Oakley Sound Systems

5U Oakley Modular Series

Journeyman
Diode Ring Filter

Journeyman PCB Issue 2 & 2.1

Builder's Guide

V2.6

Tony Allgood
Oakley Sound Systems
CARLISLE
United Kingdom

Introduction

This is the Project Builder's Guide for the issue 2 and 2.1 Journeyman Diode Ring Voltage Controlled Filter 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 boards, and a list of the various interconnections.

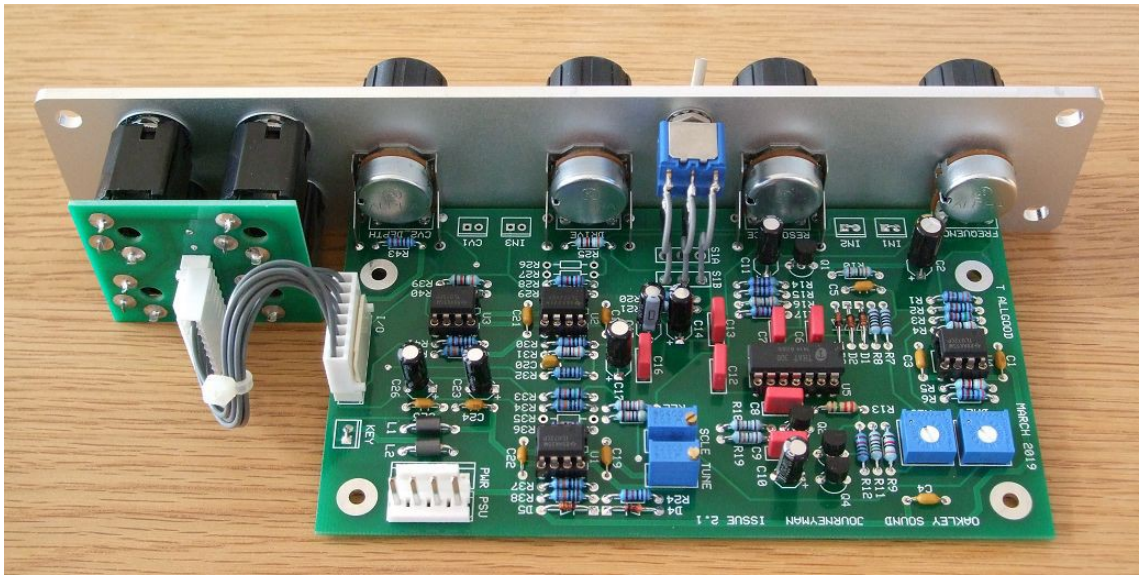
For the User Manual, which contains an overview of the operation of the unit and the calibration procedure, please visit the main project webpage at:

http://www.oakleysound.com/journey.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 Journeyman PCB



This is the issue 2.1 Oakley Journeyman VCF module behind a natural finish 1U wide Schaeffer panel. Note the use of the optional Sock4 socket board to facilitate the wiring up of the four sockets.

The issue 2.1 main PCB is 79 mm (deep) x 143 mm (high). The board is a two layer design which means it has copper tracks on both the upper and lower surfaces.

If you are building the standard 1U wide 'filter core' design 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 optional Sock4 PCB and one MTA100 or Molex KK100 solderless connection. 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 four 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.

Issue 2 and 2.1 Journeyman 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

1% 0.25W metal film types are to be recommended simply because they are better quality components. However, 5% ones can be used in all places if you wish. R13 will probably be a 5% type since getting hold of a 1% metal film resistor in this value is not normally trivial.

Components marked with a * are to be fitted only if you are building the 2U 'full' version. If you are building the 'filter core' module you do not need to fit these parts.

