THE 'jubilee' ELECTRONIC ORGAN

Part 4

M. J. HUGHES, MA, C.Eng., MIERE

This part describes the assembly of the cabinet and off board interconnections for the calculator keyboard version of the instrument. The slight variations required for the conventional keyboard version will follow next month.

Back panel wiring

In the prototype, the front and back panels were cut and folded out of 14 swg aluminium sheet. The rear panel is shown in **Fig. 1.** The large bracket at one end carries the mains transformer while the narrower flange running the full length takes self tapping screws to fasten the chassis into its cabinet. Four small brackets fix the printed circuit board into place on the back panel. Their height is critical to the final assembly of the chassis into its cabinet; read on before starting any mechanical work! These brackets should be fixed to the back panel so as to register exactly with the centres of the fixing holes on the PCB. Drill these for self tapping screws. At the same time mark and drill clearance holes at the front of the transformer platform for the mains transformer mounting bolts, which also secure the PCB at the front of the cut out.

When fitting the voltage regulators, make allowance for any variation from the specified devices. The prototype used a TO-3 encapsulation for IC21. No insulating kit is needed for this as its can should be in electrical contact with the panel. Bolt a solder tag under one of its fixing screws.

When using a plastic version, the same comments apply. The same cannot be said for IC22 (the −12V regulator). It is *most important* that a mica washer and insulating bush are used when fixing this.

The mains input cable should be clamped to the back panel and the earth wire connected to a solder tag mounted under the clamp. The neutral connection should go straight to the transformer and the live should, at this stage, be left long enough to reach the front left hand corner of the PCB—where the mains switch will be mounted. Connect the side terminal of the fuse holder to the other input of the mains transformer and then link the two secondary pairs to their respective pins of the PCB. Refer to Fig. 1.

Solder up all the chassis tag connections. All must go to the same solder tag under IC21. This cannot be stressed too highly otherwise nasty earth loop problems and instability are likely! Connections to this solder tag come from the PCB pins located as follows:

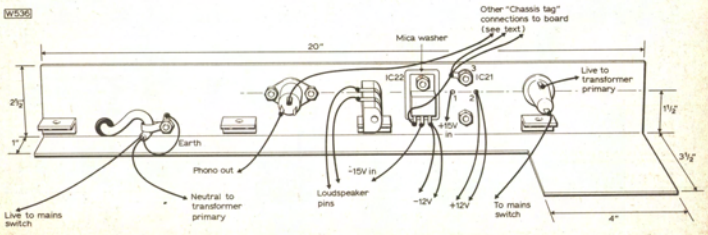


Fig. 1: Back panel assembly. The dimensions are for guidance only.

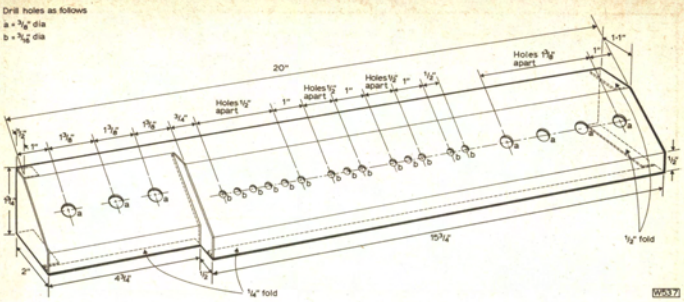
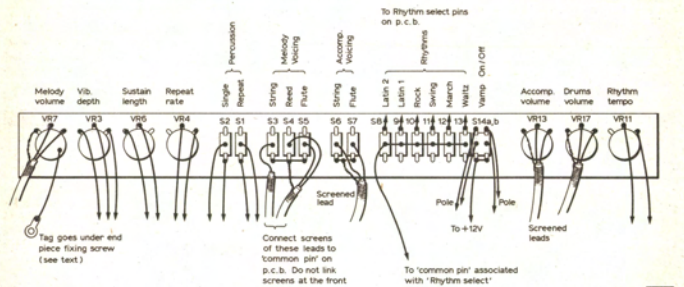


Fig. 2 (above): Front panel metalwork. The prototype front panel was constructed from three pieces of 14 gauge aluminium: two end pieces (each of different dimensions to allow for the step in the keyboard) and one main section. These are suitably folded and then stuck together with Araldite. Special attention should be paid to earthing the separate metal sections; epoxy adhesive is a very good insulator!

Fig. 3 (below): Front panel wiring. Note that earth connections to VR7, 13 and 17 are made through the screens of the stereo twin pairs; the cores connect to the wiper and to solder lug of each respective potentiometer. Screened leads are required to connect with switch groups S3, 4, 5, 6 and 7. To avoid instability problems caused by unwanted earth loops, connect the screens of the stereo pairs exactly as per this drawing.

