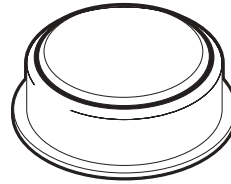


# PICAXE-08M iButton LOCK

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AXE109S Full kit including PCB, PICAXE-08M chip and iButton key.  
LOG020 Spare iButton Key

The iButton is an electronic chip armoured in a 16mm stainless steel can. Because of this unique, durable package, up-to-date information can travel with a person or object. The stainless steel button is rugged enough to withstand harsh outdoor environments; it is durable enough for a person to wear everyday on an accessory like a ring, key fob, wallet, watch, metal card or badge. It is also waterproof and so can be worn while washing or swimming.



The information within the iButton can be read by 'tapping' it against a simple 'two-contact' metal probe connected to the electronic reader circuit. This type of metal probe is much more durable than a magnetic swipe or 'smart-card', and the iButton has a much larger memory capacity.

Every iButton produced has a unique serial number - to date over 50 million iButtons have been manufactured. This serial number means that every single iButton can be uniquely identified -no two iButtons will ever have the same number. This feature makes the iButton ideal for use as a 'key' or 'tracking device' - there will never be another key with the same serial number, and it would be very hard for an impostor to 'fake' a duplicate key. The serial number is 14 digits long and, so that it can also be read by humans, it is also laser engraved on the bottom of the stainless steel can.

## How does the iButton work?

The silicon chip inside the stainless steel can is connected via two internal wires to the sides and front face of the iButton. When the iButton is momentarily touched against a probe, the side makes a ground (0V) connection, and the face makes a power/data connection. In a fraction of second the iButton 'steals' enough power from the probe to operate, and then transmits information (such as the serial number) via the same single connection. Because power and data are transmitted via the same wire, this type of connection is commonly referred to as a '1-wire' interface.

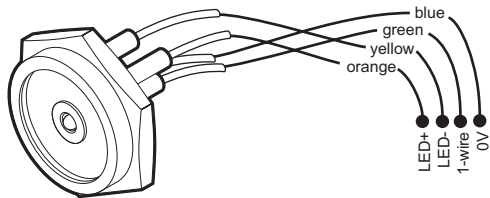
This '1-wire' interface means that most iButtons do not need an internal battery - they simply get the power they require to operate by touching against the reader probe. This means the devices never 'run-down', and because of the robust stainless steel can, they are extremely durable.

The iButton can transmit a large amount of information in a very short time - for instance it is almost impossible to 'tap' an iButton against a probe quicker than the time required by the iButton to transmit it's serial number! This makes the iButton an ideal device for applications such as locks where data has to be transmitted very quickly.

The communications protocol used by the iButton is fairly complex, because data is sent in both directions along the single-wire. For this reason it is normal to use a microcontroller to communicate with the iButton. The PICAXE-08M microcontroller has a special 'readown' (read-one-wire-serial-number) BASIC command to read this number.

### Making an iButton Probe

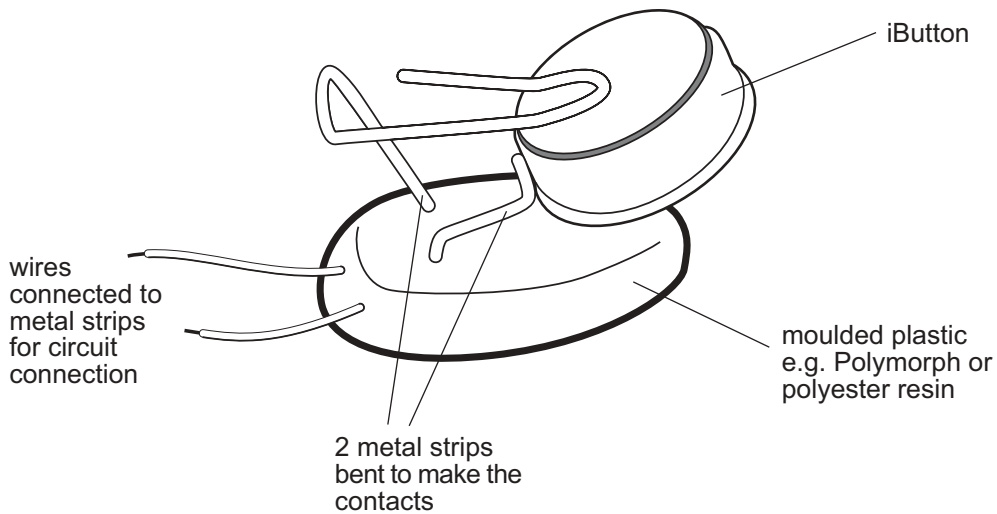
To operate the iButton it must be momentarily touched against a 'probe', which has two contact points - one contact hitting the base of the iButton can, the other hitting the side of the can. In a fraction of a second the serial number is read from the iButton and the lock accepts or rejects the iButton.



