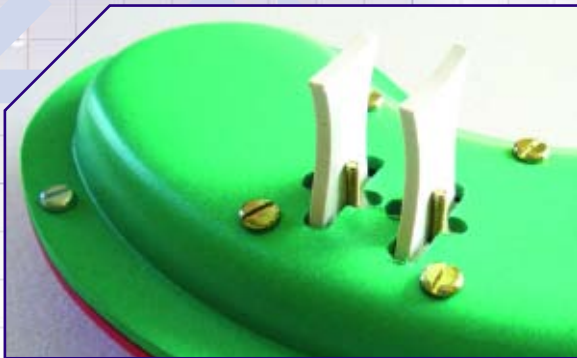


Joystick Control using QTC

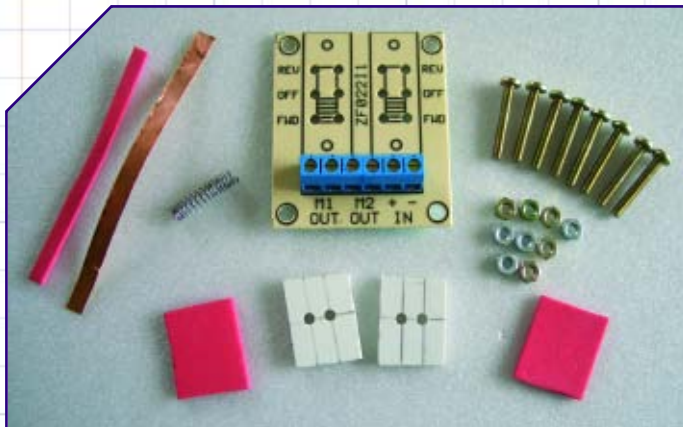


Keiron McGeever takes a closer look at using Quantum Tunnelling Composite in a practical project

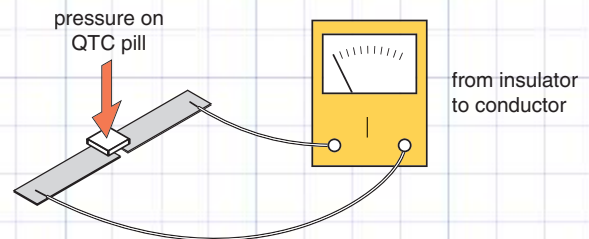
→ QTC Speed Controller A step by step guide to build a lo-cost and reliable forward and reverse speed controller

Ever since I came across Quantum Tunnelling Compound, I have wanted to make a simple speed controller, with forward and reverse control. After experimenting with several different prototypes I came up with this idea which has proved to be more reliable and easier to build. Its main component is the printed circuit board from the basic Motor Control Switchboard in the TEP catalogue, (but a home made version could be used) and four QTC pills cut in half to make eight pieces.

↘ Components List



No.	Part	Size
1	Motor Control Switchboard	
1	Neoprene sheet	150mm x 100mm approx
8	Pan head machine screws	3mm(2.5mm) x 10mm
4	Pan head machine screws	3mm(2.5mm) x 20mm
12	Steel nuts	3mm(2.5mm)
4	QTC pills	5mm x 5mm
1	Rigid Foam PVC sheet	150mm x 100 x 3mm
1	Spring from ball point pen	
1	Strip of copper track	150mm

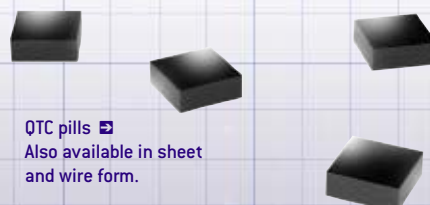


QTC is a smart material that has the amazing property of being electrically insulating in its normal state, but starts to become a conducting material when it is compressed. The more it is compressed the more current flows. This project makes use of this property to convert the forward and reversing control board from simple switching to variable speed controlling in both forward and reverse directions.

