Lightning distance meter

Schematic description

This construction measures and displays the distance between lightning and thunder within range of 0 to 9.9km

When lightning occurs the user presses Start button, and the counter starts to count in a period of 100m (291ms). When thunder occurs the user presses Stop button and counting stops. Left LED column displays lightning distance with 1km resolution and right column with 100m resolution.

Construction is based on 555 timer connected as astable flip flop with approximately 291ms period. Clock signal is connected to 2 4017 Johnson counters connected in cascade.

Start and Stop buttons control bistable flip flop created of Q2 and Q3 transistors. Start button also resets the 555 timer.

Reset button resets both 4017 timers to 0m state and also switches the bistable flip flop to Stop state.

Construction

Construction has components placed on both sides of the PCB. We populate components from bottom PCB side first. We start with resistors, then continue with diodes D21 and D22, then IC sockets. Then we populate ceramic capacitors, transistors and finish with terminal.

Then we continue with other side of PCB – top. We populate LED diodes that are placed in plastic spacers. Its better to place all LED diodes to PCB with spacer and then solder them all - we avoid melting and moving plastic spacers.

Finally, we populate buttons and switch. Caution – take care of switch orientation – see picture.

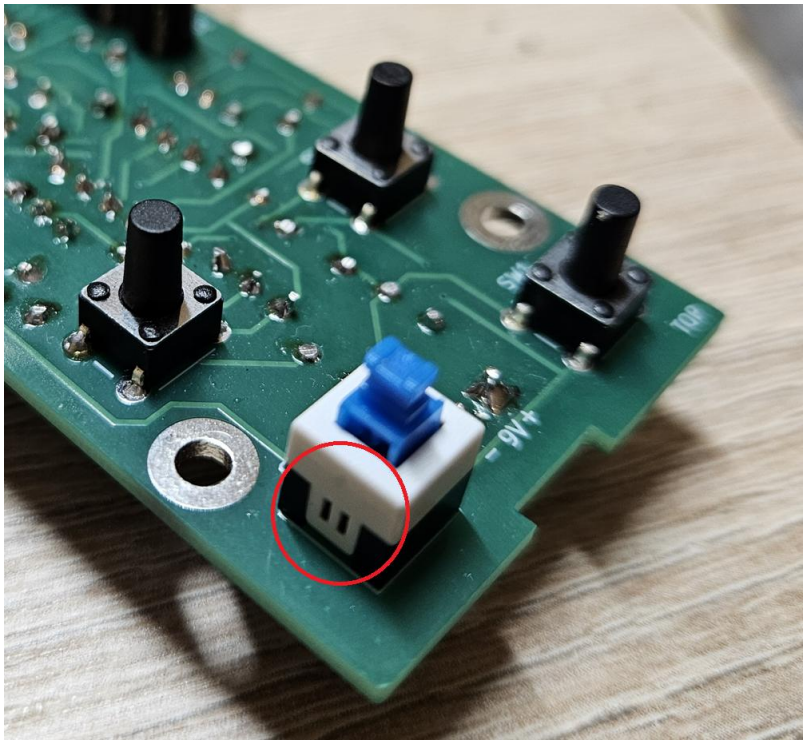
How to get it into service

It should work on the first try when everything was soldered well. The device should show 0km and 0m distance after turning on.

