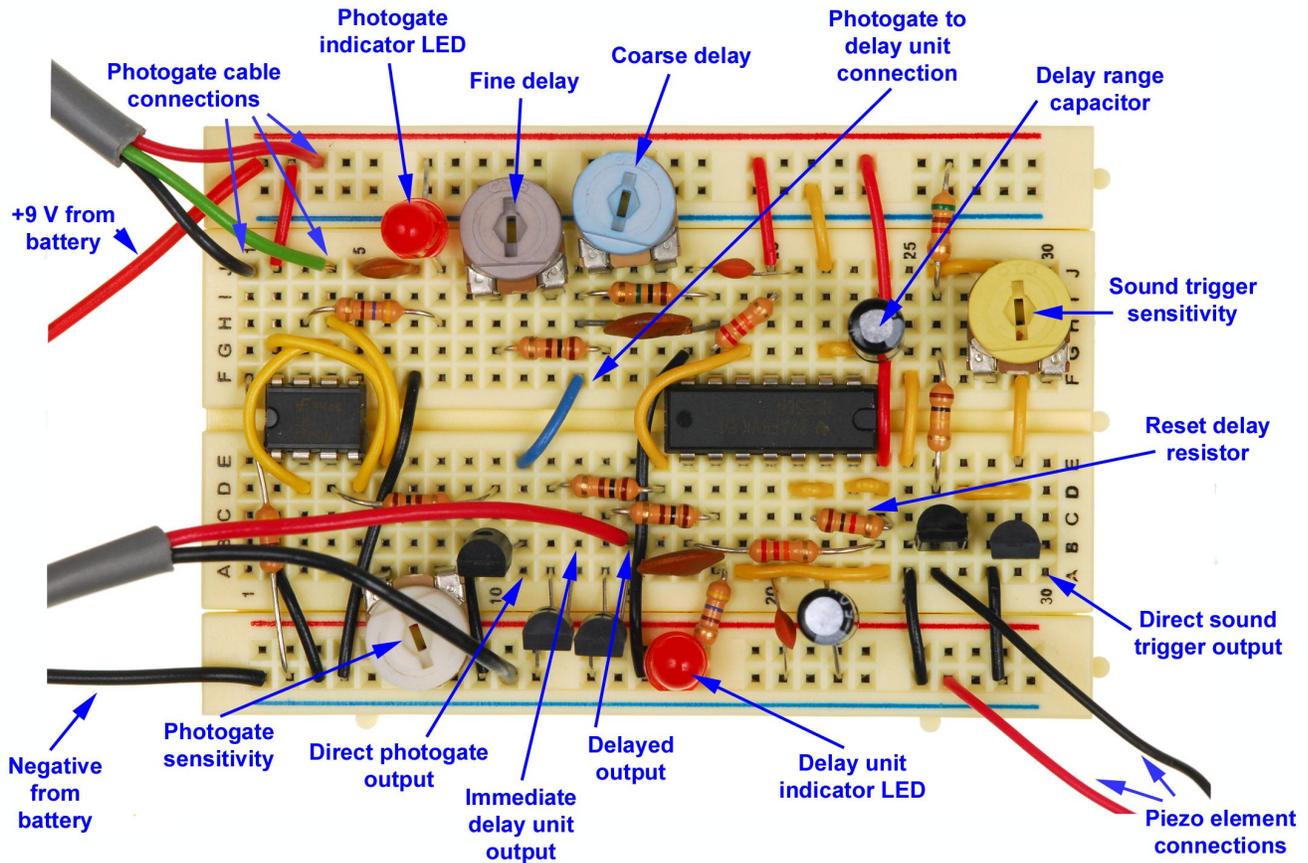


Operating Instructions for the Multi-Trigger (MT-A)

Refer to the photograph below for the placement of cables and components.



Supplied components

Circuit board with photogate, sound trigger, and delay unit
 Photogate cable with wired emitter and detector
 Photogate cable with wired interrupter
 3-foot, 2-conductor output cable

Small bag with these components:
 0.01- μ f capacitor (103)
 0.1- μ f capacitor (104)
 100-kohm resistor (brown-black-yellow)

Battery cable connection

The entire column of holes on the bottom along the blue line is negative (ground). Likewise, the entire column along the red line on the top is +9 V. These two columns are where the red and black cables from the battery clip are connected.

Connecting a photogate cable



Two photogate cables are supplied. The cable with the black U-shaped piece shown to the left (called an interrupter) is convenient for triggering on smaller drops or vibrating strings. For the passage of larger objects, use the photogate cable that has a separate emitter and detector. (The emitter has the blue case.) Both photogate cables have 3 wires: red, black, and green. Connect them to the breadboard at the locations given in the table.

Wire	Location
Red	+9 V
Black	1J
Green	4J

For some applications, it's desirable to have a large working distance between the emitter and detector of the photogate. In this case, use the cable that has the individual emitter and detector. Tape the emitter out of the way. Then use a red laser pointer as the light source on the detector. Note that if the beam is too intense, you may have trouble adjusting the photogate sensitivity (see bottom of the next page). In that case, try reducing the beam intensity either by placing a neutral-density filter over the LED or poking a hole in a piece of aluminum foil and placing that over the LED.

Connecting the piezo element

The red wire of the piezo element goes to ground (-) and the black wire goes to 26a.

Connecting both the piezo element and a photogate cable

While you can have both the piezo element and a photogate cable connected to the breadboard at the same time, you may find it preferable to only have one of them connected at a time. If you're using the photogate and the piezo element is connected, then bumping the trigger may create unwanted discharges. If you're using the piezo element and the photogate is connected, the battery will run down faster.