33R	R10, R16
100R	R8, R7
150R	R21
330R	R20
1K	R32
1K5	R11
4K7	R15, R14
10K	R30, R17, R43, R12, R24, R2, R41
15K	R3
22K	R28
33K	R1
36K	R6
39K	R39, R5, R25, R9, R40
100K	R37, R29, R42, R34, R38, R26*, R27*
150K	R33, R35*
180K	R18, R19
220K	R36
330K	R22, R31
390K	R4
470K	R23
2M2	R13

Links

These are made from either left over bits of wire from the snipped legs of resistors or small lengths of thin solid core wire.

For the 1U Filter Core module only link out each of the two way headers, KEY, IN1 and IN2. That is, join together the two pads of each of the two way headers. Do not link out IN3 and CV1.

Capacitors

100nF axial ceramic	C3, C21, C1, C5, C22, C4, C25, C19, C18, C24
10pF C0G 2.5mm ceramic	C20
22nF polyester film	C6, C7, C8, C9, C12, C13, C16
2u2, 63V electrolytic	C23, C26
10uF, 35V electrolytic	C10, C11, C17
22uF, 35V electrolytic	C14, C15
220uF, 25V electrolytic	C2

Discrete Semiconductors

BC549C NPN transistor	Q1, Q2, Q3, Q4
1N4148 signal diode	D1, D2, D3, D5
6V2 400mW zener diode	D4

Integrated Circuits

TL072CN dual FET op-amp	U1, U3, U4
OP275GP dual audio op-amp	U2
THAT300 quad NPN array	U5

U2 can also be a TL072 or any other good quality audio op-amp. It is debatable whether using anything better than a TL072 will result in any noticeable sonic improvement.

IC sockets are to be recommended. The Journeyman uses four 8-pin DIL and one 14-pin DIL socket.

Trimmers (preset) resistors

20K cermet multiturn (eg. Bourns 3296W)	SCLE
100K cermet multiturn (eg. Bourns 3296W)	TUNE
10K 6mm single turn (eg. Bourns 3386F)	BAL, RES

Potentiometers (Pots)

All pots Alpha 16mm PCB mounted types

47K or 50K linear	FREQUENCY, DRIVE, CV2_DEPTH
10K linear	RESONANCE

Three 16mm pot brackets.

Switch

A 'double pole double throw' DPDT toggle switch is required for the LPF/HPF mode selection.

Miscellaneous

Leaded axial ferrite beads	F1, F2	
MTA156 4 way header	PSU	– Oakley/MOTM power supply
MTA100 6-way header	PWR	– Synthesizers.com power supply
Molex/MTA 0.1” header 8-way	I/O	– for connecting to sockets
Molex/MTA 0.1” housing 8-way	I/O	– for connecting to sockets

Other Parts Required

Switchcraft 112APC 1/4” sockets	Four off mounted either on the Sock4 board or on panel

Four knobs

Two cable ties.

Around 2m of insulated multistrand hook up wire for the switch and socket connections.

Offboard Pots (2U format only)

