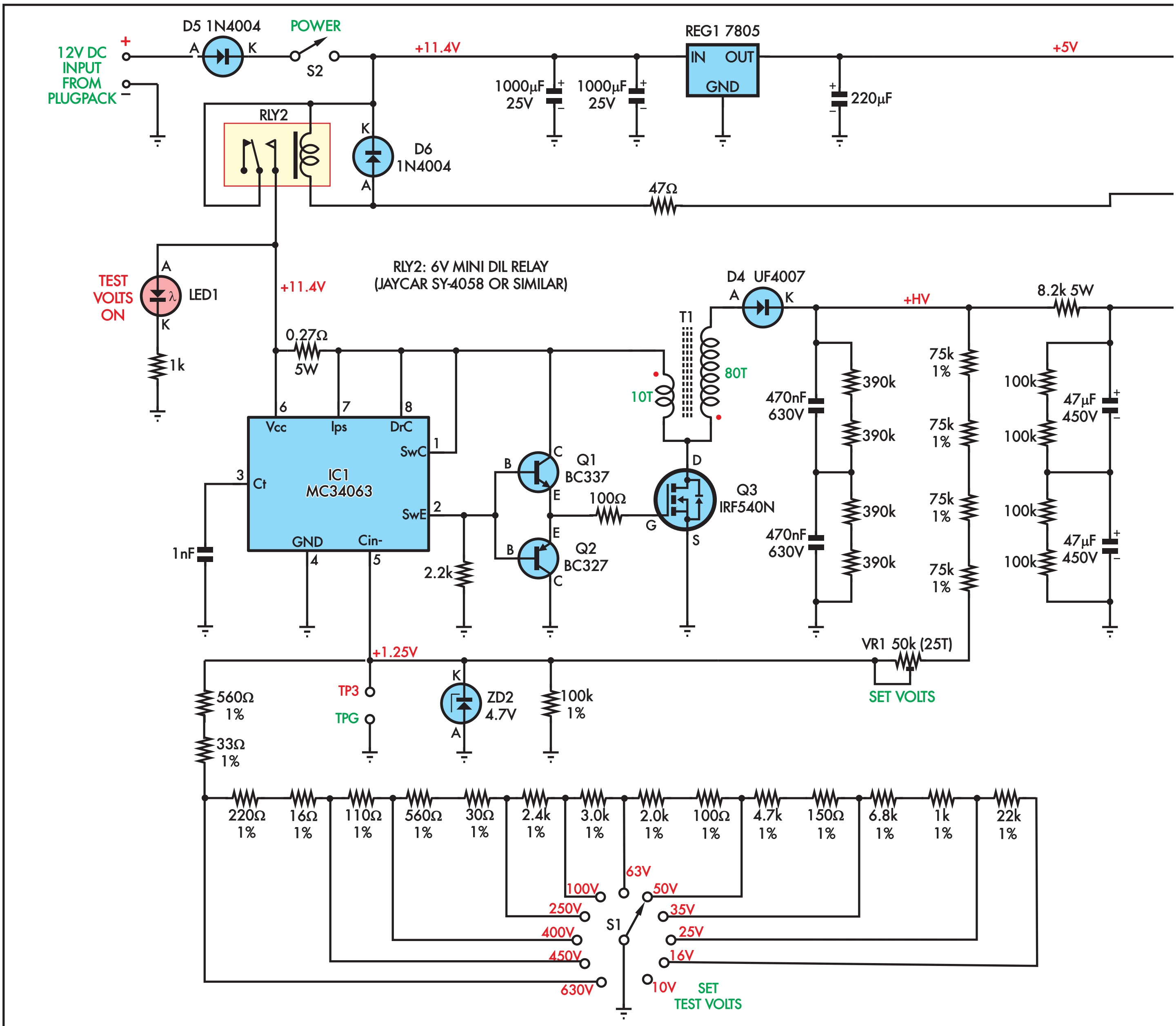

ELECTROLYTIC CAPACITOR REFORMER AND TESTER

When S1 is switched to any of the other positions, additional resistors are connected in parallel with the lower arm of the feedback divider, to increase its division ratio and hence increase the converter's output voltage. For example, when S1 is in the '16V' position, all of the series-connected resistors in the string between the various positions of S1 are in parallel with the 100kΩ resistor, increasing the division ratio to increase the converter's regulated output voltage to 16.25V.

