

Big Bang Bar - EL Board

Date: 29.12.2019

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Version: 2

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Introduction

The EL board ("Electro-Luminescence") for the Big Bang Bar (BBB) described here is a replica of the "EL Lamp Control PCB" from CAPCOM Inc. The original board is no longer available and the schematic has never been published (to my knowledge). I reconstructed the circuit using photos and designed a new printed circuit board (PCB).



Function

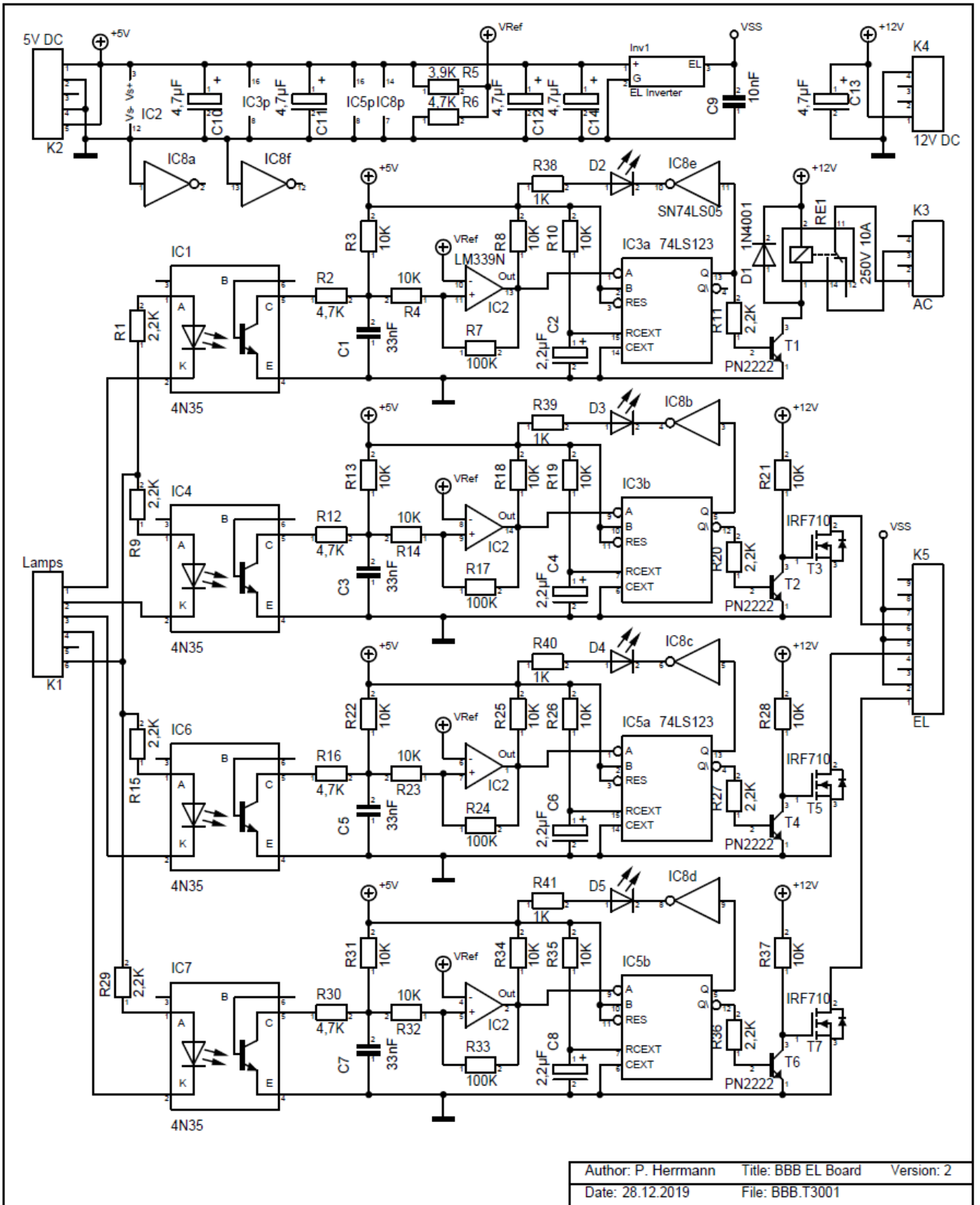
The EL board is used to control the 3 segments of the electroluminescent arrow under the left ramp and to switch the black light tube in the BBB Cabinet.

For this purpose, the voltages of 4 lamps in the lamp matrix are evaluated ("Row 1-4" in the "Col" column): Optocouplers replace the lamps, the control pulses are amplified with comparators and monoflops extend the pulses to constant signals.

MOSFETs follow for Row 1-3 – they switch the operating voltage (approx. 100 V AC) obtained by the inverter for the EL segments 1-3. Row 4 activates a relay to handle higher voltages and currents.

