

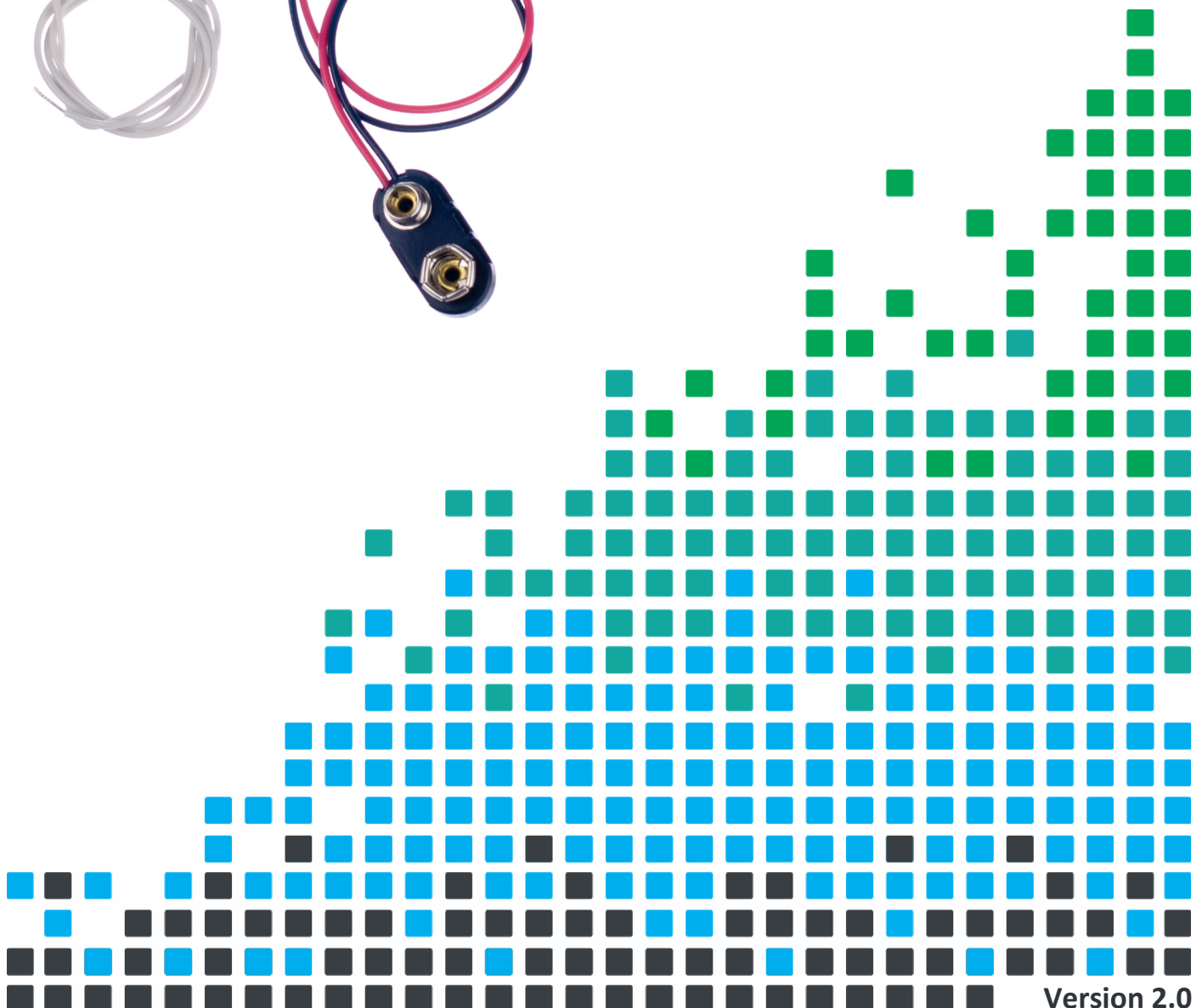
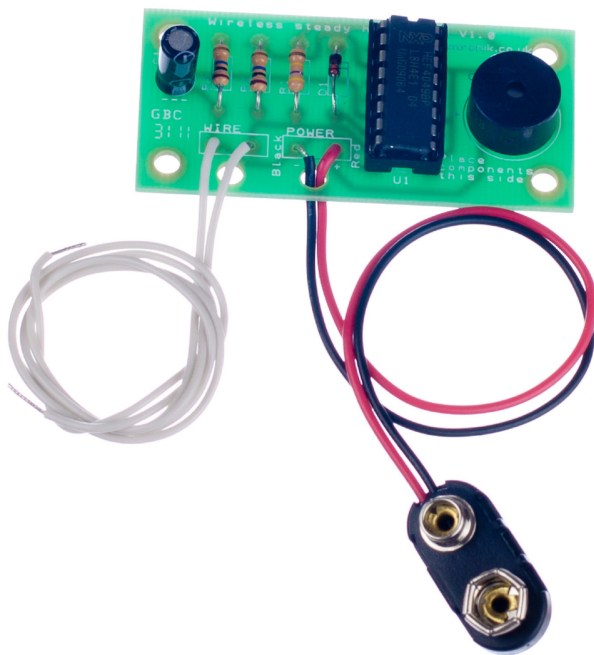


