

# IQ4 (CODE: IQ4)



The IQ4 is the latest in Mindsets' line of easy-to-use controllers. It is simply programmed using the on-board buttons, without the need for a computer. The two high-power outputs can be used to control motors, buzzers, lights and so on. Each output is capable of driving a motor forward or backward with the direction simply set using the reverse button (on the IQ3 each motor required two outputs making programming more complicated). The analogue input can be used directly with LDRs, thermistors and similar sensors, as well as switches. The input threshold can also be programmed making the controller extremely versatile.

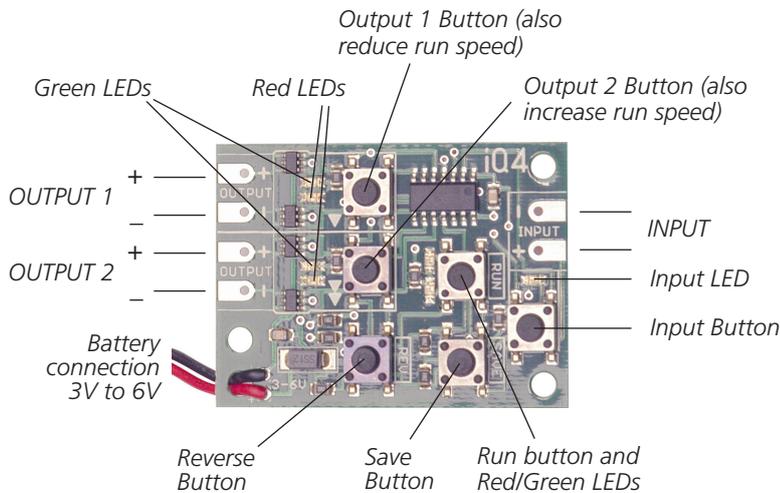
Features include:

- *simple on-board programming*
- *retention of programs when switched off*
- *analogue input that can be used directly with LDRs, thermistors and similar sensors (as well as switch based sensors)*
- *analogue threshold can be set to suit application and sensor*
- *2 outputs each capable of forward-reverse motor control (1A per output)*
- *good immunity to "dirty" motors*
- *speed control of programs*
- *compact size: 34.29mm x 45.72mm*
- *battery or PSU operation: 3v – 6v*

## GETTING STARTED

### Power to the IQ4

Connect IQ4 to a battery (3v-6v) or a regulated power supply. When connected, the run or program LED will light (green indicates run mode and red indicates program mode).



## PROGRAMMING

Programming the IQ4 is very easy. To create a line of a program, set each of the outputs to either 'on', 'off' or 'reversed'. Pressing the 'save' button will then record the state of the outputs as a line in the program. The outputs can then be changed (or left alone) before pressing save again to store the next line.

When in program mode the state of an output can be altered by pressing the adjacent output button. Pressing the button will toggle the output between 'on' and 'off'. Holding down the 'reverse' button while pressing an output button will toggle the output between 'reversed' and 'off'. The LEDs adjacent to each of the outputs indicate if the output is 'on' (green), 'reversed' (Red), or 'off'.

To run the program, press the 'run' button. The green run LED will light and the output LEDs will light up in the sequence you programmed. The program loops continuously.

Try this simple program. Note: before you start, make sure that the input LED is 'off'. The use of this is explained below.

### Sample program 1: Single Flashing light

- *Erase any stored programs by holding down the run button for 3 seconds (until the run LED flashes).*
- *Turn an output on – i.e., press the button so the green output LED lights up*
- *Press 'save'*
- *Turn the same output off – i.e., press the button again to turn off the LED*
- *Press 'save'*
- *Press run*

You have created a two-line program that turns an output on and off. Because the program always loops back to the beginning, the flashing is continuous. If you disconnect the battery and reconnect, the program will be retained. It can be erased by holding down the run button for 3 seconds (until the run LED flashes). The program can be stopped by pressing the run button again.

### Sample program 2: Alternating lights

- *Erase any stored programs by holding down the run button for 3 seconds (until the run LED flashes).*
- *Turn on output 1*
- *Press 'save'*
- *Turn off output 1; turn on output 2*
- *Press 'save'*
- *Press run*

The output LEDs will now turn on and off in an alternating pattern. You should now be able to try other programs. If you want to enter a long program, you are advised to write it down first and then copy it into the IQ4 line by line.