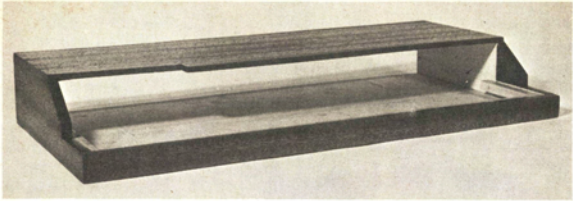


(a) Immediately to the left of B1, (b) Immediately in front of C44, (c) From pin 3 of IC22, (d) Immediately behind the positive end of C44, (e) Immediately behind IC19, (f) The earth connection of the DIN (Phono) output socket.

Having done this, connect leads between the output sockets and their respective board pins as shown on Fig. 1. Finally connect the input and output pins of the voltage regulators to their respective PCB pins—note that there are two output wires coming from each to feed different parts of the board, one pair goes to the pins above C49 and C50 while the other pair goes to the right of IC2.

Front panel

A degree of skill is needed to make the front panel as it has a 'dog's leg' in it to help differentiate between the accompaniment and melody keys. The critical dimensions are the overall height of the front panel to allow the chassis to slip into the cabinet and the depth of the step in the 'dog's leg' which is the equivalent of one row of calculator keys (0·6in). The latter is important for cosmetic reasons and to ensure that the flange running along its underside tallies with the positions of fixing holes in the PCB.



The photograph shows the plywood sleeve cabinet as used for the prototype calculator keyboard version. Note that the front of the cabinet has a pair of runners to give extra support to the keyboard section of the printed circuit board.

Start by cutting out the two end plates—these set the overall height and the depth of the step together with the angle of the bends. **See Fig. 2 for details.**

The main panel is cut and folded out of one piece. Use a fine saw and cut a slot to allow for the different positions of the bend at the 'dog's leg'. Using the smaller end plate as a template, fold the front panel for the accompaniment end of the keyboard. Start with the bottom flange then draw the material from the vice or clamp to put in the small angle bends at the top of the vertical and sloping sections. If you need to extend the slot this can be done quite easily. When folded, the end plate should fit *under* the top flange of the panel and the bottom flange of the end plate should be flush with that of the main panel.

Move to the other end of the work piece and put in the bends for the melody section of the keyboard; this time use the larger end plate as a template. Try to ensure that the sloping panel is parallel over both sections and then use a liberal quantity of Araldite to glue the end plates into position. Run a fillet of the glue under the inside edges where the sloping and vertical parts of the panel butt on to the end plates. Cut a filling piece and glue into the gap left between the two parts of the front panel. Use plenty of glue to fill any gaps or irregularities in the fit.

When the glue is rock hard—leave for at least 24 hours—mark and drill the front panel for the potentiometers and switches. Marry the panel to the PCB so that the vertical edges are just clear of the push button keys and mark positions for fixing holes along the underside flange by spotting through the PCB in the six marked locations. Self tapping screws should be used; drill the holes undersize.

At the left hand end of the panel (accompaniment end) drill a hole for a nut and bolt through the PCB and into the flange under the end piece. This hole should go through the copper area which is at earth (chassis) potential. A solder tag should eventually be fixed on this screw and a bonding connection made to the front panel with a wire soldered to the body of one of the potentiometers. **Note**—it is no good relying on connection through the end piece because the Araldite will have acted as an insulator! Drill a similar hole through the PCB and end piece at the melody end but keep the position clear of any of the PCB wiring. Fix the completed front panel to the PCB —forming threads for the self tapping screws, etc—before progressing further. Make sure that all the push buttons will operate without fouling anything.

Front panel wiring

Remove the front panel and finish it off with a rub down and give it several coats of hard polyurethane based silver lacquer. Fix all the controls in place and connect them with flying leads to their respective board pins (see **Fig. 3** for details). This operation is best done with the front panel tilted forward over the push buttons. Use screened leads for connections to VR7 (Melody Volume), VR13 (Accompaniment Volume), VR17 (Drums Volume) S3, 4 and 5 (Melody Voicing) and S6 and 7 (Accompaniment Voicing). Lightweight stereo screened pairs help cut down the number of separate leads required. Always use the earthing pin on the PCB associated with the respective 'live' terminals for each potentiometer or group of switches. **Do not** link all the earth connections on the front panel controls together or you will get major earth loop problems!

Note that the switches should be orientated as follows: S1, 2, 3, 4, 5, 6 and 7 should normally be closed in the 'Up' condition; S8 to S13 inclusive should normally be open in the 'Up' condition. When S14 a and b is 'Up'—in the Vamp OFF condition—the poles should be connected to +12V at the positive end of C17.

Screw the front panel into place—not forgetting the solder tag and bonding link going from the left hand end plate to the body of one of the potentiometers. Finally, mount the mains slide switch in front of the accompaniment keys. A small LED may be fitted next to the switch connected via a 470 ohm resistor across the −12V supply and ground. The cathode should go to the more negative voltage. Connect the live mains input lead to the main switch and run another wire from the latter to the central terminal of the fuse holder. The organ is now complete.

Next month—the variations required for conventional keyboard instruments, setting up the preset controls and fault tracing.