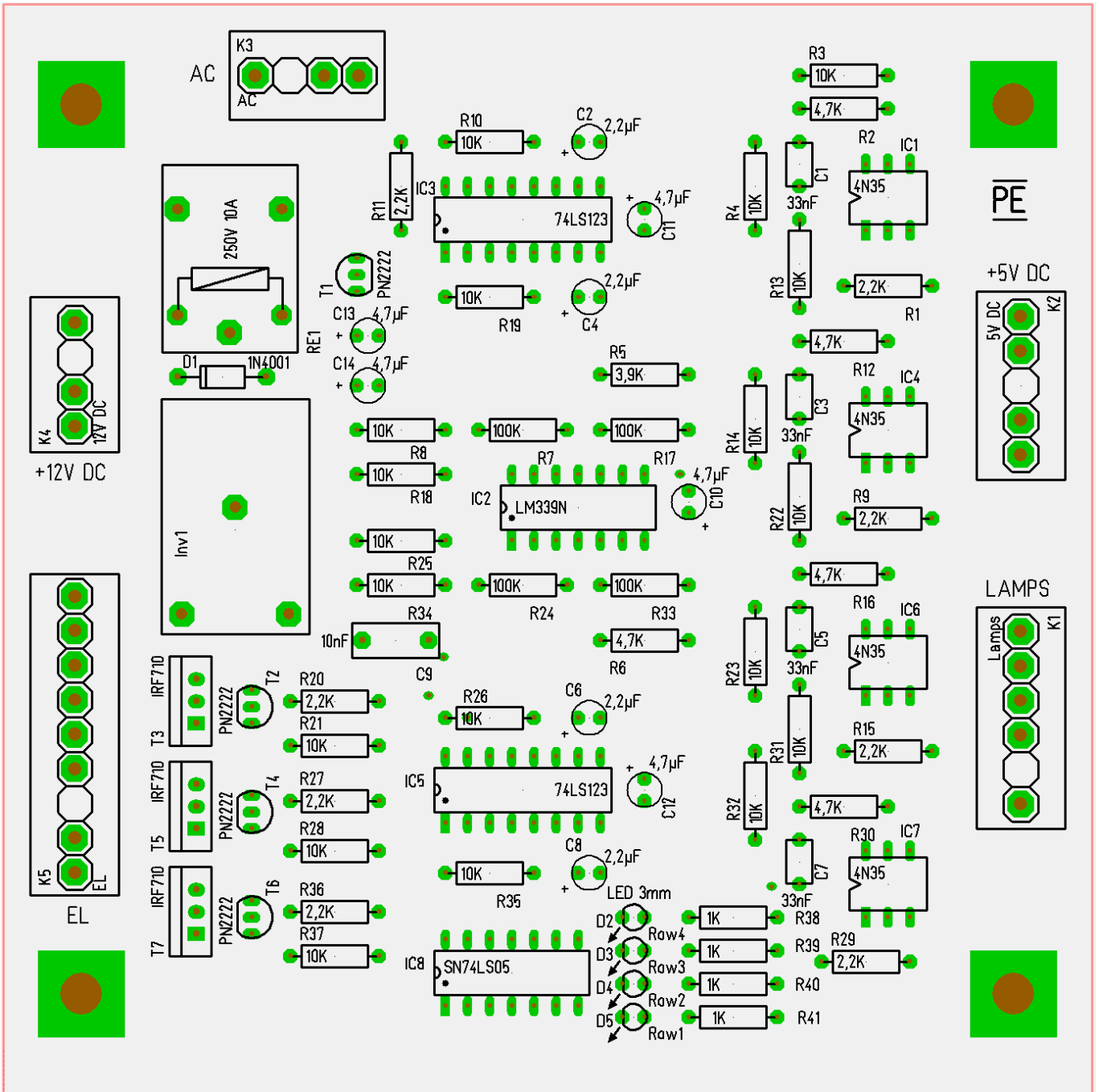
For testing and troubleshooting, I added 4 LEDs to indicate active lamps / rows (IC8, this circuit section is not available on the original board).

