

Delaware Science Olympiad Photogate Timer

The National Science Olympiad introduced photogate timer usage in the 2013 rules for Mousetrap Vehicle testing and expanded photogate timer usage in the 2014 rules to include Scrambler, MagLev and Wheeled Vehicle testing. This greatly improves the accuracy of the timing over stopwatches, particularly on long distance runs where parallax can cause significant observational errors.

Readily available photogate timers, such as the PASCO Models ME-9215A or B and priced around \$350 come with photogates with mere centimeters between the infrared beam source & receiver and provide no functionality for spanning a test track. PASCO does sell Laser Switches for around \$140 each (not including the laser senders) that are compatible with their timers and will provide the necessary functionality across test tracks. However, the use of red lasers in horizontal applications in the presence of young competitors in close proximity and the presence of public observers can present an eye safety hazard.

With the goal of finding a safer and less expensive photogate timer and with the support of the Delaware Bay Section of the IEEE, the Delaware officiating team investigated the functionality of garage door opener safety beams. These infrared beams can span across double garage door openings and reliably reverse the door closing motion when the beam is cut. Upon measuring the operating parameters of an installed Lift Master Model 41A5034 safety beam kit, we discovered that the Sender and Receiver both operate on 5 volts DC (Same operating voltage as the PASCO sensors) and with similar power consumption.

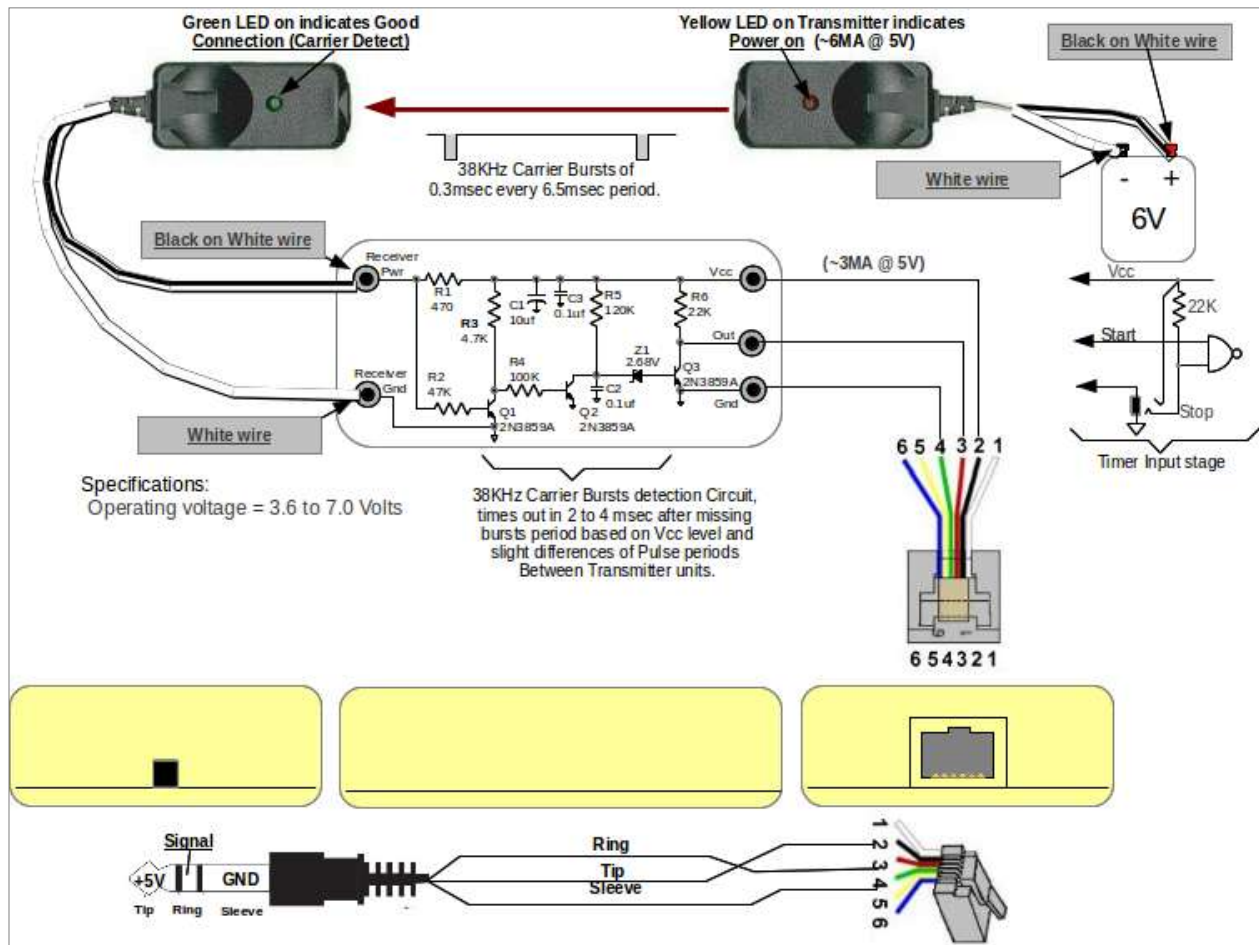
The Lift Master Model 41A5034 safety beam kit, which is widely used on Sears and other opener models, is available from Amazon for under \$20 per kit (Two kits needed). The Sender and Receiver in each kit are both two wire units that connect to the same power supply terminals on the Control Box. The Receiver communicates beam continuity back to the Control Box by pulsing the DC supply. In normal use, when the beam is cut, the pulses stop and the Control Box, sensing the lack of pulses, reverses the door travel. The beam width from the Sender is much wider than a laser and makes alignment with the Receiver much easier to achieve and maintain.

The sensor input to a PASCO timer has three conductors, 5 VDC, Ground and Signal. To obtain functional compatibility between the safety beam Receiver and the PASCO timer, we designed a pulse decoder circuit which outputs a state change on the Signal wire when the Receiver stops pulsing its DC supply conductor. The pulse decoder circuit fits inside a standard 2" x 2" surface-mount phone jack box which accommodates connection of the two Receiver leads on two of the jack terminals and provides RJ12 connector compatibility to the PASCO timer.

An output Signal delay of up to 10 msec after the beam is cut can result from the 6.5 msec period of the Receiver pulses plus the response time of the pulse decoder circuit. This potential delay is well within the hundredth of a second accuracy of a stop watch.

The open source pulse decoder circuit was developed by DAKTEK, LLC for the Delaware team and is shown below. For anyone interested in purchasing a pulse decoder circuit mounted inside a surface mount phone jack box as shown, please contact DAKTEK, LLC at: daktekllc@gmail.com

View a video at <http://youtu.be/nMbyHX2y90Y>



Delaware Photogate Timer Pulse Decoder Circuit for PASCO ME-9215A or B Compatibility Using Lift Master Model 41A5034 Garage Door Reversal Safety Beam Kits.

Designed by DAKTEK, LLC daktekllc@gmail.com