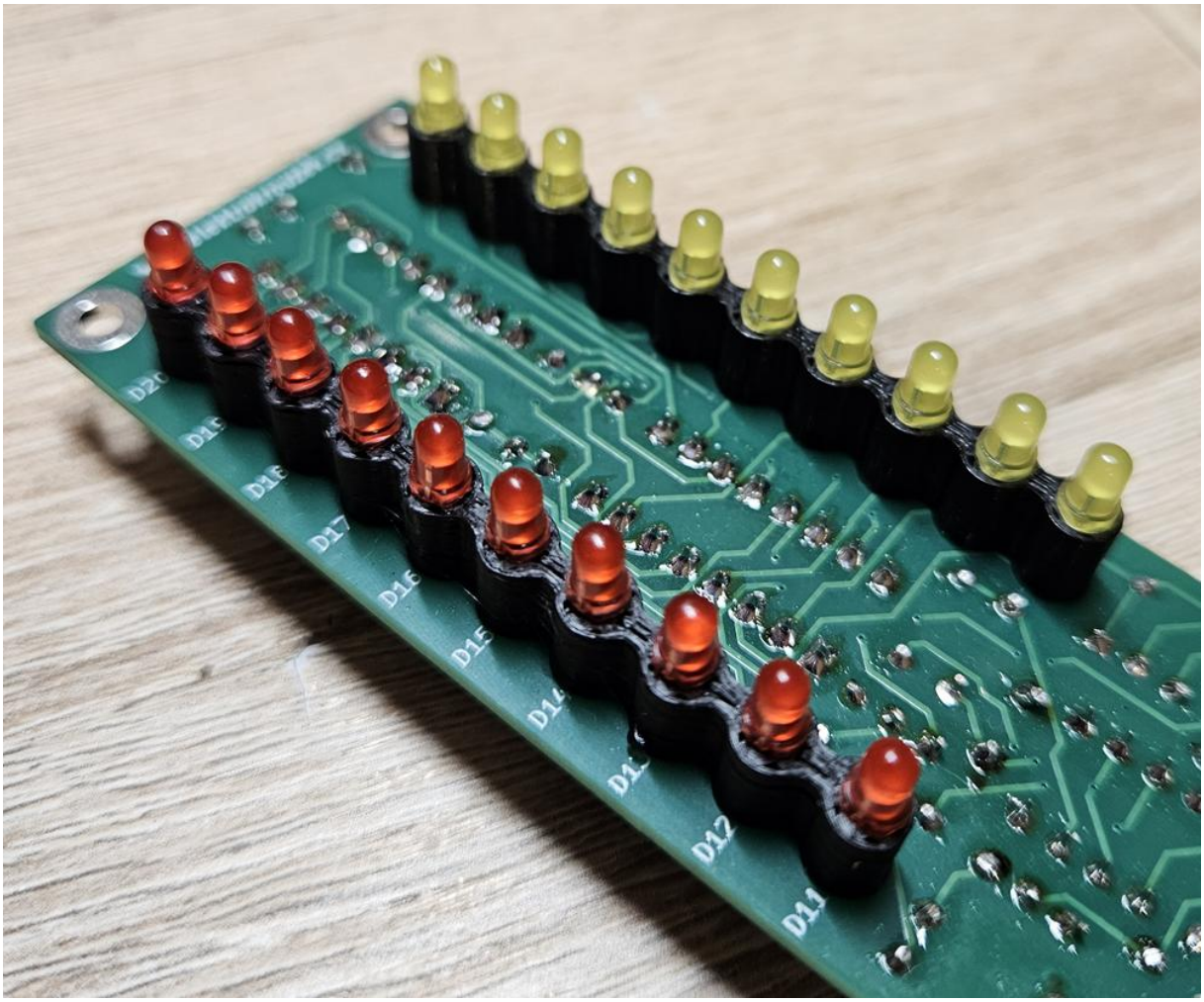
Bill of materials

Annotation	Value	Qty
C1,C3	1uF	2
C2	10nF	1
D1,D2,D3,D4,D5,D6,D7,D8,D9,D10	LED 3mm Y	10
D11,D12,D13,D14,D15,D16,D17,D18,D19,D20	LED 3mm G	10
D21,D22	1N4148	2
J1	Terminal RM3.5	1
Q1,Q3,Q4	BC546	3
Q2	BC556	1
R1,R3,R5,R8	150k	4
R2,R4,R6,R9,R10,R11	10k	6
R7	120k	1
R12,R13	680R	2
SW1,SW2,SW3	6mm	3
SW4	7x7mm	1
U1	NE555P	1
U2,U3	4017	2

