

VK5ZFZ Directional coupler assembly instructions

The directional coupler kit is a good first project for a radio amateur. It includes aspects of practical equipment assembly with the end result of a useful piece of test gear for the Ham shack. The directional coupler kit is a VHF-UHF unit and covers the spectrum from 50mhz to 500 mhz. By cutting the sample trace half way and using a microwave diode the line has been found to work into microwave frequencies as high as 2.5ghz and beyond.

The coupler presents performance that is equal or above many commercial units on the market., and can be easily assembled in less than 2 hours at a relaxed pace.

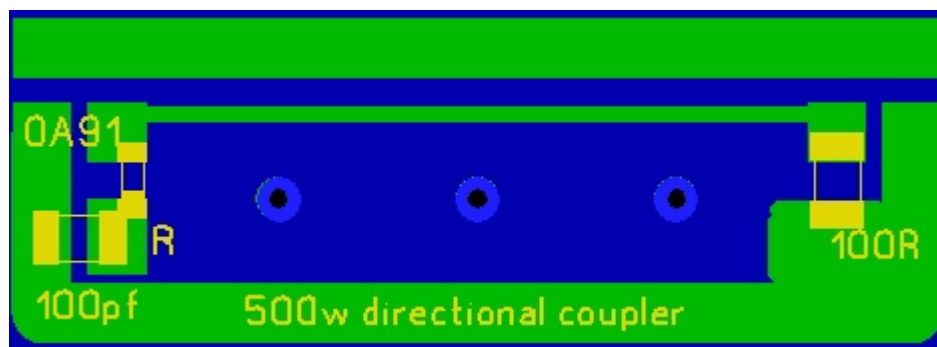
Assembly

Step one is to assemble the double sided PTH printed circuit board, before taking any parts from the kit of parts **be very careful as there is a surface mount 100pf capacitor included that is very small and easily lost.**

As there are a number of different size capacitors that are catered for by this PCB the first step is to use the flat edge of a screwdriver or a Stanley knife and scrape away a small part of the PCB silk screen overlay for the capacitor marked in white as highlighted in the following photo.



Locate the 100pf surface mount capacitor from the kit, tin the PCB in the area scraped, and with a pair of tweezers hold one end of the capacitor and reflow solder the other end to the tinned area of the PCB. The other end may now be soldered in place next to the letter R on the PCB.

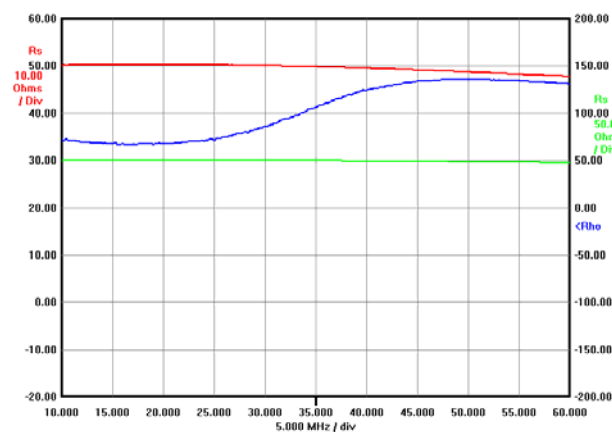


Step two is to solder the 100R resistor in place as marked on the board overlay. Next the diode (a 1n4148 I supplied) for high power use up to 500 watts forward if more sensitivity is needed an OA91 may be substituted.

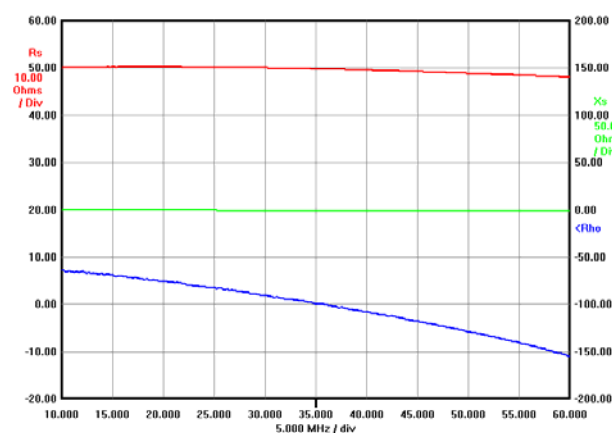
Supplied is a small PCB solder lug that may be mounted at the junction of the diode and the 100pf capacitor. This concludes the PCB assembly. Your board should now look like the following photo



Next bolt the pcb into the bottom of the diecast box using the nut and bolt provided, you may need to enlarge the mounting hole in the PCB, but the other two vias will connect both sides of the board together electrically. It is important that the PCB be mounted directly on the bottom of the diecast box, as it forms a groundplane. If you intend not to use the directional coupler board in the supplied box, but as a standalone board then you will need to earth the bottom side of the board to either connecting coax or the connectors direct. Failing to do this will effect the return loss of the coupler. Shown below are the test results of using the board with and without a proper groundplane. A return loss of better the 50db can be achieved by this method.



Without the use of a proper groundplane



With the use of a proper groundplane

The next step is to mount the PL249 (UHF) connectors on each end of the die cast box using the pop rivets supplied, and the F connector as the detector output as shown below.



Connector installation using pop rivets

Solder the PL259 sockets to the through stripline at each end of the PCB using the TCW (tinned copper wire) supplied. The F connector lead may be bent and soldered directly to the PCB solder lug on the board.



Solder the PL259 in place



Solder the F connector to the PCB lug



Finished Directional coupler wiring.



Finished Directional coupler

Last check before putting any RF into the coupler is to check continuity between the centre conductors of the PL259's with an ohm meter to ensure a low resistance path, and from the centre connector of the PL259 to ground to make sure you read infinity (high resistance with no shorts). If all tests are OK then the cover can be screwed on and the coupler tested using a multimeter to measure the loop output voltage in for ward and reverse.

Return loss and voltage to VSWR chart

Return loss (db)	VSWR	Voltage Reflection Coefficient
1	17.391	0.891
2	8.724	0.794
3	5.848	0.708
4	4.419	0.631
5	3.570	0.562
6	3.010	0.501
7	2.615	0.447
8	2.323	0.398
9	2.100	0.355
10	1.925	0.316
11	1.785	0.282
12	1.671	0.251
13	1.577	0.224
14	1.499	0.200
15	1.433	0.178
16	1.377	0.158
17	1.329	0.141
18	1.288	0.126
19	1.253	0.112
20	1.222	0.100
21	1.196	0.089
22	1.173	0.079
23	1.152	0.071
24	1.135	0.063
25	1.119	0.056
26	1.105	0.050
27	1.094	0.045
28	1.083	0.040
29	1.074	0.035
30	1.065	0.032