

**Congratulations for purchasing this Nixie clock kit “Leon”.**

**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 useful documents for download**

- The owners manual for this “Leon” Nixie clock kit
- Schematic and Parts List

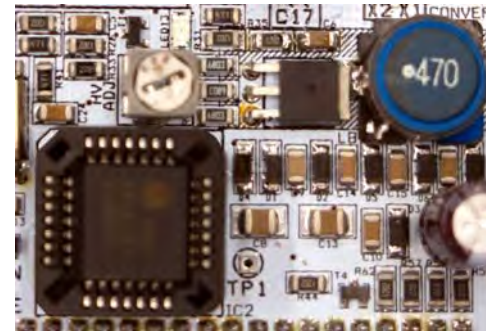
**Safety precautions:**

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.

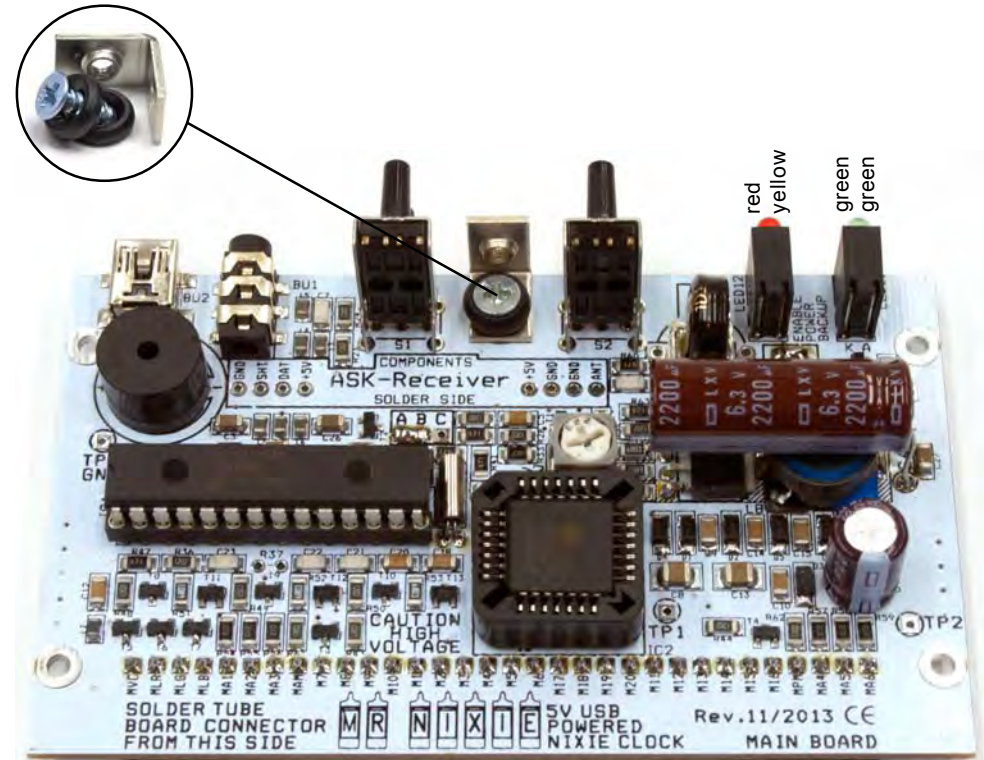
Okay, and now, Ladies and Gentlemen – start your soldering iron...

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 discharge 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.



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 volt ages 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**

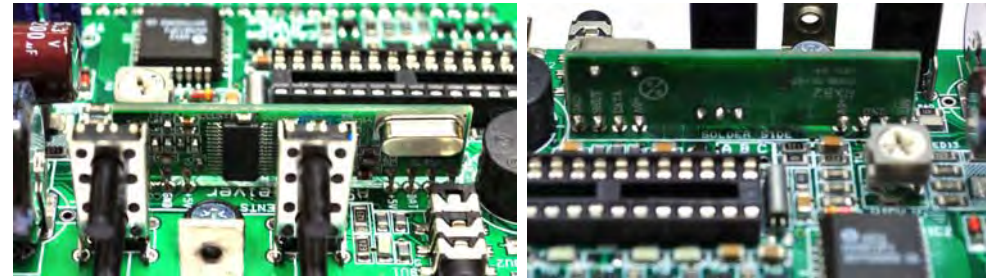
Check following the voltages on the other testpoints: **TP1 (around 4.5 V) • TP2 (around 3 V)**  
**Please do not proceed until all voltages are within their range and check for the fault.**  
If everything is ok, unplug the clock from the power supply .  
Solder now jumper **ENABLE HIGH V. CONVERTER 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 41.5 V.**  
Do following a voltage check on **TP2**. It should be in the range of 170 V .  
Push now button **SET**. The clock must make a short bleep.  
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 count s 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** direct below the ASK module.

