eLabtronics Timer

If you need to operate something for a timed period, the eLabtronics Timer module is an easy way of doing it. Not only can timed periods be triggered manually, they can also be turned on automatically by changes in temperature or light levels!

Features:

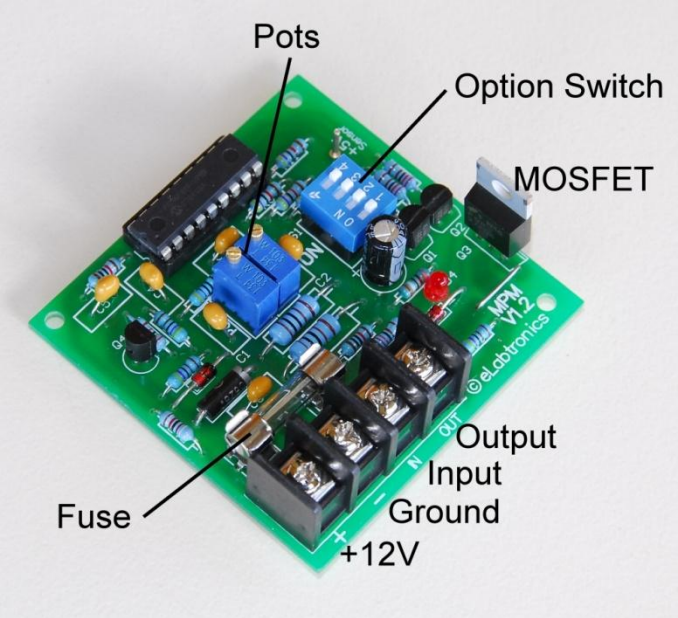
- Adjustable time period from 1 second to 1 hour
- Automatic or manual trigger
- Timed outputs: one shot, delayed 'on' or manual pushbutton
- Special manual mode counts number of times a pushbutton is pressed
- Can be configured to automatically trigger at certain temperature or light level
- On-board LED flashes twice per second during timed period
- Can switch a maximum continuous current of 10 amps (up to 100 amps with external solid state relay)
- Operates from 10 – 40V DC
- Fuse and reverse polarity protected

The Timer is completely self-contained, with its own on-board high output transistor. Wiring the Timer into place requires only four connections – power, ground, load and input trigger.

The Timer can work on any DC voltage from 10 – 40V, making it safe to use with battery or plugpack power.

Finally, by adding just a few extra components, the Timer can be automatically triggered at a certain temperature or light level.

Using the eLabtronics Timer



The Timer is based on the eLabtronics Multi-Purpose Module. It has a high current output transistor called a MOSFET, a fuse, four wiring connections, an option switch and two user-adjustable multi-turn pots.

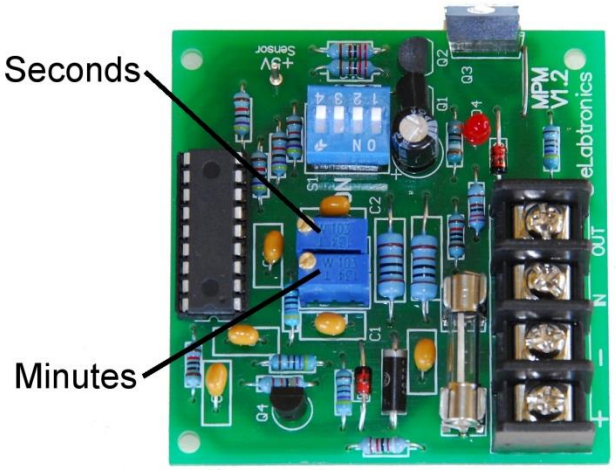
The eLabtronics Universal Timer's wiring connections are:

- **Power** - marked on the board as '+'
- **Ground** – marked as '-'
- **Input** – marked as 'in'
- **Output** – marked as 'out'

When the eLabtronics Universal Timer output MOSFET is activated, battery power is available at the **output** terminal. So all you need to do is to wire your load (lights, buzzers, horns, solenoid, fans, pumps, etc) between the output terminal and ground.

