

Congratulations for purchasing this Nixie clock kit “Lars” or “Laura”.
For successful assembly of this kit please read the following helpful hints.

- This kit is designed for someone who has advanced experience with assembling electronics.
- If you believe that the kit is too complicated for your skill level please do not try to assemble it - this generally ends up with a device that is not repairable and results in you being very frustrated. Please contact the provider and they can offer you other options that will end in a more fulfilling result!
- Take your time - this kit should take 2 hours to complete if uninterrupted. Assembling the kit in a hurry will lead to frustration and troubleshooting takes three times as long.
- Ensure your work area is well lit (daylight preferred) and clean.
- Electronic tools, such as pliers, small side-cutters or tweezers will be handy. You will also need a T10 (Torx) Allen screwdriver for the housing assembly.
- A soldering iron station with a 1 mm round tip (maximum) and a 0.5 mm (maximum) fine electronic solder (lead-free) is required. For lead-free solder we've had good experience with type Iso-Core EL Sn95,5 Ag3,8 Cu0,7 with 0,5 mm Ø and 3,5% Flux from Felder Löttechnik and a 400°C soldering tip temperature.
- For the intermediary function test you need a multimeter with at least 200 VDC range.
- A loupe (magnifying glass) to read the small device markings is often helpful.
- Assemble the board in the order as stated in the instructions - this has been proven and will minimise mistakes.
- It is assumed that you understand that semiconductors (diodes, ICs, transistors) or electrolytic capacitors are polarized components. Appropriate markings are silk-screened on the PCB and shown on the board schematic.

Together with this construction guide there are some other usefull documents for download

- The owners manual for this Nixie clock kit
- The owners manual for the BR-355 wired or “Wireless GPS Connection” system

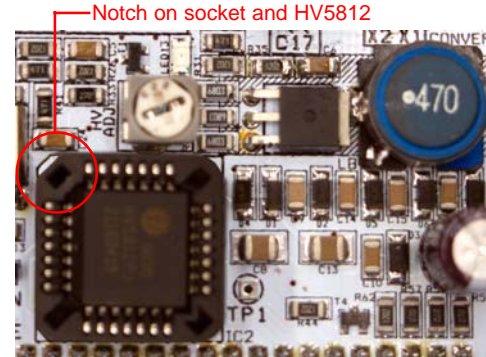
Safety precautions:

During assembly, operation, measurements and maintenance extra precautions must be taken. The generated high voltage of 160 V is dangerous. Assemble the circuit at your own risk. The clock's functionality cannot be guaranteed when assembled by the customer. No responsibility can be taken for any personal claims and damages during assembly and commission, especially for damages based on insufficient technical knowledge. The Nixie clock may only be operated in a solid and moisture-proof enclosure. The person who completes the kit and assembles this board into an enclosure for operation is considered by the German directive VDE 0869 as a manufacturer and is required to indicate their name and address including all documents when selling the clock. Ready-to-go devices, which are assembled from kits, are counted as a safety-related industrial made product.

Okay, and now, Ladies and Gentlemen – start your soldering iron...

As you might notice, most of the electrical parts are just pre-assembled and soldered. However, we recommend to check these SMT assembly for assembly faults and cold solder pads before assembling the through hole components. You'll find at the end of the manual a detailed assembly silk screen for reference.

Start with soldering the 32-pol. female header, fitted from the solder (!) side. Following fit and solder both 28-pol. IC sockets (pay attention for the notches as shown on the silk screen, the crystal, the potentiometer, the Super Capacitor and the buzzer. The polarity marking on the buzzer is negligible but keep care for the correct alignment of the Super Cap (arrows on the part package and the silk screen). **Do not insert the ICs at this stage !** Next solder the 47uH shielded inductor, than bend the leads of the RFD3055L MosFet and solder them. Take special care as this is an ESD device, so it is a good idea before handling this part that you de-charge yourself on a metallic part of your desktop. The heatsink can have contact to the left hand's inductor pad; this doesn't matter at all. Finally add the remaining parts like the 2u2 / 350V capacitor, both dual LEDs (take care for the colour), both dual switches and the mounting bracket.

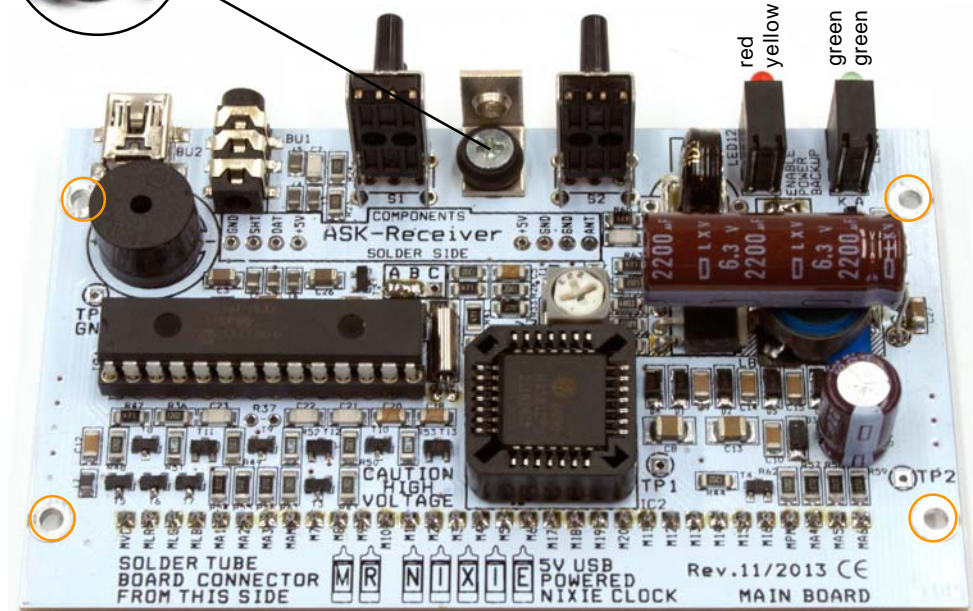


Finally cut and remove the tape from the 2.200µF capacitor. Please do not simply cut the wires at the top of the tape as the remaining length will be too short.



The following task must only be done when assembling a Laura Nixie clock

Pick up the 4 x M3 x 8 self tapping screws and the 4 x 3 mm plastic spacers and thread them to the drilling holes at the edges of the main board. The spacers are a self fixing type.



