

Foreword

Dear Nixie friend,

Thank you for purchasing this state-of-the-art Nixie thermometer DIY kit. You have purchased a product that captivates as a DIY version a component quality and choice of materials that is outstanding in the market and will certainly draw the attention of their acquaintances in the future.

However, this also means that you should not "cobble together" this kit in record time. Take a quiet evening and about one hour time to build.

Also, you should already have the necessary equipment and knowledge to be able to build such a high-quality DIY kit without complications. The resulting success will definitely reward you for your effort and stamina.

The instructions assume electronic fundamentals, i.e. you already know that ICs, LEDs and transistors are poled components and may not be soldered in reverse polarity. These parts are also very sensitive for electrostatic discharge. Furthermore, the usage of a temperature-controlled soldering station with max. 1 mm wide tip and correspondingly fine electronic solder as well appropriate as tools (multimeter, TX10, PH1/2 and mini slotted screwdriver, side cutter, tweezers, magnifying glass, etc.) are advised.

Please follow the steps and tips and hints in this manual. These are all tried out and tested and allow you a trouble-free setup.

Important Safety Instructions

During installation, commissioning and measurements and repair special care is required! Assembling of the circuit is at your own risk. The functionality can not be guaranteed, nor the suitability for certain purposes. The user himself has to check this and is responsible for this suitability.

No liability can be accepted for damages arising during or as a result of the assembly or operation, in particular for damages resulting from a lack of electronic skills.

The thermometer may only be operated in a touch-proof housing in dry indoor environment. Operation without or with defective tubes is not permitted!

The person who has completed a kit or has made an assembly ready by extension or enclosure installation, is according to VDE 0869 a manufacturer and therefore provided to supply all documents when selling the device and also give his name and address.

Devices which are assembled from kits themselves are to be considered as an industrial product in terms of safety.

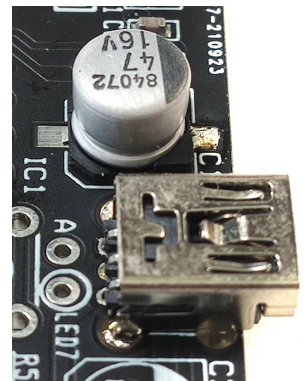
And now, after these necessary introductory words - fire up your soldering station ...

Assembling and functional test

Let's start with the USB socket BU1. Solder only one of the housing tabs from component side for fixing the part for the moment.



By soldering the following SMD components it makes sense, first to solder only one pin and – by re-heating again – finally align the component.



Next fit and solder C11 (47 μ) and C2 (82 μ) beside the USB socket. Now equip LED1 with the same height as both electrolytic capacitors. Please note that the longer LED wire is the anode "A" connection. Next solder the five pins from the USB socket and the LED from solder side and cut off their wires.

Now equip and solder in the following order:

C10 (47 μ), C3 (82 μ), L1 (well heat up the pads) and T4 (Caution, ESD sensitive MosFet).

Now fit and solder push button switch S1 - please pay attention for a straight fit, next fit the two trim-potentiometers TR1 and TR2 (pay attention for the correct value: grey = 1k / blue = 47k), the transistor T6 (BC546B) and the 8-pin. IC socket.

Then fit the PIC 12F629 into it's IC socket. Pay attention for correct orientation of the notch.

Pick up one of the two attached rubber tubes and shorten it to approx. 11 mm. Now push this tube over the middle component wire of the „transistor style“ IC3.

Then solder IC3 from the component side. Pay special attention for the correct orientation.

Finally, equip from bottom side T5 (MPSA42) and solder this transistor from the component side.

Plug in now the USB power supply. The green LED next to the USB socket must light up and the six RGB LEDs must also start with their color sequence (starting with red colour).