## ESSENTIAL INFORMATION

BUILD INSTRUCTIONS  
CHECKING YOUR PCB & FAULT-FINDING  
MECHANICAL DETAILS  
HOW THE KIT WORKS

TEST YOUR HAND-EYE COORDINATION WITH THIS

# Wireless Steady Hand Game Kit



Version 2.0

## Build Instructions

Before you start, take a look at the Printed Circuit Board (PCB). The components go in the side with the writing on and the solder goes on the side with the tracks and silver pads.

### 1 PLACE RESISTORS

Start with the three resistors:

The text on the PCB shows where R1, R2 and R3 go.

Ensure that you put the resistors in the right place.

PCB Ref	Value	Colour Bands
R1 & R2	10M	Brown, black, blue
R3	407k	Yellow, purple, yellow



### 2 Place the diode

Solder the diode into the board where it is labelled D1. Make sure the device is the correct way around. The black band on the diode should be in line with the band marked on the PCB outline for the diode.



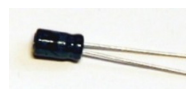
### 3 Place the IC holder

Solder the Integrated Circuit (IC) holder into IC1. When putting this into the board, be sure to get it the right way around. The notch on the IC holder should line up with the notch on the lines marked on the PCB.



### 4 Place the Capacitor

Place the capacitor into the board where it is labelled C1. Make sure the device is the correct way around. The capacitor has a '-' sign marked on it which should match the same sign on the PCB. Once the capacitor is in the right way around solder it in place.



### 5 Place the Buzzer

The buzzer should be soldered into Q1. The buzzer has a '+' mark on the side and the PCB also is marked with a '+'. The '+' on the part should be lined up with the '+' on the PCB.



### 6 Attach the battery clip

Attach the battery clip to the 'POWER' connection. The wire should be thread through the strain relief next to the power terminal. The red lead should be soldered to the '+' terminal (also marked with the text 'red') and the black lead should be soldered to the '-' terminal (also marked with the text 'black').



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## Attach the wire

Cut the short length of wire in half, then strip all four ends. Twisting the strands together will allow the wire to be put into the board easier. Connect one end of each wire to the PCB where it is marked 'WIRE'. Again use the strain relief hole. It does not matter which way around the two wires go.



## ***Making the game and attaching it to your PCB***

Start by cutting 1m of solid tinned copper wire off the reel.

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## Creating the loop

To create the loop cut about 15 - 20cm from your piece of solid tinned copper wire. Bend the end to form the desired sized loop and handle. Solder the end to the middle of the wire being careful to hold the wire with a pair of pliers and not your hands.



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## Creating the course

The remaining piece of copper wire will form the shape that will have to be negotiated with the loop. When fixing this shape to your enclosure make sure the loop has been placed on the wire before securing it. Now solder one of the wire connections from the PCB to the wire shape. The stripped section of the other wire should be feed through to the outside of the case. It is possible to connect this wire to a small piece of metal on the outside of the case.

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## Place the IC

Finally put the Integrated Circuit (IC) into the IC holder. When doing this make sure the notch on the IC matches the notch on the IC holder.



