

# **BOXA-MilliWatter Extreme**

a **BOXA-LINE** product

The **BOXA-MWEXTREME** opens up a world of extreme low power operating for the experimenter and DXer who wants a new challenge

The **BOXA-MWEXTREME** is available as an easy-to-make kit or as a ready-made unit. The **BOXA-MWEXTREME** can either be fitted into our neat custom enclosure or mounted in your own enclosure.

Building the **BOXA-MWEXTREME** is easy and fun. It will take about 2 hours to build and is suitable for a beginner.



## Revision History

20-Jan-15 First issued

## BOXA-MWEXTREME Packing List

It's a good idea to check that you have all the parts before you get started:

Designator	VALUE	NOTES
C1	Not used	Leave out
C2	100n	104 brown disk
C3	10uF	vertical mount
C4	100n	104 brown disk
C5	10uF	vertical mount
D1	BAT42	small signal diode
D2	BAT42	small signal diode
D3	5mm green	LED
D4	1N5817	power diode (black)
J1	USB-B Skt	pcb socket
J2	2 x header pins	
J3	BNC	pcb socket
J4	BNC	pcb socket
K1	RELAY	black
Q1	2N7000	FET
R1	1K2	brown-red-red-gold or brown-red-black-brown-brown
R2	100k	brown-black-yellow-gold
R3	100 3W	large brown-black-brown-gold
R4	100 3W	large brown-black-brown-gold
R5	100 3W	large brown-black-brown-gold
R6	100 3W	large brown-black-brown-gold
R7	820	very small grey-red-black-black
R8	82 3W	large grey-red-black-gold

R9	100	brown-black-black-black-brown
R10	150	brown-green-black-black-brown
R11	68	blue-grey-black-gold
R12	220	red-red-black--black-brown
R13	150	brown-green-black-black-brown
R14	5k POT	blue
R15	1k2	brown-red-red-gold or brown-red-black-brown-brown
S1	DPDT Toggle	red
S2	DPDT Toggle	red
	Jumper	small black plastic rectangle
	PCB	
	Packing slip	



Item	Number	Comments
<b>OPTIONAL ENCLOSURE KIT</b>		
Laser cut front panel	1	
Laser cut rear panel	1	
Aluminium enclosure	1	
Panel fixing screws	8	
Self adhesive feet	4	

If anything is missing, just get in touch for help.

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## Errata

None

## BOXA-MWEXTREME Instructions

The BOXA-MWEXTREME kit is easy to make and you will end up with fun addition to your station.

Step by step instructions together with photographs will make it easy to build your BOXA-MWEXTREME. It will take around 2 hours work – best over two shorter sessions.

Download the circuit diagram at [www.sotabeams.co.uk/downloads](http://www.sotabeams.co.uk/downloads)

### Spotted a mistake or need help?

Please let me know!

Email [Richard@sotabeams.co.uk](mailto:Richard@sotabeams.co.uk), telephone +44 (0) 7976 688359

### Building tips

Use a soldering iron with a fine tip (e.g. 1.2mm) and a fine solder (e.g. 0.7mm).

Pro-tip. Try to install all the resistors the same way round – so the bands always read the same way.

The resistors install with the leads bent at the resistor body. If done correctly they fit perfectly!

All the components are installed on the side of the board with the silk screened lettering.

Use the list above to identify the components.

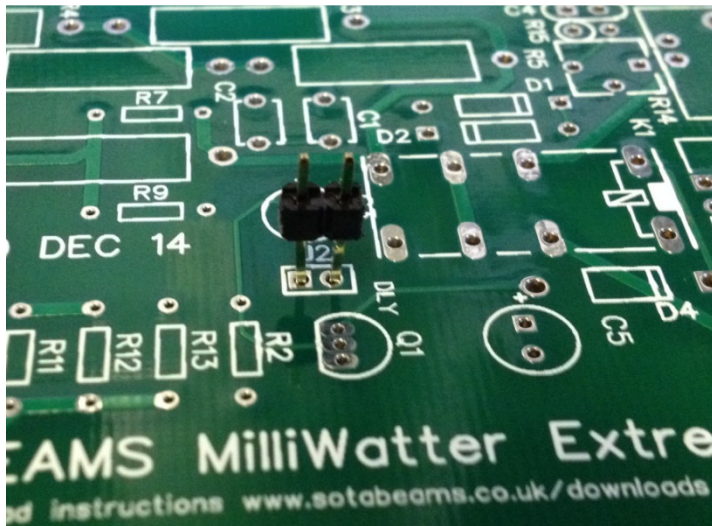
You can install up to three components at a time. This is faster than doing them individually.

Only solder a component when you are sure that you have inserted the correct one.