Schematic



Parts List

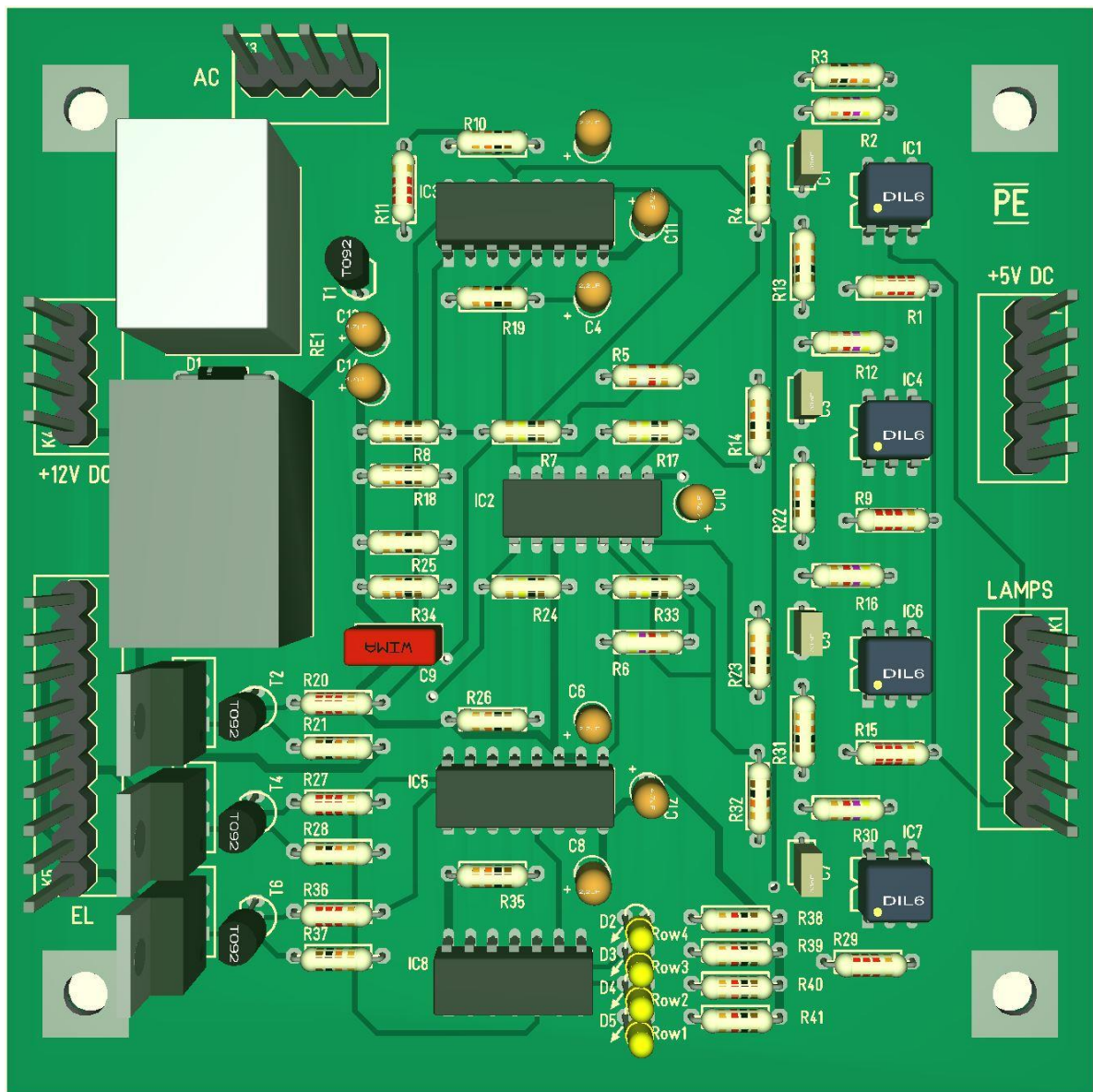
| Label | Value / Spec | Type / Package | Count |
|-------------------------------|----------------|----------------|-------|
| C1,C3,C5,C7 | 33nF | 3X5R5,08 | 4 |
| C2,C4,C6,C8 | 2,2µF 16V | D4R2,54_ELKO | 4 |
| C9 | 10nF 400V | 4X10R7,62 | 1 |
| C10,C11,C12,C13,C14 | 4,7µF 25V | D4R2,54_ELKO | 5 |
| D1 | 1N4001 | D_RM12,7_DM3 | 1 |
| D2,D3,D4,D5 | LED 3MM | LED_3MM | 4 |
| IC1,IC4,IC6,IC7 | 4N35 | DIL6 | 4 |
| IC2 | LM2901N | DIL14 | 1 |
| IC3,IC5 | 74LS123 | DIL16 | 2 |
| IC8 | SN74LS05 | DIL14 | 1 |
| | IC sockets | DIL 6 | 4 |
| | | DIL 14 | 2 |
| | | DIL 16 | 2 |
| Inv1 | EL Inverter | EL Inverter | 1 |
| RE1 | 12V / 250V 10A | Finder 36.11 | 1 |
| T1,T2,T4,T6 | PN2222 | TO92 | 4 |
| T3,T5,T7 | IRF710 | TO220 | 3 |
| R1,R9,R11,R15,R20,R27,R29,R36 | 2,2K 0,25W | 0207 | 8 |
| R2,R6,R12,R16,R30 | 4,7K 0,25W | 0207 | 5 |
| R5 | 3,9K 0,25W | 0207 | 1 |
| R7,R17,R24,R33 | 100K 0,25W | 0207 | 4 |
| R38,R39,R40,R41 | 1K 0,25W | 0207 | 4 |
| Rx (all other resistors) | 10K 0,25W | 0207 | 19 |
| K1 | Lamps | Molex Header-6 | 1 |
| K2 | 5V DC | Molex Header-5 | 1 |
| K3,K4 | AC, 12V DC | Molex Header-4 | 2 |
| K5 | EL | Molex Header-9 | 1 |



