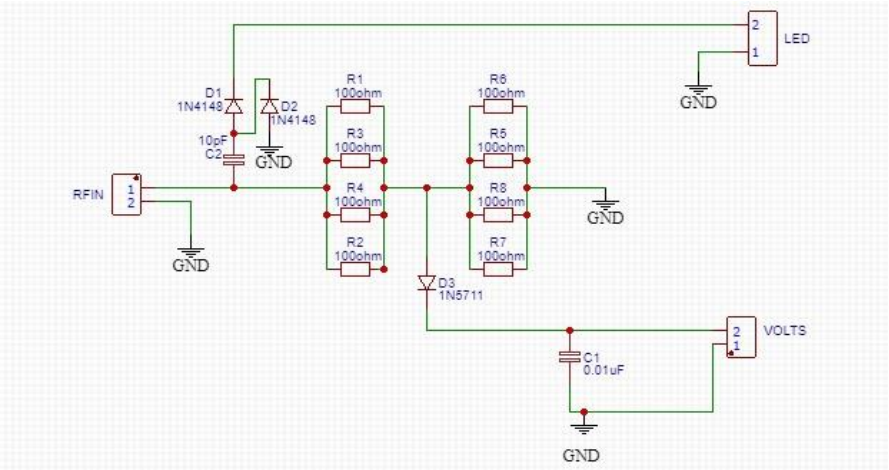
DL-2 HF Dummy Load and Power Checker

The DL-2 is a QRP+ dummy load with a RF detector circuit that allows a standard Voltmeter to be used to measure RF power out, ideal for anyone adjusting homebrew QRP Transmitters. It also as an LED indicator to show when RF is present. Power as low as 50mW (or even lower) will cause the LED to light. This type of device is not new, in fact the idea is many years old but unlike many designs the voltage tap off point is not directly taped across the 50 ohm load. In this design, the tap point is moved to a position that will protect your radio even if the voltage out terminals are short-circuited.

The DL-2 is built into a small case and makes a great bit of test equipment. It uses a bank of resistors to provide a good 50-Ohm match and each resistor is rated at 2 watts, this gives a working wattage of 16 watts max.

In practice it has been found that higher power levels can be tested if the transmission time is kept brief but do keep in mind the rating of the resistors.
The circuit for the DL-2 is here.



Parts List

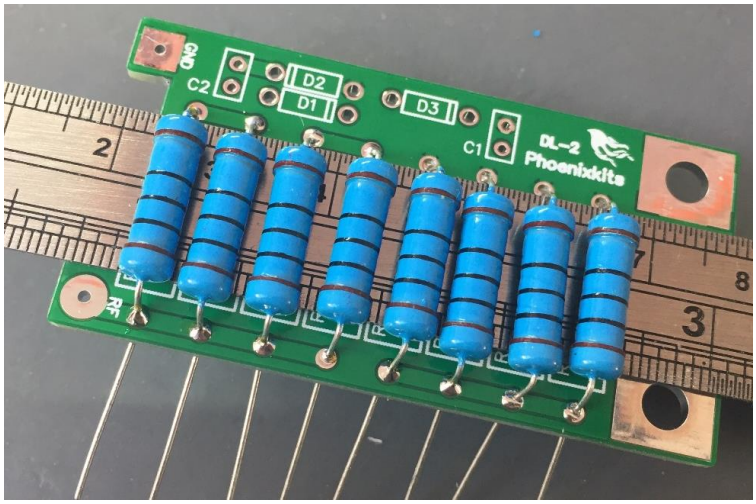
DL-2 PCB
R1 to R8 100 ohms 2watt Resistors
D1,D2 1N4148 Diodes
D3 1N5711 Low Volt drop Diode
C2 10pF Ceramic Disk
C1 10nF Ceramic Disk
1 x Red RF LED
BNC Connector
1 x Black 4mm Terminal Post
1 x Red 4mm Terminal Post
1x DL-2 Case

1 x DL-2 Front Plate
4 x stick on feet
4 x 3mm Self tapper Case screws

Please check you have all the parts before you start, any problems get back to me ASAP