Now connect the PCB to an USB power supply and check if something strange will happen; e.g. a parts runs hot. If everything is alright we will do following some voltage checkings:
Please check the voltages on the PIC's socket pins with a multimeter. **Put the negative probe (black) on TP3;** left hand from the buzzer. Put the positive probe (red) on the socket pins.

Measured Voltages

red = ca. 5 V • blue = 0...3 V • amber = ca. 0,3 V • green = ca. 0...-2 V • black = 0 V

**Pin 1 • Pin 2 • Pin 3 • Pin 4 • Pin 5 • Pin 6 • Pin 7 • Pin 8 • Pin 9 • Pin 10 • Pin 11 • Pin 12 • Pin 13
Pin 14 • Pin 15 • Pin 16 • Pin 17 • Pin 18 • Pin 19 • Pin 20 • Pin 21 • Pin 22 • Pin 23 • Pin 24
Pin 25 • Pin 26 • Pin 27 • Pin 28**

Check following the voltages on the other testpoints: **TP1 (around 4.8 V) • TP2 (around 4.5 V)**
Please do not proceed until all voltages are within their range and check for the fault.

If everything is ok, unplug the clock from the power supply.

Solder now jumper **ENABLE HIGH V. CONVERTER X1/X2**, direct above the inductor and insert ONLY (!) the PIC, but not the HV5812 driver. Keep care for correct orientation. Turn on the clock again.

Caution! Now the HV converter is working. Please check again, if something strange happens; e.g. if a part will run hot. Pick up now a screwdriver and do again a measurement of the voltage on **TP1** It should be in the range of 40 V. **Adjust now the voltage with the potentiometer to 41 V.** Do following a voltage check on **TP2**. It should be in the range of 165 V.

Push now button **SET**. The clock must make a short beep.

Unplug the clock again from power and wait 10 secs. until the capacitors are discharged.

Now insert the remaining HV5812 driver IC into its PLCC28 socket.

Stop here and flip the page. You need now assemble the tube board according to your clock. When ready assembled come back for a quick test of the tube board.

Now fit the tube board onto the main board and turn the clock on again.

The tubes should start with a „digit test routine“; which counts all digits. Also the (RGB) LEDs are checked within this routine with the following scheme:

digit 1 = red • digit 2 = green • digit 3 = blue • digit 4 = none • digit 5 = green/orange

digit 6 = none • digit 7 = violett • digit 8 = none • digit 9 = cyan • digit 0 = none

The amber column LEDs should continuously light up.

If everything is ok, unplug the clock again from power and wait 10 seconds.

Solder now jumper **ENABLE POWER BACKUP X3/X4** direct below the dual LEDs.

Solder jumper **A-B-C** direct below the ASK module connections to position A-B.

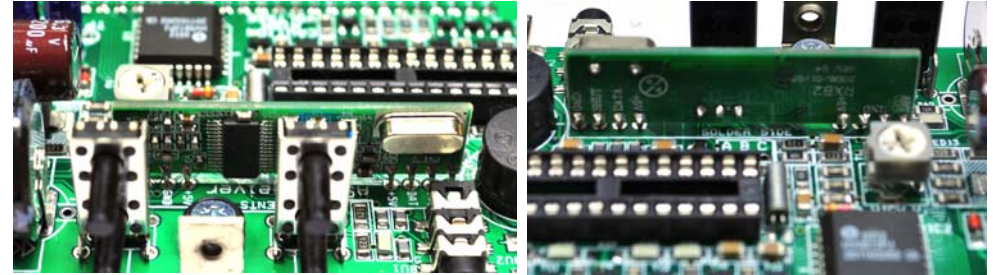
Now flip the page again and assemble the enclosure to finish your clock.



A note for handling the IN-2 Nixie tubes

Please be very carefully by handling the IN-2 tubes. The glass bottom is very fragile and will brake when applying hard force, specially when inserting into the socket or by aligning the tubes. You need not to press down the tubes fully into their sockets. Only the half is much enough.

Connecting GPS receivers (internal / external) or DCF receiver



When using the ASK module from the Wireless GPS Set 3, simply fit the module onto the mainboard and solder the 8 pins. Pay attention for correct orientation (see pictures).

The clock has a build in antenna. However, due to the RF shielding of the aluminium profiles the reception range is very limited. If the reception is too poor you can connect the supplied external antenna to the **TIME DATA** connector. Don't forget to set **option #12 to value 4** (for GPS reception) option #13 to the baud rate and option #14...16 to correct the time offset according to your location; this offset is based on standard time (not day saving).

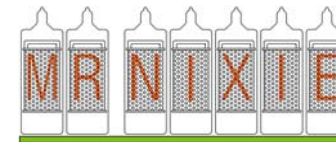
The green LED below the module will show the received data as well as the **DATA** LED on rear.

Please note that it is not possible to connect any extra external receiver to the TIME DATA connector when an ASK module is fitted, only the supplied antenna can be fitted.

Please check again, if the solder jumper A-B-C (direct below the module) is soldered in position A-B when using the internal ASK module. For setting up the „Wireless GPS Connection“ system proceed as stated in the appropriate owners manual

When connecting the wired external MicroGPS / NWTS receiver from PVElectronics set the jumpers A-B-C to position B-C set option #12 to value 4 and check for correct baud rate settings. When connecting the wired external GPS BR-355 receiver from GlobalSat set the jumpers A-B-C to position A-B and check for 4800 baud rate settings (option #13 to value 0).