## SPEED CONTROL

When in run mode the two output buttons control the program speed. The ► button slows down the program and the ►► button speeds up execution. Speed ranges from one line every 4 seconds to 60 lines per second. To run the program at slower speeds identical program lines can be saved one after the other to increase the apparent delay. This technique can also be used to achieve slower run speeds in different parts of the program. For example, if the IQ4 is set to run at one line per second, and you want to turn output 1 on for one second followed by output 2 for three seconds, you could use the following program:

- *Turn on output 1*
- *Press 'save'*
- *Turn off output 1; turn on output 2*
- *Press 'save' three times*
- *Press run*

## USING THE INPUT

The input enables you to jump between two different sub-programs. When you enter a program the IQ4 remembers whether the input was on or off and will only run that part of the program when the input is in the same state. So far, you have been programming with the input turned off. If you were to run one of your programs and press the input button, the program appears to stop because no program has been entered with the input on.

Note: before entering the program below, erase the current program by holding down the run button for three seconds (until the run LED flashes).

Try entering sample program 1, but with the input turned on (press the input button to switch the input between on and off). When you switch to run mode, the program you entered isn't executed until the input is turned on.

## USING THE INPUT IN LATCHING MODE

*This feature was added to the IQ4 in April 2012*

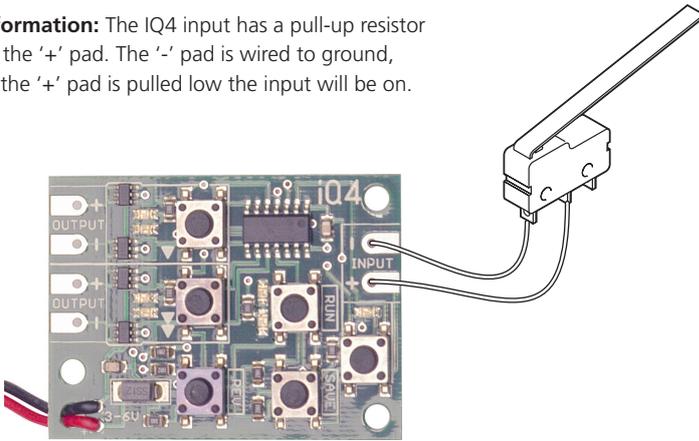
By default, when the input changes, the IQ4 switches between the two sub-programs immediately. It can be useful to have a sub-program run at least once before the input can cause the IQ4 to switch again. For example, a buggy could step through a reverse and turn sequence triggered by a momentary touch to a microswitch. To put the IQ4 into "latching" mode, hold down the 'reverse' button and press the 'input' button. The run LED will flash twice to confirm. To return the IQ4 to "non-latching" mode, press the 'reverse' and 'input' buttons again. The run LED will flash once to confirm.

N.B. The mode cannot be changed while a program is running.

## CONNECTING SWITCHES TO THE IQ4

Buttons, reed switches, tilt switches and other similar devices can be connected directly to the input. When a connection is made between the input pads (e.g. when a button is pressed) the input will be on.

**Technical information:** The IQ4 input has a pull-up resistor connected to the '+' pad. The '-' pad is wired to ground, hence, when the '+' pad is pulled low the input will be on.



## CONNECTING SENSORS TO THE IQ4

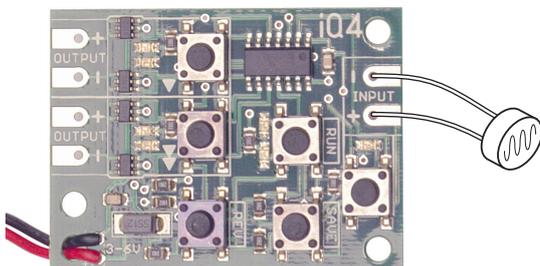
LDRs, thermistors, moisture probes and other similar devices can be connected directly to the input. The threshold at which the input switches can be set by simply holding down the input button when in program mode for two seconds (until the run LED flashes).

### Sample program 3: Analogue input (requires LDR)

- Erase any stored programs by holding down the run button for 3 seconds (until the run LED flashes).
- Set the input to on by pressing the input button (the input LED should be lit).
- Turn on an output – i.e., press the button so the green output LED lights up
- Press 'save'
- Turn off the same output – i.e., press the button again to turn off the LED
- Press 'save'
- Half shade the LDR while holding down the input button for two seconds (until the run LED flashes).
- Press run

When the light level is above the recorded threshold, the output will flash.