Building the QRPLoad

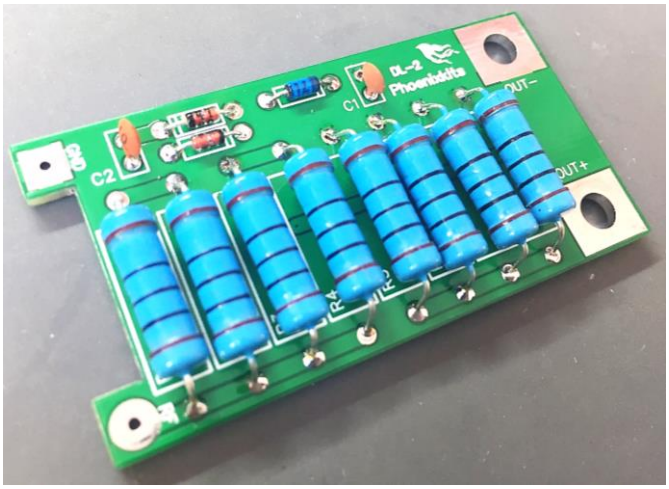
The build is easy but take care as always, wires are sharp and cuttings can fly into eyes, ideally wear eye protection when building ANY electronic circuits and do not breath in solder fumes.



First fit the 8 power resistors (R1 to R8) . When fitting these try to leave a small gap between the bottom of the resistor and the Circuit Board. This will help to keep the resistors cool. I insert a thin metal ruler under them before I solder in place so that I can keep a constant gap on all of them.

Next, we need to fit the diodes, Read the next section here BEFORE you fit any, make sure you put the right ones in the right places. There are three diodes in the kit, two IN4148's and one 1N5711. We will fit the two 1N4148's first. These are the two brown diodes and they are fitted in positions D1 and D2, they MUST be fitted the correct way.

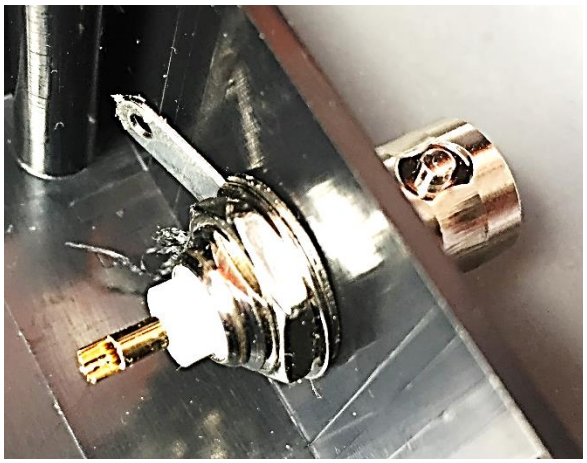
The diodes have a black band on one end. The black end of the first diode D1 must point towards the capcitor C1. The black band on D2 must be near to C2.



The diode D3 is blue, again it as a black band on one end. If you look at the silkscreen printing on the PCB (for all the diodes) you will see a line on the layout symbol. This is the end the black band needs to be.

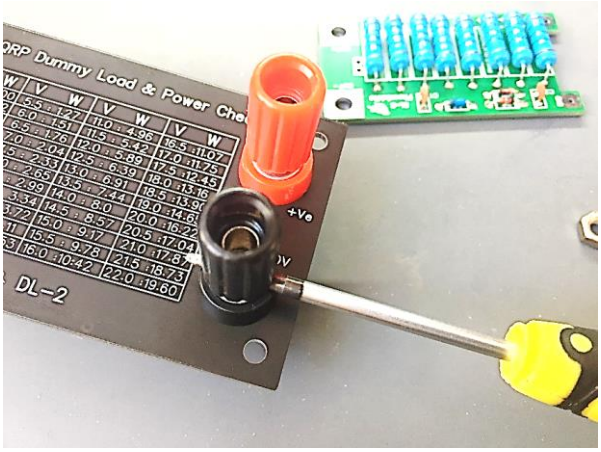
Next fit the two ceramic disk capacitors, the fist C1 is 10nF (Marked 103). C2 is next and this the 10pF disk (marked 10). This capcitor is physically a little larger than the other.

Do NOT fit the red LED yet.



Now fit the BNC socket to the case, You may find it better if you can solder two 50mm wires to the socket (one to the centre pin , one to the tag) before you assembly it onto the case. Take care with this stage and don't hurt your fingers when tightening the BNC. Ideally use a BNC wrench to hold the BNC and stop it from turning while you tighten the rear nut, don't forget to fit the earth tag.

Find the front plate and fit the two 4mm posts. The Red is the +V and black the 0V.