47K or 50K Log	INPUT1, INPUT2, INPUT3
47K or 50K Linear	CV1 DEPTH

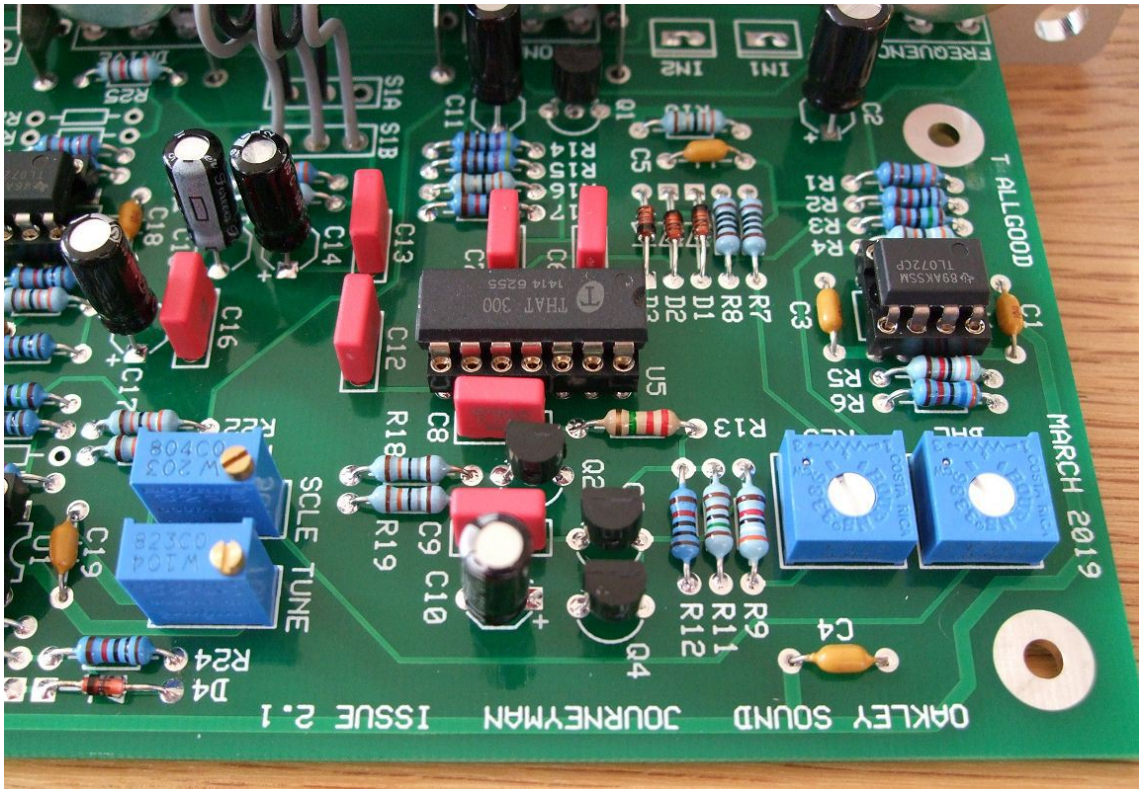
Components required if using optional Sock4 board

Molex/MTA 0.1” header 8-way	I/O
Molex/MTA 0.1” housing 8-way	I/O
112APC Switchcraft 1/4” socket	SK1, SK2, SK3, SK4

A single wire link is to be fitted to L1 on the Sock4 PCB. L2 is left open.

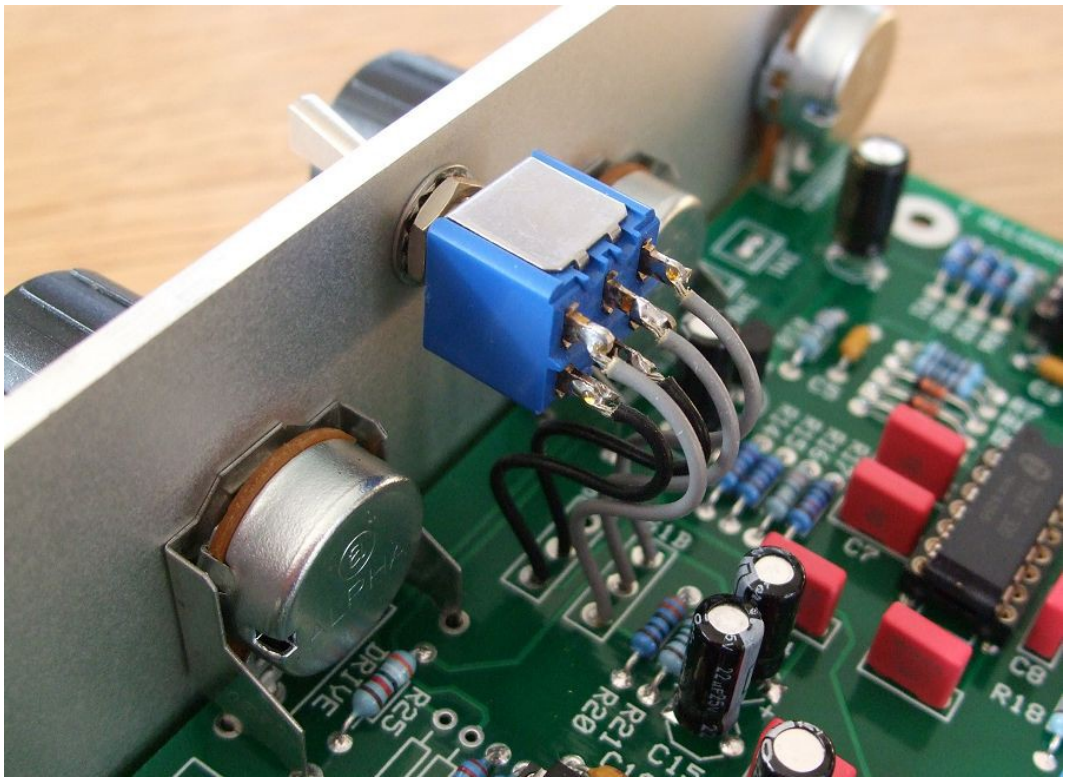
If using Molex KK you'll also need at least 16 crimp terminals.