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

## Adding the ASK Receiver Module from the „Wireless GPS Connection“



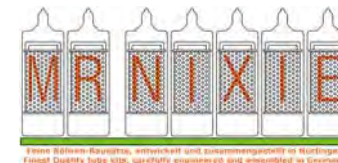
Simply fit the module onto the mainboard and solder the 8 pins.  
Pay attention for correct orientation (see pictures).

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) 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 an extra external receiver to the **TIME DATA** connector when an ASK module is fitted, only the supplied antenna can be fitted.  
Please check also, if the solder jumper **A/B** (direct below the module) is soldered.  
For setting up the „Wireless GPS Connection“ system proceed as stated in the appropriate owners manual.

**When connecting the external MicroGPS receiver you'll need to set the jumpers A-B-C to position B-C**



## Anbieterkennzeichnung • Vendor

Jürgen Grau • Enzberger Straße 1 • 74363 Güglingen • Germany • Fon: 07135 / 71899-09 • Fax: 07135 / 71899-49  
E-Mail: Mr.Nixie@Nixiekits.eu • www.Nixiekits.eu

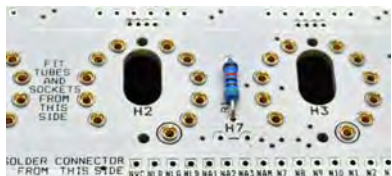
Subject change without notice – Issue 3. 0 – Version from 1.05.2015

### Revision History

Date	Issue	Description
March, 10th. 2013	1.0	Initial Release
Febr., 17th. 2014	3.0	New issue for the mainboard Rev .11-2013



## Assembling the Leon Tube Board



1.: Start with assembling the tube socket pins and both 510k resistors.

2.: When finished fix the pins and resistors with a piece of self-adhesive tape.

3.: Flip the board and solder all pins and both resistors



4.: Pick up the neons, bend the leads straight and add two 8 mm spacers.



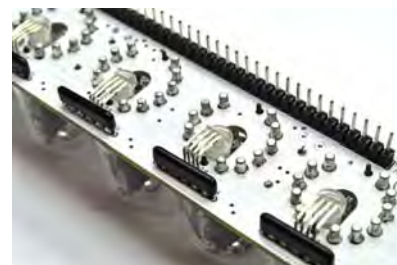
5.: Bend the neon's wires as shown in the picture. Do not make any short circuit.

6.: Add carefully all tubes and neons to the board and solder the neons.



7.: Pick up the RGB-LEDs and bend them as shown in the picture. Keep special care about the location of the Anode wire (longest wire)

8.: Fit the LEDs to the board and solder them. Use as less solder tin as possible as the spacing between the LED pins is very small.



9.: Fit the 32-pin header and the resistor arrays (the „polarity“ is negligible) from solder side and solder them.

10.: Attach the tube board to the main board. Now solder with a piece of (cutted) wire a connection between pin „HV“ of the tube board to „TP2“ on the main board. This will feed the 170V, which are necessary to power the neons, to the tube board.

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

## Assembling the Leon Enclosure



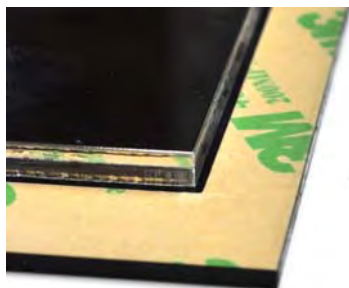
Pick up the front cover , remove both protective films and attach the cover on the aluminium profiles. Now fix the cover only with 3 screws GF M3 x 14 and tighten loose the right hand screw .



Next pick up both reinforcement profiles and attach them to the enclosure. To enable this you need to bend the (only with one screw fixed) right hand profile a little bit.