If the load has a polarity, the positive terminal goes to the Universal Timer. (Note that as with all MOSFETs, there is a slight voltage drop across it, so at high loads, a little less than full battery voltage will be available at the output at high loads.)

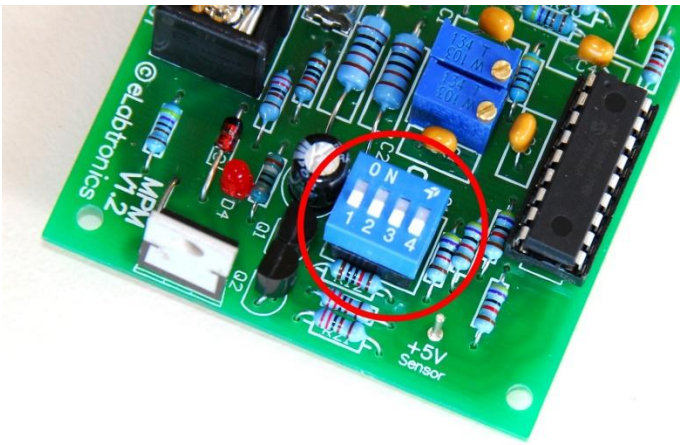
Adjustment Pots



The two on-board pots set the period the Timer runs for. One pot sets **seconds** (0-60) and the other sets **minutes** (0-60). Because these pots are multi-turn, you can accurately set a timed period from 1 second to just over 1 hour. And everything in between.

For example, if you want the timed period to be 5 seconds, set both pots fully anticlockwise. Then rotate the 'seconds' pot clockwise a little and test the timed period. (It's easy to see what the timed period is because when the timer is activated, the on-board LED flashes twice per second.)

DIP Option Switch Positions



The real smarts in the eLabtronics Universal Timer are in the four-position DIP Option Switch. **Position the board so that the terminal strip is on the right** and then the following switch positions give the listed behaviour.

Timer Mode 1

X	X	X	X

In this mode, the output is switched on for the timed period when the input signal rises above 2.6V. After the timed period has elapsed, the timer switches off – even if the input signal is still above 2.6V. This means it's a **one-shot timer** – the input signal needs to **fall and then rise again** to re-trigger.

Timer Mode 2

X	X	X	
			X

This mode is the same as the one above, except the module triggers for its timed period when the input voltage **falls below** 2.6V.

Timer Mode 3

X	X		X
		X	

This mode is easiest thought of as adding an extended 'on' time. The output switches on when the input **rises above** 2.6V, and then stays on for the timed period after the input **drops below** 2.6V.

Timer Mode 4

X	X		
		X	X

This mode is the same as the one above but the timer triggers when the input **falls below** 2.6V and then stays on for the timed period after the input **rises above** 2.6V.

Modes 1-4 can be triggered by simply connecting a wire from the input terminal through a pushbutton to the positive (+) power supply wire. However, these modes can also be triggered by monitoring sensors that have a varying output voltage. Let's have a look at that in more detail

