DO-IT-YOURSELF

THE MINIBLO

Designer Paul Williams **introduces a unique breath controller project that can be applied to either guitar or synthesiser, with a complete kit of parts available from E&MM.**

Performance controls have become very much a selling feature on modern synthesisers, allowing the musician to impress more of his/her personal 'feel' onto the music. Breath control is particularly attractive, since by using the tongue to articulate the flow of air, very fast and varied envelopes can be produced without losing the freedom of a hand.

Some synthesisers come ready-equipped with a breath controller, typically allowing amplitude and filter frequency to be controlled either by blowing into a tube which disappears into the back of the instrument, or by means of a special mouthpiece unit with onboard electronics, connected *via* a cable to the synthesiser. If you've had the pleasure of witnessing Dave Bristow demonstrate the Yamaha breath-controlled synths, then you'll appreciate just how exciting breath control can be.

E&MM's Miniblo project gives you full high-spec breath control over amplitude on any electric or electronic instrument, be it synthesiser, guitar, organ or even mixer output. The battery and all the electronics are contained within the body of a 'chunky' jack plug, which is inserted directly into the instrument output socket. A modified crystal earpiece is used as the mouthpiece, and this controls the amplitude of the signal appearing at the output socket of the Miniblo. Special techniques are used to ensure that the speed of response is adequate while still keeping the breath noise breakthrough at a minimum. Everything except the battery is mounted on the (tiny) PCB, so construction really couldn't be simpler.

Circuit

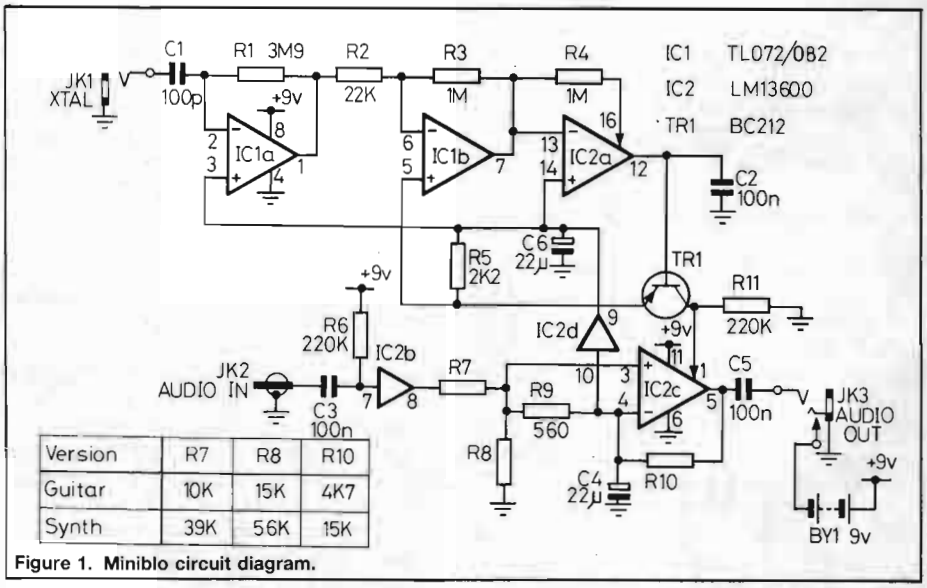
The circuit diagram shown in Figure 1 reveals yet again the author's fetish for the LM13600 dual Operational Transconductance Amplifier (OTA). One half of this device, IC2c, is used as a current controlled amplifier to vary the gain of the unit, while the other half, IC2a, is used to produce the attack and decay slopes. To reduce the tendancy for noise from the crystal mouthpiece to break through by modulating the instrument signal, and yet still retain a good fast response, linear rather than the more usual exponential envelope slopes were chosen.

IC2a ramps the voltage on C2 up and down in sympathy with the amplitude of the mouthpiece signal on IC1 pin 1. IC1b compares this signal amplitude with the voltage developed across TR1's emitter resistor R5, and controls the direction of ramping so that balance is always achieved.

The crystal mouthpiece is a perfectly standard earpiece, apart from an exhaust port which the constructor must cut to allow the air to escape. When the mouthpiece is held between the lips and blown into, the air passes by the diaphragm on its way to the exhaust port, causing the air turbulence to vibrate the diaphragm and thus produce an AC voltage proportional to how hard the mouthpiece is blown. Since the output from the crystals is quite consistent, no sensitivity control has been provided. If the sensitivity doesn't seem to be right, then the value of R1 can be changed.

The alert reader will have noticed that there are no diodes to rectify the crystal signal to DC. Rectification is in fact produced as a by-product of the asymmetrical ramping on C2 caused by R4. During an attack ramp when IC1 pin 7 is high, the current injected into IC2 pin 16 *via* R4 causes the transconductance of IC2a to be high, resulting in a fast negative ramp on C2. When IC1 pin 7 swings low, however, the reduced current *via* R4 produces a slower positive decay ramp in C2. TR1 drives a current proportional to the negative voltage on C2 into the current controlled amplifier IC2c. R11 bleeds off any leakage current, and also helps to prevent ambient noises from gating the unit.