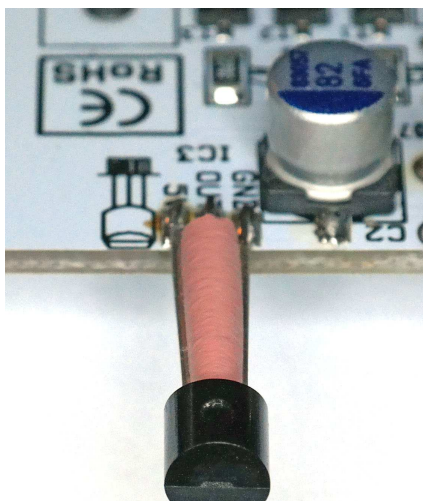
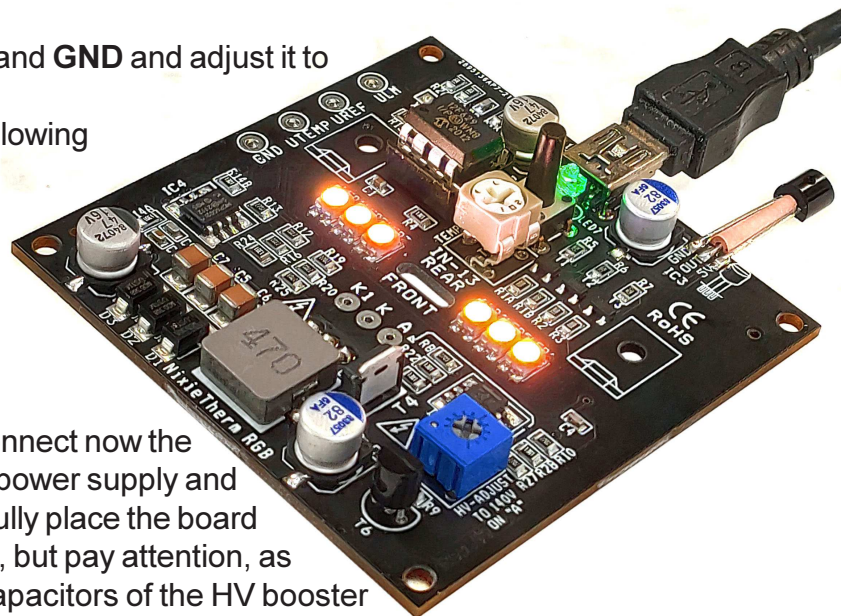
Now measure the voltage between **A** and **GND** and adjust it to 140V (+/- 3V) with TR2 **HV-ADJUST**.

Then measure - just for control - the following voltages with respect to **GND**:

ULM ~ 0.3V (temperature dependent, 10mV per °C)

UREF ~ 2.1V (in the wiper's middle position of TR1 **TEMP-CAL**)

UTEMP ~ 1.9V (6.2 x ULM)



Disconnect now the USB power supply and carefully place the board aside, but pay attention, as the capacitors of the HV booster remain charged for a few seconds.

When everything is ok. we will start assembling the IN-13 tube and the scale

Pick up the scale and remove first the protective film on the side facing away from the engraving only little bit.

Then **gently** remove the inner cut-out of the scale (the IN-13 tube's outline so to say), as it was used only for transportation protection. Next pick up the two tube clips and remove also their protective films from both sides. Now fix the acrylic scale upside down in a small vise.

Attention: Please secure the jaws with thick tape or use another protection to avoid scratching the scale.

Gently push the two clips into the scale with facing their cutout to the rear of the scale.

Next insert the tube in correct direction, the anode grid is on front side; the fully mirrored surface with the imprint is on the rear side.

Apply two M3 x 10 screws to secure the two LED covers (do not forget to remove the protective film) and the two mounting brackets on the scale. Please do not fasten the screws too hard.

Install the covers in that way that the oval cutout is facing to the tube's bottom, the small rectangular cutout to the later to be attached PCB.