Triggering From Light and Temperature Sensors

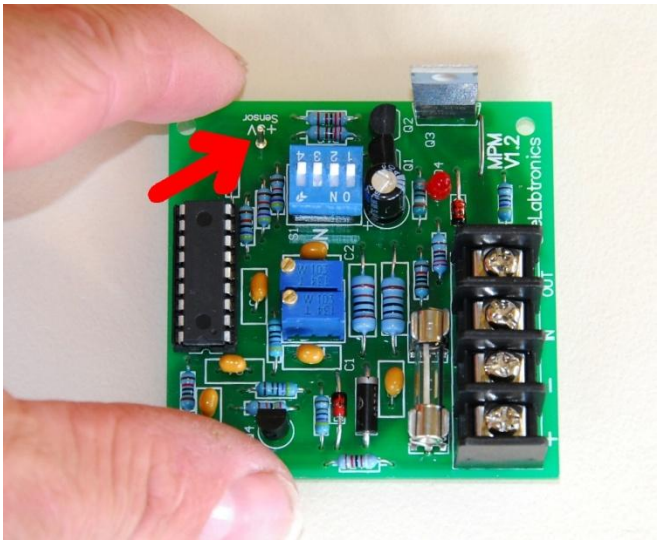
As mentioned above, while the Timer is normally switched on by connecting its Input terminal to power, the Timer actually turns on when the voltage on the Input rises above (or falls below) about 2.6V.

This seemingly minor point is very important, as it allows the Timer to be automatically triggered by changing light levels, temperature or even the output of a car's engine management sensor.

For example, the Timer can be configured to automatically turn on a beeper for 10 seconds when it gets dark, or turn on a fan or pump for a certain period when it gets hot. It can even be triggered when the **difference** between two temperatures exceeds a certain amount!

Some soldering and component recognition skills are required when configuring the Timer for automatic switch-on, so the electronic skills needed are a little higher than when wiring-in the Timer for normal manual use. However, the wiring is still very straightforward.

5V supply



To automatically trigger the Timer on the basis of temperature or light intensity, use is made of a regulated 5V supply sourced from the module. This is available on the pin shown here.

Note that while a regulated 5V is available on this pin, the amount of current that can be drawn is strictly limited. There is sufficient current available to operate the temperature and light sensor circuits described here, but there is **not** enough current available to run other sensors (eg automotive MAP sensors). In fact, the output current rating of this source is only 2 milliamps.

Effectively, the 5V pin supplies a fixed voltage that is them modified by the action of the specific sensor (temp or light) and adjustment pot before being fed to the Input.

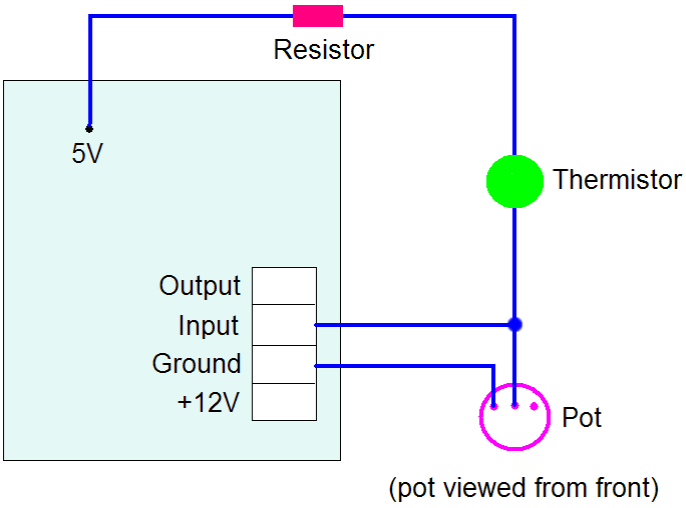
So how is the Timer wired for auto operation? Let's look at temperature first.