The component diagram above shows the arrangement of all parts. Here are a few hints for building the board:

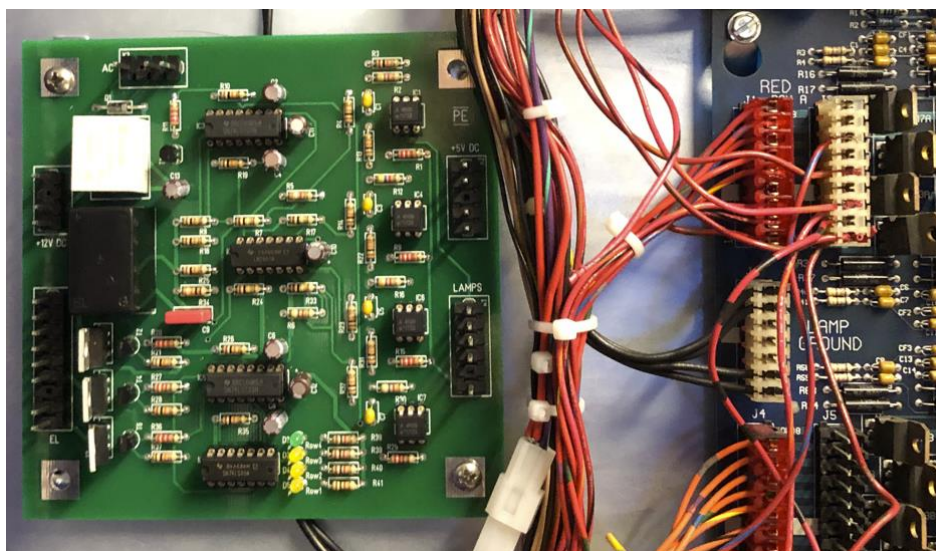
- Solder the small / low components (resistors, IC sockets, capacitors) first
- For electrolytic capacitors, a gray stripe usually indicates the minus pole. The positive connection is marked with a "+" symbol in the PCB imprint.
- For all ICs, pin 1 is located at the bottom left (see assembly diagram)
- The (original) connections of the connectors are coded with missing pins, which are pulled out of the Molex headers.

Use the following picture of the fully assembled PCB to control the correct placement of all parts (simulated preview, real photo will follow when the new PCB version is available).