When connecting the wired external DCF receiver from Mr.Nixie you'll need to set the jumpers A-B-C to position A-B and set option #12 to value 1 and omit option #13



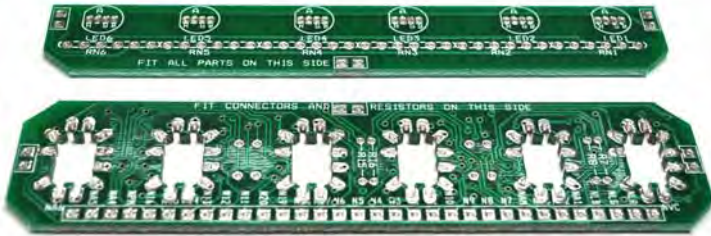
Anbieterkennzeichnung • Vendor

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Subject change without notice – Issue 3.3 – Version from 08.06.2017

Date	Description
05.08.2012	Initial Release
08.08.2012	Error correction / added replacing diodes procedure
26.08.2012	Error correction / parts value of resistor-arrays changed
27.09.2012	Changed the range of the voltage measuring values
11.11.2012	Added assembly of Lena Nixie clock
17.02.2014	New issue for the new main board version Rev.11-2013
17.04.2015	Error correction and additions in GPS receiver settings
27.12.2016	Corrected value of the measured voltages on PIC socket
08.06.2017	Adding settings for DCF / NWTS receivers

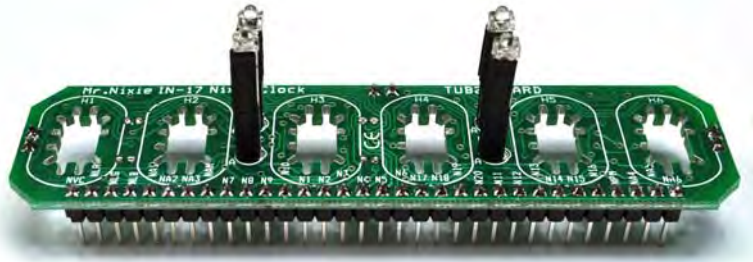
Assembling the Lars IN-17 tube board and enclosure



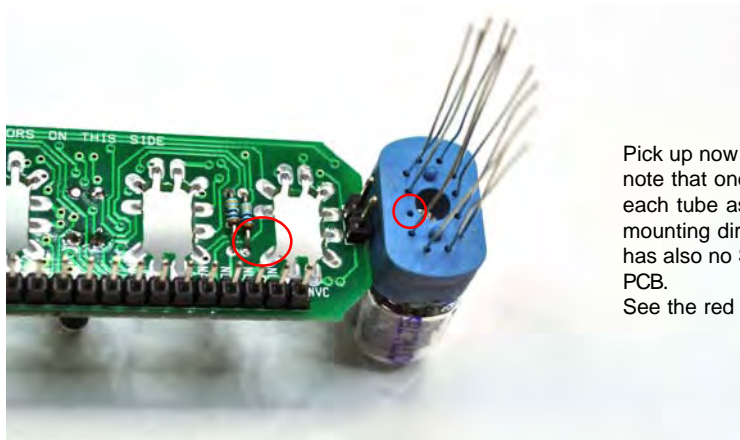
Please crack carefully both PCB's.



Assemble now the male headers (1 x 32-pol. and 3 x 2-pol.) and the 4 resistors on the tube board.



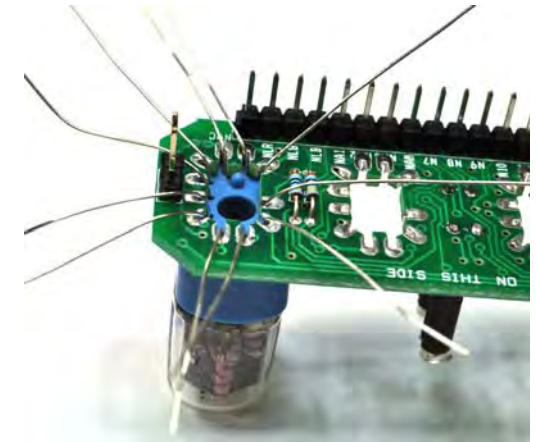
Flip the board and assemble the four LED's. Slight over the LED's wires 2 x 8 mm spacers each (8 in total). Pay attention that the anode of the LED is the longer wire and it is marked on the silk screen with an „A“. Solder at the beginning only one pad, than adjust the LED's exact upright and solder the remaining pad.



Pick up now an IN-17 tube. Please note that one wire is missing on each tube as marking for the correct mounting direction. This missing wire has also no Star Milling pad on the PCB. See the red markings on the picture.



Thread all tube wires carefully through the Star Milling cut out.



Bend all wires into the slots of the Star Milling pads. Keep care not to cross any wires.

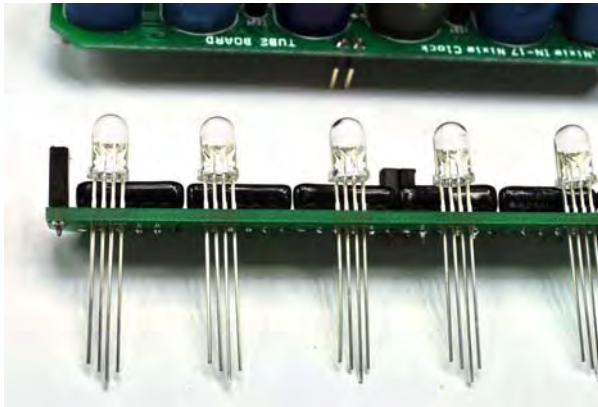


Cut the wires. Now solder only one pad. Align the tube carefully for correct adjustment by re-heating the soldered pad. If you are satisfied, solder the remaining pads. Please take care not to make any short circuits between the pads.

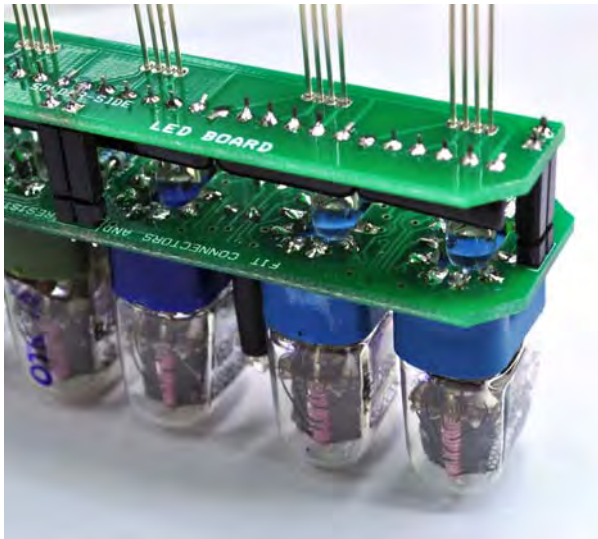
Continue this task for the remaining 5 tubes.



Pick up now the LED board and solder the 3 x 2-pol. female headers and the 6 resistor arrays. The „polarity“ of the arrays is negligible.