The instrument input on JK2 is buffered by IC2b, which also provides a mid-rail reference voltage for IC2c on C4. R7 and R9 together attenuate the instrument signal to the appropriate level for IC2c. R10 sets the maximum gain of IC2c, and thus the output level. IC2d is used to produce another, isolated reference voltage on C6 for the control circuitry. To minimise both noise and distortion, R7, 8 and 10 are selected from one of two classifications – guitar or synthesiser/ line – so that performance is optimised for the signal levels being used.



Version	R7	R8	R10
Guitar	10K	15K	4K7
Synth	39K	56K	15K

Figure 1. Miniblo circuit diagram.

Construction

Cramming all these gubbins into such a tiny box means that you'll have to follow these constructional notes carefully, just in case it won't all go in.

Armed with a fine-tipped soldering iron and fine solder (22 SWG or thereabouts), assembly of the PCB starts by inserting and soldering all the resistors, which are all mounted vertically except R6. The values of R7, R8 and

R10 can be chosen from the table depending on whether you wish to build the guitar or synthesiser optimised version. It may be helpful to form the component leads out at 45 degrees prior to soldering to secure them: trim the leads off nice and close to the joint.

Next, insert and solder the capacitors in a similar manner, checking the polarity of the electrolytic types. The transistor and integrated circuits come next, again checking orientation. There isn't sufficient room for IC sockets in this project, but with a little care, no problems should be encountered in soldering the chips directly onto the PCB. If some of the IC pins refuse to find their way into the PCB holes, then the blade of a small screwdriver should persuade them.

The 3·5mm jack socket should then be soldered in position, holding it firmly down onto the PCB whilst doing so. Attach the ¼" socket similarly. After trimming all the joints as close as possible, check the assembly thoroughly (particularly on the track side) using a magnifying glass or, preferably, an eyeglass: be on the lookout for solder splashes, bridged tracks and dry joints.

The case should be prepared as shown in Figure 3, by drilling the three holes and removing the ribs. Accuracy in marking out and drilling will pay dividends when it comes to the final assembly, due to the compactness of construction. Before installing the jack probe into the end of the case, trim the earth tag level with the end of the 'hot' tag, and solder a pair of 60mm-long insulated wires onto the two. The probe must be installed so that the tags lie one under the other when viewed from the open side of the case. Persuade the probe nut to come to rest in a position which presents one of the flats towards the PCB, and cover this flat with a few layers of sellotape, trimmed as necessary. These measures will prevent the nut from piercing the coating on R6, which could otherwise cause a short circuit and a flat battery. Yes, this is experience talking!

Trim the battery clip leads to 60mm length and solder the bared ends onto the track side of the PCB, as shown in Figure 2. The probe wires can then be inserted into the PCB from the component side and soldered in place: remember to ensure that the polarity is as shown in Figure 2.

Feed the PCB assembly into the case, manoeuvring it carefully to avoid the probe tags, so that the jack socket bushes locate into the appropriate case holes. Once secured, the jack socket nuts should hold the assembly tightly in place. Make sure that none of the resistors are touching the jack probe tags: ease any offending resistor over with the end of a screwdriver.

Once the unit has been tested thoroughly, a piece of thin insulating material must be affixed to the track side of the PCB using silicone rubber sealant or epoxy adhesive, to prevent the battery casing from shorting out any of the joints.

The crystal earpiece is modified by first separating the two halves of the moulding by working around the seam with a small blade such as a watchmaker's screwdriver. Be very careful that the foil diaphragm remains attached to the rear moulding. The exhaust port can then be cut into the rim of the front moulding (as shown in Figure 4) using a file. The port should be about 10mm wide and extend the full depth of the rim. The two halves can then be re-united, with the port adjacent to the cable entry point, using 'super glue' or epoxy adhesive to secure them.