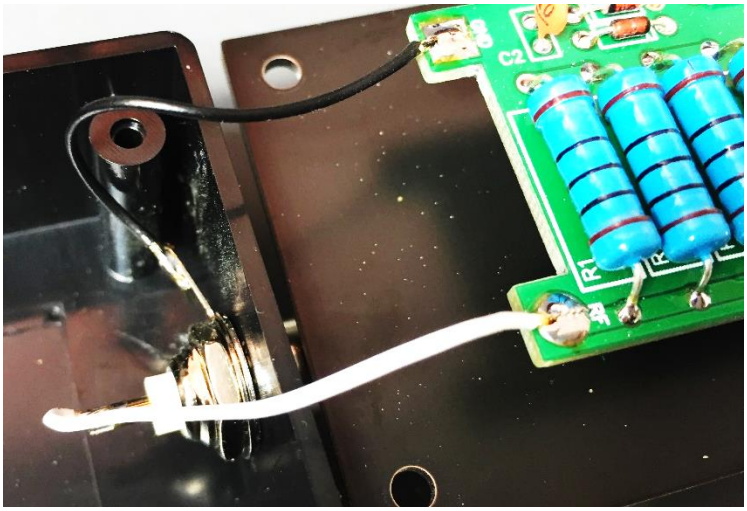


These sockets can be difficult to fit. I first only tighten them finger tight, make sure that the posts sit in the hole correctly and are sitting straight. The top section of the posts will locate flush when correctly positioned. Once fitted like this I unscrew the top section of the posts to expose the small hole in the steel shaft. I put a thin (a watch makers screw driver or the like) in the shaft through the hole and use that to stop the post turning as I nip the bottom nut to make them secure. It is important to double check that the posts are installed truly vertical or the PCB will not fit.

Now place the LED though the PCB board but do NOT solder it yet. Note the LED is fitted on the other side of the board than the resistors. Make sure the LED is fitted the correct way. The long lead goes into the round hole (Marked +). Carefully lower the front panel into the PCB, the ends of the terminal posts should pass through the board. Use the remaining nuts to secure the PCB to the posts. Now push the led up and through the front plate. Solder the led in place.

Drop the front panel assembly onto the case. If all is correct it should fit without any problem.

Remove the panel/front plate and solder short lengths of wire from the BNC to the board, these should be soldered to the BNC centre pin and earth tag. The other side should be soldered to the RF input and GND on the PCB, keep these wires as short as you can.



Place a test meter across the BNC input on the left hand edge of the board, the RF input. You should measure 50 ohm (plus or minus 1 ohm).

If that looks right we can screw the front panel to the case with the four black screws provided.

Now it's ready for use.

Connect your RF source to the load and transmit (Start with 5 watts or less) the Red RF indicator led will light (acts as a quick all working indicator). If your radio has a SWR indicator check its reading, it should be very low and safe for your radio.

Put a voltmeter on the DC terminals and measure the voltage.

Use the printed chart on the DL-2 to check the power levels.

Here is the DL-2 connected to my FT-817 @ 5Watts setting

Below I have also given a chart to convert the Voltage to Power, you can also use this voltage in a formula to be more accurate. For most people and applications, the charts will be fine

In case you like maths, heres the formula.

Now

Power=((V+Dv)^2/25)

*Dv = voltage drop across the diode mine was 0.14v so I have used that)

For example, if we find we have **13.5** volts on the terminals

So Power = ((13.5+0.14)/25)

Power = 186/25 =7.44 Watts

Each diode may have a slight difference in voltage drop but this will make only a slight difference to the calculations

Here is the chart

Volts	0	0.25	0.5	0.75
0	0.00	0.01	0.02	0.03
1	0.05	0.08	0.11	0.14
2	0.18	0.23	0.28	0.33
3	0.44	0.46	0.53	0.61
4	0.69	0.77	0.86	0.96
5	1.06	1.16	1.27	1.39
6	1.51	1.63	1.76	1.90
7	2.04	2.18	2.33	2.49
8	2.65	2.82	2.99	3.16
9	3.34	3.53	3.72	3.91
10	4.11	4.32	4.53	4.74

Volts	0	0.25	0.5	0.75
10	4.11	4.32	4.53	4.74
11	4.96	5.19	5.42	5.65
12	5.89	6.14	6.39	6.65
13	6.91	7.17	7.44	7.72
14	8.00	8.28	8.57	8.87
15	9.17	9.47	9.78	10.10
16	10.42	10.74	11.07	11.41
17	11.75	12.09	12.45	12.80
18	13.16	13.53	13.90	14.27
19	14.65	15.04	15.43	15.82
20	16.22	16.63	17.04	17.45

Print these out and keep them.

I Hope you find the DL-2 useful and enjoyed building (and Using) it.

73 Paul M0BMN