Assemble now the 6 RGB LEDs **but do not solder them yet.** The longest (third) wire is the Anode, marked with an „A“ on the silk screen



Fit the LED board on the tube board. Align now all LEDs is that way, that their lens will touch the drill hole in the tubes plastic socket.

Solder carefully all LEDs. Take special care not to make any short circuits between the LED pads as the spacing is very small. Take as less solder tin as possible.

After soldering cut all leads.

Stop here: Turn back to the assembly of the main board for a quick function check of the tube board.



Pick up one rubber surround. Please take care for the correct side. Remove from the front cover the protective film on the copper coloured side and insert the front cover carefully into the rubber surround



wrong side



Attach now the front to the tubes. From rear align the column LEDs that their lens will fit into the drill holes of the front cover.

Pick up one enclosure aluminium profile and slide the main board into the lowest nut of the profile. Attach following the second aluminium profile



Finally fix - starting with the front - the covers with the supplied screws (you'll need a Torx Tx10 screwdriver). Don't twist the screws by force and keep care not to cam out with your screwdriver as this will scratch the cover or even damage the tubes



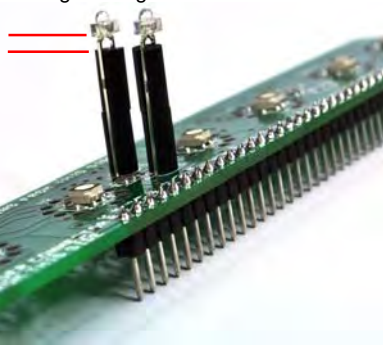
Finished assembling. Congratulations and have a lot of fun with your new Lars Nixie Clock

Assembling the Laura IN-2 tube board and enclosure



Pick up the tube board and assemble first the 32-pol. male header. Solder first only one pad and check for proper rectangular alignment of the header. When satisfied solder the remaining pads.

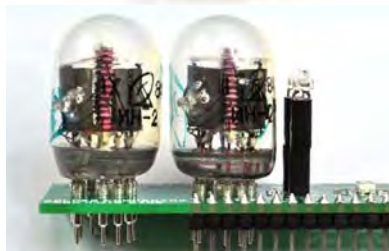
2.5 mm spacing



Now assemble the four LED's. Slight over the LED's wires 2 x 8 mm spacers each (8 in total). Pay attention that the anode of the LED is the longer wire and it is marked on the silk screen with an „A“. Solder at the beginning only one pad, than adjust the LED's exact upright and solder the remaining pad.
Please note not to forget to give around 2.5 mm extra spacing for the LEDs as shown in the picture.



Now thread over every tube pin a supplied tube socket pin. Sometimes the tube pins needs to be bend a little bit. Do this very carefully as the glass bottom is very fragile.



Insert following all six tubes with the tube socket pins into their socket drill holes in the PCB.
Do not solder them yet. After inserting all tubes align them carefully for equal spacing and tube's height. When you are satisfied solder now the tube socket pins. Take care not to make any solder bridges as the spacing between the pins is very small. **Do not trim the pins after soldering!**

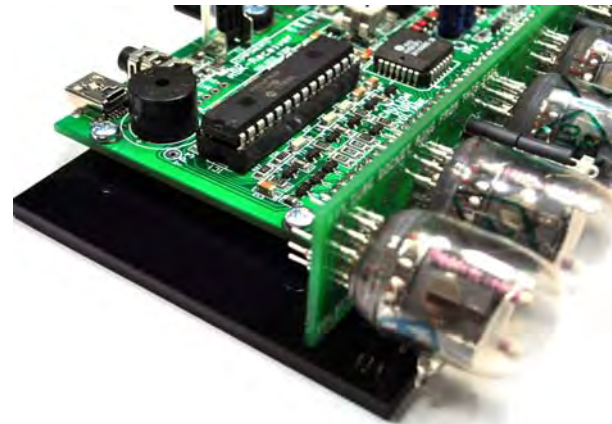


Stop here: Turn back to the assembly of the main board for a quick function check of the tube board.



Please pull out carefully (!) all tubes in that way that they are only fitted around the half of their socket pins lenght in the soldered female PCB sockets.

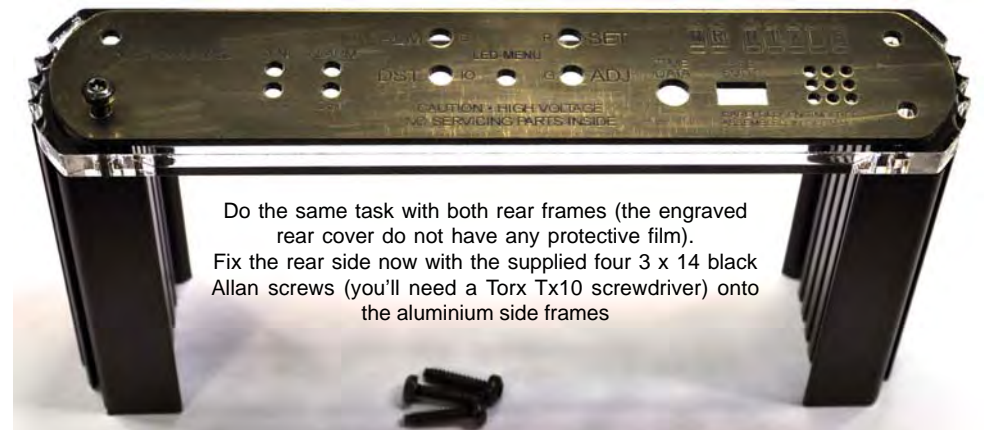
Attach now the front cover to the tubes, **but do not remove the protective films at this stage.** From rear align the column LEDs that their lens will fit into the drill holes of the front cover.



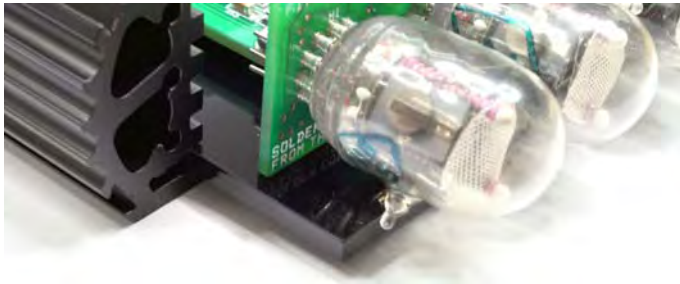
Remove both protective films from the bottom cover and fix the board on it with the 4 x M2.5 x 8 screws.