Although 'off-the-shelf' probes are available, as included with the kit, it is also very simple to make custom probes (and even key fobs) for the iButton.

Polymorph is a unique plastic material, which, when heated in hot water, becomes soft and pliable like clay. However when the plastic cools again it sets solid and so can be machined and drilled. If an iButton, or metal contacts for a probe (e.g. a paper clip!), are embedded within the plastic when it is warm and pliable, they will become permanently fixed within the plastic when it sets.

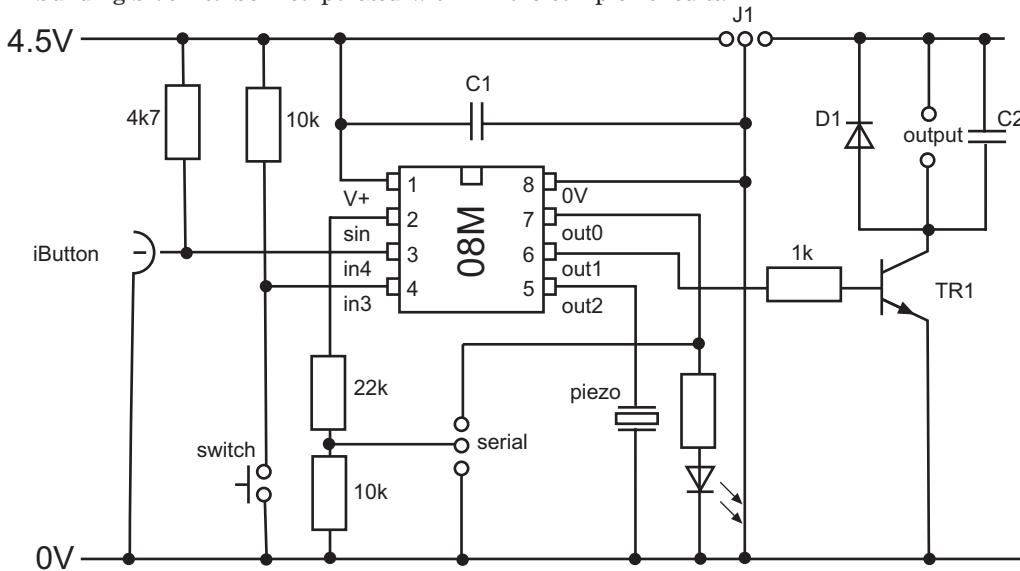
#### Home-made probe



## Reading an iButton Serial Number

The communications protocol used by the iButton is fairly complex, because data is sent in both directions along the single-wire. For this reason it is common to use a microcontroller to communicate with the iButton.

The basic circuit for the iButton reader is shown in figure below. Note that this circuit could be used as shown for a simple lock, but can also be used as a 'building-block' to be incorporated within more complex circuits.



The circuit is based around an 8 pin microcontroller, the low-cost PICAXE-08M. The circuit is fairly self-explanatory and includes the following features:

- iButton probe - (input 4) for reading the signal from the engraved face of the iButton
- probe LED - (output 0) indicator to show where to 'touch' the iButton
- input switch - (input 3) manual push switch (active low)
- piezo sounder - (output 2) for generating 'beep' sounds for user feedback
- output pin - (output 1) for driving an output locking device such as solenoid or motor

Although the output from output 1 is shown connected to a transistor, it could be used to feed a signal into another circuit.

## Using the PICAXE Software

### Important Note

The kits are provided with a PICAXE-08M microcontroller that has not already been programmed, and so it is necessary to program the microcontroller before use.

This PICAXE program lights the output LED for 5 seconds after the correct iButton has been hit. Note that you must alter the values to the unique code that is laser engraved in 2-12-2 format on the face of your iButton. The code used in this sample program would be engraved in the format

```
CC      FF
554433221100
```

