Oakley Sound Systems

5U Oakley Modular Series

Multimix

PCB Issue 6

Builder's Guide

V6.2

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Introduction

This is the Project Builder's Guide for the issue 6 Multimix 5U module from Oakley Sound.

This document contains a basic introduction to the board, a full parts list for the components needed to populate the board, interconnections and some basic testing methods.

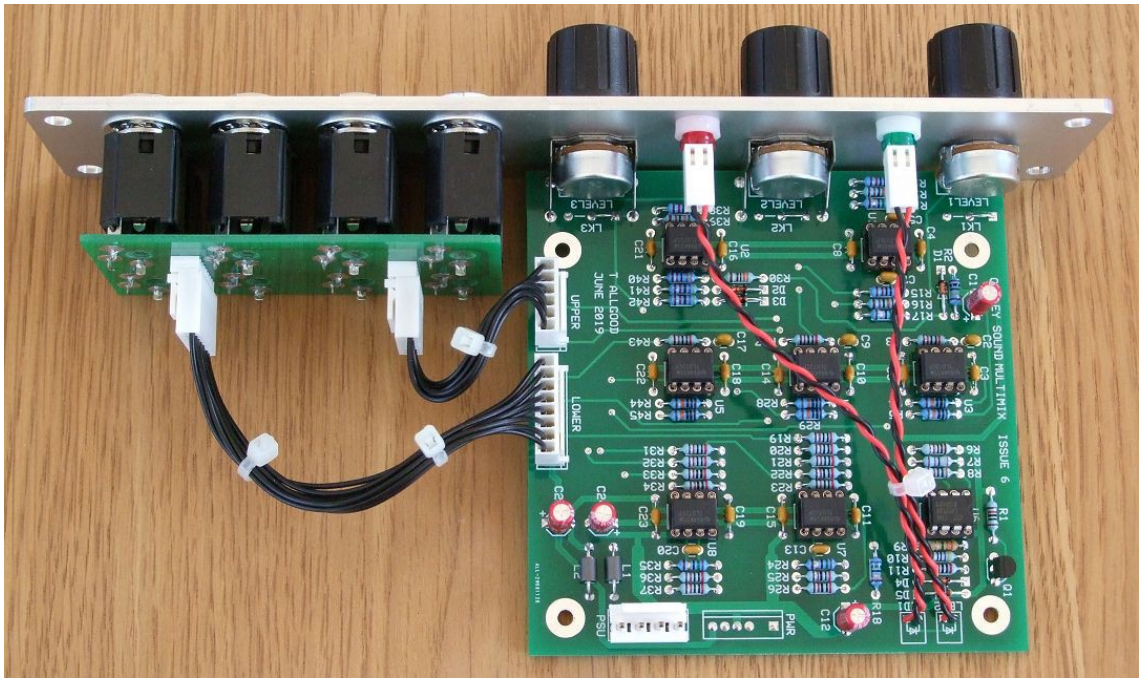
The project webpage can be found at:

http://www.oakleysound.com/multimix.htm

For general information regarding where to get parts and suggested part numbers please see our useful Parts Guide at the project webpage or http://www.oakleysound.com/parts.pdf.

For general information on how to build our modules, including circuit board population, mounting front panel components and making up board interconnects please see our generic Construction Guide at the project webpage or http://www.oakleysound.com/construct.pdf.

The issue 6 Multimix PCB



The Multimix 6 in a natural finish Schaeffer panel. Note the use of the optional Sock8 board that holds and connects the eight 1/4" sockets to the main board.

The main PCB is 104 mm (depth) x 104 mm (height) in size. The main board is a two layer design which means it has copper tracks on both the upper and lower surfaces. The main board has been laid out to accept connection to our Sock8 socket board. This small board speeds up the wiring of the eight sockets and reduces the chances of mistakes.

If you are building the standard design, with the exception of the two LEDs, there are no components mounted off the boards. All components including sockets and pots are soldered directly to the boards. All the socket wiring can be done via the socket PCB and two MTA100 or Molex KK100 solderless connections. This system will reduce assembly time and possible wiring errors.

Some people will wish to use this Oakley design in a non standard format, such as fitting it to another manufacturer's rack or one of their own invention. This is perfectly easy to do. Simply do not use the socket board and wire the main board to the sockets as per usual.