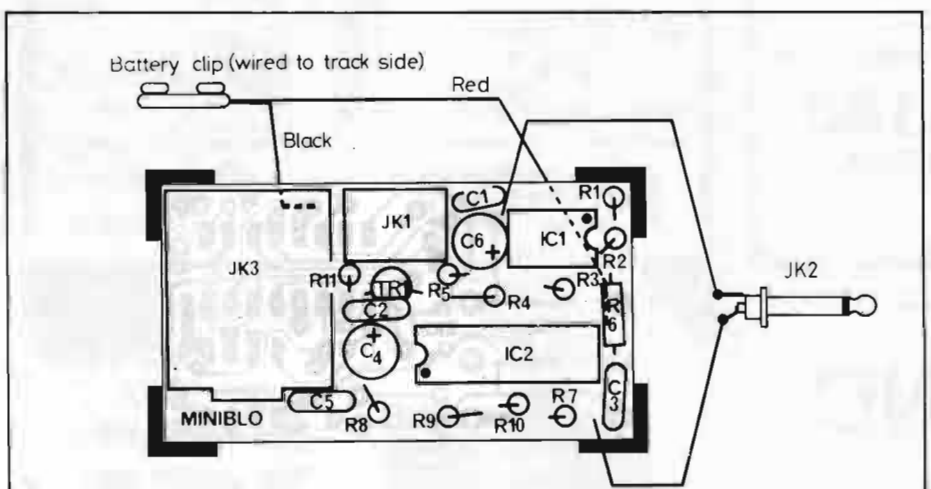
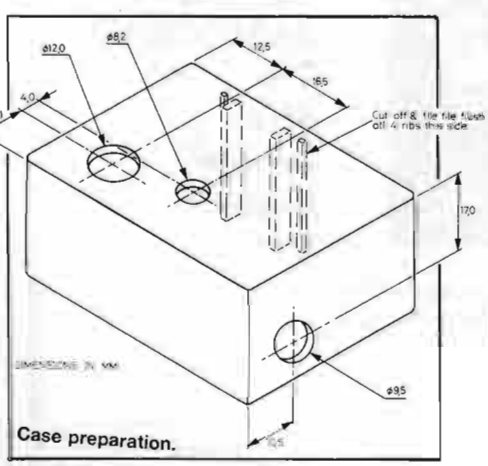


Figure 2. PCB component overlay and wiring.



Case preparation.

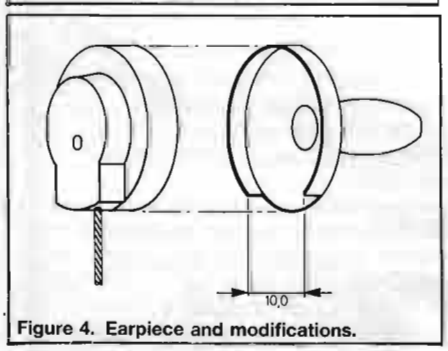


Figure 4. Earpiece and modifications.

Take a Breath . . .

Using your newly constructed Miniblo couldn't be simpler; after all, there are no controls to set up. Once you've popped in a fresh PP3 battery, screwed on the lid and plugged in the earpiece, the lead to your amplifier can be plugged into the Miniblo jack socket, which will switch the battery into circuit. The jack probe can then be plugged into your instrument output socket. If your instrument is cursed with a recessed or otherwise inaccessible output socket, then you can a) make up a short lead with a plug one end and an inline socket the other to make the link or b) replace the Miniblo probe with a cable-mounted plug.

Blowing into the mouthpiece whilst holding it either between the lips, or probably more comfortably between the teeth, you should find that the volume of your amplified instrument signal will be controlled by how hard you blow. Your newly acquired method of performance control will probably take a little time to get used to, but it'll be worth it. You should find that by using the brass player's technique of tonguing or 'spitting' air into the aperture of the mouthpiece, fast envelopes are quite easy to produce. Slow envelopes are achieved by using normal, untongued breath control.

Synthesiser envelope shapers are best bypassed so that the Miniblo has full control over the envelope, though to avoid pitch hiccups it's then a good idea to key each note a fraction before it is actually blown.

The meagre power requirements of your Miniblo should mean that the battery lasts for ages, but don't forget to unplug the output when the unit is not in use, or you'll drain the battery. You will find that as with any blown instrument, saliva tends to collect in the mouthpiece, but this should clear through the exhaust port, which has been positioned specifically with this in mind. After all, as Dave Bristow says, why shouldn't the synthesist expend some bodily fluids in putting expression into a performance?

Paul Williams **E&MM**

A complete kit of parts for the Miniblo is available direct from E&MM, price £16.95 including VAT and postage and packing. Send your cheque/PO, payable to Music Maker Publications Ltd., to Mail Order Department, E&MM, Alexander House, 1 Milton Road, Cambridge CB4 1UY. Please allow 28 days for delivery.

Miniblo Parts List

Resistors
All ⅓W 5% carbon

R1	3M9
R2	22K
R3, 4	1M (2 off)
R5	2K2
R6, 11	220K (2 off)
R7	10K/39K see text
R8	15K/56K see text
R9	560
R10	4K7/15K see text

Capacitors

C1	100pF ceramic
C2, 3, 5	100nF min. ceramic (3 off)
C4, 6	22uF 16V radial electrolytic (2 off)

Semiconductors

TR1	BC212
IC1	TL082/072
IC2	LM13600

Miscellaneous

X1	Crystal earpiece
JK1	3·5mm PC jack socket
JK2	¼" jack probe & nut
JK3	¼" PC jack socket with make contact
	PP3 battery clip
	Nylon case
	PCB
	Insulating strip
	Wire