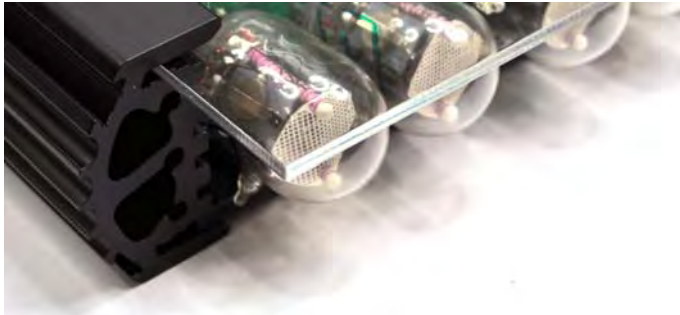
Remove both protective films from the first transparent distance holder. Remove the protective film from the brass coloured side of the front cover and than from the rear side, which is self-adhesive. Affix now the front cover onto the distance holder. Check for symmetrical alignment.



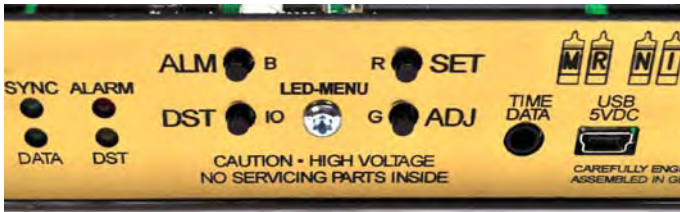
Do the same task with both rear frames (the engraved rear cover do not have any protective film). Fix the rear side now with the supplied four 3 x 14 black Allan screws (you'll need a Torx Tx10 screwdriver) onto the aluminium side frames



Slide now the bottom cover into the lowest notches of the side frames.



After removing both protective films from the transparent top cover slight it into the most upper notches of the side frames.



Fix the PCB / bottom frame with the supplied M3 x 6 Allan head screw on the rear side.



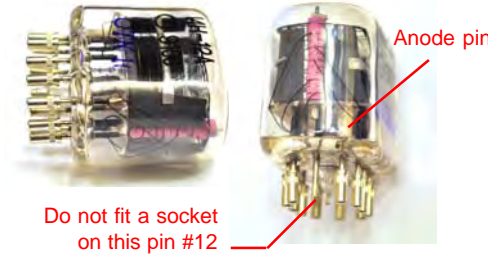
Finally attach the front cover and fix it with the remaining 4 screws and add the 4 pcs. foam feed onto the edges of the bottom cover.

Finished assembling. Congratulations and have a lot of fun with your new Laura Nixie Clock

Assembling the Lena tube board and enclosure

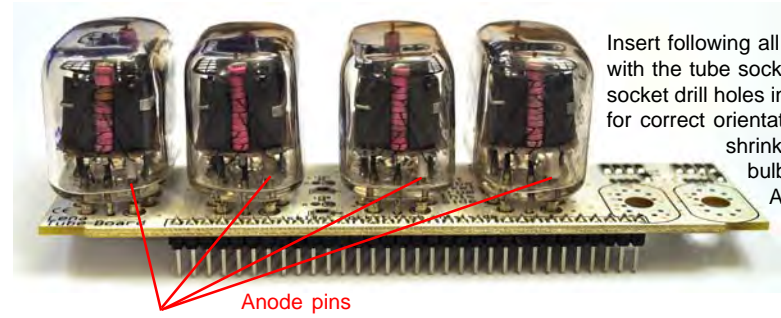


PICK up the tube board and assemble first the 32-pin. male header. Solder first only one pad and check for proper rectangular alignment of the header. When satisfied solder the remaining pads.



Now thread over every tube pin except of pin # 12 (left hand from the Anode pin) a supplied tube socket. Sometimes the tube pins needs to be bend a little bit. Do this very carefully as the glass bottom is very fragile.

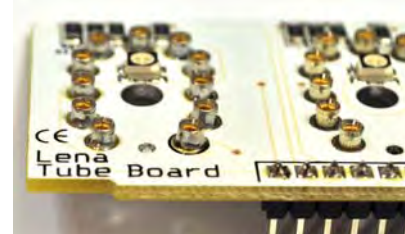
Do not fit a socket on this pin #12



Insert following all four IN-12 tubes with the tube socket pins into their socket drill holes in the PCB. Take care for correct orientation. Note the white shrink tube inside the glass bulb which marks the Anode connection. **Do not solder them yet.** After inserting all tubes align them carefully for equal spacing

Anode pins

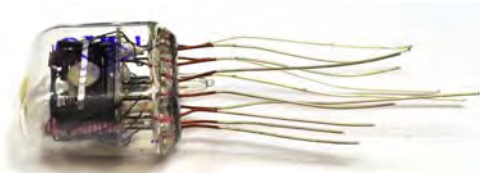
and tube's height. When you are satisfied solder now the tube socket pins from the bottom side. **Do not trim the pins after soldering!**



Now remove all tubes and solder the sockets also from the top side. Be careful not to solder the socket's holes. Use as less solder tin as possible. When finished attach the two 3 mm LEDs with two 8 mm plastic spacer each to their position. The longer wire is the Anode of the LED and marked on the PCB with an „A“; the shorter wire is the Cathode, marked with a ring.

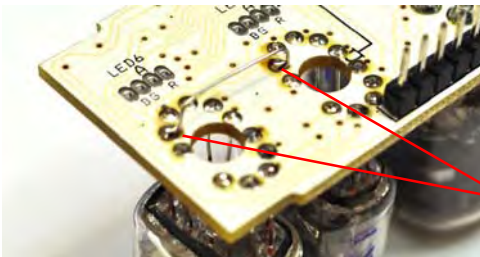
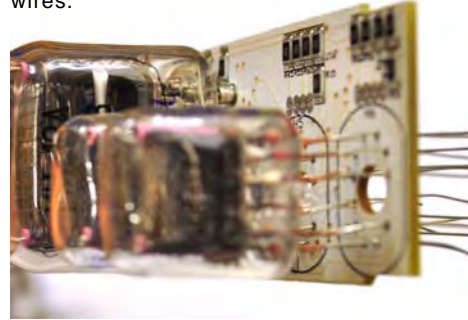
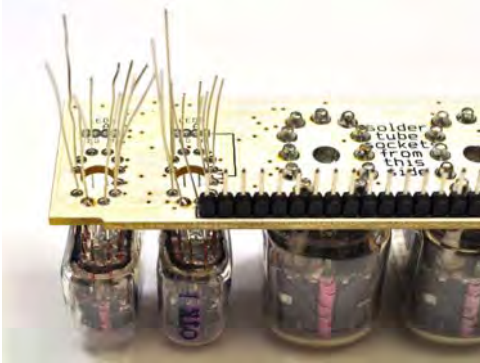
When finished solderin the LEDs re-attach the IN-12 tubes into their sockets again.