## Checking your steady hand PCB

Check the following before you insert the batteries:

Check the bottom of the board to ensure that:

- All holes (except the 4 large 3 mm holes in the corners) are filled with the lead of a component.
- All the leads are soldered.
- Pins next to each other are not soldered together.

Check the top of the board to ensure that:

- The band on the diode matches the outline on the PCB.
- The '-' on the capacitor matches the '---' on the PCB.
- The '+' on the buzzer matches the '+' on the PCB.
- The notch on the IC is next to the text "hand game".
- The colour bands on R3 are yellow, purple, yellow.
- The power clip is connected to the 'Power' and the red wire connects to the '+'.

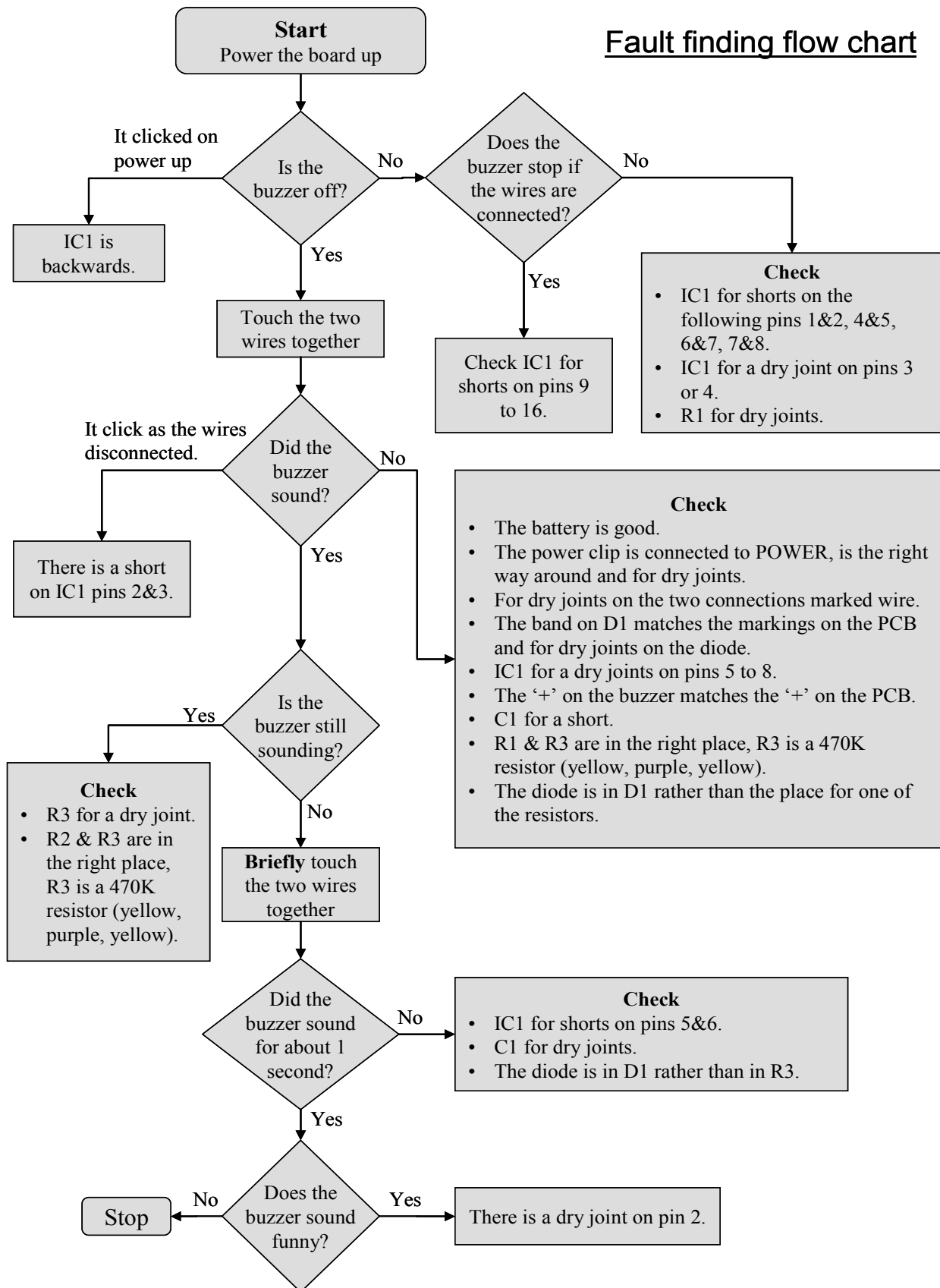
## Testing your steady hand game

When you power up the board it should be silent.

