STOPShot

Turning ordinary moments into extraordinary pictures

Owner's Manual

Revision 1.10

Cognisys, Inc.

Where the left and right brain meet.

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1. Safety Instructions

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

Follow all CAUTION notices to reduce the risk of personal injury, prevent damage to the StopShot module, accessories, and devices (cameras, flashes, etc). Failure to follow all CAUTION notices may void your warranty. CAUTION may also indicate a potentially hazardous situation which, if not avoided, may result in personal injury.

The safety alert symbol ⚠ precedes a general CAUTION or WARNING statement.

The electrical hazard symbol ⚠ precedes an electric shock hazard CAUTION or WARNING statement.

2. Getting Started

2.1 The StopShot Controller

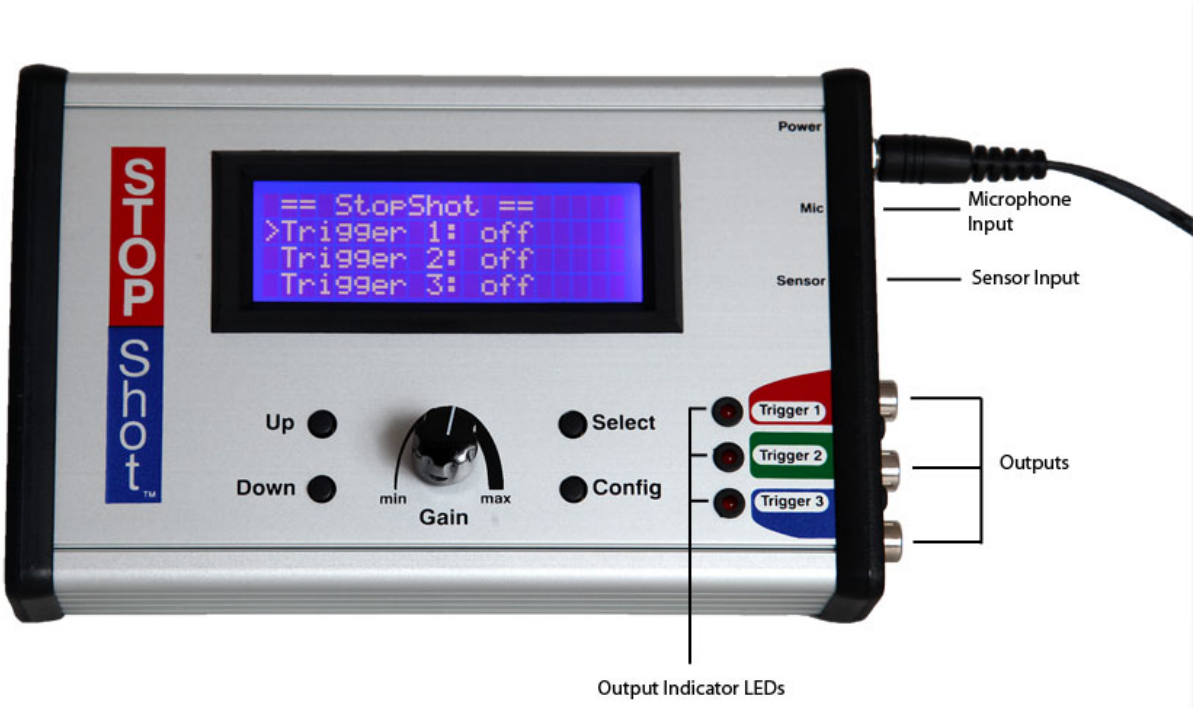


Figure 1 - StopShot Controller

The latest version of this manual is available at http://www.cognisys-inc.com.

2.2 Getting Familiar with StopShot

When you first apply power you will see a splash screen that displays the software version for a couple of seconds. The display will then fade to the screen you see in the image above. This is what we call the main screen.

The main screen shows the state of the three outputs or 'Trigger' channels that correspond to the 3 sockets on the bottom of the right edge of the unit. (Color coded Red, Green and Blue). You can see that they are all OFF. StopShot will not activate any outputs in this state regardless of what happens at the sensor inputs. The outputs will be connected to the devices you want to control, for example a camera, flash, or even a water valve or solenoid. The output indicators will light anytime StopShot activates the output next to the corresponding indicator LED.

We're going to walk you through some basic scenarios to get a feel for navigating StopShot. If you have the water drop kit and would rather skip this, you may want to go directly to the water drop kit walk-through in section "5.1 - The StopShot Water Drop Kit".

The microphone or vibration sensor work very well for demonstration purposes to get a feel for how StopShot works. If you have either of these sensors please connect one of them now. If you have the microphone, insert it into the MIC input. If you have the vibration sensor connect it to the Sensor input. If you don't have either, skip ahead to section "2.3 - Connecting StopShot - Beam Sensor - (laser or IR)" to connect one of the beam sensors. Once you have connected a sensor of some kind you can come back and follow the steps below.

Looking at the main screen you will notice that preceding the "*Trigger 1*" line is a "*>*" symbol. This represents the currently selected output or trigger. The current state of "*Trigger 1*" is "*Off*". If you press the **UP** button just once, you will see the "*Off*" value change to 50 microseconds or 50uS. The display will then look like this:

```
    == StopShot ==
>   Trigger 1:  50 us
    Trigger 2:  Off
    Trigger 3:  Off
```

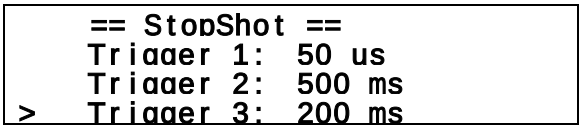
The output for Trigger 1 is now *enabled*, and will activate the Trigger 1 output with a (minimum possible) delay of 50 microseconds, or 50 millionths of a second after an input *event*. For most purposes, this simply means that as soon as an event is detected by the sensor or microphone input, the output of Trigger 1 is energized (the output can fire a camera or a flash). You can think of this as zero delay, even though it is actually 1/20000th of a second. (50 microseconds = 50/1000000 seconds = 1/20000 seconds).

[**Note**: The initial units of the delay, once you have pressed the UP button are microseconds (uS) *or millionths of a second* – once you have accumulated a thousand of these, the units convert to

milliseconds (mS) *or thousandths of a second*. Take note of the units on each output Trigger. A microsecond is a thousand times faster than a millisecond.]

If you now adjust the GAIN knob on the front of the StopShot to about halfway (indicator on the knob pointing up), then tap the microphone or vibration sensor, you will see the LED on the Trigger 1 output illuminate for a half of a second. Notice that if you activate the sensor a couple of times quickly, the LED illuminates only once. There are two reasons for this. First, if the output is currently active (on), the trigger will not re-arm until it completes (LED goes out). Secondly, there is also a default 'blanking period' imposed by the StopShot of a half second on the Trigger 1 output. This period is fully adjustable from zero to 24hrs, and simply prevents multiple triggers on the output before, say, a flash is recharged. If this output was connected to a flash, the StopShot would fire the camera every time the LED was illuminated, not every time an event occurs at the sensor – a key feature. If you wanted StopShot to fire the flash on *every* event, you would simply adjust the blanking time to its minimum (see section "3.5.3 - Trigger" for more details).

Now we'll play a little more to understand the multiple outputs. If you click on the **SELECT** button you will see the "*>*" symbol moves down to "*Trigger 2*". Pressing and holding down the **UP** button increases the delay on "*Trigger 2*" (if it is selected), gradually accelerating through the scale. If you let go at a certain point, and press/hold again, it will start to increase from where you left off, gradually accelerating once more. If you overshoot, the Down button will reduce the value in the same fashion. Pushing and releasing the **UP** or **DOWN** buttons will increment or decrement the delay value by the smallest step. Let's set the delay on "*Trigger 2*" to about 500 milliseconds (500/1000ths, or ½ a second). Getting exactly 500 milliseconds is not important – anything between 400 and 600 is fine for this test. Push **SELECT** again to move to "*Trigger 3*". Applying what you did previously set the delay on "*Trigger 3*" to be "*200 ms*" (milliseconds). The display will look like this when you are finished.

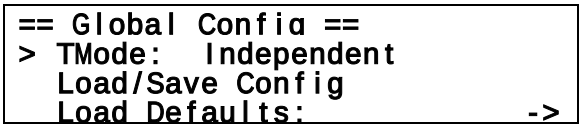


Now activate the sensor again. What happened? Is it what you expected?