Connecting the output cable to a flash unit

The output cable has 2 wires: red and black. Make the following connections, depending on which mode of output you would like to use:

Output Mode	Red Wire	Black Wire
directly from photogate (no delay)*	11A	ground (-)
directly from sound trigger (no delay)*	30A	ground (-)
from the immediate output of the delay unit	13B	ground (-)
from the delayed output	15B	ground (-)

Connect the other end of the output cable to the PC cord from your flash unit. See the following link for illustrated instructions on splicing the output cable to a PC cord or Flash-to-PC adapter:

http://hiviz.com/kits/instructions/flash_info.htm.

*When connecting a flash to the direct output of the photogate or sound trigger, first disconnect the wire from the output of the trigger to the input of the delay unit. This is the wire from 11E to 13F for the photogate and 30E to 13F for the sound trigger. If this wire is left in place, some flash units can burn out the 556 timer.

Connecting the output cable to a camera or wireless trigger

If you wish to trigger either a wireless transmitter or your camera shutter instead of a flash unit, see this page:

http://hiviz.com/kits/instructions/camera_wireless_info.htm.

Powering the unit

The circuit runs on a 9-V battery. Connect the wires from the battery clip to the +9 V and ground columns. Disconnect the battery when the circuit is not in use. You may also choose to use a 9-V AC/DC adapter to power the unit. Any AC/DC adapter that provides up to an ampere of direct current at 9 V should do. Here's an example: http://hiviz.com/kits/ACDC_adapter.htm.

Connections from the triggers to the delay unit

Connect either the sound trigger or the photogate to the delay unit but not both at the same time. If you connect both at the same, the trigger may not work.

The photo shows a blue wire connecting the photogate trigger from 11E (photogate output) to 13F (delay unit input). In order to connect the output of the sound trigger to the delay unit, first disconnect the wire from 11E to 13F. Then connect a jumper wire from 30A to 13F.

Minimizing delay with the sound trigger

For some situations when using the sound trigger, it's desirable to keep the delay between sound reception and discharge of the flash to a minimum. In order to do this, connect the flash to the direct output of the sound trigger, place the microphone as close to the source of sound as possible, and adjust the sensitivity of the sound trigger to its maximum.

Adjusting the delay time

You can make either coarse or fine adjustments to the delay time. To observe a delay, connect the output cable to the delayed output. To increase the delay time, do the following:

For coarse adjustment, rotate the 1M potentiometer (blue knob).

For fine adjustment, rotate the 100k potentiometer (brown knob).

For either knob, clockwise rotation increases the delay time.

Adjusting sensitivity

Sound Trigger: Start with the 1k potentiometer (yellow knob) turned all the way clockwise. Connect a flash unit to the direct output of the sound trigger. Now turn the knob slowly counterclockwise until the flash unit discharges

spontaneously. This is the point of maximum sensitivity. Past this point, the flash unit won't discharge, because the SCR is being held in a closed state. Back up the knob a bit so that you can get a flash discharge from a finger snap.

You may find that when you're using an output of the delay unit, the sensitivity must be adjusted. Turning the knob about three-fourths of the way clockwise is usually sufficient. The sound trigger isn't as sensitive when used with the delay unit; however, this shouldn't be a problem since the microphone needn't be placed far from the source of the sound when setting delays electronically.

Photogate Trigger: First make sure the photogate is working. Then turn the white knob clockwise until the photogate indicator LED goes off. Back off the knob a little bit until the LED comes back on. Adjustments may need to be made if you change the separation of the emitter and detector. If you increase the separation, do so in small steps, testing the photogate and readjusting the sensitivity as needed to ensure that the photogate continues to be aligned and working.

Changing the delay range by switching capacitors

A half second delay works well for capturing splashes of falling drops, but for many situations much shorter delays are needed. You can change the delay by replacing the 0.47- μf capacitor with one of smaller value. An extra 0.1- μf and 0.01- μf capacitor have been provided for this purpose, and will yield the following time delays.

Capacitor	Time Delay	Location
0.47- μf (cylindrical)	Half second	(+) to 23H, (-) to 25G
0.1- μf (labeled "104")	Up to $\sim 1/10$ second	23H-25G (nonpolar)
0.01- μf (labeled "103")	Up to $\sim 1/100$ second	23H-25G (nonpolar)

Replacing the 1-kohm resistor with a 100-kohm resistor to increase the reset delay

The 1-kohm resistor from 22C to 24C can be replaced with the extra 100-kohm resistor in order to increase the dead time after a triggering event. During this dead time, the circuit won't trigger. This is useful to prevent secondary events such as a second drop from actuating the circuit. The dead time is approximately equal to the value of the resistor in kilohms divided by 100. For example, the dead time for a 100-kohm resistor would be 1 second.

Using the red LEDs to check the functioning of the photogate and delay unit

Photogate indicator: The red LED connected from 8J to +9 V is normally on when the battery is connected and the photogate is unblocked. This LED should go off when the photogate is blocked.

Delay unit indicator: The red LED connected from ground to the adjacent column is normally off. It will flash momentarily when the delay unit is triggered on by either a photogate or sound trigger output.

The red LEDs aren't needed for operation of the trigger. They can be removed in order to preserve battery life. If you remove an LED and then want to reconnect it, note that the rim around the case of the LED has a flat side. The leg on that side is negative.

Replacing components

Due to the nature of an open circuit on a breadboard, components may become dislodged and need to be resealed. Step-by-step instructions showing placement of components can be found at the following link.

<http://hiviz.com/kits/instructions/mt-manual.htm>