Holding the two wire connections will cause the buzzer to sound. A brief touch will sound for about a second. If this is not the case use the fault finding flow chart to work out what is wrong.



## Fault finding flow chart



## Designing the Enclosure

When you design the enclosure, you will need to consider:

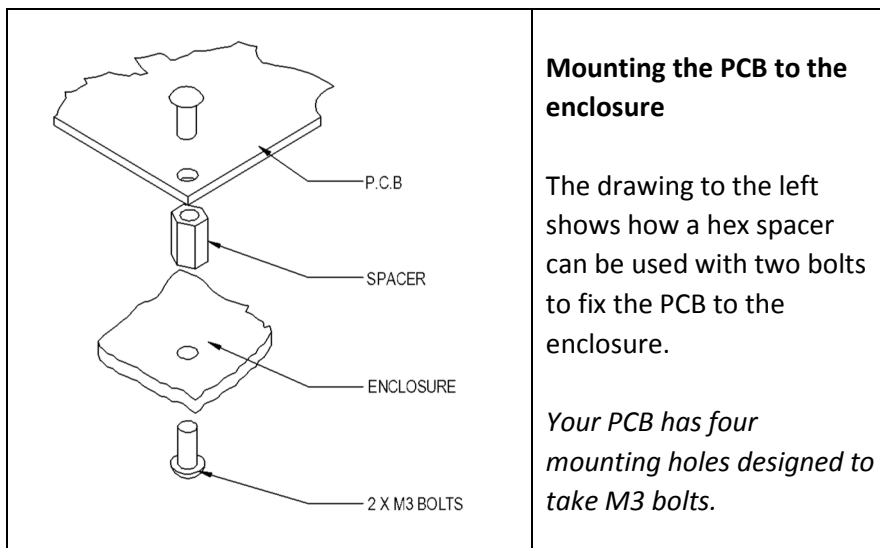
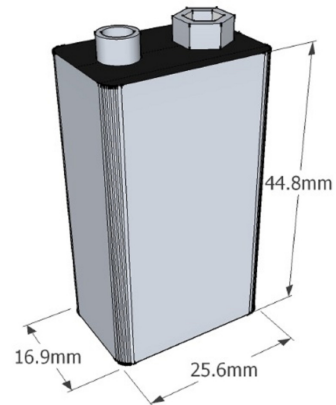
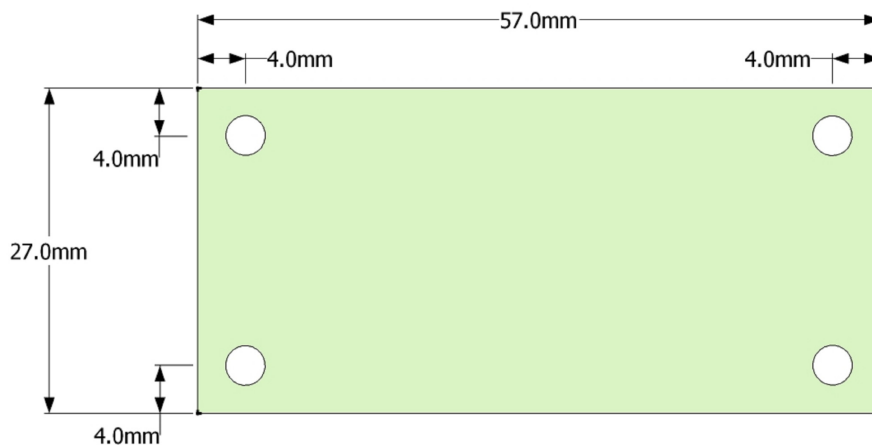
The size of the PCB (below – left)

