Light Module Documentation

A diagram of a circuit board

Description automatically generated

A computer circuit board with many wires and numbers

Description automatically generated with medium confidence

This module is built to make integration of a blinking light system into other systems easier. The circuit reduces the wiring to a basic power connection and a single trigger input. When the trigger input is given a low pulse (a change from a held high voltage to a temporary low voltage), a monostable (countdown-style) timer configuration set up by dual timer module U1, as well as R1 and C2, will count the duration for which the light should blink. Through Q1 and Q2, this then controls the astable (repeatedly running) timer assembled from U1, R5, R6, and C4. While the monostable timer counts down, the astable timer uses Q3 to blink light D1. If a second low-voltage pulse arrives, the monostable timer’s countdown resets without affecting the astable timer’s oscillations. 17 seconds after the last pulse, if another has not arrived, the monostable timer resets and the light stops blinking. Below is a rough, not-to-scale diagram which summarizes the behavior:

A black outline of a piano

Description automatically generated

There are three headers in the circuit, a 1x1 header and a 2x1 header, just to the left of the IC, U1. These are the inputs required to integrate into the circuit. The single header should be a 5V power supply, such as a 5V pin on the Raspberry Pi. While 3.3V may work, it has not been tested and may make the light very dim.

In the 2x1 header, the slot furthest from the 1x1 header for power, labeled GND in the circuit board design, is the ground connection. **This should be tied to the ground connection of the same device connected to the power supply input**, such as the GND pins on a Raspberry Pi. Not connecting both power and ground to the same device may damage the light module and/or the connected devices. However, if the two devices have their ground connections tied together, that will be safe so long as this connection is maintained. For instance, since a Raspberry Pi HAT is generally connected to the Pi’s power and ground connections, the HAT’s ground circuit is equivalent to the Pi’s and will also be a safe place to connect this point. **The ground header should have a connection to the ground circuit on the device supplying the power header.**

The point on the 2x1 header closer to the 1x1 header, labeled “Trig” in the circuit board design, is the trigger input. This input should be held high to keep the light system idling. When the trigger input reaches a low voltage (defined as below 1/3 of the power supply voltage), the light will begin blinking. Once the trigger input returns to high, the light will continue pulsing for approximately 17 seconds. Essentially, to start the light blinking, send a single pulse. **If the pulse is too short, the capacitor will be unable to fully discharge and may cause unexpected blinking times**. A pulse of 1ms should be sufficient. If the light stops blinking after an unexpectedly short time (see the below formulas for the intended time; default 17 seconds), try a longer pulse.

Replacing the capacitor at C2 with another capacitor will rescale this blinking time. The specific formula for the time the blinking will continue for, in seconds, is . **Replacing R1 with a smaller resistor to change this time may cause large current draws on activation and is not recommended. Change C2 instead.** The default value is approximately . **Ensure that any replacement capacitor is rated for more than the supply voltage and is placed in the same orientation**; large capacitors are generally polarized and must be placed in the correct direction.Also note that to change the capacitor will require soldering. Soldering improperly may result in incorrect connections being made, which may damage this module and any connected devices. **If you do not know how to solder, it is not recommended to attempt to change out the capacitor or any other part.** It is also not recommended to change out other parts, as some are present to limit current to components which will be damaged by high current, and others have more complicated effects.

If the light must be replaced with a device requiring a higher voltage or current than the existing circuit can provide (limited to approximately 4.7V and 8mA), then the LED can be replaced with a relay and a diode, as shown in the circuit section below. The high power light controller should then be connected to this relay’s unconnected pins. However, this change is relatively complex, and has not been tested. Consult the datasheets for the high-power light system you are utilizing to see how best to control it and what relay is required. The power providing device should also be able to handle the current that the relay requires. As previously stated, **if you do not know how to solder, it is not recommended to change out parts in the circuit.**

A diagram of a circuit

Description automatically generated

For initial setup, note that the device may blink when the system is initially set up, or blink for the wrong amount of time on the first run, regardless of the input. This is expected, as the capacitors may not be charged when the circuit is first powered on, and therefore the countdown may be in the middle of running. Similarly, if power to the module is cut and restored, and the timer was running when the power was cut, it may continue to blink after restoration, even though the intended time has passed, as the capacitor may not have discharged before power went out. Therefore**, the module should generally be used for situations where power is consistent, and/or where a false positive reading is not as severe a problem as a false negative**.