Pick up now both IN-17 tubes and remove their plastic spacers. Now cut the leads in a kind of a „spiral staircase“ as shown in the picture. This will help you to easy fit the tubes into their drilling holes, which should be done following this cutting.

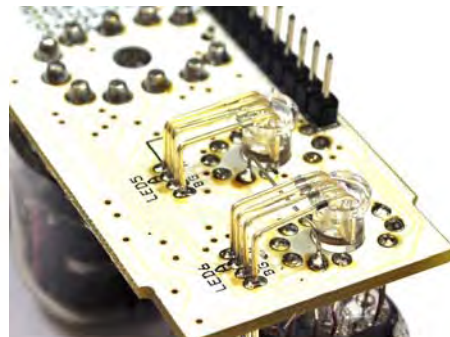
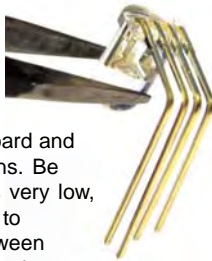
Solder only one wire first and adjust the tube for correct spacing and alignment as shown in the pictures. Than solder and cut the remaining wires.



Unfortunately on the first batch of the tubes PCBs one track is missing which causes that the digit „0“ will not shown on the 1st seconds tube. So pick up a piece of wire and add the missing connection from the 10th seconds to the 1st seconds tube as shown on the picture. Take care not to make any short circuits.

Wire link

Pick up now both RGB LEDs and bend them as shown in the picture. The longest wire is the Anode, marked on the silkscreen with an „A“. Finally attach the LEDs to the tube board and solder carefully the connections. Be aware that the pad spacing is very low, so use as less tin as possible to produce no short circuits between these pins. Check also not to make a short circuit to the added wire link.



Stop here: Turn back to the assembly of the main board for a quick function check of the tube board.



Remove from the front cover the protective film from front- and rear side. Note that the rear side is self-adhesive. Attach the front cover carefully at the U aluminium frame and fix it with four of the supplied M3 x 14 black screws.

Than slide the board from the rear into the enclosure.



Remove from the acrylic cover both protective films and slide it into the most upper nut into the U frame.



Remove from the rear cover the protective film on the self-adhesive side and attach it at the U frame.

Fix the cover first with the M3 x 6 screw and following with the remaining M3 x 14 black screws.

Finally attach on the bottom the supplied transparent self-adhesive feeds.

Finished assembling. Congratulations and have a lot of fun with your new Lena Nixie Clock.



Part List Rev.11-2013
USB powered Nixie Clocks

Through hole components Main PCB Rev.11-13 for all clock versions			
Qty	Part description	Value	Position / Code
1	Duo-LED	green / green	LED11
1	Duo-LED	red / yellow	LED12
4	LED spacer	8 mm	Tube Board
2	Dual push button switch		S1, S2
1	Buzzer		SND1
1	Super Capacitor	0.1F, 0.33F or 1F 5V5	C17
1	Electrolytic capacitor	2200uF 6V3	C4
1	Electrolytic capacitor	2u2 350V	C16
1	Potentiometer	47k	TR1
1	Crystal	32.756 kHz	Q1
1	IC-Socket	28-pol.	IC1
1	16F1938 Processor	16F1938	IC1
1	IC-Socket	28-pol. PLCC	IC2
1	HV5812 HV-Driver	28-pol. PLCC	IC2
1	Shielded Inductor	47uH	L8
1	MosFet Transistor	RFD3055L	T14
1	Female Connector 90°	32-pol.	32-pol.
1	Male Connector 180°	32-pol.	32-pol.
1	Mounting Bracket	M3 / 3.2	
1	Sheet metal screw	2.9 x 9.5	
1	Allan flat hat screw	M3 x 6	
1	Rosette 10.5 mm diameter	Plastic black	
1	Main Board	SMT preassembled	white