The same kind of change occurs in all of the other positions of S1, producing the various preset output voltages shown. Although the test voltages shown are nominal, if you use the specified 1% tolerance resistors for all of the divider resistors they should all be within ±4% of the nominal values, because the 1.25V reference inside the MC34063 is accurate to within 2%.

IC1 operates only when the 11.4V supply rail is connected to it via relay RLY2, under the control of micro IC3. The converter circuit then operates and generates the desired test voltage across the two 470nF/630V metallised polyester reservoir capacitors, connected in series, with their voltage-sharing resistors in parallel. At the same time, LED1 is illuminated, to warn you that the test voltage will be present at the test terminals.

Note that the test voltage present at the top of the feedback divider is not fed directly to the positive test connector, but is first fed through a low-pass RC filter formed by the 8.2kΩ 5W resistor and the series-connected 47µF/450V capacitors (which again have voltage-sharing resistors in parallel).

This filter is to smooth out any ripple present in the output of the voltage source/converter. The filtered test voltage is then made available at the positive test terminal via a 2.2kΩ 5W

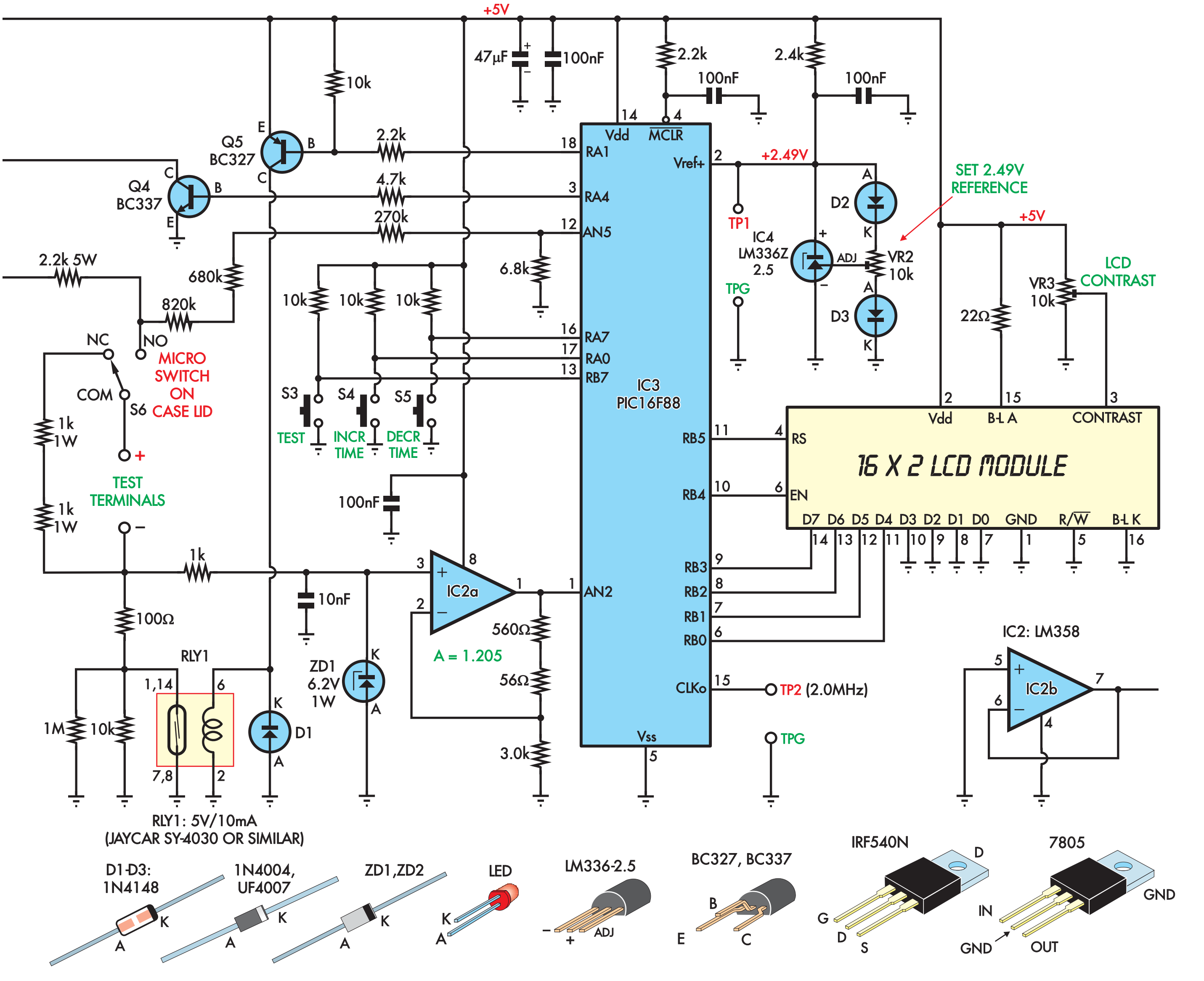

Fig.2: similar to the block diagram, the circuit is divided into two distinct sections – the high voltage generation on the left side and the reforming/reading/metering section on the right, which itself is under the control of a PIC microcontroller. Don't depart from this circuit diagram – a lot of effort has gone into making it safe!

series resistor, which together with the 8.2kΩ 5W series resistance of the filter forms the protective current-limiting resistance shown in Fig.1.

Charged electros can be lethal!

Before the test voltage is fed to the capacitor's positive test connector, it first has to pass through microswitch S6, which is attached to the case so that it switches when the case lid is opened. Normally, (ie, with the lid closed) the test voltage is connected, but when the lid is opened, the test capacitor's positive terminal is connected to its negative terminal via two 1kΩ, 1W resistors, which will discharge even the largest high voltage capacitors normally encountered in less than a second. Two 1W resistors are used to obtain a sufficiently high voltage rating for the highest value test setting.