This project could be used in school with Year 10's as a practical demonstration of QTC material, on an electronics course, as part of a Physics lesson, or as part of a Systems and Control Technology project.

The description of how to build this controller may sound a little complicated but should be easier to understand by looking carefully at the photographs. The controller works by trapping a small piece of QTC underneath the head of a pan head screw and the pads on the circuit board, then by compressing the screw head with a simple lever system the resistance in the circuit can be varied and controlled.

The greater the lever pressure the more the QTC will conduct. This provides increased current to motors or other devices.



QTC pills Also available in sheet and wire form.

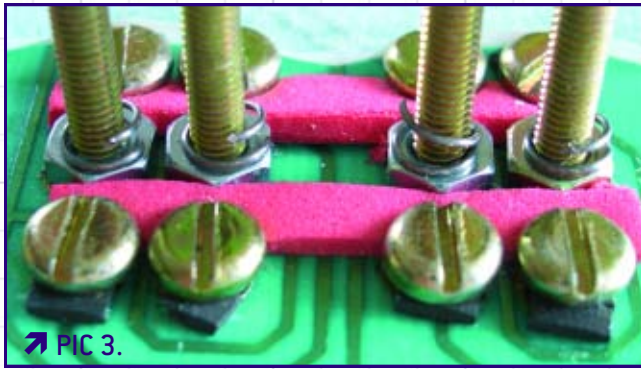
Adapting the Circuit Board

1→ If you start with the standard Motor Control circuit board out of the TEP catalogue, then you either need to get your hands on 2.5mm diameter pan head machine screws and nuts or drill out the switch mounting holes to fit 3mm diameter pan head machine screws and nuts (see PIC 1).

2→ Cut out a piece of neoprene rubber sheet big enough to cover the holes for the switches in the circuit board and poke holes through it with "a sharp stick" to match them. This acts as a sprung spacer for the 10mm screws that holds the QTC in place and goes on the TOP SURFACE of the board.

3→ Fix the rubber in place with the four 20mm screws, pushed through from the top of the board in the centre holes of the switch mounting (see PIC 2), and screw them up tight so that they make a good contact with the solder pad on the underside of the board.

4→ Cut two thin strips of neoprene rubber 30mm by 5mm.



➤ PIC 3.

5→ Fit the eight 10mm screws through the rest of the switch holes from the UNDERSIDE of the board and trap the rubber strips underneath the heads of the screws (see PIC 3) and only tighten the nuts until they just grip the rubber. This allows the screws to be pressed and to spring back when released. NOTE: the pan head of the screw should be on the same side of the board as the solder pad.

6→ Cut eight pieces of QTC (the size of four pills cut in half 5mm x 2.5mm) and fit them under the heads of the eight 10mm screws as in Pic 3. Adjust the tension on the screws until they just grip. Seal the pills in place with tape making sure that the tape does not cover the heads of the screws (see PIC 4).