Temperature

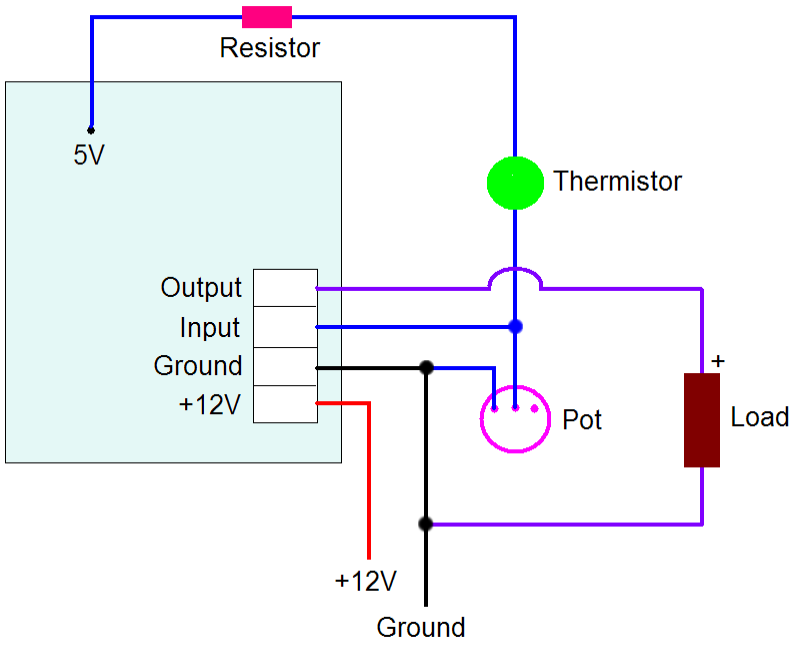
By using one or two low cost temperature sensors (thermistors) and a few other components, the Timer can be configured to switch itself on the basis of temperature. The switching point is adjustable and a number of different configurations can be used.

- **Turns on when it gets hot**

This is the approach to go for when things need to be turned on for a set period once the temperature **rises above** a certain point. One example use is to sound an over-temp alarm.



Here is the wiring diagram. Note that for the sake of simplicity, the power and load connections for the Timer are not shown here (or in most of the wiring diagrams in this story).



However, as a special once-off, here is a full working system, complete with ground, +12V and the load connections.

To trigger the Timer on the basis of temperature, the required additional components are:

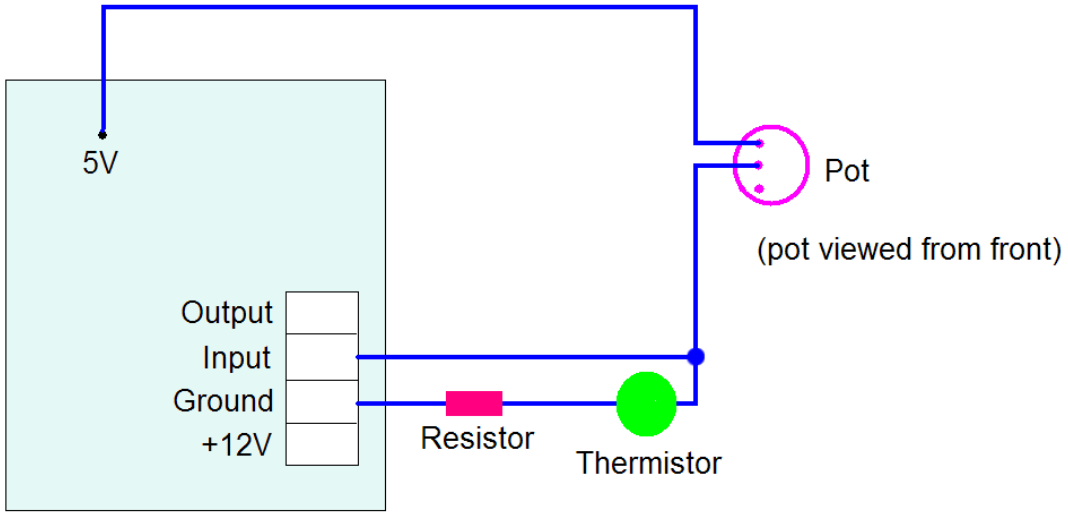
- 200 kilo-ohm resistor
- 100 kilo-ohm thermistor
- 1 meg-ohm kilo-ohm potentiometer (“pot”)

The circuit is wired as shown here. Note that the pot is shown from the front view (if you wire the pot in reverse, the adjustment will just work in the opposite direction). You can use any type of 1 meg-ohm pot, including a multi-turn design that will allow finer adjustment of the temperature set-point. The thermistor and resistor have no polarity so they can go into the circuit either way around.