Remove all protective films from both transparent covers and from the silvery cover. Keep special care to remove only the „inner“ film on the self-adhesive side from the silvery cover.



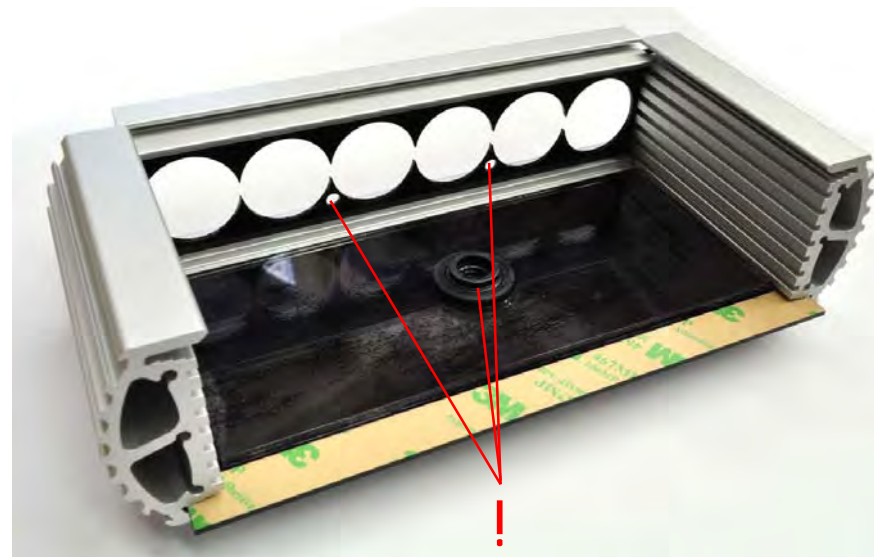
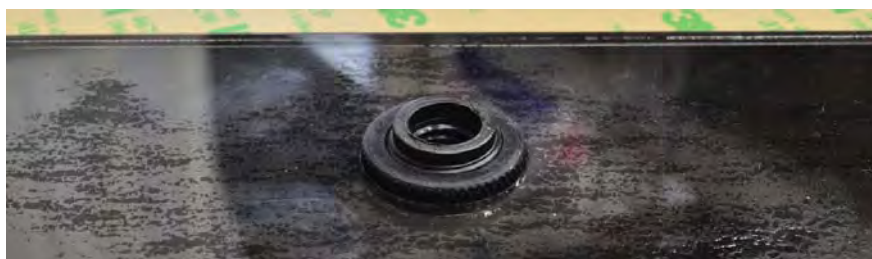
Attach next the transparent covers on the self-adhesive side. Check for proper alignment before this task as it is very difficult to remove this covers when fixed.



Pick up next the rubber grommet and insert it into the hole of the bottom cover.



Attach now the 5/8" to 3/8" adapter together with the nut.



Attach both covers to the enclosure. Add the remaining screw on the front cover and tighten them.



Attach now two red „ears“ and fix them with the GF M3 x 20 screws.



Remove from the rear cover the protective film from the self-adhesive side (the engraved outer side has no film) and fix it on the main board with the M3 x 6 screw





Next remove the bottom cover from the enclosure and add the electronics plus a reinforcement profile as shown in the photo.



Add four rods to the aluminium profiles. Keep care about the correct orientation of the nut. Next add to the assembled top cover the remaining reinforcement aluminium profile.

Slide carefully the electronics together with the bottom cover into the enclosure. Check if the neons will fit into their holes on front. Next fix the rear with the remaining 4 x GF M3 x 14 screws



Finally fit the remaining two „ears“ and fix them. Congratulations. Your clock is now ready assembled. Have a lot of fun.