Each unique code uses the Hex digits 0-9 and A-F. Do not confuse D and 0!

```
main:
    let b6 = 0    ' reset family code to 0
    low 0         ' LED off
    low 1         ' output off

loop:
    toggle 0      ' LED on or off
    if pin3 = 0 then open    ' switch pushed
    pause 250      ' wait
    readown 4     ' read serial number on input4
    if b6 <> 0 then test    ' ibutton detected
    goto loop

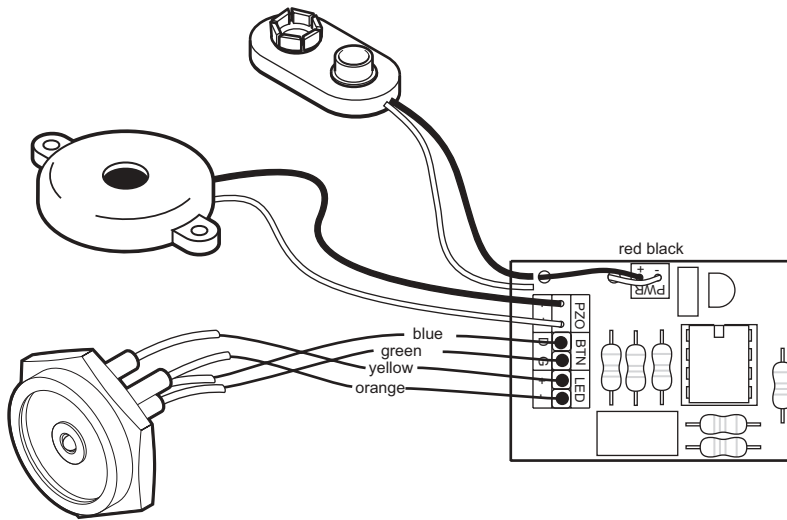
    ' ibutton detected so check code
    ' if wrong code jump back to start

test:
    sound 2,(50,50)    ' beep
    high 0             ' probe LED on
    if b6 <> $FF then main    ' !!! modify all these
    if b7 <> $00 then main    ' !!! to your unique
    if b8 <> $11 then main    ' !!! serial number
    if b9 <> $22 then main
    if b10 <> $33 then main
    if b11 <> $44 then main
    if b12 <> $55 then main
    if b13 <> $CC then main

    'Everything is ok so switch output on for 5 seconds

open:
    sound 2,(100,50)    ' beep
    high 1             ' LED on
    high 2             ' output on
    pause 5000         ' wait 5 seconds
    goto main
```

**AXE109 – iButton Lock Kit Assembly Instructions**



**Contents:**

- R1            4k7 resistor (yellow violet red gold)
  - R2            1k resistor (brown black red gold)
  - R3            330 resistor (orange orange brown gold)
  - R4,R5        10k resistor (brown black orange gold)
  - R6            22k resistor (red red orange gold)
  - D1            1N4001 diode
  - C1            100nF polyester capacitor
  - Q1            BC548B transistor
  - PZ            piezo sounder
  - CT1          10 pin header (snap down to 4 way)
  - CT2,3,4      2 pin terminal block (may be supplied as 4 way - snap into 2x2)
  - CT5          stereo download socket
  - IC1          PICAXE-08M microcontroller and 8 pin socket
  - BIN          iButton probe, iButton key and plastic key fob holder
  - PCB          printed circuit board, battery snap and 4.5V battery box
- Note that parts IC2 and C2 are not required for this project.*

**Assembly:**

1. Solder the resistors and the diode D1 in position, ensuring the white bar of the diode is to the right.
2. Solder a resistor leg as a link between the two outer + holes on jumper J1.
3. Solder the 8 pin IC socket in position and insert the microcontroller.
4. Solder the capacitor C1 into position.
5. Solder the transistor Q1 into position, ensuring correct orientation of curved edge.
6. Snap the 10 pin header into a 4 and 6 pin section. Solder the four pin section into the LED and iButton connection holes.
7. Solder the piezo in position, red wire to +, black wire to -.
8. Solder the stereo download socket into position, ensuring it 'clicks' flat onto the PCB.
9. Solder the terminal blocks into position. connect the battery snap to the power connector CT2 (V+ red, 0V black)
10. Connect the probe to the 4 pin header; connecting the coloured wires as shown in the picture above.

**Testing:**

1. Connect 3x AA batteries into the battery holder.
2. Download the test program into the PICAXE-08M microcontroller. Do not forget to modify the test program to use your unique serial number.
3. Touch the iButton against the probe. The LED should light and the piezo sound.

**Notes:**

- The PICAXE-08M microcontroller must be programmed to react to the iButton provided in the kit by modifying the program.
- The transistor output can be connected to external devices (e.g. a motor) via the 2 pin 'output' screw terminal block.
- If you wish to power the transistor output with a different supply from the battery box, remove the jumper link JL. Connect the separate supply by linking both 0V supplies together in PWR connector CT2, and connecting V+ of the second power supply in the V+ hole of the output connector CT3.