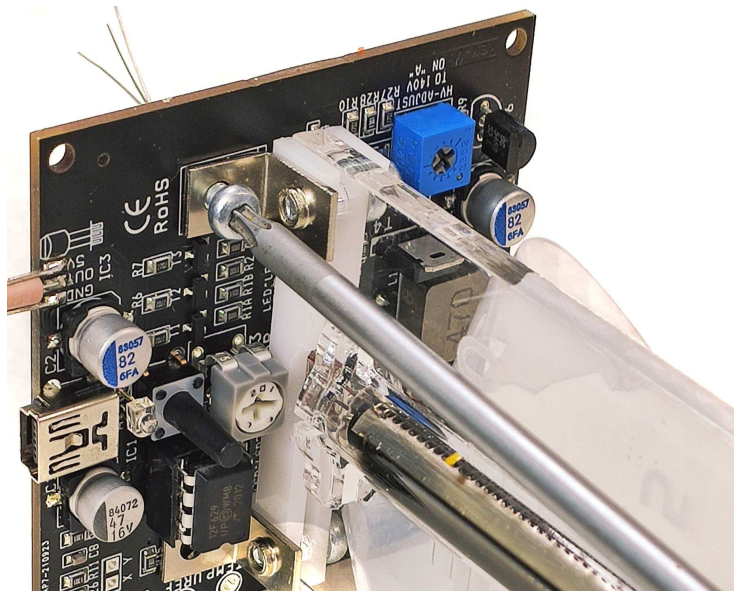
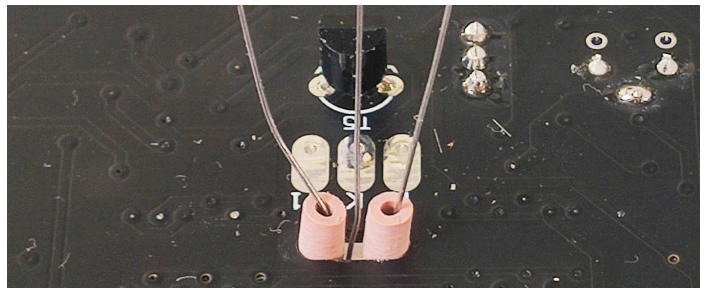
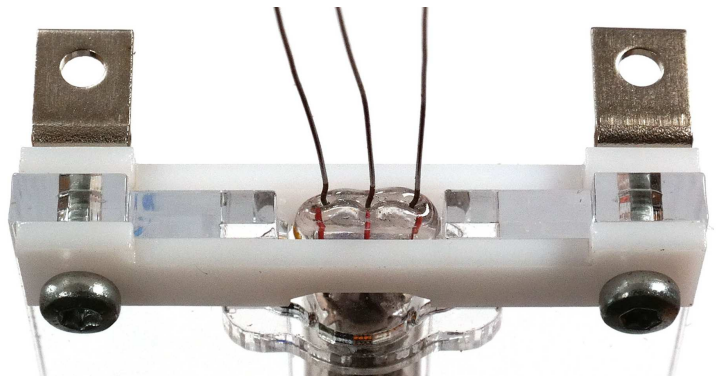
Before fastening the second screw compress the sides of the scale to be sure, that the tube clamb next to the LED covers will proper fit into the cutout of the scale.

Align the mounting height of the tube that the yellow / red mark on the tube's glas will match the 9°C line of the scale.

Next thread carefully the three wires of the tube through the cutout in the PCB without crossing each other, place the scale on the PCB as shown and secure it with two M3 x 6 self-tapping screws.

Cut the pink rubber tube in two halves and **slide** it over the outer wires of the IN-13 tube and **all the way down through the cutout.**