I have provided space for the three main control pots on the PCB. If you use the specified 16mm Alpha pots and matching brackets, the PCB can be held firmly to the panel without any additional mounting procedures. The pot spacing is 1.625" and is the same as the vertical spacing on the MOTM modular synthesiser and many of my other modules.

Parts List

For general information regarding where to get parts and suggested part numbers please see our useful Parts Guide at the project webpage or http://www.oakleysound.com/parts.pdf.

The components are grouped into values, the order of the component names is of no particular consequence.

A quick note on European part descriptions. R is shorthand for ohm. K is shorthand for kilo-ohm. R is shorthand for ohm. So 22R is 22 ohm, 1K5 is 1,500 ohms or 1.5 kilohms. For capacitors: 1uF = one microfarad = 1000nF = one thousand nanofarad.

To prevent loss of the small '.' as the decimal point, a convention of inserting the unit in its place is used. eg. 4R7 is a 4.7 ohm, 4K7 is a 4700 ohm resistor, 6n8 is a 6.8 nF capacitor.

Resistors

To save confusion with different colour codes I recommend all resistors be 0.25W or 0.4W 1% metal film types.

75R	R14, R17, R18, R24, R35
120R	R1
470R	R10
3K	R8
3K3	R30
3K9	R7
10K	R12, R15, R38
11K	R6
13K	R13, R16, R39
20K	R33, R19, R27, R43, R32, R37, R31, R20, R36, R23, R11, R34, R21, R25, R22, R26, R3
33K	R40
47K	R41, R42
100K	R4, R5, R29, R28, R44, R45
1M	R2
3M3	R9

Capacitors

100nF axial	C3, C4, C6, C8, C10, C11, C14, C15, C16, C18, C19, C21, C22, C23
33pF 2.5mm C0G	C5, C7, C13, C20
100pF 2.5mm C0G	C2, C9, C17
1uF, 63V electrolytic	C1
2u2, 63V electrolytic	C24, C25
22uF, 35V electrolytic	C12

Discrete Semiconductors

1N4148	D1, D2, D3, D4, D5
BC559 PNP transistor	Q1
Red LED 5mm	LED1 – mounted off board
Green LED 5mm	LED2 – mounted off board

Integrated Circuits

TL072ACP dual FET op-amp	U1, U2, U3, U4, U5, U7, U8
LM2903 dual comparator	U6

IC sockets are recommended. You need eight 8-pin DIL sockets.

Potentiometers

47K linear Alpha 16mm	LEVEL1, LEVEL2, LEVEL3

Two Alpha pot brackets are also required. The LEVEL1 pot has no bracket.

Miscellaneous

Leaded Ferrite beads	L1, L2
Knobs to fit 6mm shafts	Three off
Molex or MTA 4 way header	PSU – Oakley/MOTM power supply
MTA100 6-way header	PWR – Synthesizers.com power supply
Molex/MTA 0.1” header 6-way	UPPER – for connecting to sockets
Molex/MTA 0.1” header 8-way	LOWER – for connecting to sockets
Molex/MTA 0.1” housing 6-way	UPPER – for connecting to sockets
Molex/MTA 0.1” housing 8-way	LOWER – for connecting to sockets
Molex/MTA 0.1” housing 2-way	LED1, LED2
1/4” sockets	Eight off mounted either on the Sock8 board or on panel

Hook up wire (26awg).

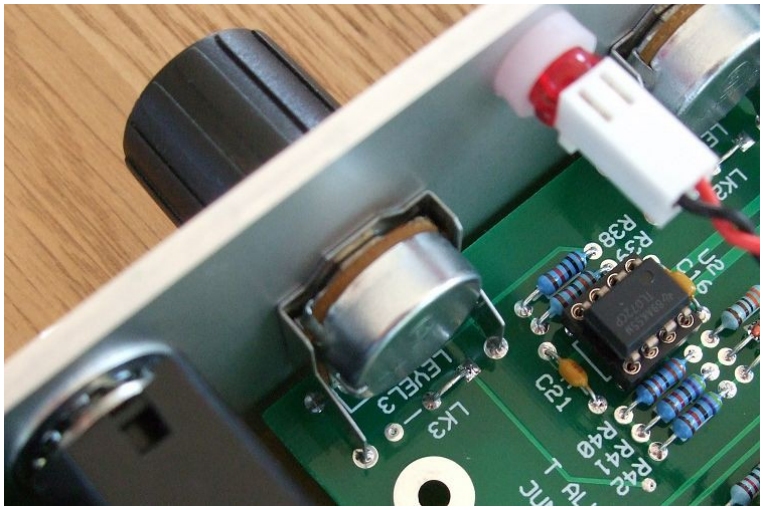
Wire Links

You will also need three 2cm long pieces of solid core wire to make the three links on the board. The actual position of these links determines how the three level controls work, either as a simple level control or as a reversible attenuator. The links can be made from component leg clippings or uninsulated tinned copper wire. Simply solder a small hoop of the wire joining the relevant pads of

each link. For each of the ‘three pad links’, LK1, LK2 & LK3, pad 1 is the square pad at one end, pad 3 is middle pad, and pad 2 is the round pad on the end.