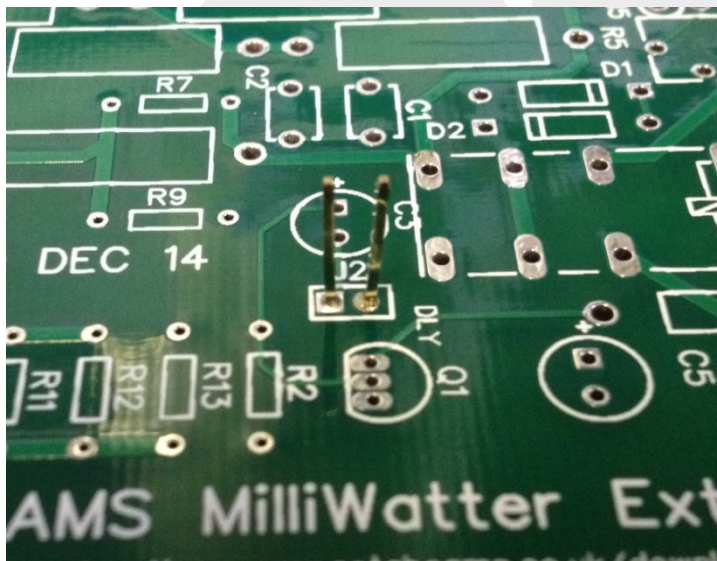
Once soldered, cut the surplus lead.

Designator	Value	Notes	Tick when done
R5	100	large resistor	
R6	100	large resistor	
R3	100	large resistor	
R4	100	large resistor	
R7	820	very small resistor	
R14	5k POT	blue	
R15	1k2	mounted vertically	
C4	100n	disk ceramic, bend leads to fit	
C2	100n	disk ceramic, bend leads to fit	
D1	BAT42	signal diode. Align band as shown on PCB	
D2	BAT42	signal diode. Align band as shown on PCB	
R8	82	large resistor	
R1	1k2		
R9	100		

Designator	Value	Notes	Tick when done
K1	RELAY	solder opposite corners first to hold relay against the PCB. Solder all 6 connections. Avoid excessive heating.	
C3	10uF	Silk screen slightly obscured by relay. Longer lead is positive.	
J2	header pins	The holes in the pcb are a little too close together. Squeeze the pins together slightly and insert the header pins as shown. Then slide off the black plastic spacer. Finally slid on the shorting jumper. See photos below.	
D4	black diode	Align band as shown on PCB.	
C5	10uF	Longer lead is positive.	
Q1	2N7000	The silk-screen is the wrong way round so install the FET so that the flat side faces C5. The pins on his device are very close together. Check that you do not short them out when soldering. Solder wick is helpful if you do put too much solder on.	
R2	100k		
R13	150		
R12	220		
R11	68		
R10	150		
S1	red toggle sw	make sure that the switch is sitting flat on the pcb	
S2	red toggle sw	make sure that the switch is sitting flat on the pcb	
J1	USB skt	make sure that the skt is sitting flat on the pcb	
J3	BNC skt	make sure that the skt is sitting flat on the pcb Tack solder the fixings to hold the skt firmly.	
J4	BNC skt	make sure that the skt is sitting flat on the pcb Tack solder the fixings to hold the skt firmly.	
D3	LED	Stage 1. Shorter lead in hole adjacent to the flat on the silk screen. Insert so that bottom of LED body is 6 mm above pcb. See photo below.	
D3	LED	Stage 2. Bend the Led as showing the photo below	