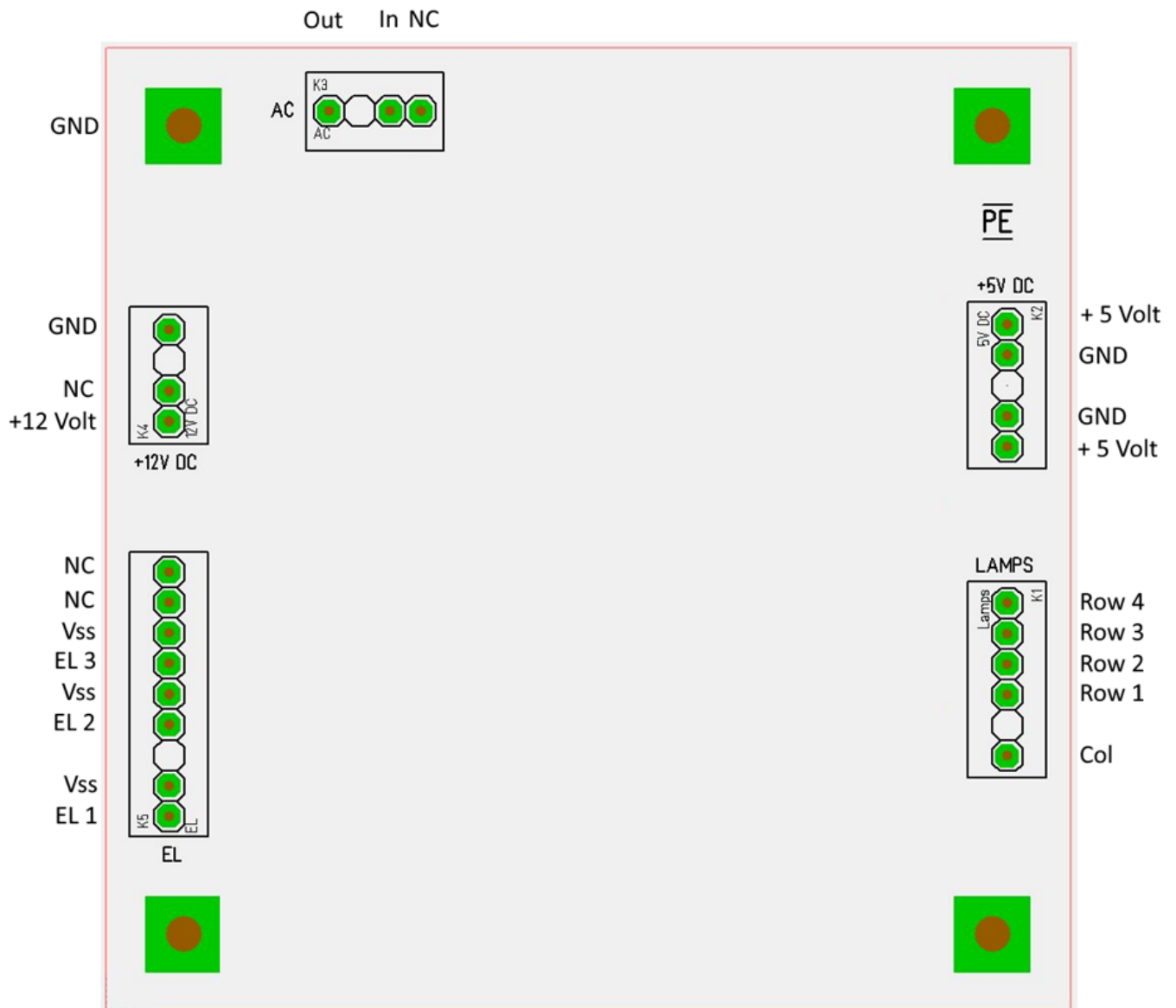


Installation and first use

The board is mounted in the BBB backbox to the left of the Driver board.



The next sections describe a step-by-step startup procedure by gradually connecting the 5 Molex headers on the board shown in the picture below. The pin assignment is identical to the CAPCOM board. Therefore, original cables can be used and the board can be exchanged 1:1.

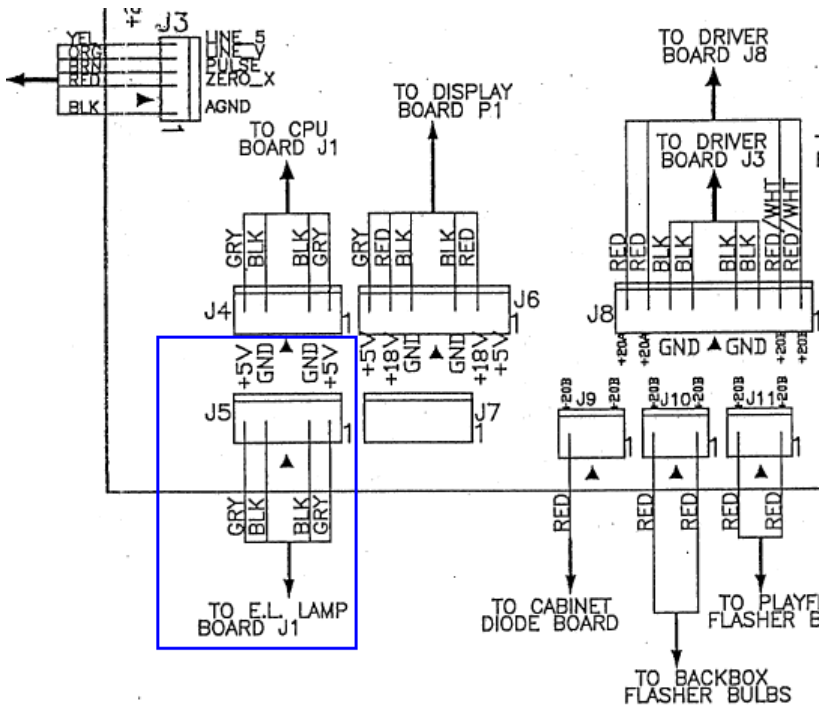


Step 1: 5 Volt Power Supply

In the first step, the board is connected to a +5 volt DC supply voltage via the "+ 5V DC" header.

The circuit diagram of the BBB Power Board shows that connector J5 is designated to provide the required voltage. Two pins each provide the same signal - both should be connected (bridge in the connector) to reduce the contact resistance.

| BBB Board | Connector | Pin | Label | Wirecolor | EL-Board Label |
|-----------|-----------|---------|-------|-----------|----------------|
| Power | J5 | 1 und 5 | +5V | GRY | + 5 Volt |
| Power | J5 | 2 und 4 | GND | BLK | GND |