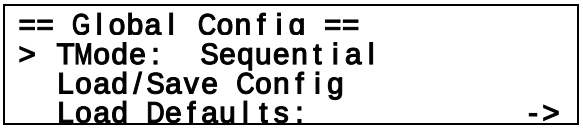
What you should have seen is the Trigger 1 LED illuminating as soon as you activated the sensor, followed by Trigger 3, then Trigger 2. If you think about the delay values we just set, it should make sense – each of the Trigger outputs was delayed with reference to the input event from the sensor. The Trigger outputs operated *independently* of each other.

This is the StopShot operating in *Independent Triggering* mode – the default mode (See section "3.5 - Independent Triggering" for more details). It is very easy to change this behavior in order to have the second Trigger output dependent upon the first Trigger output, and the third dependent upon the second. Let's try it:

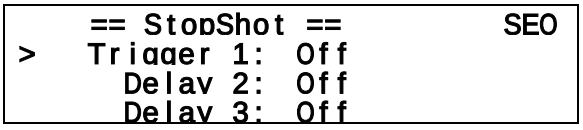
To configure the StopShot into *Sequential Triggering* mode, simply press the **CONFIG** button for 2 seconds until "*Global Config*" is displayed. This brings you to the Global Configuration Page; you should see this on the display:



Press the **UP** button to change the mode from "*Independent*" to "*Sequential*". In the configuration menus the ">" symbol again shows the active line. Use the **SELECT** button to move through the list and the **UP** and **DOWN** buttons to change the values. Your display should look like this:



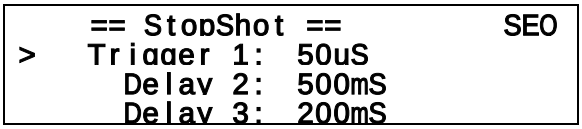
Press the **CONFIG** button again to get back to the main screen.



Note the "*SEQ*" in the upper left hand corner of the display indicating you are in Sequential Triggering Mode. Also note the delay values you set in the previous exercise have been erased. Due to the different modes available in each of the timing modes StopShot clears the previous values when switching back and forth between Sequential and Independent timing modes.

Sequential mode is very useful when setting up complex triggering scenarios like synchronizing a camera flash and external shutter. See section "3.6 - Sequential Triggering" for more details regarding Sequential mode.

Using the same procedures as above to adjust the delay values so your display looks like this:



Activate the sensor again and observe what happens. You will see the Trigger outputs occur sequentially – the delay values that we entered are now applied to the end of the previous trigger output. So in the independent case above, we saw Trigger 1, then 3 then 2 occur. In the dependent mode, it was Trigger 1 (on and off), followed half a second later by Trigger 2, then Trigger 3 followed 200mS (a fifth of a second) after the end of Trigger 2. This is the default behavior in Sequential Triggering Mode; however this too can be easily changed for greater flexibility. See Section "3.6.4 - Delayed Trigger" for Delay-Sync mode – a very special and useful mode for syncing external flashes with any type of camera.

By now, you will have noted that the LEDs remain illuminated for a half of a second. This is the time that each Trigger output is energized, and of course is itself completely adjustable. This default value is set to be long enough to fire most contemporary DSLR's *once* if the DSLR is in Single Shot mode. If your camera can shoot at 10 frames per second, and we adjust this output pulse time to be 1 second, then put the camera into continuous shooting mode, guess what? You will get 10 frames exposed for every output trigger that occurs on the channel that the camera is connected to (Trigger 1, 2 or 3). See section "3.5.3 - Trigger" for more details on adjusting this output time "*Tpulse*".

So now you already have a pretty good understanding of the fundamentals of the StopShot, and you haven't even taken a picture, or had to read the entire manual. We hope that this simple exercise has given you a good taste of the flexibility and possibilities StopShot offers in capturing whatever events you can dream up.

2.3 Connecting StopShot - Beam Sensor - (laser or IR)

If you purchased a beam sensor for your StopShot connect it as shown in the diagram below. All of the cables shown are included with the sensor set. The 2.5mm patch cable provides power to the IR (or Laser) transmitter so no additional battery packs are required. The laser beam sensor is connected in the same way but the IR transmitter pictured below is replaced with the laser transmitter.

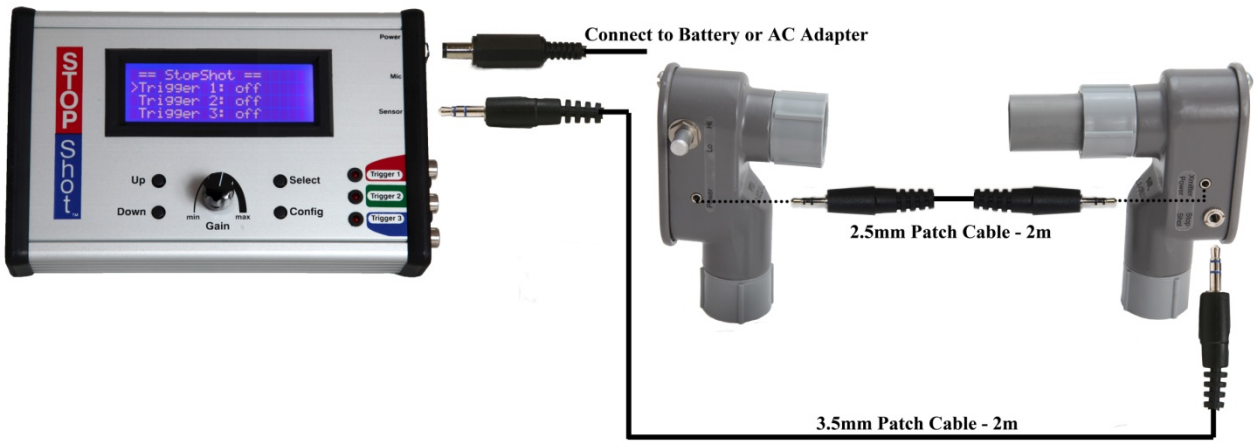


Figure 2 – Connecting the Beam Sensor

Power to the StopShot module is provided through an AC to DC power adapter. Plug the power adapter into the StopShot module jack labeled "Power", and plug the adapter into the wall. The unit will power up, display a splash screen, and then continue to the main screen.

⚠ **WARNING:** High voltage flashes should NOT be connected to the StopShot module or any of its associated adapters/connectors/cables. Doing so could expose you to dangerously high voltages resulting in serious injury or death. These flashes are **NOT** intended for use with the StopShot module. Any flash intended for use with a modern DSLR will not have high voltages present on the hot-shoe and are safe to use with StopShot.

2.4 Connecting StopShot – Multiple Flashes

The easiest way to connect multiple flashes is with the flash splitter or with RCA Y cables. This will keep all of the signals to each flash synchronized. StopShot has plenty of current capability to activate many flashes simultaneously. Connecting multiple flashes that are different makes or models is generally not an issue but if you do this you will want to keep an eye out for ghosting should the flashes have slightly different sync times. Below are connection diagrams showing the connections for multiple flashes to a single output trigger. The flash splitter shown in Figure 4 demonstrates three flashes connected but has the capability to fire five flashes.