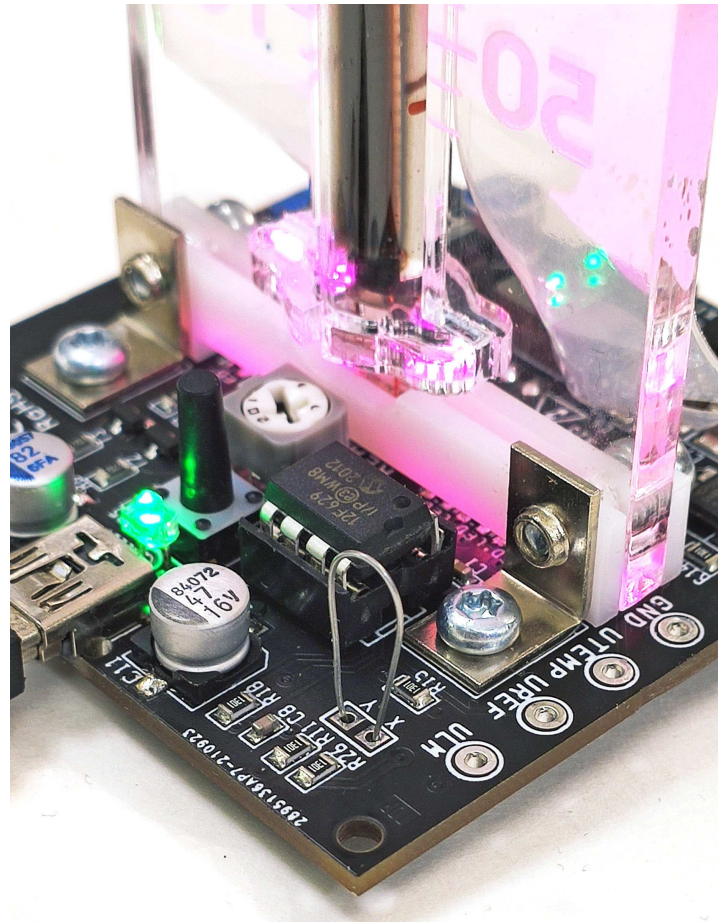
Now solder all three wires of the tube to it's soldering pads and cut the protruding wires.



Burn-in procedure

Many - but not all - IN-13 tubes are initially unable of displaying the full height of the glow column. Therefore connect the assembled NixieTherm board to the USB supply and have a close look to the IN-13 tube.

Tip: If you only see one small glow and not the small "pilot glow" lefthand from the main column and also not the anode grid, the tube is installed the wrong way round and you have to "turn" the tube after removing the scale. Now fit a short piece of wire (for example from the LED or the tube) into the burn-in pads X and Y. The glow column of the tube will now become brighter and will slowly rise up. The burn-in procedure is finished when the glow column reaches the top of the tube. This may take several minutes. Note: The tube and the transistor T3 on the bottom will become warm during this procedure.



Installation into the enclosure

Remove the burn-in wire and the power supply from the NixieTherm. Peel up the protective film from the bottom panel and the rear panel from both sides each.

Attach the four M3 x 12 plastic spacers to the bottom panel with four M 3 x 8 pan head screws. Then fit the four plastic self-adhesive feet to the edges of the bottom.

Stick the M2.5 x 6 screw through the drill holes of the printed circuit board at it edges and slide a self-retaining 2.7 mm spacer over the screw thread from the solder side. Insert the circuit board together with the rear panel and tighten the circuit board.

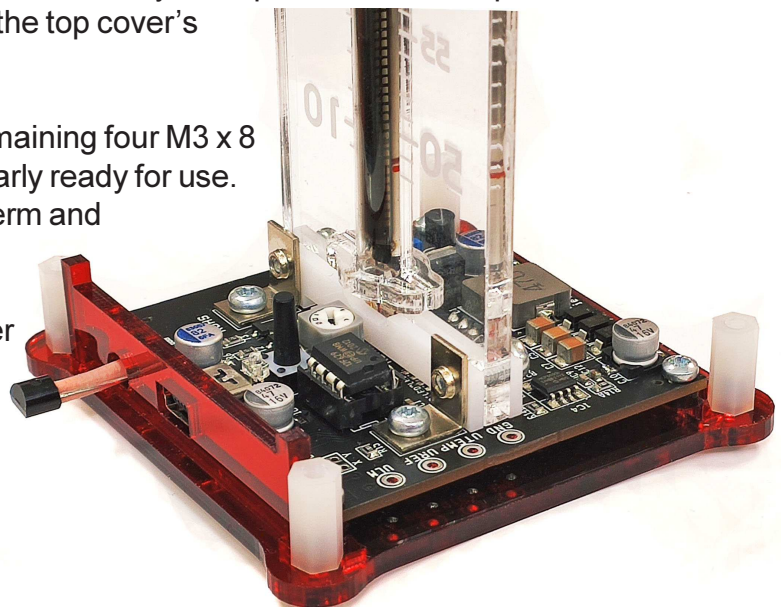
Finally, remove the protective films from the three side panels, the top panel of the case and the scale, insert the side panels and then attach carefully the top cover. The side panels need sometimes a slight adjustment to fit into the top cover's outouts.