Suitable lengths of wire to make up the single 100mm interconnect and two cable ties.



IC sockets are to be recommended because it allows the ICs to be simply swapped out in the event of a failure.

Wiring the Switch



The LPF/HPF mode switch.

Mount the switch to the panel before you attempt to solder the five wires required to connect it to the board. Note I said five wires even though there are six tangs on the switch and six pads on the board. There is no need to connect the top pad of S1A to the bottom right tang on the switch as it is not used in the Journeyman.

The pads labelled S1A go to the bottom row of tangs on the switch. These are the two black wire slightly hidden from view in the photograph above. Each tang simply connects to the pad directly below it – the middle tang going to the middle pad, the left tang going to the lower pad.

S1B is wired similarly but this time you have three wires. Each tang is wired to the pad directly below it as you can see from the three grey wires in the above photograph.

Connections

Power 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 1 on the I/O 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.

Power connections – 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 with the pin that is in location 2 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.

* Issue 2.1 Journeyman main boards now connect the unused pin 6 of the MU connector to socket ground. With the link on PSU not fitted, and using an Oakley MU Dizzy distribution

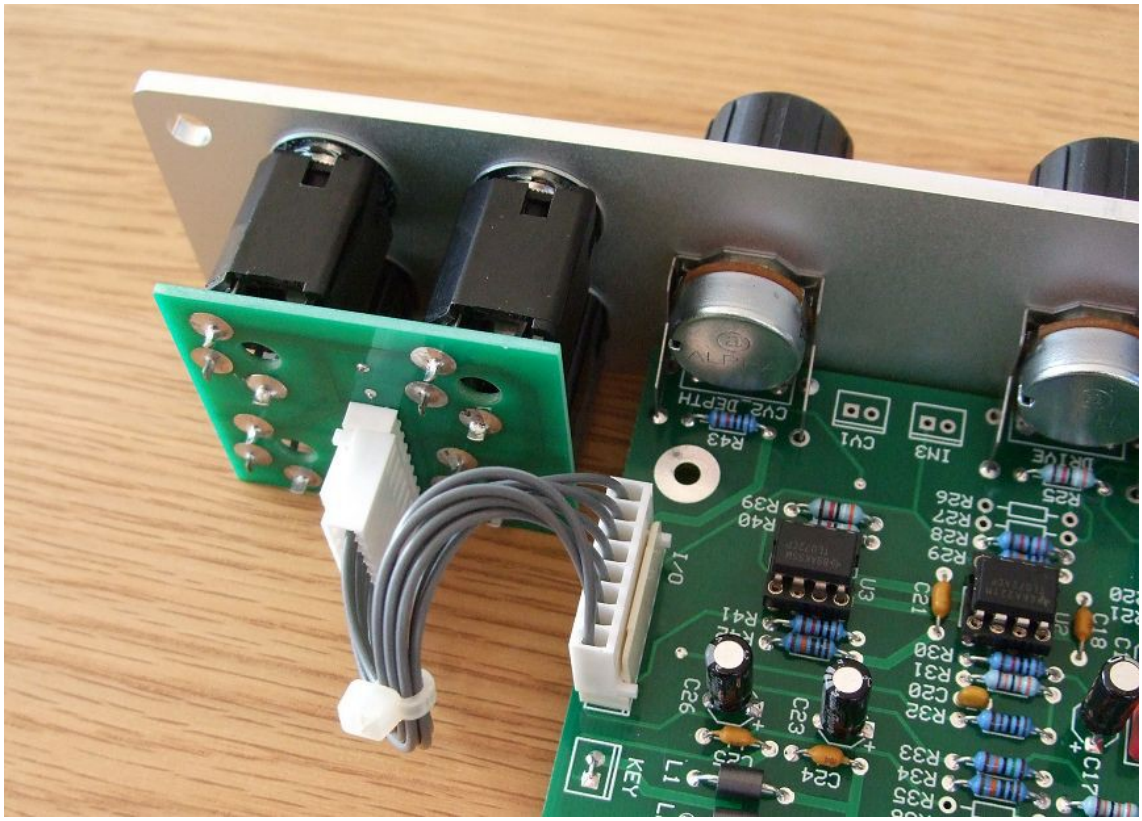
board with a five way power cable, will allow the socket ground to be kept separate from module ground to prevent ground loops.

Building the Filter Core 1U wide module using the Sock4 board

This is the simplest way of connecting all the sockets to the main board. The Sock4 board should be populated in the way described in our construction guide found on the project webpage. There is only one eight way header and it is to be fitted to the bottom side of the board.