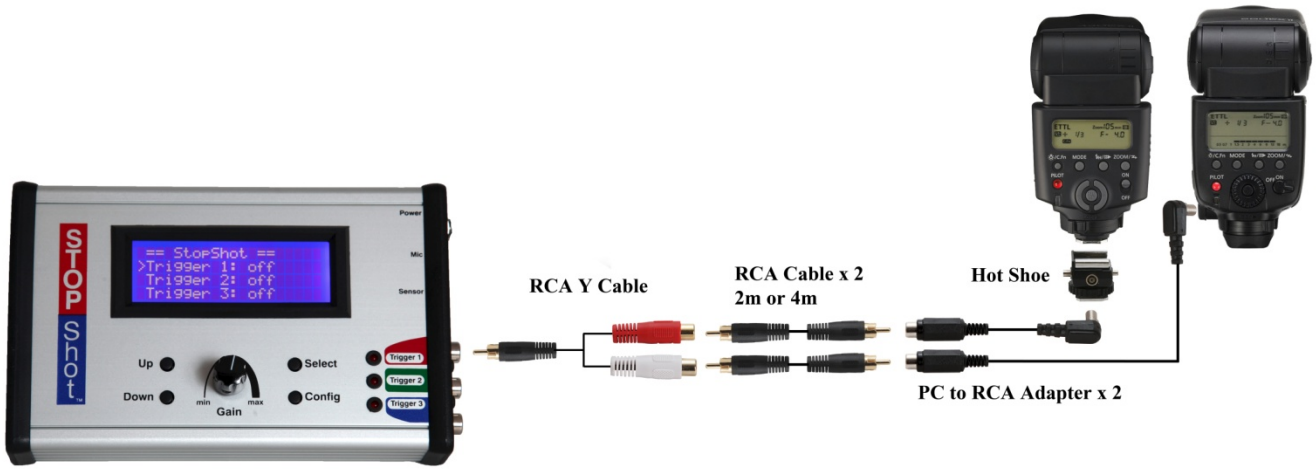


Figure 3 - Connecting two flashes to a single output

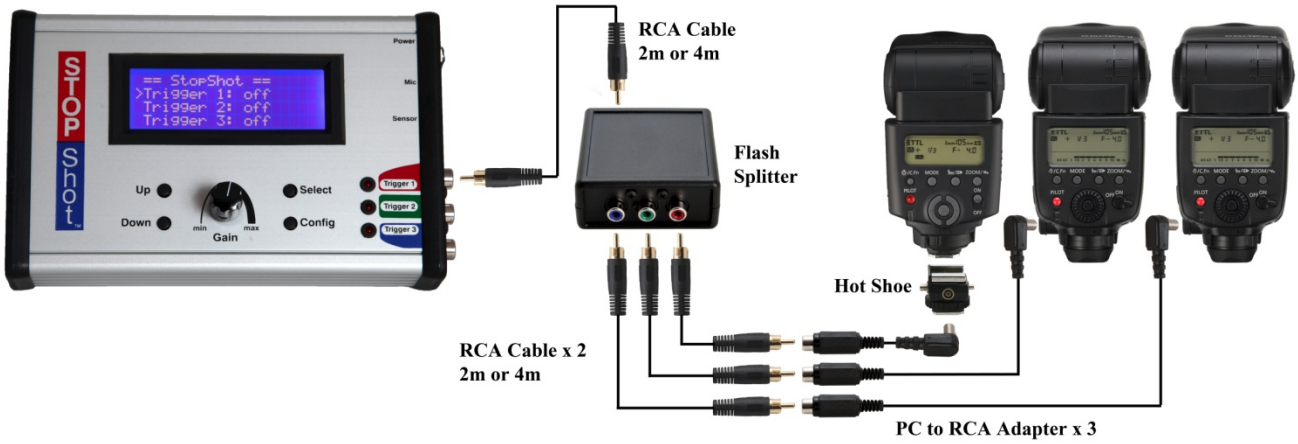


Figure 4 - Connecting multiple flashes with the Flash Splitter

2.5 Connecting StopShot – Shutter Interface Switch

Figure 5 - Shutter Interface Switch (Canon)

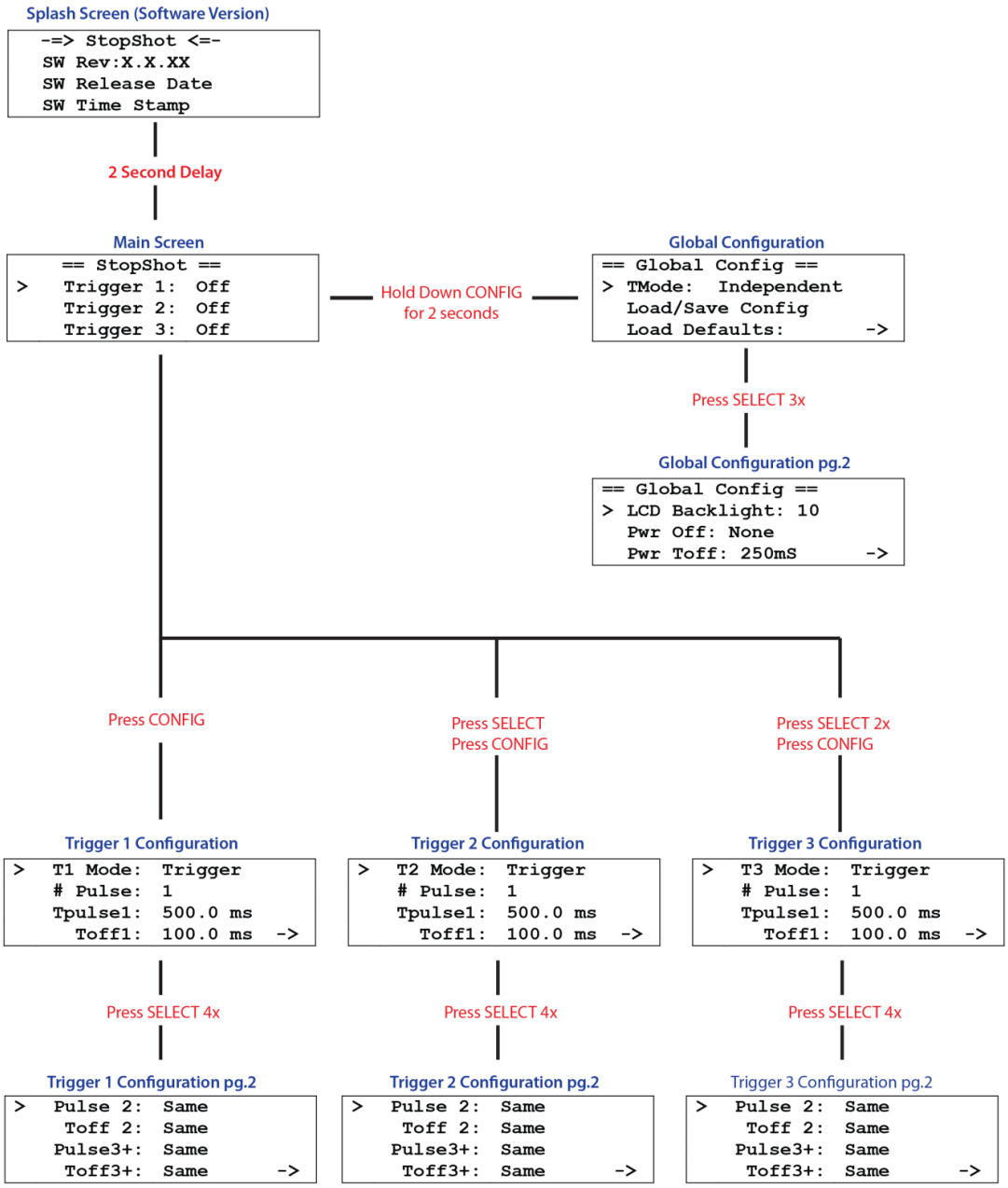
The Shutter Interface Switch has a male RCA on one end and the appropriate camera connector on the other. The male RCA can be connected to any of the 3 trigger outputs on StopShot. The shutter switch has 3 positions:

Wake – In this position the ½ press (focus) is held down at all times on the camera. This has a couple of effects – it will not allow the camera to sleep and it makes the cameras response time as quick as possible. This position minimizes shutter lag at the expense of faster battery consumption. For most cameras this position will also prevent any changes to the settings or any review of captured images on the LCD.

Off – In this position there is no connection between StopShot and the camera. This setting is useful if you need to adjust your settings or sensor positions and you do not want your camera to take images in the process.

Sleep - In this position the camera will be allowed to sleep but unlike our standard shutter cable the shutter switch is able to wake the camera. This mode is useful where the subject is slower moving and shutter lag is not as important as battery life. For example you are using the RangeIR to capture mammals.

2.6 Navigating StopShot



3. Detailed Operation

In this section we'll go into all the capabilities of StopShot. If you find your eyes glossing over with all the technical discussion you can always skip to the "5 - Setup Examples" section to start using StopShot.

3.1 Overview

StopShot allows precise control over flashes, cameras, and other electronic devices. It may be configured to give virtually any combination or sequence of events. This allows for several different effects: Stopping water drops in time, projectiles paused at the moment they pierce an object, or even time-lapse imagery. Once comfortable with simple settings, advanced triggering can be used to coordinate complex series of events: Pushing a button to release a water drop from a solenoid controlled valve, crossing through a beam sensor, and then firing a high-speed flash.

The **SELECT** button moves the cursor from line to line on the display. The **UP** and **DOWN** button adjust the values for each line. The different modes of operation are listed in subsequent sections.

Settings will be saved across power cycles.