After tightening the top cover with the remaining four M3 x 8 pan head screws, your NixieTherm is nearly ready for use.

Re-plug the power supply to the NixieTherm and keep it operational for about an hour. In the meantime, place an accurate thermometer next to the NixieTherm. After one hour adjust the displayed temperature range of the NixieTherm with the trimmer behind the scale to the value of the reference thermometer.



Congratulations.



Stückliste / BOM NixieTherm RGB Last Batch

Check	Qty.	Value	Package	Ref.
SMD-Bauteile vorbestückt / SMD components preassembled by PCB manufacturer				
<input checked="" type="checkbox"/>	2	Ceramic Capacitor 1u	0603	C1,C12
<input checked="" type="checkbox"/>	3	Ceramic Capacitor 2u2 100V	1210	C5,C6,C7
<input checked="" type="checkbox"/>	3	Ceramic Capacitor 330p	0603	C4,C8,C9
<input checked="" type="checkbox"/>	3	Fast Switching Diode US1M	SMA	D1,D2,D3
<input checked="" type="checkbox"/>	1	Rail-to-Rail OP-Amp MCP6002T	SO-8	IC4
<input checked="" type="checkbox"/>	1	Timer NE555DR	SO-8	IC5
<input checked="" type="checkbox"/>	6	RGB-LED	2835	LED1,LED2,LED3,LED4,LED5,LED6
<input checked="" type="checkbox"/>	2	100R	0805	R1a,R3
<input checked="" type="checkbox"/>	2	330R	0805	R1b,R2
<input checked="" type="checkbox"/>	12	1k3	0805	R4,R9,R11,R14b,R14a,R15,R18,R21,R22, R24,R26,R28
<input checked="" type="checkbox"/>	10	27k	0805	R5,R6,R7,R10,R12,R13,R16,R19,R20,R27
<input checked="" type="checkbox"/>	2	270k	0805	R8,R25
<input checked="" type="checkbox"/>	3	N-Channel Mos-Fet 2N7002	SOT-23	T1,T2,T3

Check	Qty.	Value	Package	Ref.
Vom Kunden zu bestückende Bauteile / Trough hole components, assembled by customer				
	1	LM35DZ Temp-Sensor	TO-92	IC3
	1	MPSA42 HV-Transistor	TO-92 Ammo	T5
	1	BC546B	TO-92	T6
	1	LED ocean	1.8 mm	LED7
	1	PIC12F629 programed	DIP-8	IC1
	1	IC Socket	DIP-8	IC1
	1	AOI4286 MosFet Transistor	IPAC	T4
	1	Mini-USB Connector		BU1
	2	47uF 16V	Size 6.3 x 5	C10,C11
	2	82uF 6V3 Polymer	Size 6.3 x 5	C2,C3
	1	1 k Trimmer	grau / grey	TR1
	1	47 k Trimmer	blau / blue	TR2
	1	Push Button Switch	13 mm	S1
	1	Inductor 47 uH	10 x 10	L1
	8	Fk M3 x 8 Tx Flathat Screw	M3 x 8	Fixing top and bottom cover
	2	GF M3 x 10 Tx Selftapping Screw	M3 x 10	Fixing mounting brackets on scale
	2	GF M3 x 6 Tx Selftapping Screw	M3 x 6	Fixing mounting brackets on PCB
	4	GF M2.5 x 6 Pz Selftapping Screw	M2.5 x 6	Fixing PCB on bottom
	2	Mounting Brackets	M3 + 3,2 mm	Mounting scale on PCB
	4	DI 12mm Plastic Spacer white	M3	Spacers for top and bottom cover
	4	Spacer 2.7 x 2 mm	for M2.5	Spacers for PCB
	2	Rubber Tube	20 mm	Isolation of the IN-13 / LM35DZ wires
	4	Bumpers selfadhesive	8 x 2.2 mm	

Check	Qty.	Value	Package	Ref.
Divers				
	1	NixieTherm RGB board preass.		NixieTherm RGB LastBatch
	1	Acrylic enclsoure parts incl. Scale		
	1	IN-13 tube		