**Part List Rev.11-2013**  
USB powered Nixie Clocks

<b>Through hole components Main PCB Rev.11-13 for all clock versions</b>			
<b>Qty</b>	<b>Part description</b>	<b>Value</b>	<b>Position / Code</b>
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	42 ohms voice coil imp.	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 or 2	1 x Rosette 10.5 mm diameter or 2 x Rosettes 7.5 mm diameter	Plastic black	
1	Main Board	SMT preassembled	white

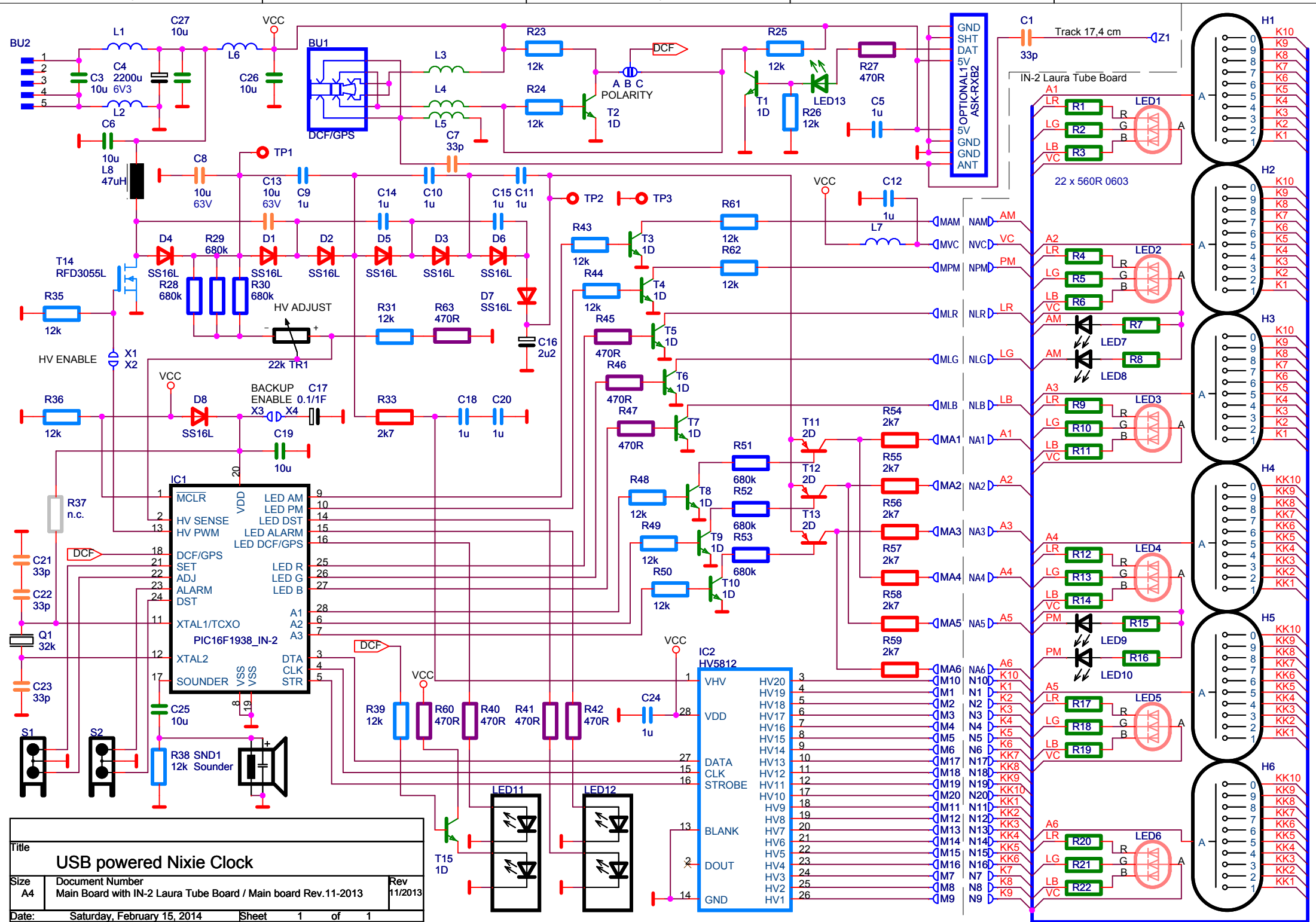
<b>Electrical Parts for Laura Nixie Clock Tube Board</b>			
Ca. 70	Tube socket pins		H1...H6
<b>Mechanical Parts for Laura Nixie Clock</b>			
4	LED 1,8mm	Amber clear	Tube Board
4	LED spacer	8 mm	Tube Board
4	Screw self tapping	M2.5 x 8	
8	Alan flat hat screw self tapping	3 x 14 black	
4	Spacers	2.7 inner 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	