If the Multimix is to be built with three reversible attenuators (the 'Stooge' variant) then each of the three links need to have pads 1 and 3 linked. That is, the middle pad to the square pad.

If the Multimix is to be built with three standard level controls (the 'Sum' variant) then each of the three links need to have pads 2 and 3 linked. That is, the middle pad to the end round pad.



The link LK2 configured in 'Stooge' mode with pads 1 and 3 linked together.

Additional components required if using optional Sock8 board

Molex/MTA 0.1” header 6-way	UPR
Molex/MTA 0.1” header 8-way	LWR
Molex/MTA 0.1” housing 6-way	UPR
Molex/MTA 0.1” housing 8-way	LWR

112APCX Switchcraft 1/4” socket SK1, SK2, SK3, SK4, SK5, SK6, SK7, SK8

If using Molex KK you'll also need at least 28 crimp terminals.

Suitable lengths of wire to make up the two interconnects and three cable ties.

Wire Link

You also need to fit a wire link into the location on the Sock8 PCB marked as L1. This ensures that the NC lug on the IN4 socket is grounded.

Connections

MOTM and Oakley

The PSU power socket is 0.156” Molex/MTA 4-way header. Friction lock types are recommended. This system is compatible with MOTM systems.

Power	*Pin number*
+15V	1
Module ground (0V)	2
Socket ground	3
-15V	4

Pin 3 on the LWR header is connected to pin 3 of the PSU header and has been provided to allow the ground tags of the jack sockets to be connected to the power supply ground without using the module’s 0V supply. Earth loops cannot occur through patch leads this way, although screening is maintained.

MU and Synthesizers.com

The PWR power socket is to be fitted if you are using the module with a Synthesizers.com system. In this case you should not fit the PSU header. The PWR header is a six way 0.1” MTA, but the pin in location 2 is removed. In this way location 3 is actually pin 2 on my schematic, location 4 is actually pin 5 and so on.

Power	*Location number*	*Schematic Pin number*
+15V	1	1
Missing Pin	2	
+5V	3	2
Module ground (0V)	4	3
-15V	5	4
Socket Ground *	6	5

+5V is not used on this module, so location 3 (pin 2) is not actually connected to anything on the PCB.