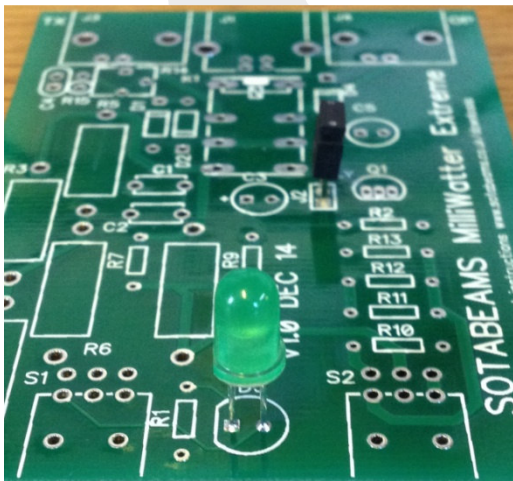
Insert the header pins upside down



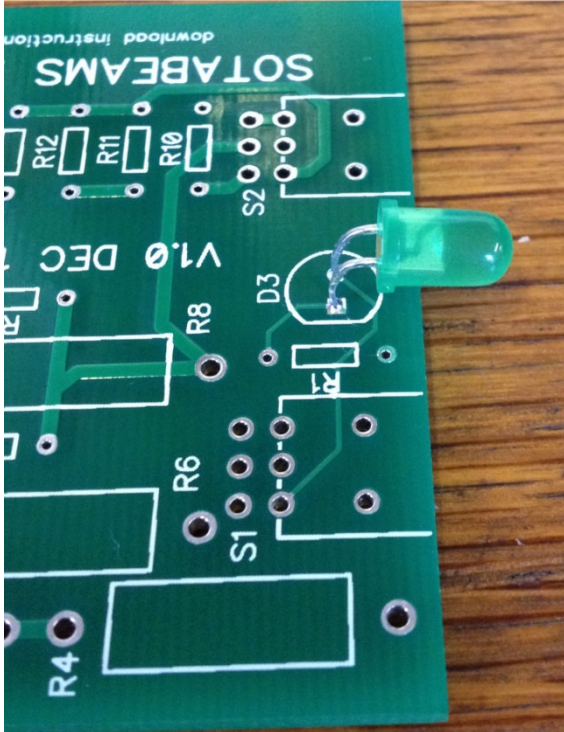
Pull off the plastic spacer



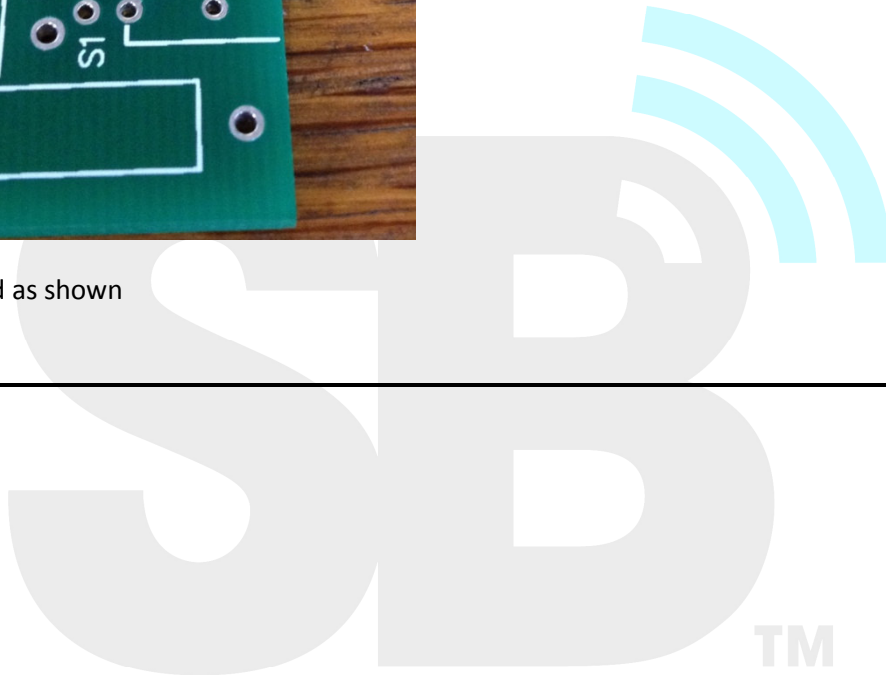
Push on the shorting jumper



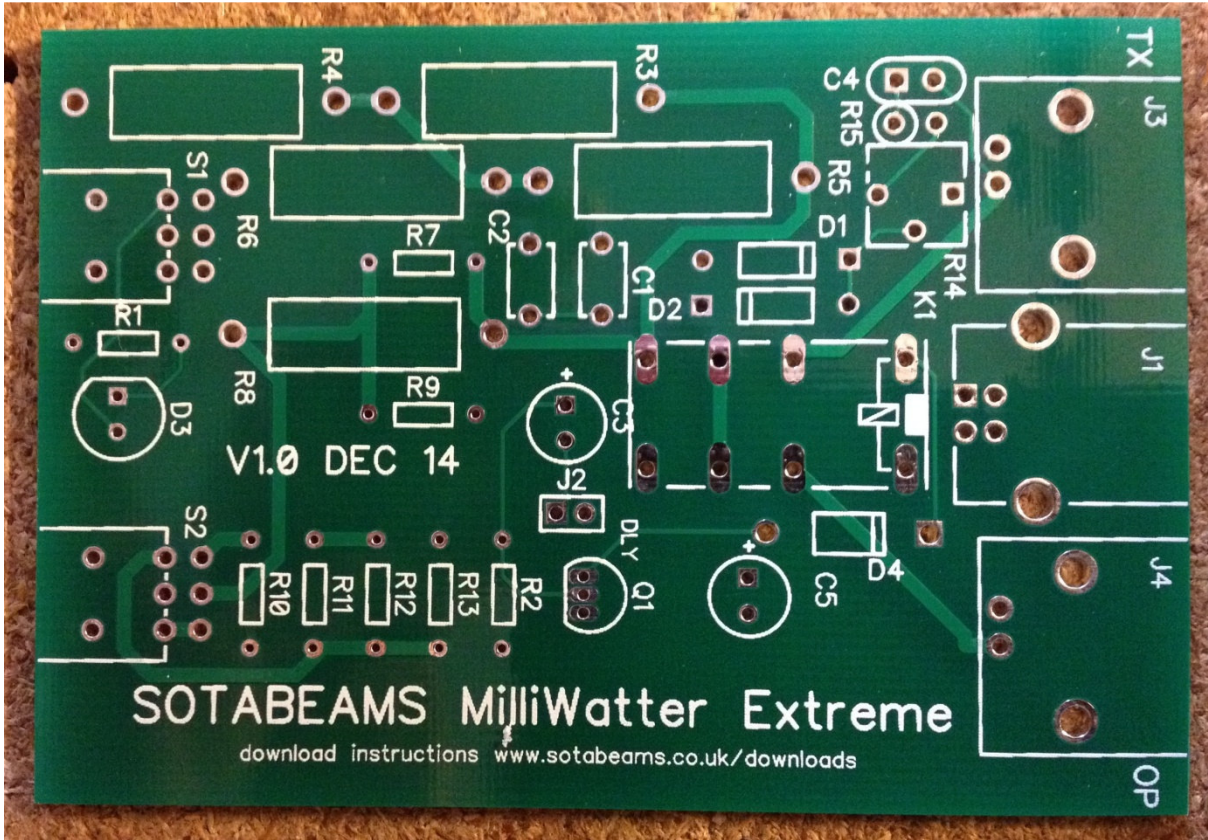
insert the LED



Bend the Led as shown







This completes construction of the PCB. All the components should be in place with just a gap at C1 (not required).

Carefully check the solder joints with a magnifying glass. Areas where shorts can occur are the pins of J1, J3 and J4, the pins of Q1 and the pins of S2 and S1. Use solder braid to remove any solder bridges.

### Optional enclosure instructions

1. If you have the BOX-MWEXTREME enclosure kit, located the BOX-MWEXTREME laser cut front panels.
2. Check the edges of panels are smooth. In the event that there are sharp edges, file smooth.
3. If the panels have been supplied with protective masking paper or plastic in place, carefully remove this.
4. The panels can be polished with a soft cotton cloth and alcohol or water before installation.
5. Stick the four self adhesive feet on the bottom of the aluminium box – this is the plain side, the top has milled grooves.
6. Using four self tapping screws (supplied) install the front panel (labelled MilliWatter Extreme). Make sure that the panel is the right way up – there are milled ridges on the top of the box. **DO NOT OVERTIGHTEN THE SCREWS** – if you do so you may crack the plastic panel.
7. Slide the completed PCB into the enclosure in the bottom set of grooves. The switches and LED should slot into place quite easily. If the LED is not positioned correctly adjust and reinsert the PCB.
8. Using remaining self-tapping screws, screw the rear panel into the enclosure. If the holes do not line up, check that the PCB is in the correct grooves.  