The main display of StopShot indicates how the three outputs are configured. The default settings are as follows:

```
    == StopShot ==
>   Trigger 1:  Off
    Trigger 2:  Off
    Trigger 3:  Off
```

This indicates that all three outputs are configured to trigger on an input (see section 3.5.3 for details regarding the "*Trigger*" function). The "Off" indicates that this output is currently disabled. If you press the **UP** button, the value will increase to 50us. If you hold the **UP** button, the time will continue to increase. The longer you hold the **UP** button the faster the time will increase. This value is the time from when a trigger input is detected from a sensor to when the selected output will activate. Consider the following example:

```
    == StopShot ==
>   Trigger 1:  100.0 ms
    Trigger 2:  100.0 ms
    Trigger 3:  500.0 ms
```

If a sensor is activated (a beam is crossed, sound is detected, a vibration, etc), "Trigger 1" and "Trigger 2" outputs would activate simultaneously 100ms after the sensor detection. "Trigger

3”, however, would wait 500ms from sensor detection before activating the output. This main-screen “delay” is used for virtually all of StopShot’s operation modes.

3.2 Gain Control

The gain knob is used to adjust the sensitivity of StopShot to the trigger inputs. If using the microphone and the microphone gain is set to minimum, it would take a louder noise to cause StopShot to trigger (because the sensitivity is turned down). If the gain is set to maximum, then quiet noises will trigger. If ambient noise is triggering StopShot then turn the gain down.

When using the standard beam sensor the gain may be used to adjust the sensitivity. Decrease the gain if the sensor is triggering falsely due to ambient light or noise. For most applications that use the IR and laser beam sensors the gain should be set to the middle position. Digital inputs such as the cross-beam sensors should also have the gain set to the middle position.

To avoid false triggers is always best to keep the gain at the lowest setting while still reliably triggering. If the LED for a particular channel is on or flashing try turning the gain down to correct this issue. You may see this if you have a sensor cable attached to StopShot with no sensor plugged in and the gain turned all the way up.

3.3 Global Configuration

To enter StopShot's *Global Configuration*, press and hold the **CONFIG** button for two seconds. The display will change to indicate that you are now in the "Global Config" menu. To return to the main screen press the **CONFIG** button.

3.3.1 Global Trigger Mode Overview

There are four available global trigger modes ("*TMode*"). The "*Independent"* mode (default) means that if all the output channels are configured as triggers, once an input event occurs (an infra-red beam is crossed, or a sound threshold is exceeded) all three outputs will function simultaneously. For example, if each output trigger is configured for a 5ms delay, all three outputs will trigger at the same time. They are independent because they do not depend on the state of any other trigger. Other possible triggering options are discussed in section 3.5.

If the "*TMode*" in Global Configuration is set to "*Sequential"* and all three trigger outputs are set to 5ms, the first time an input event occurred the first output would fire, the next input event would cause the second output to fire, the third input event would cause the final third output to fire. Each trigger output may be configured to handle the input event differently and the options are discussed in section 3.6. If all the different types of configurations are scaring you – don't worry. We'll walk you through them step by step. In the "section 5 - Setup Examples" of this manual, we'll show you exactly what settings are being used, how the shot was physically set up, and the picture we ended up with.

Another available "*TMode*" is "*Time Lapse"*. This allows the Trigger 1 output to be fired at a specified interval. For help with this mode please see section 3.7 .

The final mode is *Shutter Lag Measurement* ("*Shutter Lag*"). This convenient feature allows the measurement of a camera's shutter lag. See section 3.8 for more information regarding this feature.

3.3.2 Loading/Saving configurations

StopShot automatically saves the last settings used, but sometimes it is more convenient to save different configurations for different setups (one configuration for insects, another for water-drops, and yet another for ballistics). To load or save the settings, press the **SELECT** button until the cursor is next to "*Load/Save Config*" and press the **UP** or **DOWN** button to enter the next screen.

```
== Global Config ==
  TMode:  Independent
> Load/Save Config
  Load Defaults:          ->
```

From this screen you have two options – to either load or save the configuration. Press the **SELECT** button to change between the two options.

StopShot contains two pre-loaded configurations to simplify the initial set-up for water-drop photography. Preset 1 is called "Single drop", and Preset 2 is "Drop on Drop". You have the capability to over-write these presets with your own settings. See section **Error! Reference source not found.** for more details regarding the specific setup for these presets.

Under the "*Load*" screen, you will see the following:

```
== Load Config ==
  1. Single drop

  Up/down to select.
```

Using the **UP** or **DOWN** buttons, you can scroll through the ten available configurations to retrieve. If they have never been saved with a configuration before it will show up as "*empty*" otherwise it will show the name you had previously saved. Once you have highlighted the desired configuration to load, press the **SELECT** button. This will take you to the main screen for this configuration. You can abort the loading screen by simply pressing the **CONFIG** button.

The process is similar for saving a configuration. Once "*Save*" is selected, you will see the following screen:

```
== Save Config ==
  1. Single drop

  Up/down to select.
```

Use the **UP** or **DOWN** buttons to select which configuration you would like to save. You can overwrite previously stored configurations. In this example, the DOWN button is pressed until an "*empty*" configuration is displayed.

```
== Save Config ==
  3. <empty>

  Up/down to select.
```

Once the desired configuration is selected, press the **SELECT** button. At this point you can enter a name. The cursor underlines your current position. The **UP** and **DOWN** buttons may be used to change the characters. Each time **SELECT** is pressed it will take you to the next character position. Keep pressing select until all the characters have been entered (A total of 12 may be used). Not all spaces need to be filled, just keep pressing select to finish the entry. Upon saving the configuration the screen will show:

```
== Save Config ==
  3. My own config
  Saved.  Cfg exits.
  Up/down to select.
```

In this case the setting name was set to "*My own config*". Press the **CONFIG** button to exit to the main screen.

3.3.3 Load Defaults

```
== Global Config ==
  TMode:  Independent
  Load/Save Config
> Load Defaults:          ->
```

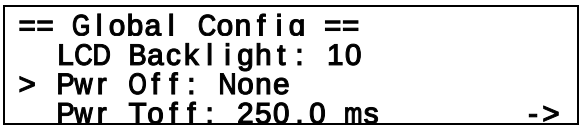
Once this option is selected, pressing the **UP** or **DOWN** button will reset all the current settings in StopShot to the factory default. If you've changed the configurations into something where it just isn't doing what you expected or it will take longer to get everything back to an initial condition – use this option. Beware that by selecting this option all the current settings will be lost. **Note**: This action will not erase your presets.

3.3.4 Backlighting

```
== Global Config ==
> LCD Backlight: 10
  Pwr Off: None
  Pwr Toff: off           ->
```

Backlighting ("*LCD Backlight*") is on the second configuration page and is the amount of light that the display generates so that you can see the text on the screen. It may be beneficial to adjust the backlighting lower if working in low light situations. This preserves your eyes sensitivity to light and also doesn't cause unwanted secondary light in your exposure. To increase the backlighting, press the **UP** button. To decrease the backlighting, press the **DOWN** button. The backlighting may be adjusted from a range of 1 – 10.

3.3.5 Sensor Power Off



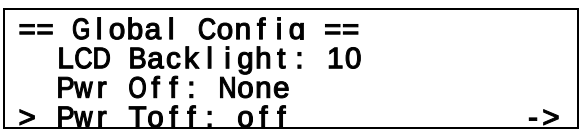
StopShot has the ability to disable sensor power once an input event occurs. This feature is extremely useful to disable laser transmitters prior to triggering a camera or flash. The available options for this Power Off ("*Pwr Off:*") mode are:

1. "*None*": The feature is disabled and the sensor(s) will remain powered.
2. "*Trig 1*": Sensor power will be disabled when an input satisfies Trigger 1.
3. "*Trig 2*": Same as #2 above, but with Trigger 2.
4. "*Trig 3*": Same as #2 above, but with Trigger 3.
5. "*All*": If any of the three trigger conditions are satisfied the sensor power will be disabled.

The sensor power is immediately disabled when an input condition is satisfied. If a trigger output is configured for a 50ms delay, the power will be disabled immediately when an input event occurs, wait 50ms, and then activate the trigger output. The different trigger output modes for StopShot are discussed in section 3.4. The "*Pwr Toff*" is the duration that the power will remain disabled.

Note: An important consideration when using this mode is that it may prevent other triggers from seeing an input for the duration that the sensor power is disabled.