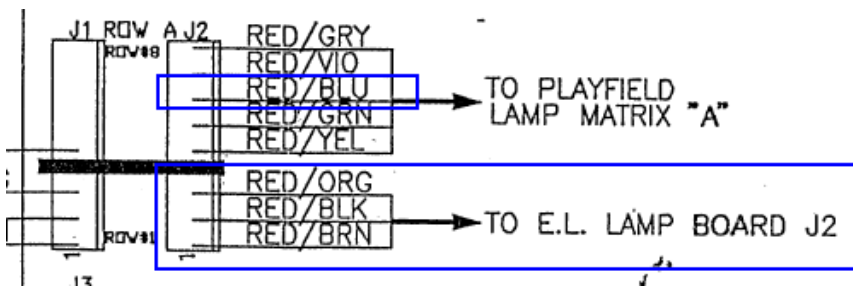


Step 2: Lamp Signals

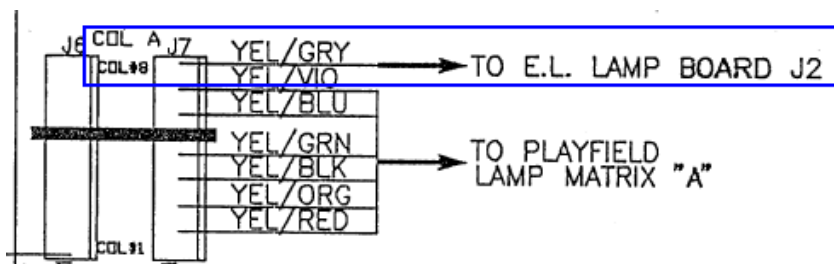
Before a first test, the lamp signals must also be connected to the "LAMPS" header. The row signals are available on connector J2 of the BBB Driver Board, Col can be found on J7.

The individual connections are as follows:

| BBB Board | Connector | Pin | Label | Wirecolor | EL-Board Label |
|-----------|-----------|-----|--------|-----------|----------------|
| Driver | J2 | 1 | Row #1 | RED/BRN | Row 1 |
| Driver | J2 | 2 | Row #2 | RED/BLK | Row 2 |
| Driver | J2 | 3 | Row #3 | RED/ORG | Row 3 |
| Driver | J2 | 7 | Row #6 | RED/BLU | Row 4 |
| Driver | J7 | 8 | Col #8 | YEL/GRY | Col |

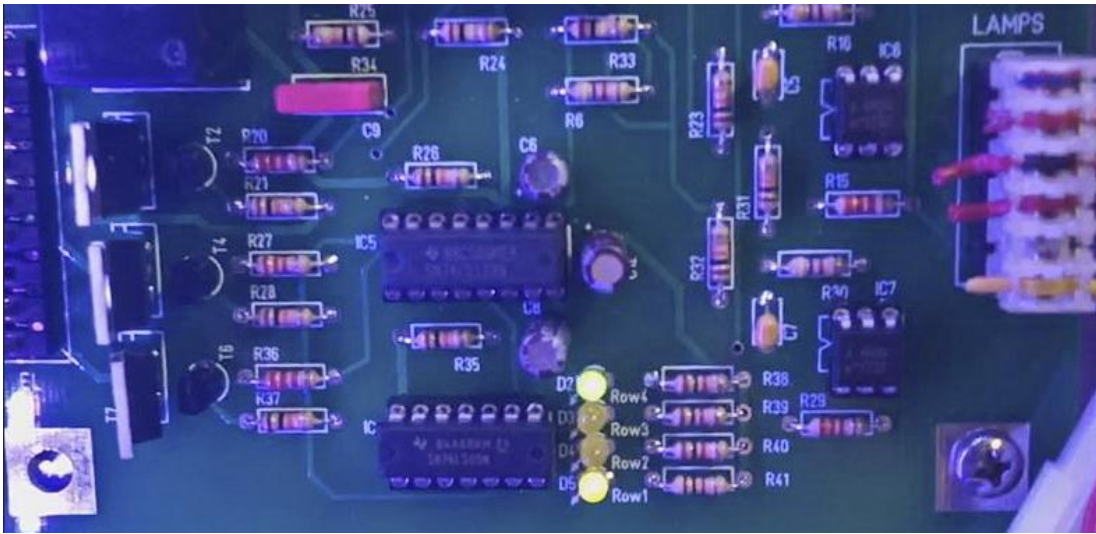


Note: The interface of Row#6 to the EL LAMP Board is not mentioned in the BBB schematics



Test 1: Lamp Signals

Now it is time to perform a first test of the EL board and the wiring. After switching on and booting the BBB to the "Attract Mode", the LEDs Row1 to Row3 should light up as "moving light". The Row4 LED is briefly activated at larger intervals.

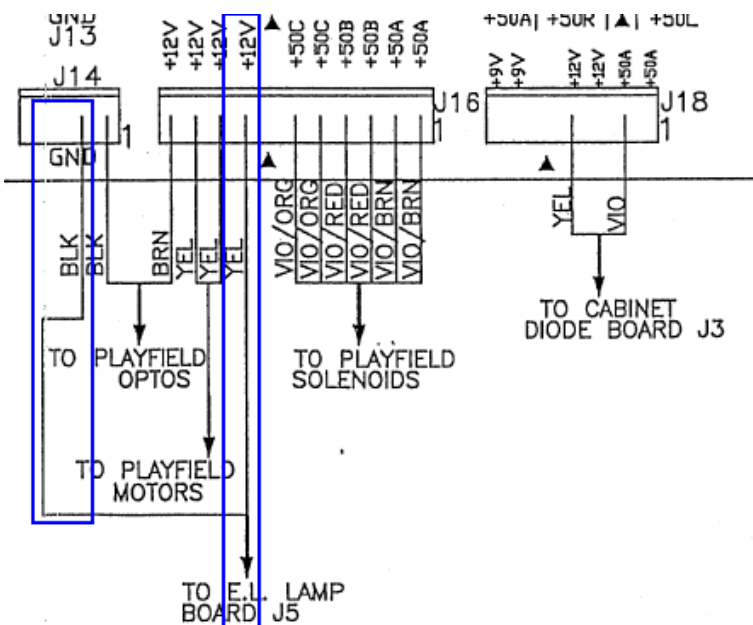


The inverter is already working (you can hear a high-frequency beep) - but the relay and the EL outputs are not yet functioning because they require 12 volts.

