kOhm (switching frequency = 215 kHz). In case of successful implementation of bigger L4, R11 stay 62k.
11. Changing the value of the resistors R56 from 100Ohm to 10kOhm (**11a**), R59 from 100Ohm to 10kOhm (**11b**) (Protects feedback gain from influence of ELMB power cycles.)
12. Unsoldering R26 = 1kOhm (under voltage = 190V). Soldering R26 = 1.5kOhm (under voltage = 135V).
13. Cut trace from pin 11 of J2 connector. (Disconnect ELMB from LT 1681's Thermal Shutdown pin 3, by removing one Temperature measurement. Thermal shutdown will still function).
14. Cut line between R33 and OVLO pin 2 (LT 1681) (**14a**), then this point through 330k resistor connects to +200VDC (**14b**). And change C22 to R = 1.8k (**14c**) (Additional 200V divider for V input measurement). Recommended values to reduce power dissipation (after 17 Nov 2006) are R33 = 680k (**14b**) and R = 3.6k (**14c**).

15. Unsoldering C78 = 100nF. Soldering C78 = 10nF. (Speedup of feedback.). This point is still under study.

16. **Start-up Sequence.** To start the bricks in sequence in one LVBOX it is necessary to change C9 by table 3. Here you find a comparison between C9 values of the original version v6.5 with identical capacitors (all bricks started at the same time), modified version v6.5.1 from 19th of Oct 2006 with already proposed start-up sequence, and proposed C9 values for final version of brick v6.5.2.

| Brick's type | V6.5.orig. | v.6.5.1 19 Oct2006 |            | v.6.5.2 08 Nov 2006 |             |
|--------------|------------|--------------------|------------|---------------------|-------------|
|              | C9         | C9                 | Start seq. | C9                  | Starts seq. |
| -5V MB       | 10uF       | 1.2uF              | 1.         | 1.0uF               | 1. first    |
| +15V MB      | 10uF       | 25uF               | 3.         | 4.7uF               | 2. second   |
| +5V MB       | 10uF       | 10uF               | 2.         | * 10uF              | 3. third    |
| +3.3V DIG    | 10uF       | 1.2uF              | 1.         | 4.7uF               | 2. second   |
| +5V DIG      | 10uF       | 10uF               | 2.         | * 10uF              | 3. third    |
| -15V HV      | 10uF       | 1.2uF              | 1.         | 1.0uF               | 1. first    |
| +15V HV      | 10uF       | 10uF               | 2.         | 4.7uF               | 2. second   |
| +5V HV       | 10uF       | 25uF               | 3.         | * 10uF              | 3. third    |

Note: \* original value

17. **Maximum Iout current limit of bricks.** First cut one end of both Isense-resistors R23 and R41 ("Butterfly" pcb Isense resistors) (1c) and solder new values by the following table 4, SMD size 2512. Over current protection limits (OCP) at Vout of each brick are listed.

| Brick type | V6.5    | v.6.5.1 19 Oct 2006 |         | v.6.5.2 08 Nov 2006 |         |
|------------|---------|---------------------|---------|---------------------|---------|
|            | OCP [A] | Isense resistor     | OCP [A] | Isense resistor     | OCP [A] |
| -5V MB     | 16-20   | 2x5mOhm             | 16      | 3mOhm               | 13      |
| +15V MB    | 16-20   | 5mOhm               | 8       | 22mOhm              | 2       |
| +5V MB     | 16-20   | 1.5mOhm<br>(1mOhm)  | 20      | 2mOhm               | 18      |
| +3.3V DIG  | 16-20   | 2x5mOhm             | 16      | 3mOhm               | 13      |
| +5V DIG    | 16-20   | 2x5mOhm             | 16      | 3mOhm               | 13      |
| -15V HV    | 16-20   | 5mOhm               | 8       | 10mOhm              | 4.5     |
| +15V HV    | 16-20   | 5mOhm               | 8       | 22mOhm              | 2       |
| +5V HV     | 16-20   | 5mOhm               | 8       | 22mOhm              | 2       |

18. Adjust feedback gain:

- Brick starts at minimum trimming: measure Vout
- By formulas in Excel calculate additive (parallel) resistor for R42 (SMD size 0603):
- $R_n = 2 * (V_{theor} / V_{out}) - 1$ ;
- $R_{add} = R_n / (1 - R_n)$ ;
- Take nearest nominal in row E24(1%), size 0603, soldered in parallel with R42.

| Type of Brick | Vmin [V]   | Vmax [V]    | OVP [V]    |
|---------------|------------|-------------|------------|
| 3V            | 3.25±50mV  | 3.9±50mV    | 4.2±100mV  |
| 5V            | 5.0±50mV   | 5.9±50mV    | 6.1±50mV   |
| 15V           | 14.4±100mV | 15.65±100mV | 16.0±100mV |

19. Additional modifications for 15V bricks:

- (a) Replace R46: from 4.7k to 7.5k (to reduce trimming range)
- (b) Put preload resistor: 47 - 56 ohm

20. Additional modifications for 5VHV brick:

Put preload resistor 22-33Ohm.