<b>Electrical Parts for Lars Nixie Clock Tube/LED Board</b>			
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
<b>Mechanical Parts for Lars Nixie Clock</b>			
8	Alan flat hat screw self tapping	3 x 14 black	
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**

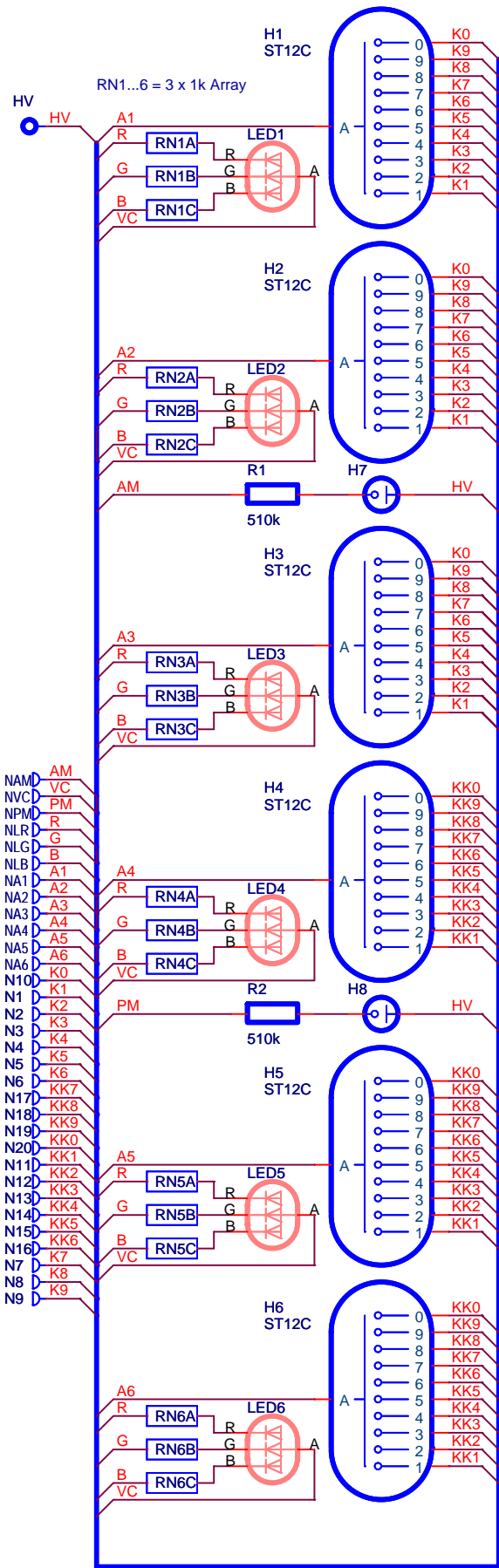
<b>Electrical Parts for Lena Nixie Clock Tube Board</b>				
44	Harwin tube socket pins			H1...H6
<b>Mechanical Parts for Lena Nixie Clock</b>				
8	Alan flat hat screw self tapping	3 x 14 black		
2	LED 3mm	Amber diffused		LED7,LED8
2	LED 5mm	RGB comm. Anode		LED5,LED6
4+1	Transparent plastic feeds	7 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		

<b>Electrical and Mechanical Parts for Leon Nixie Clock Tube Board</b>				
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		
Size	Document Number	Rev
A4	Main Board with IN-2 Laura Tube Board / Main board Rev.11-2013	11/2013
Date:	Saturday, February 15, 2014	Sheet 1 of 1





- NAM D AM
- NVC D VC
- NPM D PM
- NLR D R
- NLG D G
- NLB D B
- NA1 D A1
- NA2 D A2
- NA3 D A3
- NA4 D A4
- NA5 D A5
- NA6 D A6
- N10 D K0
- N1 D K1
- N2 D K2
- N3 D K3
- N4 D K4
- N5 D K5
- N6 D K6
- N17 D KK7
- N18 D KK8
- N19 D KK9
- N20 D KK0
- N11 D KK1
- N12 D KK2
- N13 D KK3
- N14 D KK4
- N15 D KK5
- N16 D KK6
- N7 D K7
- N8 D K8
- N9 D K9

Title		
<b>Leon Tube Board</b>		
Size	Document Number	Rev
	For USB Nixie Clock Main Board	0
Date:	Saturday, February 23, 2013	Sheet 1 of 1