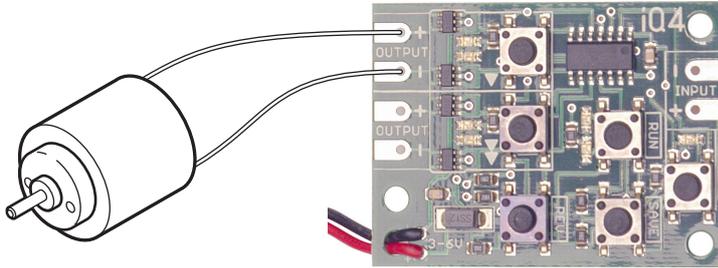
A small amount of hysteresis is built in to prevent the input states from changing too rapidly.



## CONNECTING OUTPUTS TO THE IQ4

The two outputs of IQ4 can be connected directly to things such as d.c. motors, lamps and buzzers either by soldering direct to the output pads or by using screw terminals.

Motors can easily be driven in both directions by setting the output to 'reversed'.



## EXAMPLE APPLICATIONS

### 1. Timing

*A buzzer (LED or bulb) connected to one output sounds after a set period.*

Program the required output 'off' for several lines (the timed period) and then turn 'on' for a few lines. When the program is run, nothing happens for the timed period – and the buzzer then sounds.

### 2. Flashing lights

*One or more high intensity LEDs flash 'on' and 'off'.*

High intensity LEDs are connected to one or more outputs and made to flash on and off as in sample program 1. This simple program can be used for cycle lamps, decorative lights, safety beacon etc.

### 3. Alarm

(a) *A buzzer sounds intermittently when a wire is broken.*

An output is programmed to turn 'on' and 'off' - as in sample program 1 - when both inputs are 'off'. After programming is complete, a thin breakable wire is connected across one of the inputs so that this input remains 'on' after 'run' is pressed. The program will not run until this wire is broken and both inputs are 'off'. Foil window tape can be substituted for the wire.

(b) *A buzzer sounds intermittently when an external switch is triggered.*

Substitute a trembler, tilt or other type of switch for the wire above.

### 4. Buggy/robot control

(a) *IQ4 controls the direction of a buggy or robot driven by two motors.*

The motors are programmed to be 'on' together (forward movement) or one 'on' and the other 'reversed' to effect turning.

(b) *A motor with off-centre mass is turned on and off in a simple robot 'bug'.*

### 5. Sensing

(a) *A buzzer, lamp or motor turns on when light falls on a light dependent resistor (LDR).*

One or more outputs of the IQ4 are programmed to come 'on' 1 when one input is 'on'. After programming, an LDR is connected to the input. The program runs only when sufficient light falls on the LDR to turn the input 'on'. (Note: the input will be 'off' in dark room and 'on' in a light.)

(b) *A buzzer, lamp or motor turns on when a pad becomes wet.*

An absorbent pad of kitchen paper (or equivalent) is trapped between two wires connected in place of the LDR. When the pad gets wet, its resistance falls and turns the input 'on'.

(c) *A thermistor is connected to the input and the threshold set to a temperature at which a motor driven fan is powered.*

### 6. Sequencing

*Outputs connected to different devices and programmed to turn on and off in a sequence.*

Examples, include robotic arm control, automata control, cylinder actuation (via a solenoid valve), production line modelling etc.

## 7. Bipolar stepper motor control.

*Bipolar stepper motors have two coils: stepping is achieved by changing the direction of current through the coils:*

*coil 1: forward current*

*coil 2: forward current*

*coil 1: reverse current*

*coil 2: reverse current*

Connect each coil to an output and use the 'on' and 'reversed' output states to step the motor.

## 8. Creating sound

If a loudspeaker is connected to the output, running sample program 1 at different speeds will produce sound of different pitches. The sound will range from clicks at slow speed to a buzzing at top speed (approx 60 Hz – or 60 clicks per second). Although you cannot program in a change of 'run' speed, you can switch from one pitch to another using the inputs . E.g., for a relatively high pitch, you might enter sample program 1 and for a lower pitch, you might program output 1 'on' for one line and then 'off' for 5 lines.

People are finding new uses for the IQ4 every day, and we would welcome any feedback to mention in future publications. If you have found a new use, please contact us by e-mailing to our website.



Supplied by: Mindsets (UK) Limited, Unit 10, The IO Centre, Lea Road, Waltham Cross, Herts, EN9 1AS  
Tel: 01992 716052 Fax: 01992 719474 [www.mindsetsonline.co.uk](http://www.mindsetsonline.co.uk)