In this circuit, turning the pot clockwise **increases the temp** at which the Timer turns on. With the depicted components, the selectable temp range is from about 0 degrees C to about 100 degrees C.

- **Turns on when it gets cold**

This is the approach to go for when things need to be turned on once the temperature **falls below** a certain point.



The required components are again:

- 200 kilo-ohm resistor
- 100 kilo-ohm thermistor
- 1 meg-ohm kilo-ohm potentiometer (“pot”)

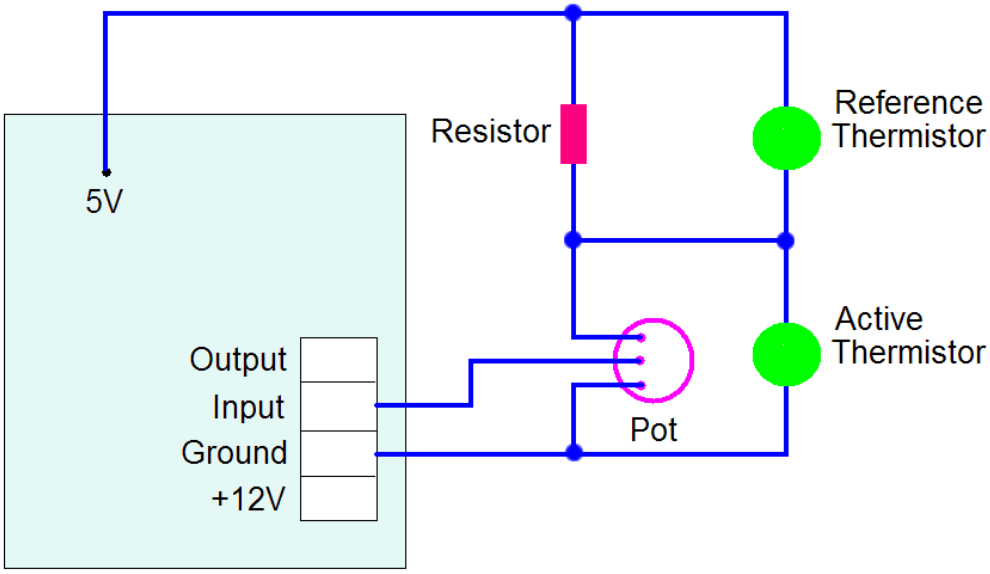
The circuit is wired as shown here. Note that the pot is shown from the front view (if you wire the pot in reverse, the adjustment will just work in the opposite direction). As before, you can use any type of 1 meg-ohm pot, including a multi-turn design. The thermistor and resistor have no polarity so they can go into the circuit either way around.

In this circuit, turning the pot **anti-clockwise decreases the temp** at which the Timer turns on. With the depicted components, the selectable temp range is from about 0 degrees C to about 100 degrees C.

- **Turns on when temperature difference is high**

This is the approach to go for when things need to be turned on for a set period once the **temperature difference** between two sensors **increases above** a certain point.

The benefit of using two sensors is that it takes into account different ambient temp levels that might exist.



The wiring is carried out as shown here. The 'reference sensor' is placed so that it will be the cooler of the two sensors. When the 'active sensor' is (say) 15 degrees C higher in temp than the reference, the Timer will be switched on. This temp difference can be set by the pot.