3.3.6 Power Off Duration



This setting ("*Pwr Toff*") allows the adjustment of the duration that the "Sensor Power Off" feature discussed in section 3.3.6 will leave the sensor(s) disabled. This duration is only used if the "*Pwr Off*" setting is set to a value other than "*None*". Use the **UP** and **DOWN** buttons to adjust the duration. The sensor can be disabled longer than the delay that a trigger output is configured. Any sensor activity will be missed for the duration of this power off time since the sensor(s) are disabled.

See Figure 6 below to demonstrate the behavior of this feature.

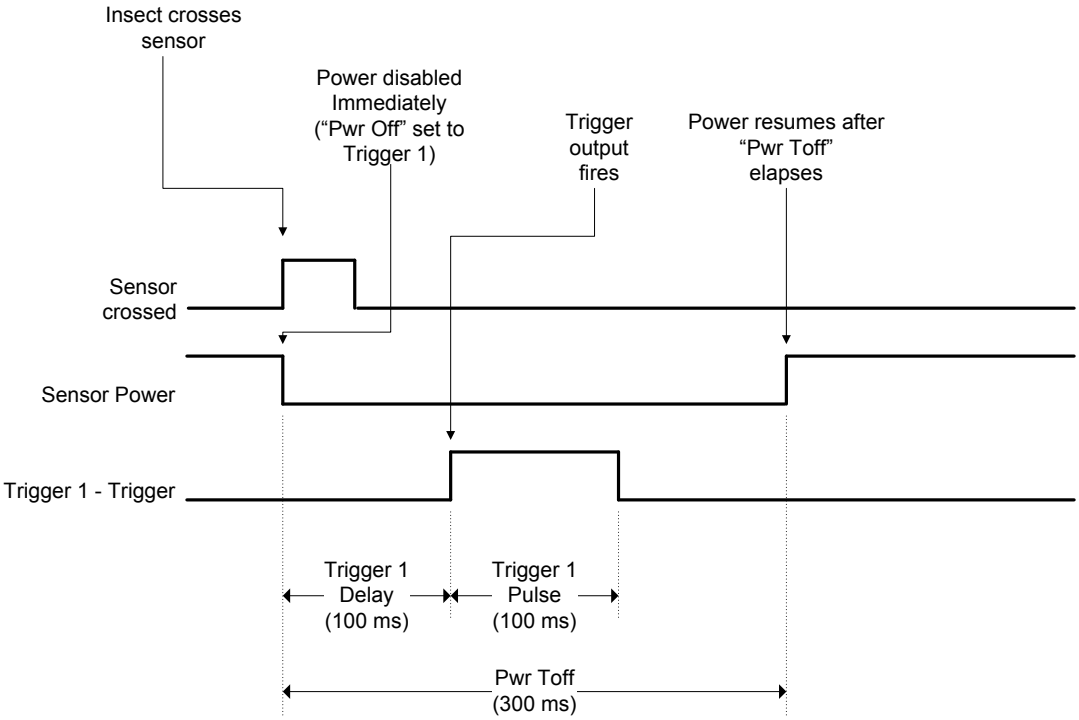


Figure 6 - Sensor Power Disable

This timing diagram shows Trigger 1 configured for a 100ms delay, "*Pwr Off*" set to "*Trig 1*", and "*Pwr Toff*" set to 300ms. The sensor is immediately disabled when the input event (for example a laser beam being crossed) occurs. The re-enabling of the sensor power occurs independently from the Trigger 1 delay configuration. Don't worry about all these settings yet – they're discussed in detail starting with section 3.4.

3.3.7 Sequential Timeout

```
== Global Confia ==
> SEQ Tout: off              ->
```

Sequential timeout ("*SEQ Tout*") is only displayed if your trigger mode (See section 3.3.1) is set to "Sequential". Once the trigger mode is set appropriately an arrow in the bottom right hand corner of the display appears indicating that additional settings are available. Continue pressing the **SELECT** button past "Load Defaults:" to reach the second page. Sequential timeout is useful to abort a sequence if all of the triggering conditions are not met within the specified amount of time. When a sequence is aborted it will return to the first enabled trigger in the sequence. The **UP** or **DOWN** buttons adjust the value of this timeout. To return to the previous configuration screen press the **SELECT** button again. To disable the sequential timeout (which will cause the sequence to wait forever) is achieved by holding the **DOWN** button until the timeout reaches zero. "*Off*" will be displayed when it is disabled. See section 3.6 for more details regarding Sequential operation.

NOTE: Sequential timeout may cause some "curious" behavior which may appear as StopShot not working properly. This is because the timeout will abort the sequence and restart it (which is its intended function). It takes precedence over any active trigger. Make sure you're comfortable with your settings prior to enabling the timeout. As always, contact us with any questions.

3.4 Output Configuration

From the main screen, the **SELECT** button moves from one trigger output ("*Trigger*") to the next. To change the output delay (if so configured) you may press and release the **UP** or **DOWN** button, or hold the button down to automatically increment /decrement the value. In this way one or more trigger outputs may be activated.

To change the configuration of each output, first press the **SELECT** button until the cursor is next to the "*trigger*" output you want to change. Press the **CONFIG** button. This will bring up the output configuration screen. This screen enables each trigger output to be configured in a different way by changing the parameters described in the sections below. The trigger output type ("*T Mode*") is adjusted by using the **UP** and **DOWN** buttons. The **SELECT** button moves from one configuration parameter to the next. If an arrow appears on the right side of the screen that indicates that an additional screen of configurations is available. As you press **SELECT** it will switch to the next screen automatically. To return back to the main screen, press the **CONFIG** button again. The main screen is changed to indicate how each output is configured.

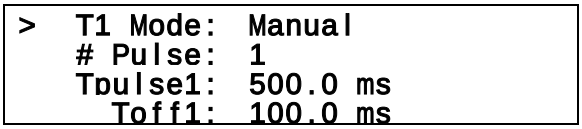
3.5 Independent Triggering

3.5.1 Overview

Independent triggering means that the output timers/triggers operate completely independent of each other. Independent triggering is a "Global Configuration". Once this global configuration is set (described in the "Global Configuration" section 3.3 above), the output modes below are available.

3.5.2 Manual

"Manual" trigger mode requires an **UP**/**DOWN** button press to activate. To change an output to "*Manual* "configuration, from the main screen press the **SELECT** button until the desired trigger output is selected. Press the **CONFIG** button. This will bring up the timer configuration screen. Press the **UP**/**DOWN** buttons until the "*T Mode"* is changed to "*Manual"*.



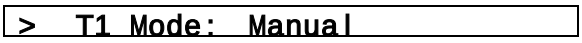
With this type of output you have the option of adjusting the duration of the output pulse that is generated. It functions exactly as discussed in the "*Trigger"* mode (section 3.5.3). The number of pulses ("*# Pulse"*) may be set to a value greater than one if multiple trigger output pulses are required. This could be used to generate multiple initial events (such as multiple water drops). "*Tpulse1*" is the duration that the output is active and "*Toff"* is used as the off-time between pulses provided the number of pulses is greater than one. This allows complete flexibility for the on and off duration of the output. If you wish to adjust the on and off times of the pulses independently, StopShot allows up to three unique on/off durations. If "*# Pulse*" is set to greater than three, all subsequent pulses will use the time of "*Tpulse3*" and "*Toff3*".

Press the **CONFIG** button to return back to the main screen. The "*Manual"* mode is activated by pressing the **UP**/**DOWN** button when the cursor is next to this trigger output. If the cursor is not next to the desired trigger output, press the **SELECT** button until the cursor is next to it.

Manual triggering can also be used in sequential mode for staging shots. This allows a sequence of events to start upon a button press. The maximum number of pulses that can be generated is 1000.

Once a manual event is triggered, it may be aborted by pressing either the **UP** or **DOWN** button.

