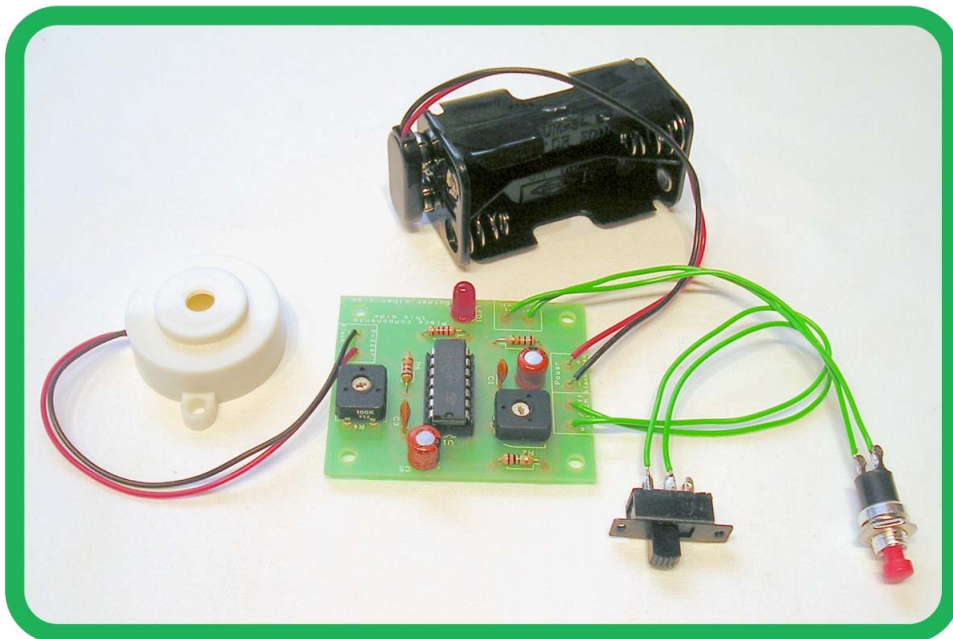




Electronic Timer



Build Instructions

Issue 1.2



Build Instructions

Before you put any components in the board or pick up the soldering iron, just 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. You will find it easiest to start with the small components and work up to the taller larger ones. If you've not soldered before get your soldering checked after you have done the first few joints.

Step 1

Start with the four small resistors (shown right):

R1 and R6 are 10K Ω (Brown, Black, Orange coloured bands)

R3 is a 330 Ω (Orange, Orange, Brown coloured bands)

R2 is a 1M Ω (Brown, Black, Green coloured bands)

Fit R2 if you want your timer to have a time out period between 100 and 200 seconds.

Fit a wire link if you want the timer to last less than 100 seconds



The text on the board shows where R1, R2, etc go. Make sure that you put the resistors in the right place

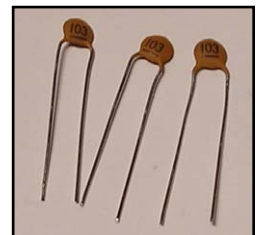


Step 2

There are two variable potentiometers (pictured left). One is 1M Ω and the other 100K Ω . They are clearly marked on the side of the housing.

Solder the 100K Ω variable potentiometer into R4 on the PCB.

Solder the 1M Ω variable potentiometer into R5 on the PCB.



Step 3

Solder the three ceramic capacitors in to C1, C2 and C3. They can go in either position as they are all the same.



Step 4

Solder the two electrolytic capacitors in to C4 and C5. They can go in either position but it is important that the '-' on the capacitor line up with the ---- markings on the PCB.

Using an electrolytic capacitor backwards could result in it being destroyed.

Step 5

Solder the Integrated Circuit (IC) holder (shown right) in to U1. 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.



Step 6

Solder the Light Emitting Diode (LED) (shown left) in to LED1. The timer won't work if it doesn't go in the right way around. If you look carefully one side of the LED has a flat edge, which must line up with the flat edge on the lines on the PCB.

Step 7

The buzzer should be soldered into the 'buzzer' terminal. The red wire must go to the + terminal and the black wire must go to the - terminal.





Build Instructions (continued)



Step 8

The battery connector should be soldered into the 'Power' terminal. The red wire must go to the + terminal and the black wire must go to the – terminal.

Step 9

Cut and strip two pieces of wire to the required length for connecting to the on/off switch (shown right). Solder one end of each wire to an edge and the center terminals (both connections on the same row) on the switch and the other end to the terminals labeled 'On/Off switch'. It does not matter which wire goes to which terminal.