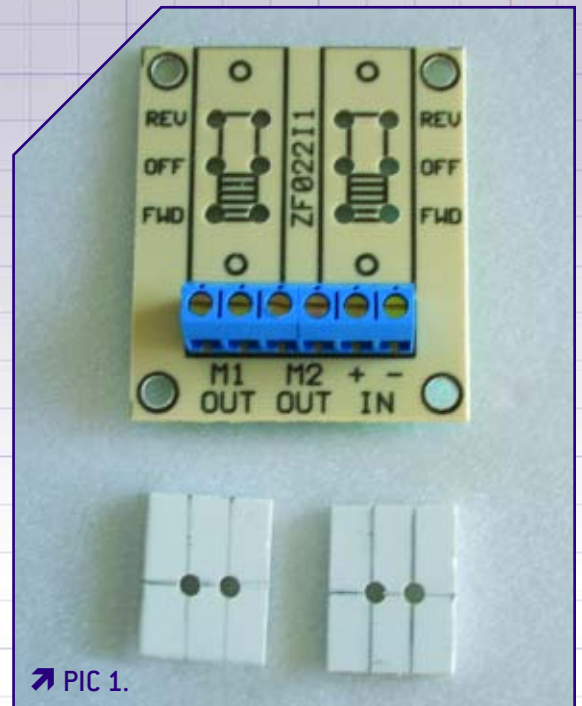
Making the Control Levers

7→ Cut two rectangles of expanded PVC plastic 22mm x 16mm x 3mm to make two pressure plates. Mark out and drill two holes in the centre of each one to match the centre switch holes in the circuit board. Make the holes a loose fit on the screws i.e. 3.5mm diameter if you are using 3mm screws (see PIC 1).

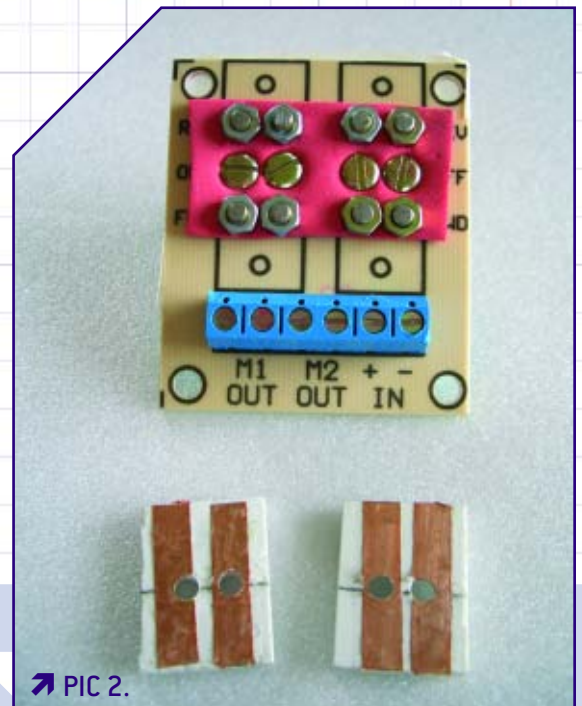
8→ Cut four pieces of copper track and stick them to the rectangles as in Pic 2 and poke the holes through the track with the "sharp stick".

9→ Take the small compression spring (taken from a ball point pen or similar), which should loosely fit the screws that you are using and cut four short sections of it. The sections should be about 1.5 turns of the spring.

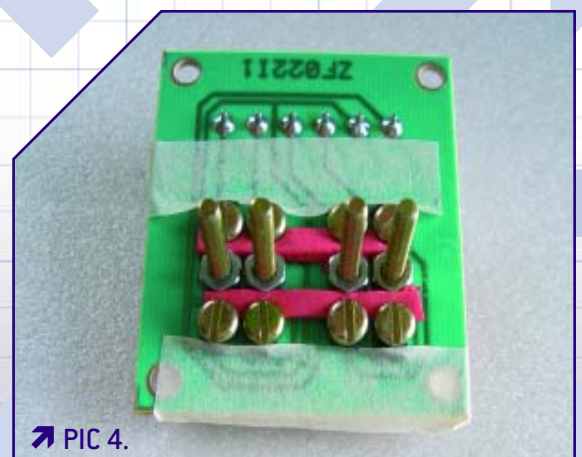
Continued overleaf ➤



➤ PIC 1.



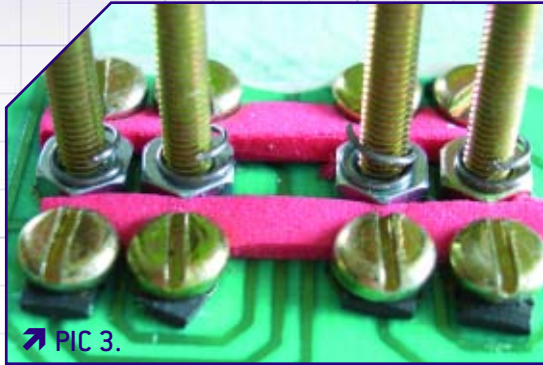
➤ PIC 2.