The required components are:

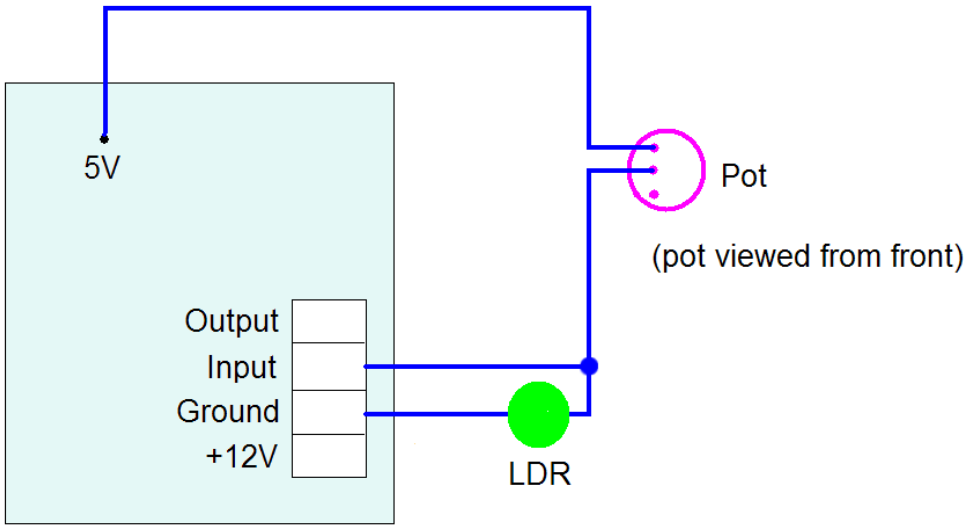
- 1 x 200 kilo-ohm resistor
- 2 x 100 kilo-ohm thermistors
- 1 x 500 kilo-ohm potentiometer ("pot")

In this circuit, turning the pot **clockwise increases the temp difference** at which the Timer turns on. With the depicted components, the selectable temp range is from about 0 degrees C to about 100 degrees C.

Light Intensity

- **Turns on when it gets dark**

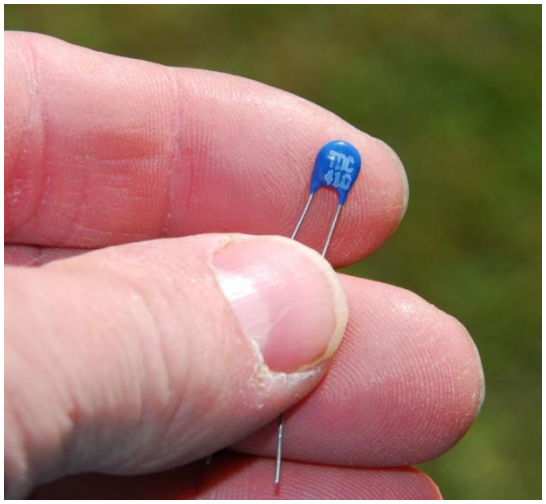
Wired in this form, the Timer switches itself **on when it gets dark.**



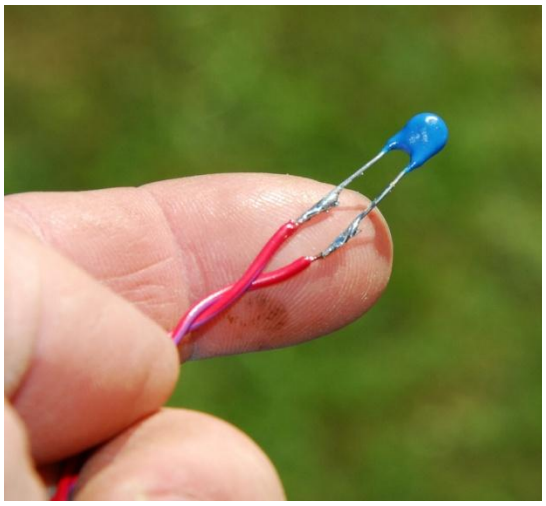
The wiring requires a Light Dependent Resistor (LDR) with a nominal 48 – 140 kilo-ohm response and a 1 meg-ohm pot. Turning the pot clockwise increases the level of darkness needed to trigger the Timer.

Mounting the Sensors

Both the thermistors and LDR come as bare electronic components. To wire them into place, you'll need to do two things: solder them to extension wiring and mount them.



