PROTECTIVE GEAR

So far in the course, we have looked at how the user ports of the Commodore 64 and BBC Micro work, and designed some simple input programs. In this article, we investigate ways of producing an output from the user port and outline a comprehensive control network that we will show you how to build in future instalments.

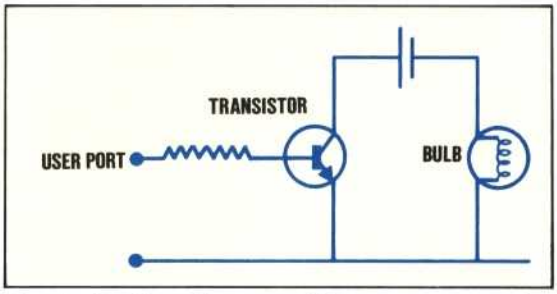
In most microprocessor applications the term 'buffer' (see page 208) has come to mean a temporary storage place for data that is being transferred from one part of a computer system to another. In analogue electronics, however, the term is used to describe a circuit that protects one device from the actions of another. If we wish to connect and drive electric motors or other electrical components under control from the user port then we must protect the delicate internal circuits of the micro from the components that we attach to it.

The input/output chip inside your microcomputer works at voltage levels of 0 and +5 volts and uses currents measured in a few milliamps (mA). Therefore, we must ensure that we don't put voltages higher than +5 volts on any of the user port lines, nor draw more than about 30 to 40 mA of current.

In our introductory instalment of this project (see page 514) we showed you how touching the bare wires of the user port lead together could change the contents of the data register. We found that earthing the register cells in this way didn't introduce dangerous voltages or currents to the system, and therefore no protection for the micro's internal circuitry was required. If we wish to connect other devices, however, then protection must be included, and this can take several forms. We may wish only to ensure that no more than 20 mA of current is drawn from any one port pin. This could be done by using a relay connected to the user port to switch the output device on and off, and inserting a resistor in the feed circuit to the relay. If the circuit operates at +5 volts, and we require a current of not more than 20 mA, then we can use Ohm's Law (voltage = current × resistance) to calculate the resistance value needed:

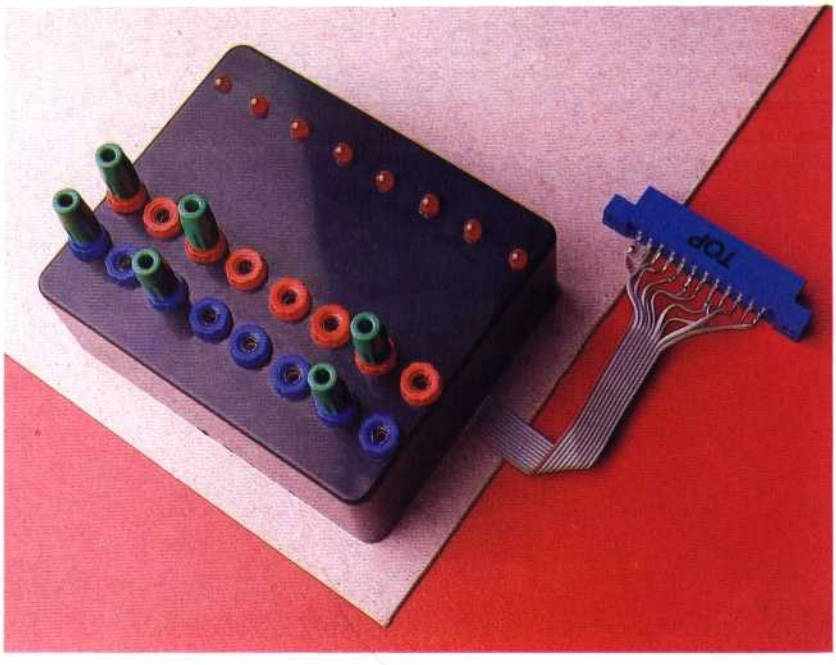
$V = I \times R$
$R = V / I$
$R = 5 / 0.02$
$R = 250$ ohms

Alternatively, the output from a user port pin could be used to trigger a transistor switch to complete an external circuit:

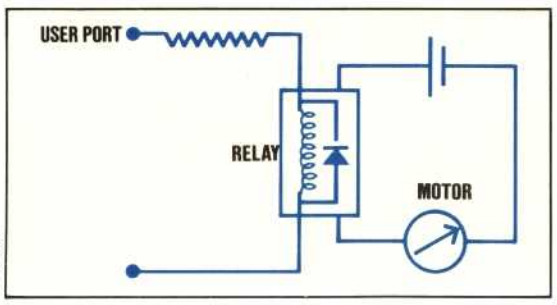


The buffer box that we will construct uses the transistor switching principle to protect the user port. This is a matter of convenience, as the circuits for all eight lines are available on a single chip.

Once buffering of the user port has been achieved we can go on to add a series of modules to the user port, which will allow us to connect other devices to it. These modules will make it possible for us to control the switching of LEDs, low and high voltage motors and mains relays. We will then be able to control household devices such



The Go-Between
The buffer box is connected to the user port of the Commodore 64 or BBC Micro by the lead described in the last instalment (see page 514). The box protects the computer against harmful input/output current levels. The LEDs indicate the state of the user port output lines, and the plugs and sockets act as on/off switches on the input lines.



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