1. The diagram of FIGURE 2 shows a bi-directional opto coupler input interface circuit. When a supply voltage of 20 V is applied the LED carries a current and 2 V is dropped across it. Calculate the value of the LED current and the value of current through the 3 k resistance.

*External wiring*

*Switch*

*3k*

*470*

*Signal*

*to micro- computer*

*Bi-directional*

*opto-coupler*

*Separate supply used for inputs.*

*Note: Either polarity.*

*Internal wiring*

FIG. 2

1. The circuit shown in FIGURE 3 is part of the interface of a relay output module. *I*b is 1 mA and *V*CC is 9 V. The relay requires a

minimum of 50 mA to energise.

Complete the values of the assumptions listed below in order to calculate:

* + voltage across *R*1
	+ value of *R*1
	+ voltage across the relay coil
	+ voltage across *R*2
	+ value of *R*2
	+ collector of current *I*c.

Assumptions: Logic '1' = V

Logic '0' = V

Transistor forward current gain *h*fe = LED current = 10 mA LED voltage drop at 10 mA = V Base/emitter voltage = V

Collector emitter voltage when transistor is on = 1 V

*External Terminals*

*+V*

*CC*

*R2*

*R*

*N/O*

*R1*

*Logic Signal*

*0 volts*

FIG. 3