Step 10

Cut and strip two pieces of wire to the required length for connecting to the timer start switch (shown left). Solder one end of each wire to each of the terminals on the switch and the other end to the terminals labeled 'Start Switch'. It does not matter which wire goes to which terminal.

Step 11

The IC can be put into the holder ensuring the notch on the chip lines up with the notch on the holder.

Checking Your Timer 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) are filled with the lead of a component
- All these leads are soldered
- Pins next to each other are not soldered together

Check the top of the board to ensure that:

- The notch on the IC and the IC holder are in the same orientation as the markings on the printed circuit board
- You are confident that all the resistors are in the correct places
- The red wire on the battery connector goes to the + terminal on the power terminals and the black wire goes to the – terminal
- The red wire on the buzzer goes to the + terminal on the buzzer terminals and the black wire goes to the – terminal
- The LED is in the right way around



Testing the PCB

The circuit has been designed to allow easy testing of the PCB.

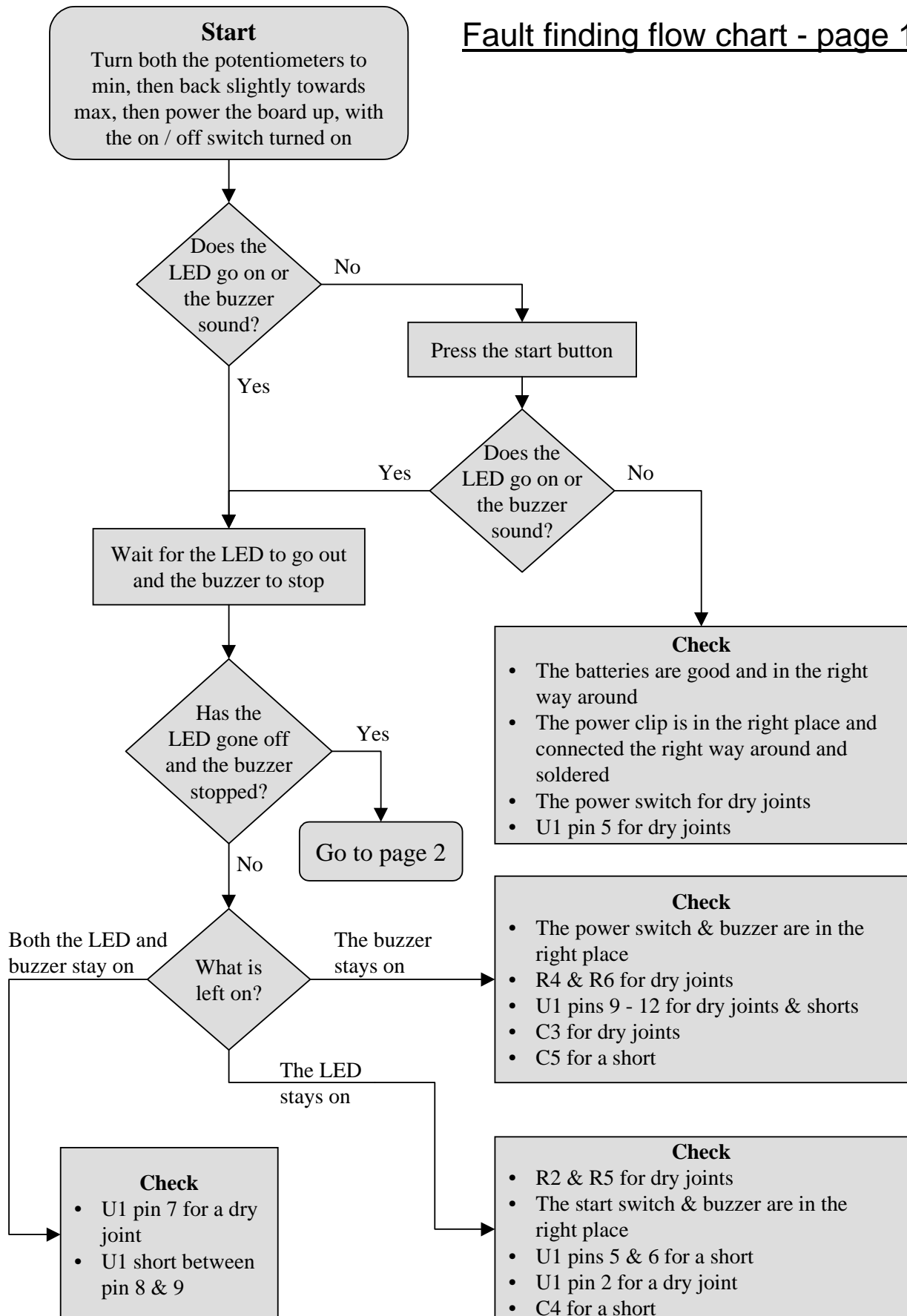
Turn both the potentiometers to minimum and then back slightly towards max (Almost fully anti-clockwise – as marked 'min' on your PCB). Then insert the batteries with the power switch in the on position. The timer may:

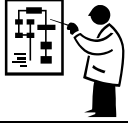
- Illuminate LED1 or / and sound the buzzer for a period of time
 - If this is the case, just wait for the LED to go out and the buzzer to stop, before testing as follows:
- Press the start button and check again that the LED lights for a period and when the LED goes out the buzzer sounds for a period.
- Check that R5 can be used to adjust the time out period and that R4 can be used to adjust the period for which the buzzer sounds
- Turn the timer off using the on/off switch

If you have problems with any of the above use the fault finding flow charts to find the cause of the fault.

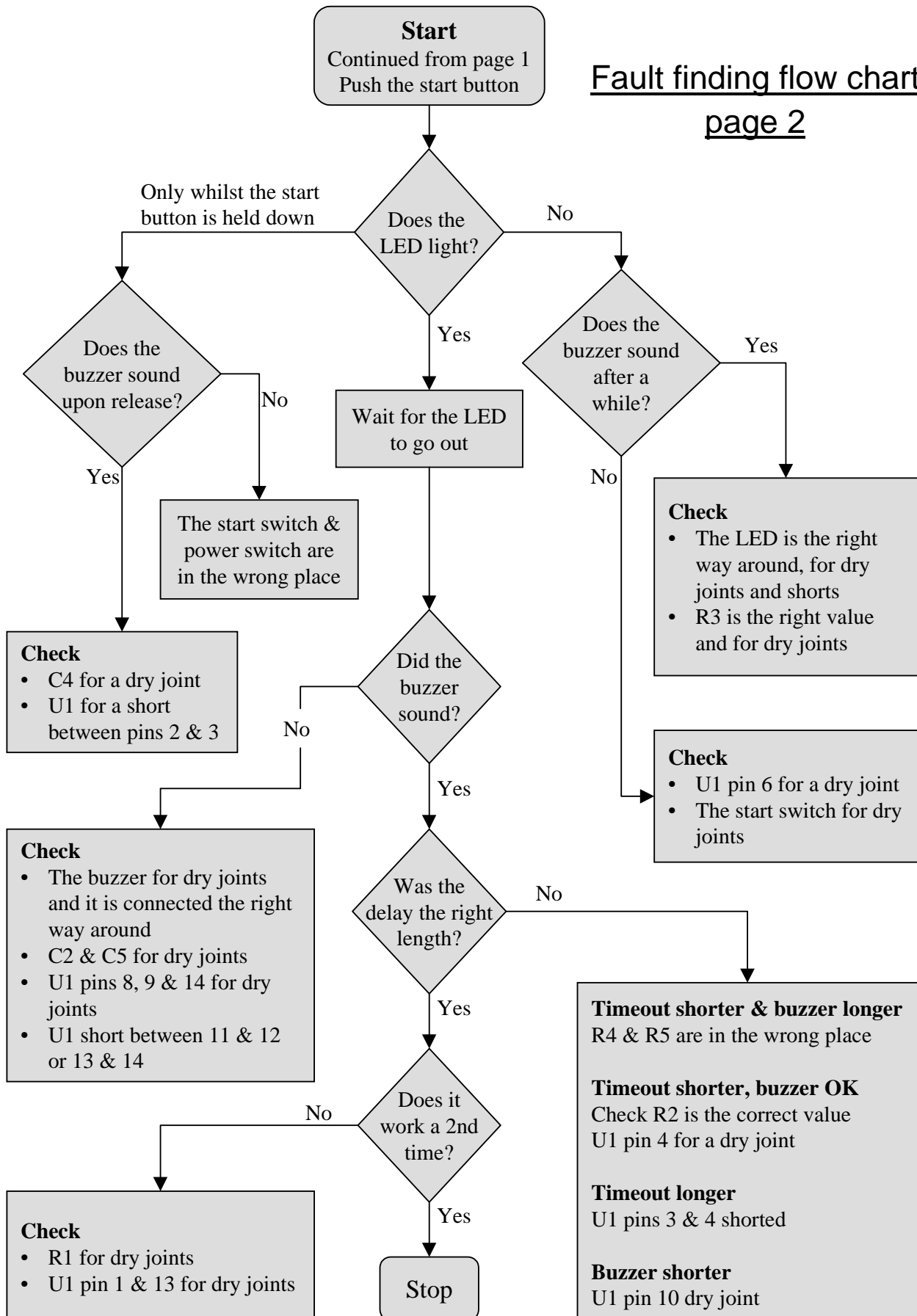


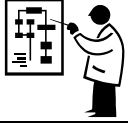
Fault finding flow chart - page 1



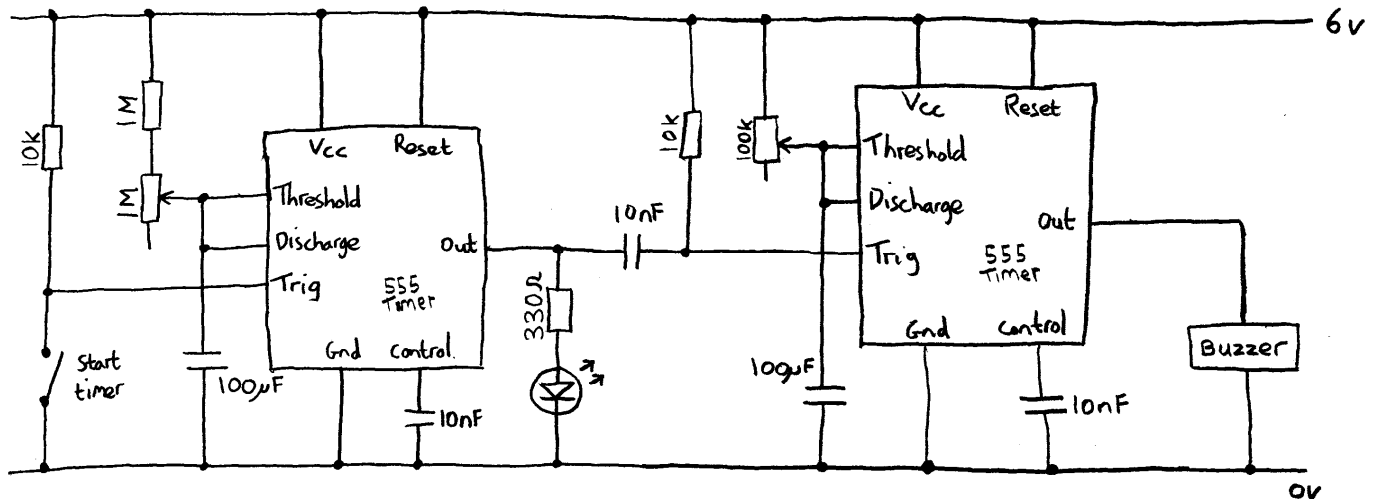


Fault finding flow chart page 2





How the Timer Works



The timer is based around the 556 timer. This is simply two 555 timers in the same device.

The 555 timer is a versatile IC (integrated circuit) and can be used to form many circuits. One of these circuits is a monostable timer. This circuit produces a single pulse when triggered. This means the Out pin is high (causing the LED to light or buzzer to sound).

To trigger the circuit the Trig input must go from a high to a low voltage. When the start switch is pressed (closed) the Trig input is taken low and the output pulse starts.

The duration of the pulse generated is determined by the RC constant (see Capacitor worksheet) formed by the resistor and capacitor connected to the Threshold input. When triggered the Discharge pin is used to start the $100\mu\text{F}$ cap charging. When it reaches $2/3$ of the battery voltage the Out pin changes from high to low.

The first 555 timer is used to provide the timing delay, which is the time you have to before the buzzer is sounded. This can be adjusted between 0 seconds and 200 seconds. This is because R_5 , the variable $1\text{M}\Omega$ can be adjusted between $1\text{M}\Omega$ and 0Ω and an additional $1\text{M}\Omega$ resistor can be added. This gives a maximum RC constant of $100\mu\text{F} \times 2\text{M}\Omega$ ($1\text{M}\Omega + 1\text{M}\Omega$) = 200 seconds and a minimum of $100\mu\text{F} \times 0\text{M}\Omega$ ($0\text{M}\Omega + 0\Omega$) = 0 seconds.

When this times out the output goes low and causes the second 555 timer circuit to start and the LED to go out. At this point the buzzer will begin to sound. The second timer and therefore the period for which the buzzer sounds can be adjusted to between 0 seconds and 10 seconds ($100\mu\text{F} \times 100\text{K}\Omega = 10$ seconds).