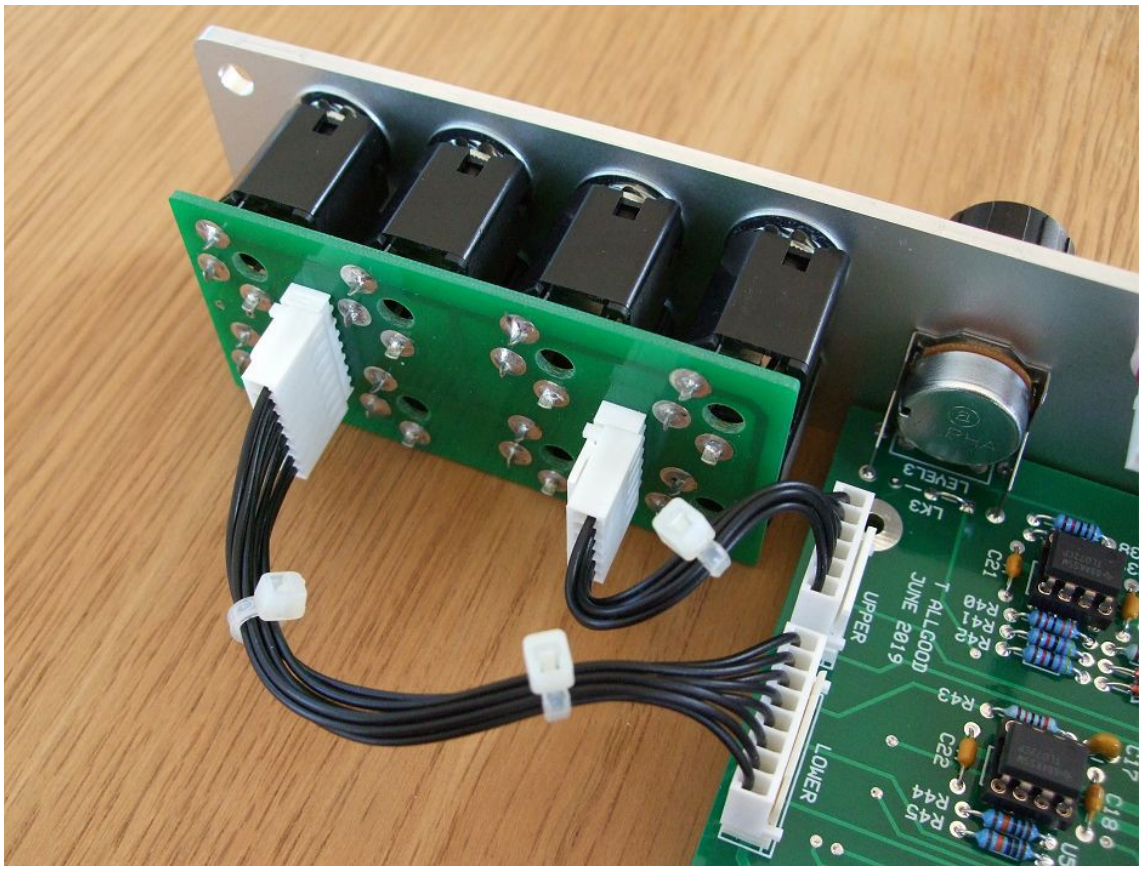
If fitting the PWR header and using it with a standard MU power distribution system, you will also need to connect together the middle two pads of the PSU header on the main board. This link connects the socket and panel ground with the module ground. Simply solder a solid wire hoop made from a resistor lead clipping, or bit of solid core wire, to join to the two middle pads of PSU.

* The issue 6 Multimix boards connect the normally unused pin 6 of the MU connector to socket ground. With the link on PSU not fitted, and using an Oakley MU Dizzy distribution board with a five way power cable, will allow the socket ground to be kept separate from module ground to prevent ground loops.

Building the Multimix 6 module using the Sock8 board

This is the simplest way of connecting all the sockets to the main board. The Sock8 board should be populated in the way described in our construction guide found on the project webpage. There are only two headers, UPR (for upper) which is six way, and LWR (for lower) which is eight way. Both headers are fitted to the bottom side of the board.

You need to make up two interconnects. The six way one should be made so that it is 80mm long. The eight way should be made to be 130mm.



The Multimix module showing the detail of the board to board interconnects. Here I have used the Molex KK 0.1" system to connect the Sock8 to the main PCB.

Building the Multimix 6 module by wiring the sockets manually

If you have bought Switchcraft 112A sockets you will see that they have three connections. One is the earth or ground tag. One is the signal tag which will be connected to the tip of the jack plug when it is inserted. The third tag is the normalised tag, or NC (normally closed) tag. The NC tag is internally connected to the signal tag when a jack is not connected. This connection is automatically broken when you insert a jack.

Once fitted to the front panel the ground tags of each socket can be all connected together with solid wire. I use 0.91mm diameter tinned copper wire for this job. It is nice and stiff, so retains its shape. A single piece of insulated wire can then be used to connect those connected earth tags to pin 1 of LWR. Pin 1 is the square solder pad.

All the other connections are shown in the tables below:

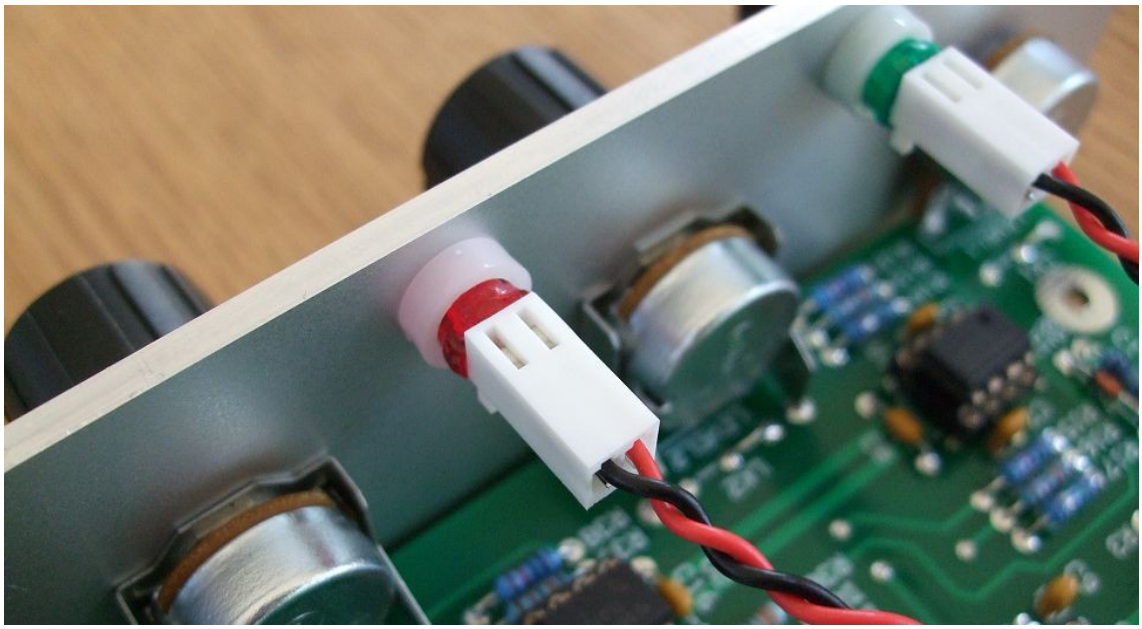
UPPER

Pin	*Pad name*	*Socket Connection*	*Lug Type*
Pin 1	OUT2	Connect to OUT2	Signal lug
Pin 2	NC2	Connect to OUT2	NC lug
Pin 3	NC1	Connect to OUT1	NC lug
Pin 4	OUT1	Connect to OUT1	Signal lug
Pin 5	module ground	Connect to IN1 & IN2	NC lugs
Pin 6	IN1	Connect to IN1	Signal lug

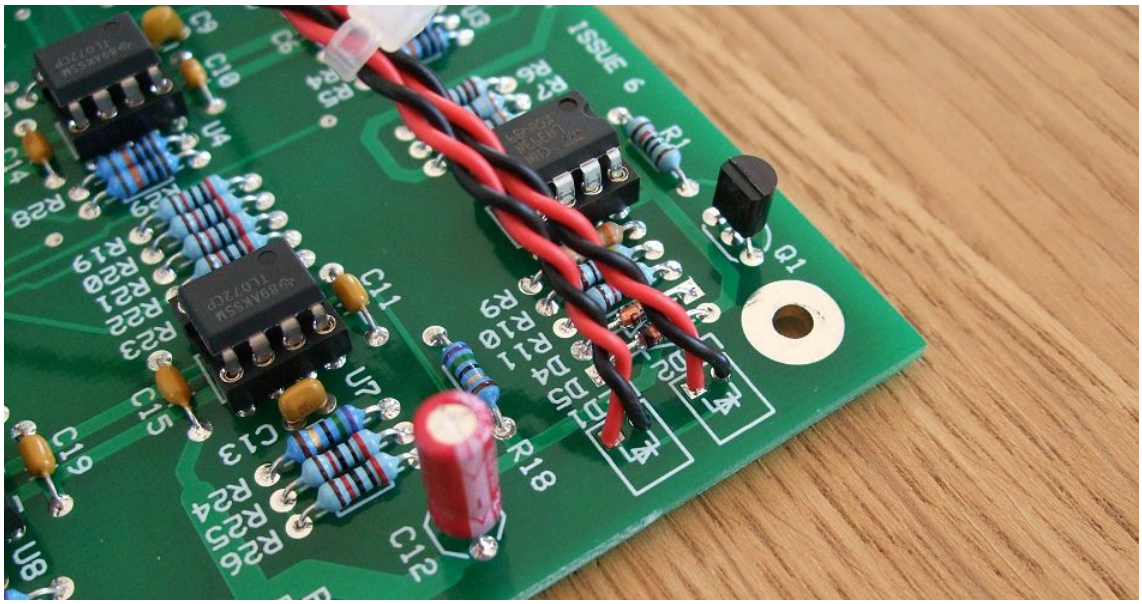
LOWER

Pin	*Pad name*	*Socket Connection*	*Lug Type*
Pin 1	Panel ground	Connects to all sockets	Ground lugs via wire frame
Pin 2	MIX+	Connect to MIX OUT	Signal lug
Pin 3	IN4	Connect to IN4	Signal lug
Pin 4	OUT3/MIX	Connect to OUT3/MIX	Signal lug
Pin 5	module ground	Connect to IN3	NC lug
Pin 6	IN2	Connect to IN2	Signal lug
Pin 7	module ground	Connect to IN4	NC lug
Pin 8	IN3	Connect to IN3	Signal lug

Light Emitting Diodes



The peak LED fitted to the panel with a translucent red cliplite. A two way Molex KK housing is used to make the connection to the LED device. This allows the LED to be removed easily.