Of course, very high value lower-voltage capacitors will take much longer to discharge (as much as a few seconds or so) but these are not considered as dangerous to life and limb.

It is important for your safety (and more importantly, the safety of others) that the microswitch is not left out nor bypassed or worse, the circuit is built into a case which does not have a hinged lid allowing this form of protection. The circuit is perfectly safe as described.

Wiring external to the PC board (ie, the high voltage wiring) ***MUST*** be made with 250V AC-rated cable. The easiest place to get such cable is from a surplus flexible mains lead. In fact, you might be lucky enough to find that you have some with red and black insulated wires (which are needed for the test capacitor connections) and newer ones with brown and blue insulated wires (ideal for the connections between PC board and microswitch). We wouldn't use the green or green/yellow wiring for ANY purpose except earth wiring.

Winding transformer T1

Many constructors are put off projects which involve winding a transformer, but in most cases, it's not too difficult a job and requires just a little care and attention to detail.

In the case of the *Electrolytic Capacitor Reformer and Tester*, step-up autotransformer T1 has only 90 turns of wire in all, with an initial primary winding of 10 turns of 0.8mm diameter enamelled copper wire followed by four 20-turn layers of 0.25mm diameter enamelled copper wire to form the secondary.

And as you can see from the coil assembly diagram (Fig.4, below), all five layers are wound on a small nylon bobbin which fits inside a standard ferrite pot core (bobbins are sold to match the cores).

Coil winding

Here's the procedure: first you wind on the primary using 10 turns of 0.8mm diameter enamelled copper wire, which you'll find will neatly take up the width of the bobbin providing you wind them closely and evenly. Cover this first layer with a 9mm-wide strip of plastic insulating tape or 'gaffer' tape, to hold it down.