Do not forget to solder in the wire link L1. Link L2 must be left open.

You need to make up only one eight way interconnect. It should be made so that it is 100mm long.



The Journeyman filter core module showing the detail of the board to board interconnect. Here I have used the Molex KK 0.1" system to connect the Sock4 to the main PCB.

Hand wiring the sockets

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 I/O. Pin 1 is the square solder pad.

All the other connections are connected to the signal or NC lugs of the sockets. The tables below show the connections you need to make:

Pin	*Pad name*	*Socket Connection*	*Lug Type*
Pin 1	PANEL_GND	Connect to all sockets	Earth lugs
Pin 2	CV2	Connect to CV 2	Signal lug
Pin 3	GND	Connect to CV 2	NC lug
Pin 4	CV1	Connect to CV 1	Signal lug
Pin 5	GND	Connect to CV 1	NC lug
Pin 6	OUT	Connect to OUTPUT	Signal lug
Pin 7	GND	Connect to INPUT	NC lug
Pin 8	IN3	Connect to INPUT	Signal lug

2U Journeyman full format

I am not going into great detail with this format as the PCB has been designed with the 1U filter core module in mind. However, I will mention a few things that may be useful to you if you do decide to build the larger format design.

The 2U format contains seven sockets and four additional pots. As with the 1U module, you need to ground the sockets' earth lugs. Do this by joining together the earth lugs for each row with stiff single core wire. Then with a piece of insulated wire, or a well placed piece of stiff wire, connect together the two horizontal pieces of stiff wire. Now all your socket ground lugs are connected together. Then with a piece of insulated wire connect one of the stiff pieces to pin 1 of the I/O header on the PCB. Pin or pad 1 of I/O is connected to panel ground on the power sockets, ie. pin 3 on the MTA/Molex connectors.

The pads in box labelled I/O at the bottom of the board are mainly set up for the 1U version, but you will need to use some of these pads too.