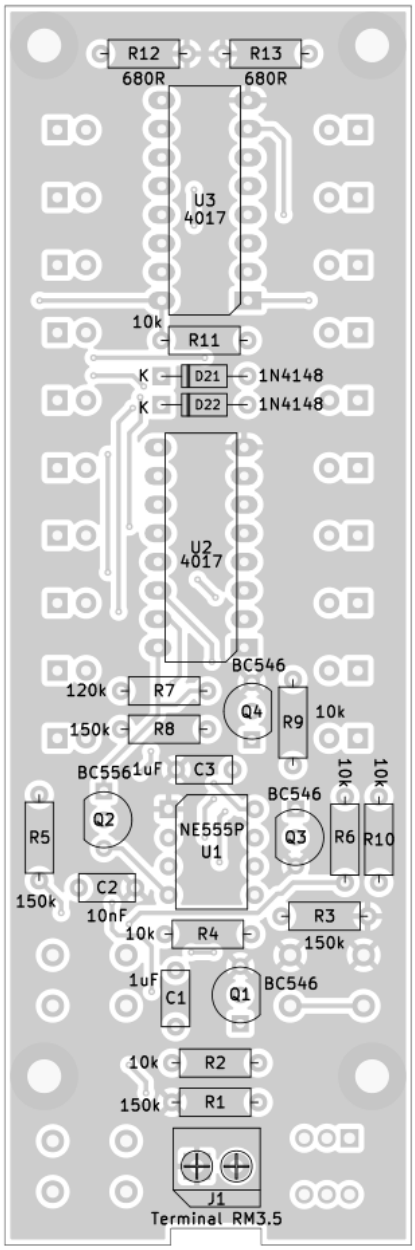
Switch orientation

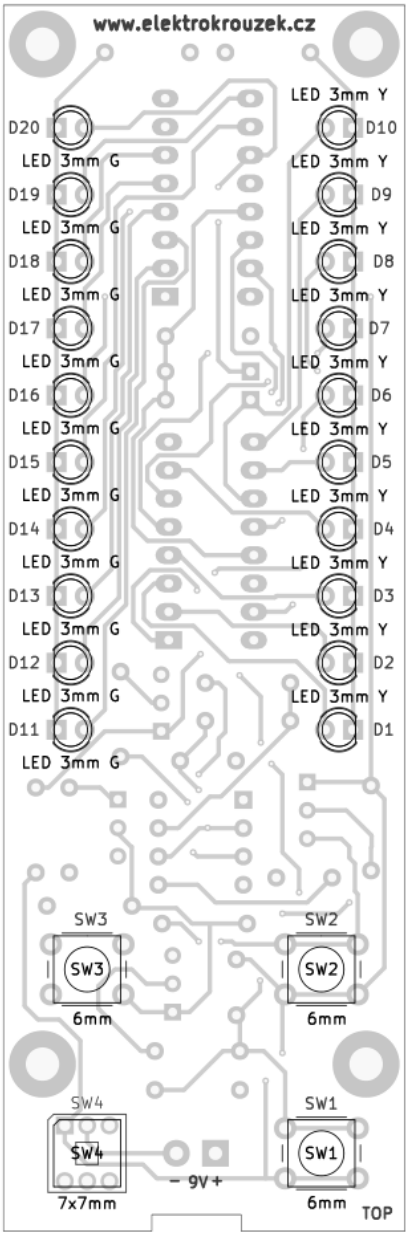


LED diodes spacers

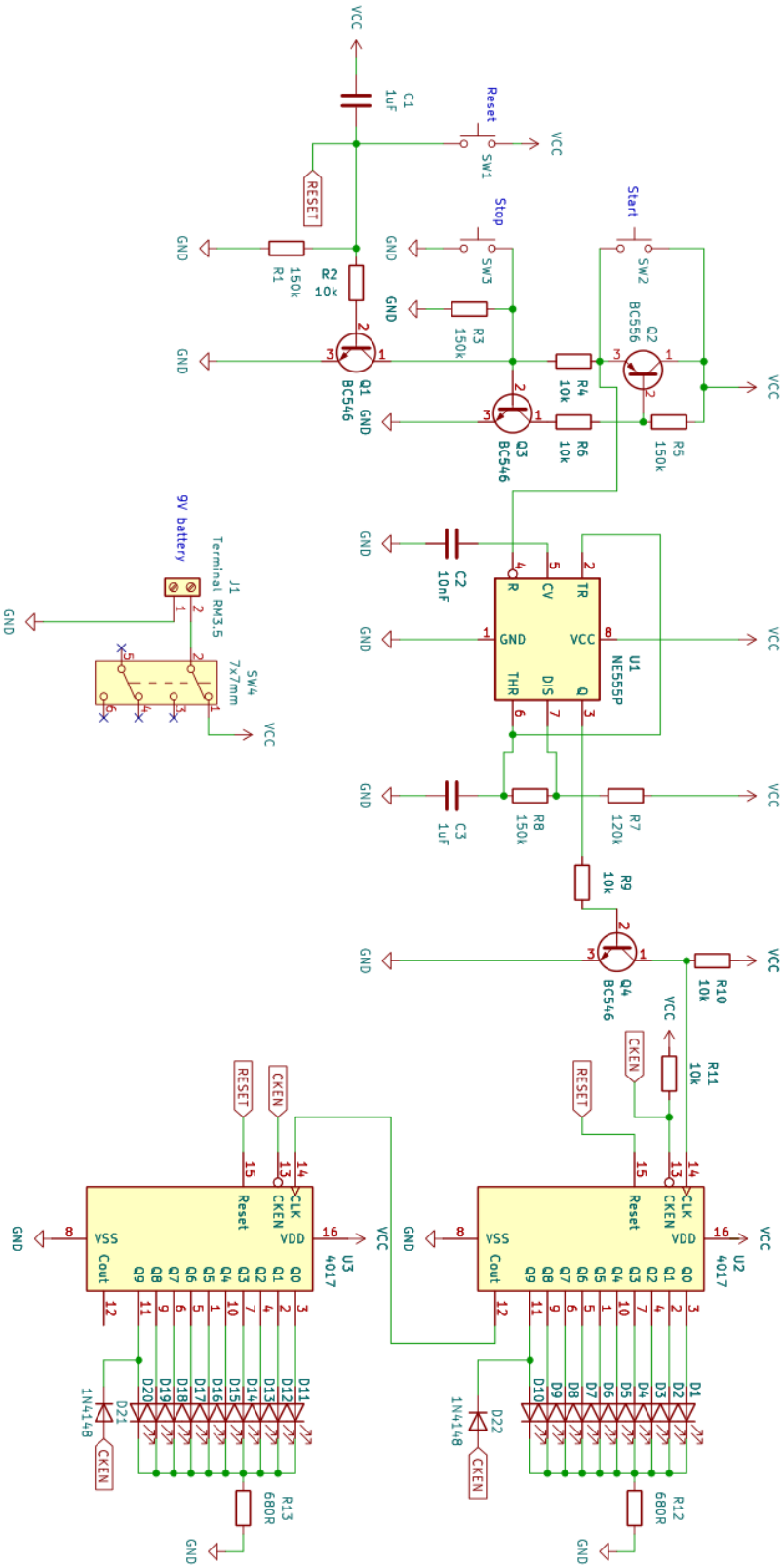


PCB assembly





Schematic


VCC
C1
1uF
Reset
SW1
RESET
GND
R1
150k
R2
10k
Stop
SW3
R3
150k
Start
SW2
Q2
BC556
Q1
BC546
R4
10k
Q3
BC546
R6
10k
R5
150k
9V battery
J1
Terminal RM3.5
SW4
7x7mm
C2
10nF
U1
NE555P
R
CV
TR
GND
VCC
THR
DIS
Q
C3
1uF
R8
150k
R7
120k
R9
10k
Q4
BC546
R10
10k
R11
10k
CKEN
U3
4017
U2
4017
Reset
CLK
VSS
Cout
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
D16
D17
D18
D19
D20
D21
D22
1N4148
R12
680R
R13
680R