➤ PIC 4.

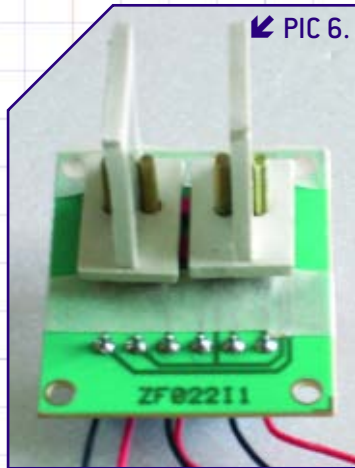
Joystick Control using QTC

Continued



➔ PIC 3.

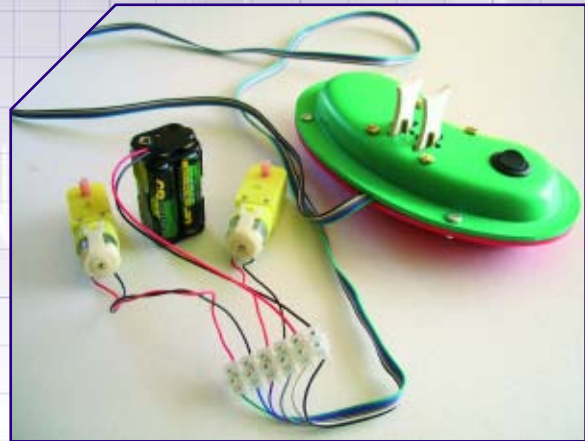
10➔ Fit the springs over each of the 20mm screws [see PIC 3] and then fit the pressure plates track side down. This will allow the plates to rock slightly backwards and forwards whilst making electrical contact with the centre screws all the time and contact with the other screws only when pressed one way or the other. Pressing down hard on one end of the plate will compress the QTC which will complete the circuit and control the current by how much pressure is used.



➔ PIC 6.

11➔ To make the control of the pressure plates easier cut two further pieces of plastic about 30mm long [see PIC 6], but they can be any length and shape to suit the use that the controller is to be put, and stick them to the pressure plate with plastic glue. They should just fit between the two ends of the 20mm screws. Shape the ends to fit your thumbs.

12➔ The controller is now ready to use. Check the circuit board for any short circuits caused by the screws or the nuts touching each other and insulate them with card strips or tape. Fit the wiring from the project to be controlled (on this board a terminal block has been used) and the batteries and test. If the pressure boards do not quite make contact with the screws add a little solder to the copper track in the appropriate place.



➔ Pod Box

Having tested your controller it can now be finished off by fitting it into a suitable pod box for a professional finish and ease of use.



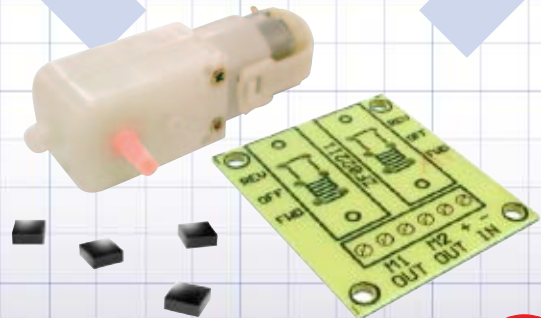
➔ Resources

Take a look at the PODs feature on the TEP website to find out how to make your own press-formed control boxes at:

➔ www.tep.org.uk/Frames/_f.tech_bulletins.html

A future article will focus on using QTC in a fully functional joystick controller.

If you are keen to produce your own PCBs you can download a PCB file from the TEP website under the News and Views tab.



- ➔ QTC Pills – Stock code QTC 001
- ➔ Economy Gearbox Motor 120:1 – Stock code EW2 ECK4
- ➔ Economy Gearbox Motor 200:1 – Stock code EW2 ECK6
- ➔ Motor Control Board – Stock code EW2 030