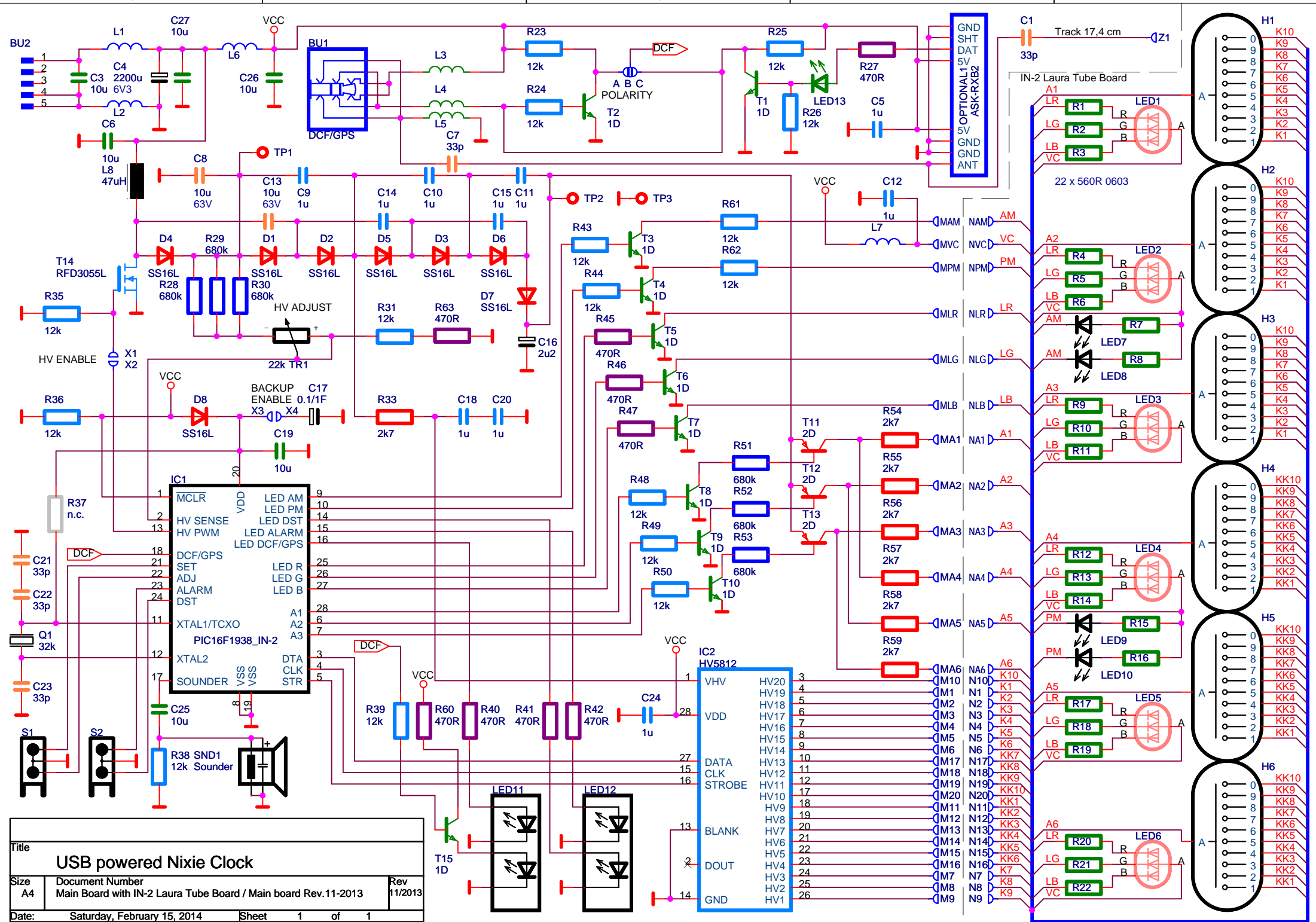
Electrical Parts for Laura Nixie Clock Tube Board			
Ca. 70	Tube socket pins		H1...H6
Mechanical Parts for Laura Nixie Clock			
4	LED 1,8mm	Amber clear	Tube Board
4	LED spacer	8 mm	Tube Board
4	Screw self tapping	M2.5 x 8	
8	Alan flat hat screw self tapping	3 x 14	
4	Spacers	2.7 inner x 3 plastic	
4	Foam feeds	12 x 12 mm	
1	Front cover	1.6 mm brass col.	
1	Rear cover	1.6 mm brass col.	
1	Top cover	2 mm transparent	
1	Bottom cover	3 mm black	
2	Aluminium side frames	Black anodized	
1	IN-2 Tube Board	Board preassembled	

Electrical Parts for Lars Nixie Clock Tube/LED Board			
4	LED 1,8mm	Amber clear	Tube Board
4	LED spacer	8 mm	Tube Board
6	Resistor-Array	SIL6-3 560R	RN1...RN6 on LED board
6	LED 5mm	RGB comm. Anode	LED1...LED6 on LED board
3	Female Connector 180°	2-pol.	for LED board
3	Male Connector 180°	2-pol.	for tube board
4	Resistors 0204	330R	R7,R8,R15,R16
Mechanical Parts for Lars Nixie Clock			
8	Alan flat hat screw self tapping	3 x 14 / 3 x 10	
2	Aluminium enclosure frames	Black anodized	AKG D 105 30 80 SA
2	Rubber enclosure surrounds	blue	
1	Front cover	1.6 mm copper col.	
1	Rear cover	1.6 mm copper col.	
1	IN-17 Tube/LED Board	Duo-Board with V-cut	

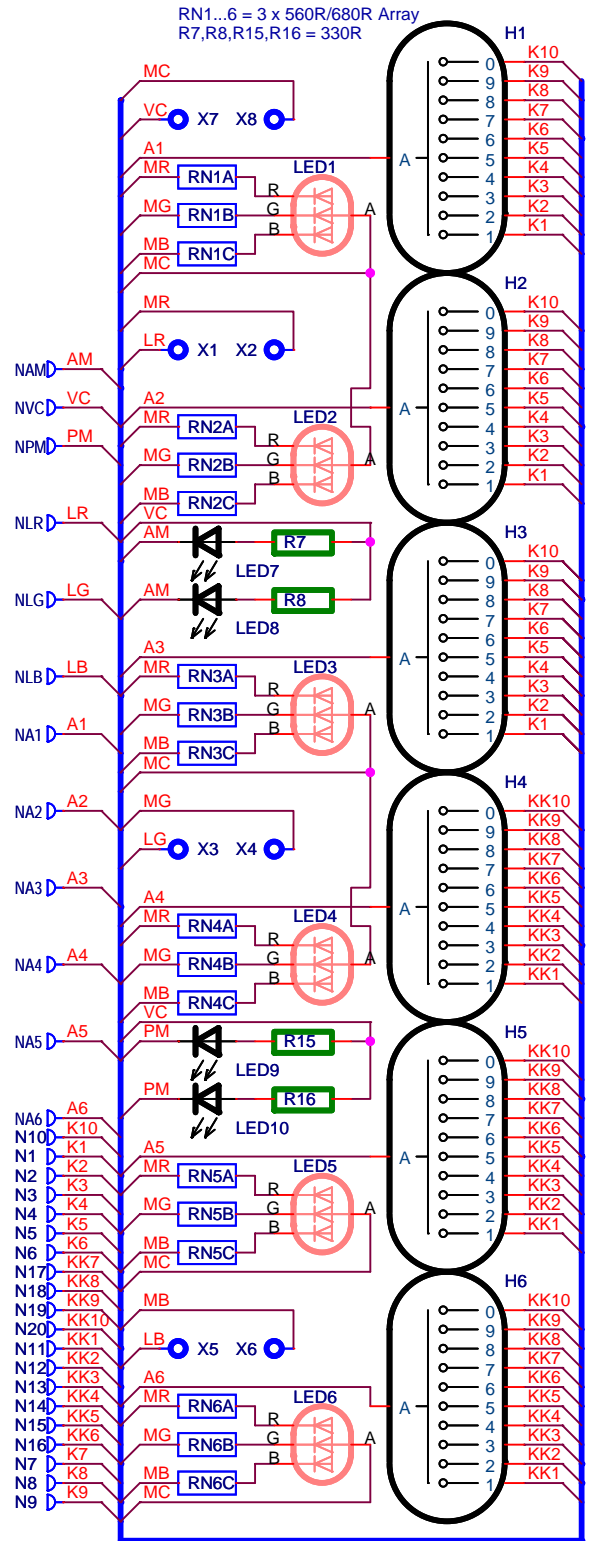
Part List Rev.11-2013
USB powered Nixie Clocks