Figure 7 illustrates the configuration below:



```
  # Pulse:  3
   Pulse1:  500.0 ms
    Toff1:  500.0 ms
```

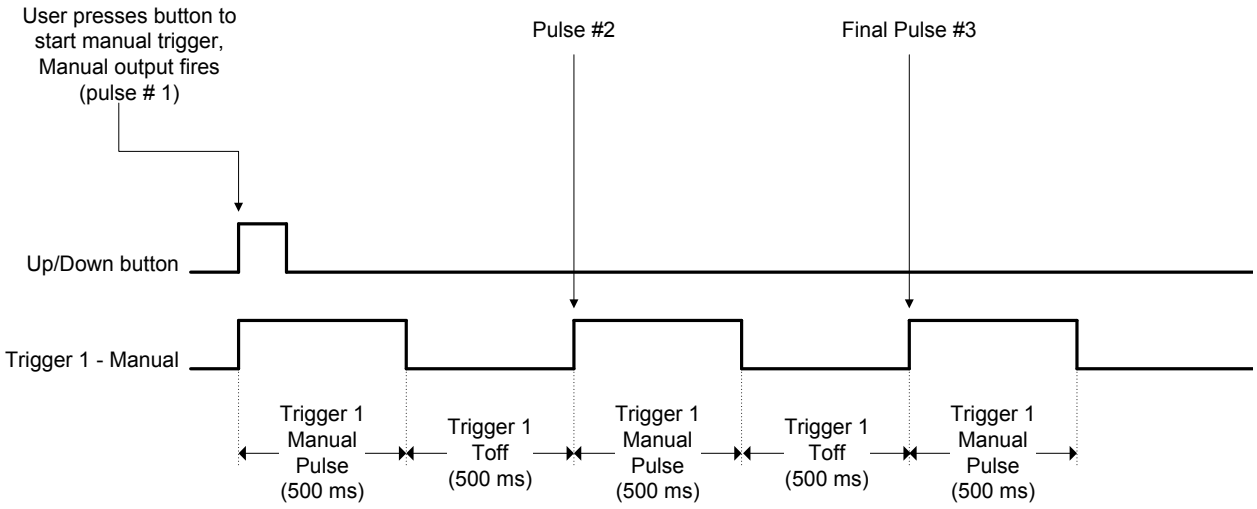


Figure 7 - Manual Mode Timing Diagram

Since "*Manual*" mode is frequently used for water drops, a valve "purge" feature may be enabled by holding down the **UP** or **DOWN** button for at least one second. This will activate the trigger output allowing the water valve to purge any trapped air or fluid for as long as one of the buttons remains pressed. The display will show "*Purging*" while this feature is activated.

3.5.3 Trigger

All three trigger outputs may be configured to react to a sensor input. When a trigger output's mode ("*T Mode*") is configured as "*Trigger"*, an input event is required. This is the mode that is required for using a beam sensor or microphone input. To change an output to "*Trigger"*, from the main screen press the **SELECT** button until the desired output is selected. Press the **CONFIG** button. This will bring up the Timer Configuration screen. Press the **UP**/**DOWN** buttons until the "*T Mode"* is changed to "*Trigger"*.

```
>  T1 Mode:  Trigger
   # Pulse:  1
   TPulse1:  500.0 ms
     Toff1:  100.0 ms        ->
```

In this trigger mode you have additional options to modify (if required).

Pulse:

"*# Pulse"* specifies the number of pulses this output should generate once triggered.
See the section 3.5.2 "*Manual"* Triggering for additional information regarding "*# Pulse"* .

Pulse1:

With this type of output you have the option of adjusting the first output pulse that is generated. This is the "*Pulse1"* field. The default is 500ms, but may be adjusted as necessary for your application. Some loads may have a minimum pulse time before they will trigger. For electro-mechanical devices such as a relay controlling a solenoid, you may need to increase this time. Cameras and flashes are generally edge sensitive and the pulse duration can be left at the default. This duration may be adjusted to "*Latch"* for sequential mode, discussed in section 3.6.
Note: Some devices such as flashes are "edge-sensitive", that is, they fire when the output transitions. Increasing the duration of "*Pulse1*" has no effect on these type of devices because they only trigger on the transition. Devices like relays, water valves, and solenoids are "level-sensitive" in that they will remain active for the duration of the pulse.

Toff1:

"*Toff1"* is the duration the output remains off following the first "*Pulse1*".

See the section 3.5.2 "*Manual"* Triggering for additional information regarding "*Toff"* .

Pulse2:

Pressing the **SELECT** button through the bottom of the first configuration page will reveal a second list of configurations:

```
>    Pulse2:  Same
       Toff2:  Same
     Pulse3+:  Same
      Toff3+:  Same              ->
```

When the number of desired pulses on an output (See "*# Pulse*" above) is set to greater than one, you have the option of choosing the second pulse to be a different duration than the first. StopShot defaults to "*Same*", meaning that the second pulse after the first will be the same as the "*TPulse*" duration. You can use the **UP** or **DOWN** button to adjust the timing of "*Pulse2*". If you want to return back to "*Same*", hold the **DOWN** button continuously until the time counts down. Eventually "*Same*" will be displayed and the time of "*TPulse2*" will again track the duration of "*TPulse*".

Toff2:

"*Toff2"* is the duration the second output pulse remains off following "*Pulse2*".

Pulse3+:

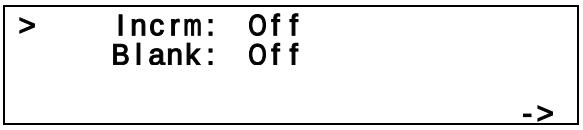
If "*# Pulse*" is three or greater the value of "*Pulse3+*" will control the on time of the trigger output. It functions similarly to "*Pulse2*" but controls the third and all future pulses. "*# Pulse*" must be set to a value of three or greater for this to have any effect.

Toff3+:

Similarly to "Toff2", this controls the off time for the third and future pulses. "*# Pulse*" must be set to a value of three or greater for this to have any effect.

Incrm:

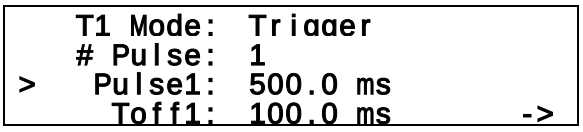
Pressing the **SELECT** button will reveal the third and final trigger configuration. This timer mode has the option to automatically increment the timer's main delay every time an event occurs by adjusting the "*Incrm"* configuration. If an event is easily repeatable and this increment is set you can create a simulated "time lapse" for some quickly occurring event (like a drop of water falling).

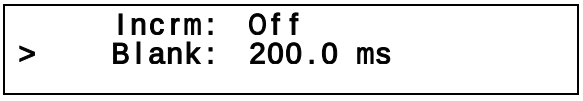


If this value is set to 10.0 ms, and from the main screen the trigger output is set to 100.0 ms, every time a trigger occurs the delay would increase by 10ms. The delay setting will be updated on the main screen following each trigger event. The first time the trigger would wait 100 ms. The second: 110 ms. The third: 120 ms. Every time StopShot activates the trigger output the delay on the main screen will be incremented by the "*Incrm"* value. If you want to start the sequence over simply adjust the trigger output value on the main screen back to its original value using the **UP/DOWN** buttons.

Blank:

Additionally, you can adjust "*Blank"*, which is the amount of time that the input is ignored after the output pulse is complete. Let's say the following settings are used:





->

In this example, "*Pulse"* is set to 500ms, and "*Blank"* is set to 200ms. When an input event occurs (for example, a beam sensor being crossed), the trigger output will delay by whatever value is entered on the main screen, generate a 500ms pulse, and then wait 200ms before looking for an input again. "*Blank"* is useful for ignoring all but the first of a series of rapidly occurring events. If the trigger output is being used to control a flash this allows time for it to fully charge before triggering again.

Figure 8 demonstrates the timing functionality of the "*Trigger*" mode. The timing events are initiated on the rising edge of the sensor input ("Trigger In" below).

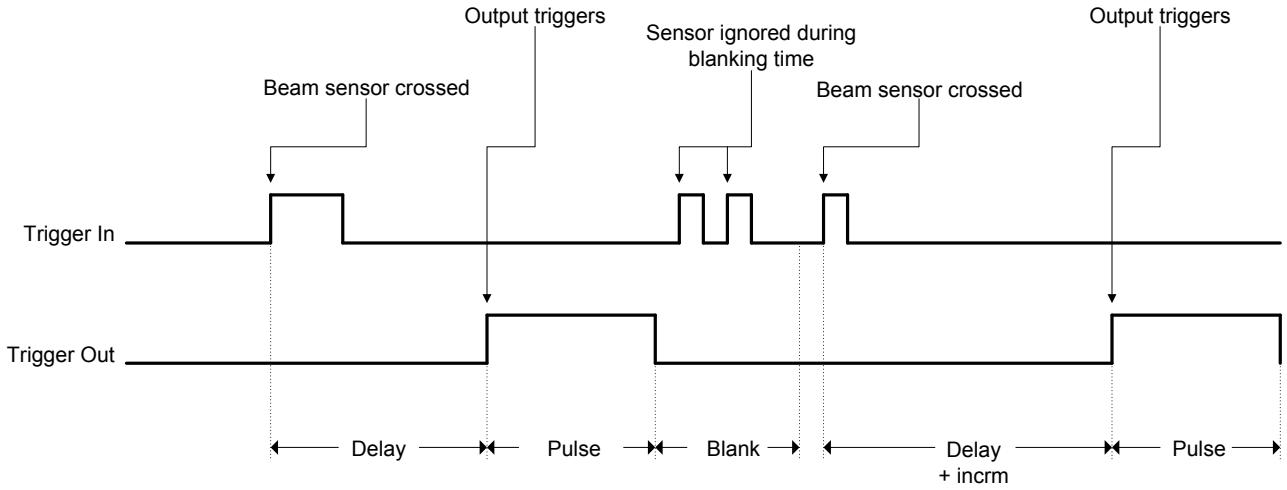


Figure 8 - Trigger Timing Diagram

3.5.4 Cross-Beam sensor modes

If you have purchased the cross-beam sensor additional trigger modes are available. These modes are present in all StopShot modules so if you decide to purchase the beam sensor at a later date no software upgrade is required. The cross beam sensor opens up a multitude of options for creative triggering especially for capturing things in the natural world like insects and birds.