**DO NOT OVERTIGHTEN THE SCREWS** – if you do so you may crack the plastic panel.
9. Finally attach the BNC sockets to the panel using a serrated washer and nut on each BNC.
10. Tighten all four nuts on the BNC sockets.

Your BOXA-MWEXTREME is now ready to test.

### Testing

Set S1 and S2 so that the toggles are pointing left.

Plug in 5 Volts (+/- 1 Volt) via the USB connector. Switch toggle S1 to the right and ensure that the LED lights.

Connect a transmitter to socket J3. Set the transmitter to a power output of 5 Watts on 14MHz and send a carrier. With toggle S1 set to ON (LED alight) you should hear relay K1 click faintly. Un-key the transmitter and you should hear the relay click again. Adjust R5 so that the relay “hangs” for a little less than half a second when you stop transmitting. The adjustment is not critical and the aim is that the relay does not try to follow CW keying or small delays in speaking on SSB. The relay is not fast enough for full-break in operation.

If you want to use data modes, removing the jumper on J2 will make the relay switch in and out much quicker.

### Tip

If using datamodes, faster “on” switching can be achieved by soldering a resistor across J2. Try a value between 1 and 10k for a start. Note that I have not tried this but it makes sense from a technical perspective!

### Using the MilliWatter Extreme

See the instructions for use at [www.sotabeams.co.uk/downloads](http://www.sotabeams.co.uk/downloads)

### Fault finding

The most likely problem on this board is a poor solder joint, Inspect your soldering carefully. Check that Q1 is in the right way round (flat surface facing C5).

If you get stuck, send me an e-mail for help! [Richard@sotabeams.co.uk](mailto:Richard@sotabeams.co.uk)