Step 3: 12 Volt Power Supply

In the next step, a +12 volt DC voltage is connected to the "+ 12V DC" pin header. The source is again the BBB Power Board, in the circuit diagram there is a corresponding note close to the connectors J14 and J16:

| BBB Board | Connector | Pin | Label | Wirecolor | EL-Board Label |
|-----------|-----------|-----|-------|-----------|----------------|
| Power | J16 | 8 | +12V | YEL | + 12 Volt |
| Power | J14 | 2 | GND | BLK | GND |

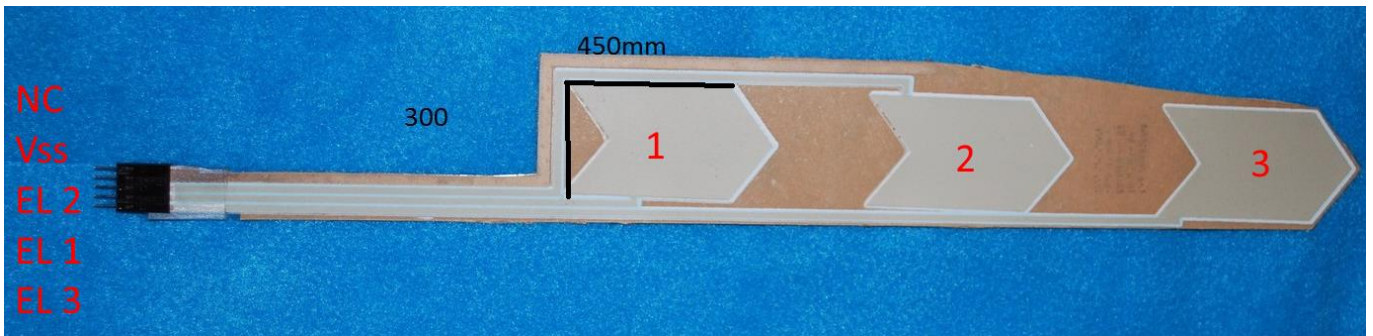


Test 2: 12 Volt Power Supply

If the BBB is now switched on, the relay should pull in with an audible switching noise when the Row4 LED lights up.

Step 4: EL Arrow

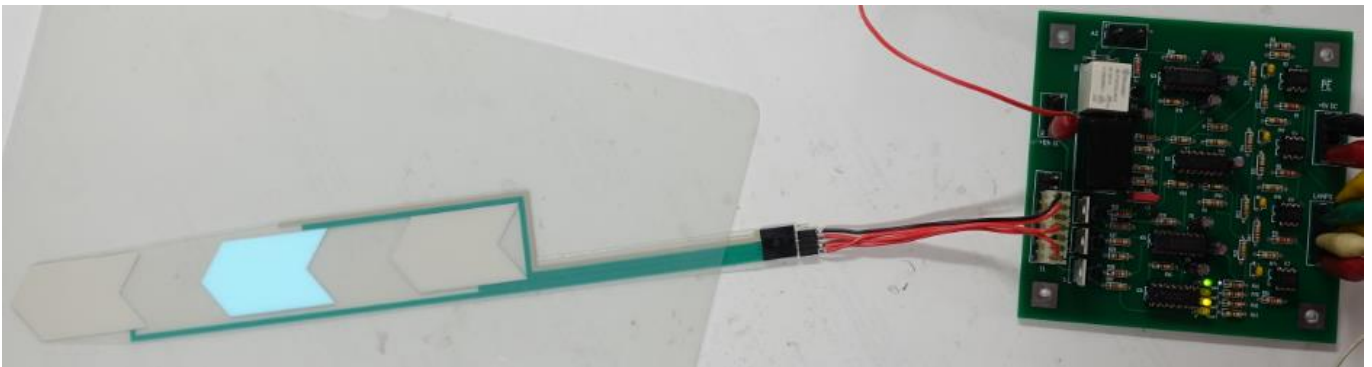
The connector pinout of the EL arrow is shown in the following figure (NC is also attached to Vss but not needed).



Wire the EL arrow with the identically labeled connections of the „EL“ header on the EL board. It does not matter which of the 3 Vss pins is used – they all offer the same EL operating voltage.

Test 3: EL Arrow

After switching the BBB on again, the EL segments should light up together with the Row1-3 LEDs.