To change a trigger output to one of the cross-beam sensor configurations, from the main screen press the **SELECT** button until the desired trigger output is selected. Press the **CONFIG** button. This will bring up the Timer Configuration screen. Press the **UP**/**DOWN** buttons until the "*T Mode"* is changed to the desired cross-beam mode. These are discussed below.

See section "4.4 - Cross-beam Sensor" for instructions on connecting this sensor.

3.5.4.1 X-Beam A

In this trigger mode configuration only crossing beam "A" of the cross-beam sensor is considered a trigger condition. Crossing beam "B" or both simultaneously will have no effect. For this mode to work properly, beam "B" must be active (transmitter "B" aligned with receiver "B"). An example of this mode would be using it in conjunction with the "X-Beam B" mode to open the camera shutter when beam "A" is crossed and then firing the flash when beam "B" is crossed.

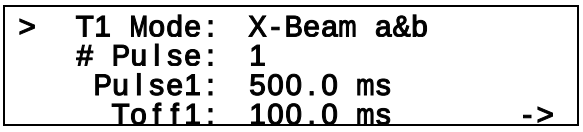
3.5.4.2 X-Beam B

This mode functions identically to "X-Beam A" above, but uses beam "B".

3.5.4.3 X-Beam a&b

This is a true cross-beam configuration. Both beams "A" and "B" must be broken simultaneously for a trigger condition to be considered valid. The main screen will display "*XBS a&b*" for this mode. Breaking only beam "A" or "B" will not be considered a input trigger. This mode is useful for detecting objects in a tightly controlled area (especially if lasers are used).

The following configurations are available for this sensor:



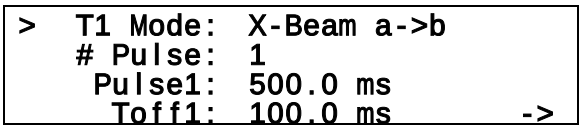
These configurations function identically to the "*Trigger*" mode in section 3.5.3.

3.5.4.4 X-Beam a|b

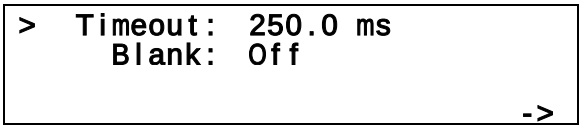
In this configuration "A" or "B" will create a trigger condition for StopShot. The main screen will display "*XBS a|b*". Use this sensor mode when it doesn't matter which sensor is activated. The possible configurations for this mode are identical to the "*X-Beam a&b*" mode.

3.5.4.5 X-Beam a->b

The main screen will display "*XBS a->b*" for this mode. Use this mode if you want to trigger on an object only moving in one direction. A good example would be capturing a bird entering a nest but not leaving. The configuration for this mode is shown below:



The final page of the cross-beam configuration reveals the following:



"*Pulse*" and "*Toff*" function the same as the previous modes (see section 3.5.3). When beam "A" is broken, the letter "a" in "*XBS a->b*" on the main screen will be capitalized ("*XBS A->b*") to indicate that the "A" condition has been met and StopShot is waiting for the "B" condition. If the "B" beam is not broken prior to the configured "timeout" then the letter "A" will revert back to lower-case indicating that StopShot is once again waiting for the "A" condition. This "timeout" option is a way for the trigger to re-arm if event "B" never occurs. In the example of the bird entering a nest – If the bird flew close to the nest but did not land, it would allow StopShot to re-arm the trigger output for the next time the bird would approach the nest.

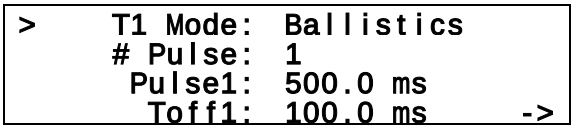
"*Blank*" functions identically to the "*Trigger*" mode (see section 3.5.3).

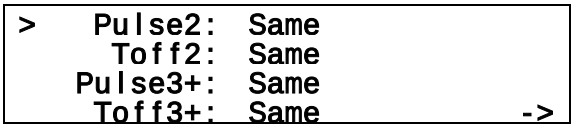
3.5.4.6 X-Beam b->a

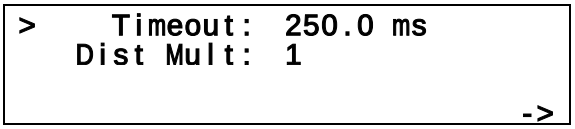
This mode functions the same as "*X-Beam a->b*" but beam "B" must be broken first, followed by "A". This allows direction reversal through the sensors without having to physically move them.

3.5.5 Ballistics

Ballistics mode ("*Ballist*" on the main screen) simplifies triggering on objects that pass between two beam sensors. For this mode you need the cross-beam kit. This configuration virtually eliminates the variability involved with capturing something that has an unpredictable (or unknown) speed. In this mode, StopShot measures the time elapsed between the two beam sensors and then triggers the output that duration (plus a configurable delay). By pressing the **CONFIG** button, you have the following configurations that you may adjust for this mode:







Similar to the other modes, the "*Pulse1*" time is the duration that the output will be active. "*Timeout*" is the maximum time that an object can take to travel from the first sensor to the second before StopShot resets its ballistics capture. This timeout feature is useful to abort the capture event and reset in the event that an object never crosses the second sensor. "*Dist Mult*" is the distance multiplier used. Here is an example of a ballistics sensor setup using the above configuration. The first and second sensors are spaced exactly six inches apart from each other. If an object crosses the first sensor and the second sensor within 250ms, the output will fire when the object is six inches past the second sensor. If the "*Dist Mult*" was to "2", the output will fire 12 inches after the second sensor.

Some notes regarding Ballistics mode:

1. Only one Trigger may be configured for ballistics mode at a time. This is due to the precise control and resources required to create repeatable timing.
2. The time to cross between beam sensors may range from 100us to hours.
3. The object must be traveling fast enough to prevent the sensor from reaching a "steady state" dark condition. Otherwise StopShot will measure the time between light->dark then dark->light.
4. Despite the name "Ballistics" this mode may also be used to capture wildlife.
5. Laser sensors are more difficult to align with the projectile. The beam-width of the laser also requires precise alignment. We recommend using infrared transmitters for capturing small projectiles; they are much more forgiving to align.

   Shown below is the timing, measurement, and output triggering of Ballistics mode.