Here’s a bare thermistor



Shorten the leads and then solder two insulted wires to the leads.

Use insulation tape (when working with relatively low temps) or good quality heatshrink (high temp sensing) to insulate the connections.

The Light Dependent Resistor (LDR) can be handled in the same way.

If the sensor is detecting just ambient conditions (eg in-house temperature or light intensity), the sensor can simply be positioned appropriately and held in place with a cable tie. However, if the sensor is working in a much tougher environment, use high-temp epoxy to mount the sensor in a threaded brass fitting so that it can be securely mounted.

Timer Mode 5

X		X	X
	X		

This mode is different to the others in that it is designed to be used with a normally-open pushbutton that connects the input to power. In short, it makes the module a **manually-controlled timer**. But there's a trick in it – and it's a very good trick.

What the timer does is count the number of times you press the button. Let's say you use the on-board pots to set the timer for a 1-minute period. If you press the external pushbutton once, the timer will turn on for a minute. But if you press the button twice, it will turn on for 2 minutes! And so on – the number of button presses multiplied by the timed period sets the total output time.

This is the perfect mode when you want for manual control over when the timer operates, and for how long it operates. Almost anything requiring a manually timed period can be run in this way.

You can also cancel the output at any time, just by keeping your finger on the button for a few seconds.

This mode (and mode #1) are also useful when setting the timed period. After setting the DIP switches correctly, trigger the timer by momentarily connecting the input terminal to power.

Mode Summary

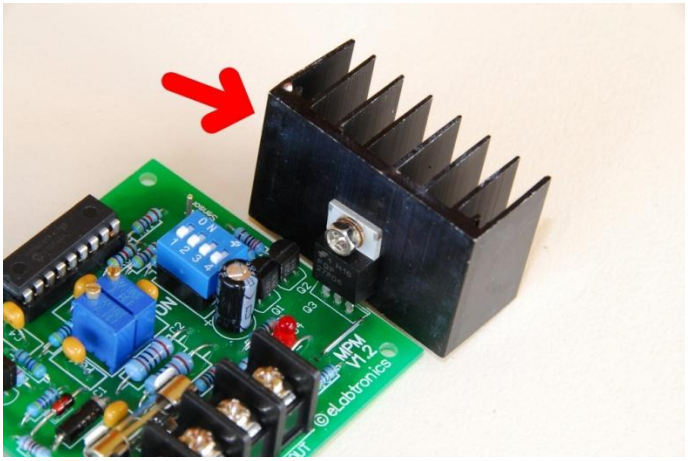
OK, so let's take a summary look at the five different timer modes.

Mode	Output	Input Trigger
Mode 1	One shot then off	Activates when input rises above 2.6V
Mode 2	One shot then off	Activates when input falls below 2.6V
Mode 3	Extended 'on' time	Activates when input rises above 2.6V
Mode 4	Extended 'on' time	Activates when input falls below 2.6V
Mode 5	One shot then off	Number of press-button pushes

Note: if you need to repetitively operate something for a timed period (eg 5 minutes on, 2 minutes off, 5 minutes on, 2 minutes off, etc) use the eLabtronics Pulser module.

Output Power

The output MOSFET (transistor) is rated to handle a continuous 10 amps – but that's when it is fitted with a big heatsink.



As a general rule of thumb, no heatsink will be needed if you're operating relays, warning globes, LEDs or beepers. If you're operating a pump, a medium sized heatsink like the one pictured will be needed. If you're turning on high powered lights or horns, a large heatsink will be needed.

The heatsink needs to be isolated from ground and positive supplies, so either mount it so it fits inside a box (and can't touch anything metallic!) or mount the heatsink to the MOSFET using an insulating spacer and nylon nut and bolt.

Conclusion

The eLabtronics Timer is simple to operate and set up. It has numerous applications in hobby, educational, industrial and automotive fields.