Now twist the start of the 0.25mm wire around the 'finish' end of the primary winding and proceed to wind on the first layer of the secondary – winding in the same direction as you wound the primary, of course.

In this case, you should find that 20 turns will neatly take up the width of the bobbin, providing you again wind them closely and evenly.

After winding this first layer of the secondary, cover it with another layer of insulating tape. Then wind on another layer, again of 20 turns and cover it with a layer of insulating tape as before.

Exactly the same procedure is then followed to wind on the third and fourth layers of the secondary.

Each of these extra layers should be covered with another 9mm-wide strip of plastic insulating tape just as you did with the first layer, so that when all five layers have been wound and covered, everything will be nicely held in place.

The 'finish' end of the wire can then be brought out of the bobbin via one of the slots (on the same side as the primary start and primary finish/secondary start leads) and your wound transformer bobbin should be ready to fit inside the two halves of the ferrite pot core.

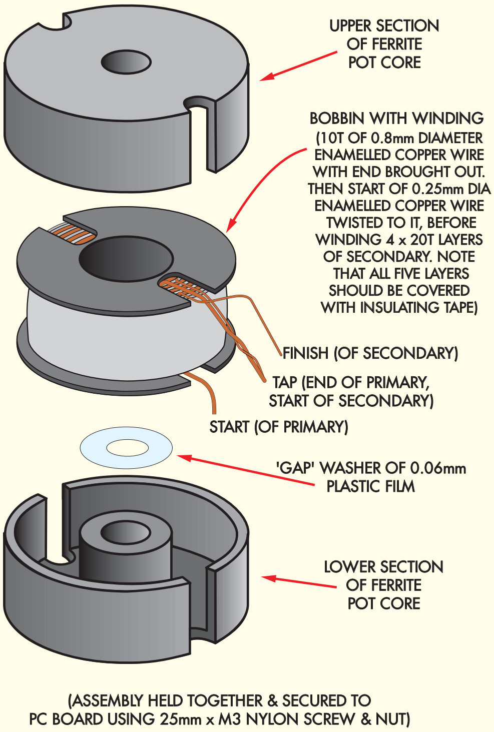

Fig.4. Ferrite pot core assembly

Just before you fit the bobbin inside the bottom half of the pot core, though, there's a small plastic washer to prepare. This is to provide a thin magnetic 'gap' in the pot core when it's assembled, to prevent the pot core from saturating when it's operating.

The washer is very easy to cut from a piece of the thin clear plastic that's used for packaging electronic components, like resistors and capacitors. This plastic is very close to 0.06mm thick, which is just what we need here.

So the idea is to punch a 3mm to 4mm diameter hole in a piece of this plastic using a leather punch, and then use a small pair of scissors to cut around the hole in a circle, with a diameter of 10mm. Your 'gap' washer will then be ready to place inside the lower half of the pot core, over the centre hole.

Once the gap washer is in position, you can lower the wound bobbin into the pot core around it and then fit the top half of the pot core. Your autotransformer should now be ready for mounting on the PC board.

Mounting on the PCB

To begin this step, place a nylon flat washer on the 25mm-long M3 nylon screw that will be used to hold it down on the board. Then pass the screw down through the centre hole in the pot core halves, holding them (and the bobbin and gap washer inside) together with your fingers.

Then lower the complete assembly down on the upper left of the board with the 'leads' towards the bottom, using the bottom end of the centre nylon screw to locate it in the correct position.

When you are aware that the end of the screw has passed through the hole in the PC board, keep holding it all together but up-end everything so you can apply the second M3 nylon flat washer and M3 nut to the end of the screw, tightening the nut so that the pot core is not only held together but also secured to the top of the PC board.

Once this has been done, all that remains as far as the transformer is concerned is to cut the primary start, 'tap' (primary finish/secondary start) and secondary finish leads to a suitable length, scrape the enamel off their ends so they can be solder 'tinned', and then pass the ends down through their matching holes in the board so they can be soldered to the appropriate pads.

Don't forget to scrape, tin and solder BOTH wires which form the 'tap' lead – if this isn't done, the transformer won't produce any output.