Where the batteries will be housed (below - right)

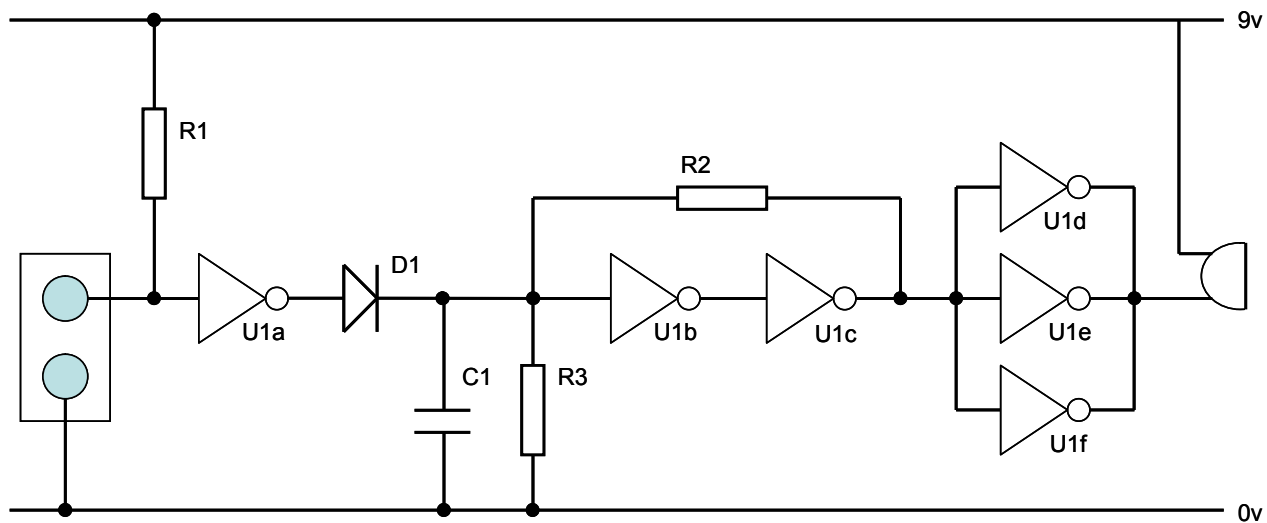
These technical drawings of the steady hand components should help you plan this.

All dimensions are in mm.

The four PCB mounting holes are 3.3 mm in diameter.



## How the wireless steady hand game works



The connections to the wire are shown on the left of this diagram. When the two are joined there will be a resistance across the connections made by the body. Resistor R1 is a 10M resistor and this normally holds the input to the not gate (U1a) in a high state. When the connection is made across the input, which will be in the order of a few hundred K $\Omega$ , the input to the not gate (U1a) will be low.

Since this is a not gate the output will be the opposite of the input, so it will normally be low, going high when the input is touched together. Whilst the output of this first gate (U1a) is high the capacitor C1 is charged. When the wires are no longer touched, the output of the not gate (U1a) drops low, however on the other side of the diode D1 the capacitor will still have voltage across it. Over the period of about a second (the time the buzzer sounds for) the capacitor C1 discharges through R3. As this happens the input to the 2nd not gate (U1b) changes from a high state to a low state.

The third not gate (U1c) inverts the signal back to the same state it was in at the input to gate (U1b). Whilst this might not sound very useful there will only be a small amount of current driving the input and the output can drive a higher current so it has worked as a buffer. Finally the three not gates (U1d, U1e, U1f) are used to drive the buzzer. As the three are used in parallel the current driven into the buzzer is three times higher than it would have been for a single gate and is therefore enough for the buzzer to work. When the output from U1c is in a high state the output of the three not gates (U1d, U1e, U1f) will be low and there will be 9V across the buzzer, so it will sound.



## Online Information

Two sets of information can be downloaded from the product page where the kit can also be reordered from. The 'Essential Information' contains all of the information that you need to get started with the kit and the 'Teaching Resources' contains more information on soldering, components used in the kit, educational schemes of work and so on and also includes the essentials. Download from:

<http://www.kitronik.co.uk/2140>



This kit is designed and manufactured in the UK by Kitronik

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