Electrical Parts for Lena Nixie Clock Tube Board				
44	Harwin tube socket pins			H1...H6
Mechanical Parts for Lena Nixie Clock				
8	Alan flat hat screw self tapping	3 x 14 / 3 x 10		
2	LED 3mm	Amber diffused		LED7,LED8
2	LED 5mm	RGB comm. Anode		LED5,LED6
4+1	Transparent plastic feeds	7 mm diameter		
1	Front cover	1.6 mm copper col.		
1	Rear cover	1.6 mm copper col.		
1	Top cover	2 mm transparent		
1	Aluminium U frame	Black anodized		GB 83 83 SA
1	White Lena Tube Board	Board preassembled		

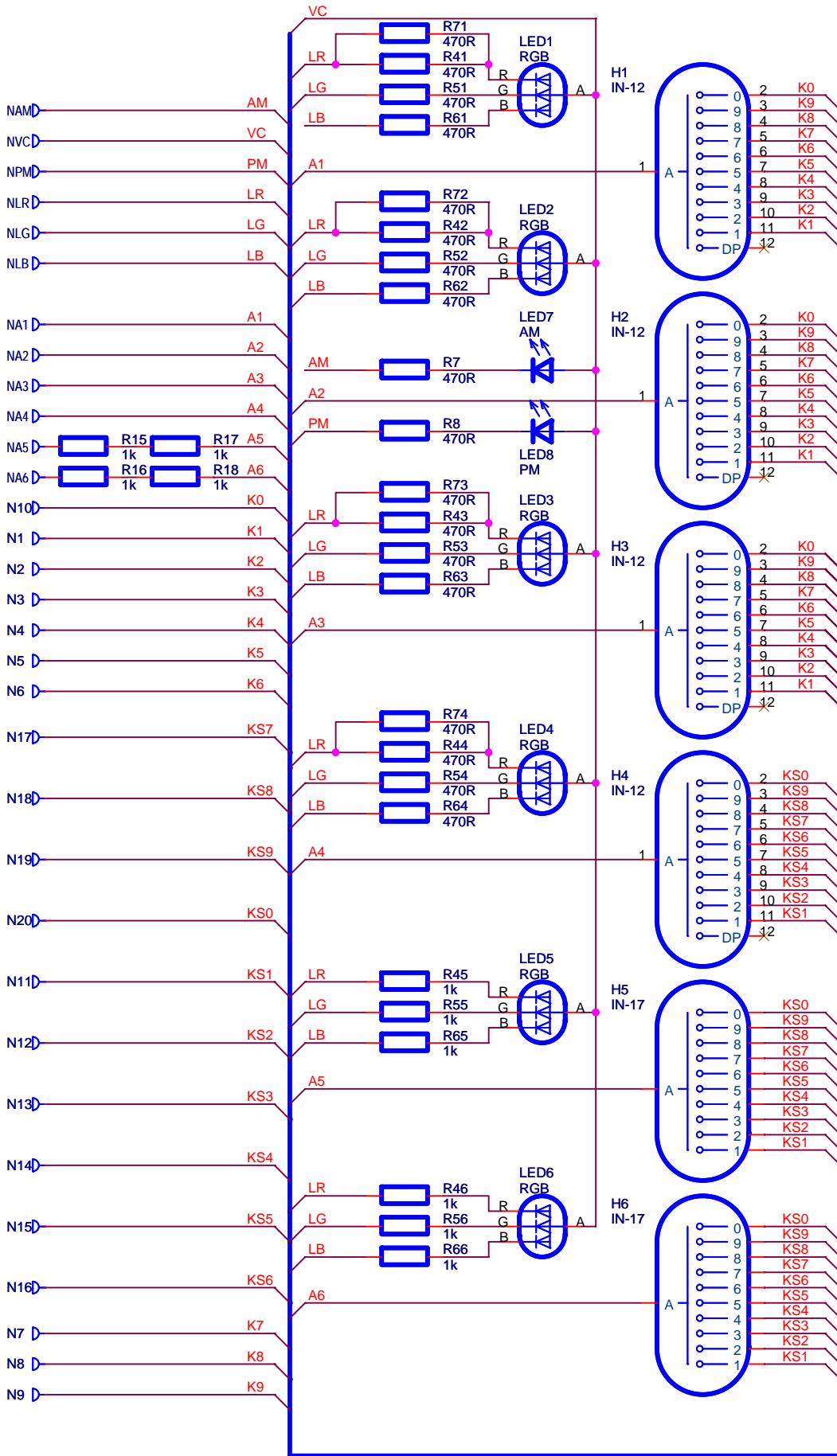
Electrical and Mechanical Parts for Leon Nixie Clock Tube Board				
Ca. 70	Tube socket pins			H1...H6
8	Alan flat hat screw self tapping	M3 x 14		
4	Alan flat hat screw self tapping	M3 x 20		
4	Roads	Red plastic		
6	RGB-LEDs	5mm diffus		LED1...LED6
2	Neons			H7,H8
2	Resistors	510k		R1,R2
6	Resistor Arrays	1k		RN1...RN6
2	Aluminium side profiles			
1	Rubber grommet			
1	5/8" to 3/8" adapter			
1	Nut for adapter			
4	"Ears"	Red plastic		
4	Aluminium reinforcement frames			
1	Leon Tube Board			
1	Front cover	1,6 mm silvery		
1	Rear cover	1,6 mm silvery engraved		
1	Top cover	1,6 mm silvery		
1	Bottom cover	1,6 mm silvery with drill hole for adapter		
2	Reinforcement frames	3 mm acrylic transparent with drill hole		



Title USB powered Nixie Clock		
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Title		
Lars Tube/LED Board		
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Title		
Lena Nixie Clock Tube Board		
Size	Document Number	Rev
	for USB Nixie Clock Main Board	0
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