Step 5: AC Connector

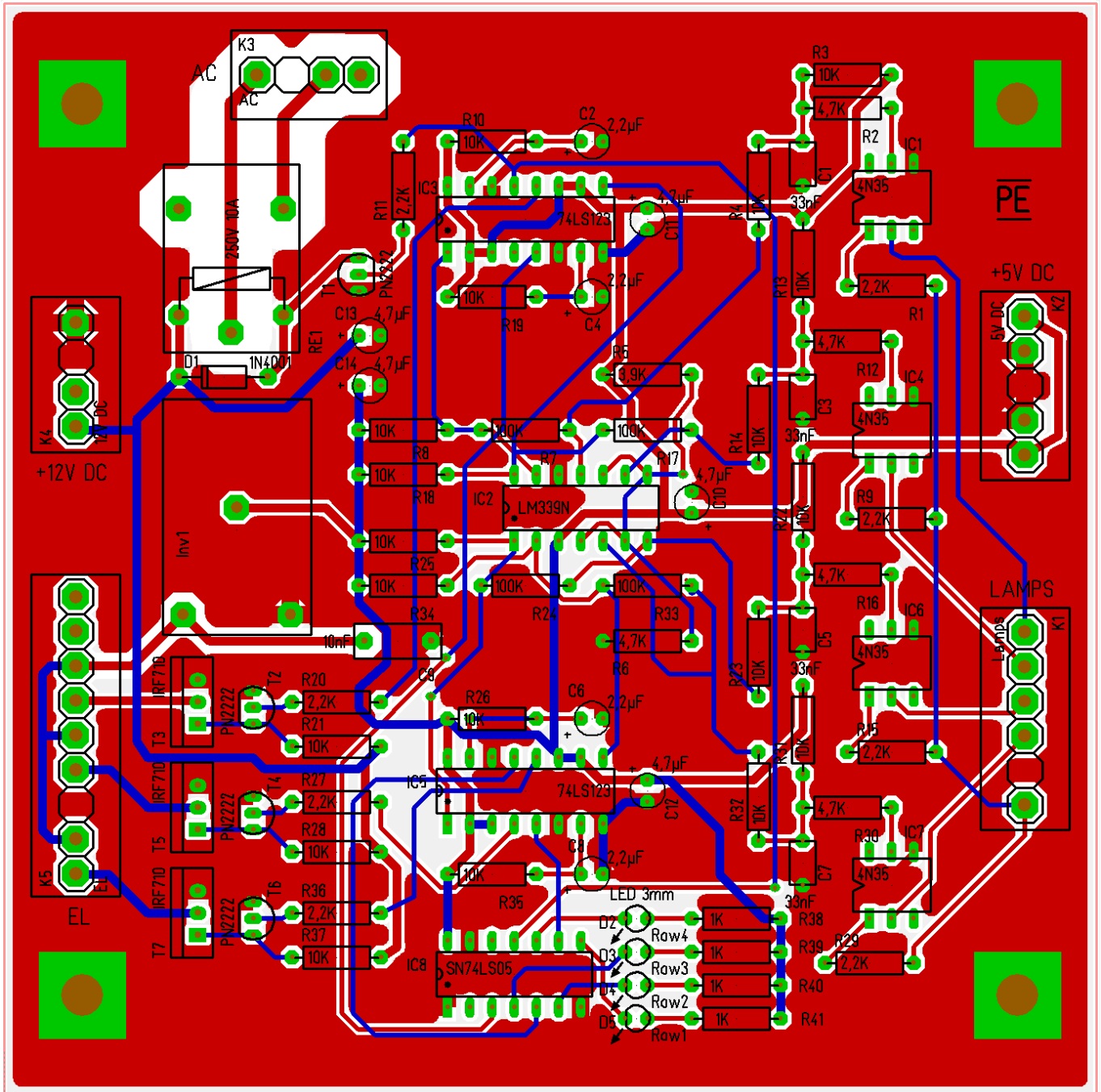
The two pins „In“ and „Out“ of the „AC“ header are electrically connected to each other by a switching contact in the relay when the Row4 LED lights up. The switch is electrically isolated from the other components and can switch voltages up to 250V AC, the current should not exceed 1 Ampere (even if the relay is specified for more).

Caution: Only connect mains voltages to the EL board if you are familiar with such work. There is no extra isolation. Always make sure to switch off the pinball before working in the backbox!

Connect one AC phase directly to the black light tube and run the other phase via the „In“ and „Out“ pins of the „AC“ header.

Test 4: AC load

The running BBB should now activate the attached AC device in parallel to the Row4 LED.



Change Log

Version 2:

- New clearances of the mounting holes: 107 mm (42 inch) horizontal and 102 mm (40 inch) vertical (old values 105 x 105 mm did not fit)
- New placement and trace layout for the relay. The old layout was not suitable for higher voltages and currents.
- Corrected hole position and size for the inverter. Increased clearance of EL power lines.
- Added decoupling capacitor C14
- Increased general ground plane spacing (from 1mm to 2mm)