Pin	*Pad name*	*Socket Connection*	*Lug Type*
Pin 1	PANEL_GND	Connect to all sockets	Earth lugs
Pin 2	CV2	Connect to CV2	Signal lug
Pin 3	GND	Connect to CV2	NC lug
Pin 4	CV1	Not used	
Pin 5	GND	Connect to CV1	NC lug
Pin 6	OUT	Connect to OUTPUT	Signal lug
Pin 7	GND	Connect to IN1, IN2, IN3	NC lugs
Pin 8	IN3	Not used	

All your other connections will be made via the five two way 0.1" headers, four of which are situated on the board near the pots and the fifth at the bottom of the board. They are labelled and positioned appropriately to help you connect up your module correctly. These are KEY (which goes to the KEY CV socket), CV1 (which goes to the CV1 pot), IN1 (INPUT1 pot), IN2 (INPUT2 pot) and IN3 (INPUT3 pot).

KEY is the only header that does not go to a pot. Instead, simply connect pin 1, the square pad, to the signal lug of the KEY CV socket. Pin 2, the round pad, connects to the NC lug of the KEY CV socket.

Pots have three pins. For all four 'off-board' pots two of these pins (the CCW and wiper pins) will be connected to PCB via those two way headers, whilst the remaining pin (the CW pin) will be connected to the appropriate socket's signal lug.

CW is 'clockwise' end of pot's resistive track (from the rear this is the left hand side with the pins facing down). CCW is the 'counter-clockwise' end of the pot. The wiper is the middle pin.

The middle pin of the pots, the wiper, will carry the signal to the appropriate two way header on the PCB. The pots' wires will attach to the underside of the board at each header, and thus be soldered from the topside of the board. For each header, pin 1 is connected to the wiper of

the pot. Pin 1 is the square pin so it is easily spotted even from the underside of the board.

The pot has two other pins, one will be connected to ground, the other to the signal lug on the socket it controls.

With pins facing down and looking at the back of the pot, the right hand pin (CCW) should go to the ground connection of the header, that is pad 2 on each of the headers. Take a wire from the right hand pin to the round pad on the PCB next to the one that the associating wiper connects.

Now each pot will have one unsoldered pin left, the CW pin. Connect these to the appropriate socket. The wire should go to the signal lug of the socket. The pot labelled INPUT1 goes to the signal lug on the socket labelled IN1, and so on.

There are a quite lot of wires here, but it should be quite neat once it is all done.

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 and the polarity of the electrolytic capacitors.

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. The A below middle C, 220Hz, is a good note to use.

Connect your amplifier or mixing desk input to the output socket. Set the Drive control to its minimum value and switch to LP mode. Moving the Frequency control should produce the usual and distinctive filter effect from the output.

Turn up the Drive the control and notice that the sound should become louder. Click the switch into the HPF position and the output should now become fizzy. Sweep the frequency again with the Frequency pot. At the top end, the sound should be very thin, or be gone altogether. At the low end, you should hear the sawtooth as normal.

Turning the RESONANCE up will accentuate the ‘electronic’ nature of the sound in both the LPF and HPF modes. Check that at maximum resonance the filter output will oscillate. Note that the trimmer RES may need to be tweaked for self oscillation to occur across the whole audio band. Beware, it is quite possible to get this filter to oscillate well above the range of hearing. So be careful so as not to damage your studio monitor’s tweeters.

Listening to the low pass output with the sawtooth input still connected, patch an LFO output to the CV 2 input. Set the CV 2 depth pot to its maximum position. You should now hear the frequency of the filter being swept with the LFO. Reduce the CV 2 depth with the pot and hear how the modulation depth decreases to nothing with the pot in the middle and then increases as the pot moves around to the inverting position.

If all this happens, the chances are that you have a working module.

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 can't get your project to work and you are in the UK, 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 SynthDIY and Analogue Heaven mailing lists and at Muffwiggler.com.

Tony Allgood at Oakley Sound

Cumbria, UK