Both LEDs are wired to the board via flying wires. I twist the wires and cable tie them together to keep them neat. The cathode of the LED, in this case via black wire, is connected to the round pad on the board.

Testing, testing, 1, 2, 3...

Apply power to the unit making sure you are applying the power correctly. Check that no device is running hot. Any sign of smoke or strange smells turn off the power immediately and recheck the polarity of the power supply, and the direction of the ICs in their sockets.

Assuming everything is OK so far, it is time to apply an audio input. Use a bright signal like a sawtooth output from a VCO. Middle A, 440Hz is a good note to use.

Connect up an amplifier or mixing desk input to the OUT3/MIX socket. Now connect your signal to the first input. You should be control the level with the top pot. If you have built the Stooge version, you should be able to silence the input by moving the pot to its middle position. If you have built the Sum version, the pot should act as an ordinary volume control.

Input channels two and three should perform identically

Now listen to the output coming from MIX OUT. This should behave much like the OUT3/MIX socket, but it should also be able to pass any signal connected to IN4. Connect your VCO to IN4 and check you can hear the VCO's output through MIX OUT. None of the level pots should have an affect on the level of the signal coming into IN4.

If you are using a modular VCO as a source for your input signal, check that the green LED turns on when the input level is turned to its maximum. The LEDs track the output signal coming from the MIX OUT socket. The green LED will turn on when the signal level reaches over +/-5V which should be obtained when the input level is fully clockwise (and also fully anti-clockwise in the case of the Stooge variant). You should note that the actual trigger value does depend a little on input wave shape and frequency. The red LED only turns on when the output level exceeds +/-11V. To test this function on your modular the easiest thing to do is use two VCOs, each one going to a separate input on the Multimix. With two sawtooth input signals, and both their level controls set to maximum, the peak LED should light in time with the audible beating of the two VCOs. If your LEDs fail to light make sure you haven't reversed the connections to the LEDs.

Another way to check the LED's operation is to use a voltage source. The Oakley midiDAC is an excellent source of voltage that can be used to test the Multimix. Simply connect the modulation wheel output to IN1 and turn its level pot fully up. Then as you rotate the mod wheel on your controller the midiDAC will put out an increasing positive voltage. At just under half way it will put out around 5V and the green LED should light. Fully up the midiDAC will be producing 10.6V and this should be easily enough to tickle the RED LED to light.

You should now check the output from OUT1 and OUT2. OUT1 should be a pot controlled version of IN1, and OUT2 should be a pot controlled version of IN2. Inserting a jack plug into either OUT1 or OUT2 will cut the respective input from the OUT3/MIX socket, but not from the MIX OUT socket. The MIX OUT socket will always sum IN1, IN2, IN3 and IN4 together regardless of any jack plugs inserted into OUT 1, OUT2 or OUT3/MIX.

Final Comments

If you have any problems with the module, an excellent source of support is the Oakley Sound Forum at Muffwiggler.com. I am on this group, as well as many other users and builders of Oakley modules.

If you are in the UK and can't get your project to work, then Oakley Sound Systems are able to offer a 'get you working' service. If you wish to take up this service please e-mail me, Tony Allgood, at my contact e-mail address found on the website. I can service either fully populated PCBs or whole modules. You will be charged for all postage costs, any parts used and my time at 25GBP per hour. Most faults can be found and fixed within one hour, and I normally return modules within a week. The minimum charge is 25GBP plus return postage costs.

If you have a comment about this builder's guide, or have a found a mistake in it, then please do let me know. But please do not contact me directly with questions about sourcing components or general fault finding. Honestly, I would love to help but I do not have the time to help everyone individually by e-mail.

Last but not least, can I say a big thank you to all of you who helped and inspired me. Thanks especially to all those nice people on the Synth-diy and Analogue Heaven mailing lists and those at Muffwiggler.com.

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