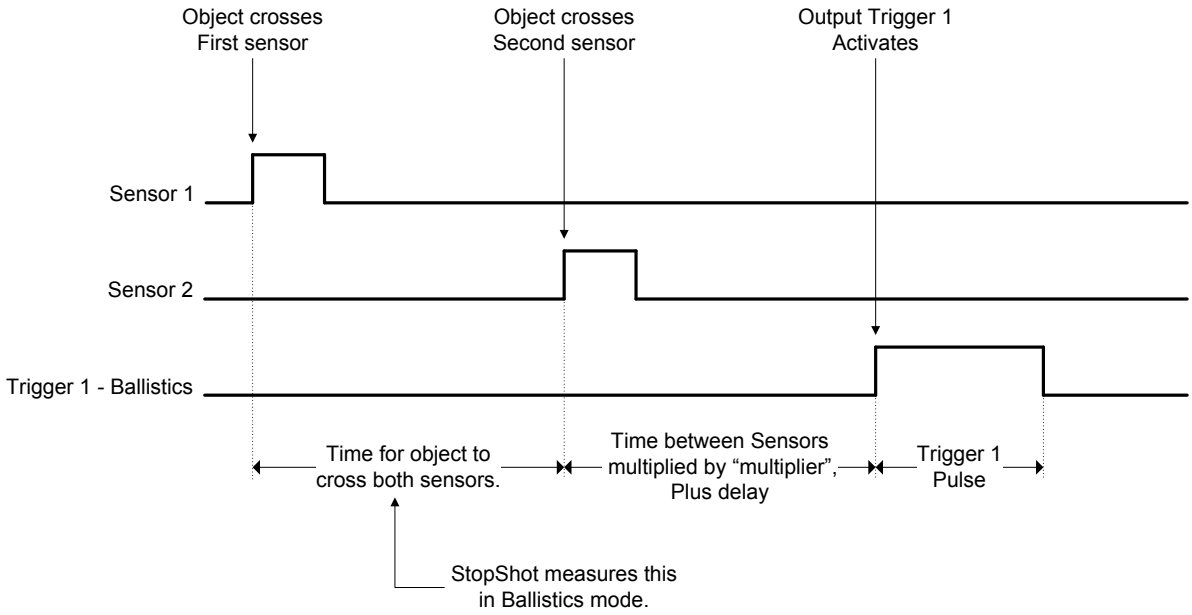


Figure 9 - Ballistics Timing

3.6 Sequential Triggering

3.6.1 Overview

Sequential triggering indicates that the output timers/triggers depend on each other. Sequential triggering is a Global Configuration. Once this Global Configuration is set (described in section 3.3.1), the output modes below are available. When in Sequential Triggering, "*SEQ"* is displayed in the upper-right hand corner of the main screen to differentiate between this mode and Independent mode.

Sequential mode expands the number of creative shot possibilities. Let's say the following configuration is used:

```
  == StopShot ==              SEQ
>    Manual 1:  Waiting
    Trigger 2:  200.0 ms
      Delay 3:  10.0 ms
```

In this example, trigger output 1 is set up as "*Manual"*, output 2 set as "*Trigger"*, and output 3 set as "*Delay"*. With this configuration, trigger output 1 will run to a solenoid controlled water valve, output 2 to a shutter on a camera, and output 3 to a flash. When the manual output is activated by pressing the **UP**/**DOWN** button, the water drop would be released from the water valve. StopShot would then advance to the output 2 configuration and wait for the water drop to cross the beam detector. Once it crosses the beam detector, output 2 will wait the configured amount of time (200.0 ms) to open the shutter on the camera. Output 3 will delay long enough for the shutter lag to expire, and then fire the flash. This is a fairly complicated setup, but it would allow you to take a high speed picture with the lights on in a room. See Figure 10 below for a timing diagram of this scenario.

As each sequential step is completed, the ":" next to the step will change to a "*" to indicate that it is complete.

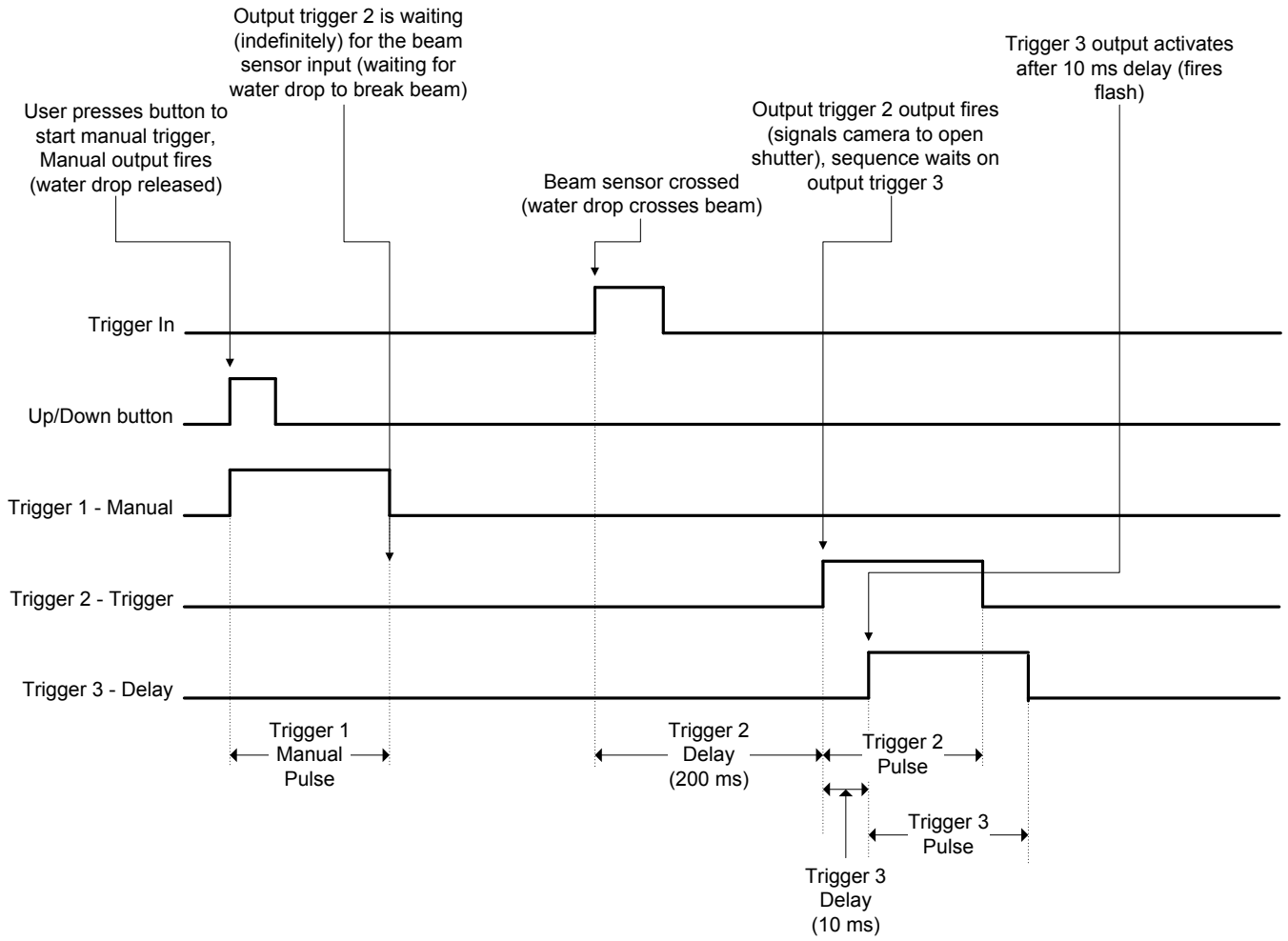


Figure 10 - Sequential Mode Timing Diagram

If a trigger output is configured as a "*Trigger*" but the delay on the main screen is set to "*off*", then the subsequent trigger outputs will be used. The sequence will be aborted if a configuration for a trigger output is entered (by pressing the **CONFIG** button).

There is an optional sequential mode timeout that may be adjusted as necessary. See section 3.3.7 for details on how to enable the sequential timeout. In the above usage scenario if the timeout was set to one second, StopShot would wait for trigger output 2 up to one second before resetting the sequence and waiting for trigger 1 (configured for manual mode). This is the maximum timeout to wait for each step of the sequence not the time to wait for the entire sequence. Care should be taken when setting this timeout. Time timeout can be set short enough to abort the current trigger output (i.e., setting a two second output pulse would be aborted after one second in the above example). As stated above, the ":" next to each step is

updated with a "*" as it completes. If this timeout occurs all the steps will revert to showing the ":" to indicate that StopShot is once again waiting for the first step.

Sequential mode has an additional feature that lets the "*Pulse*" duration of the trigger outputs to be configured as "*Latched"*. This means that the output will stay active until either the sequence completes or it times out. When adjusting the duration of "*Pulse*", use the **DOWN** button to adjust it to the minimum. Once the minimum is reached, "*Latched*" will be displayed.

NOTE: Do not set the final trigger in the sequence to "*Latched*". Since it is the final output, it will be disabled immediately (i.e., will not trigger the output).

NOTE: Setting the pulse duration to "*Latched*" when multiple pulses are selected will not generate multiple pulses on that trigger output. The output will stay active for the duration of the sequence (The latched feature overrides).

At the end of any sequence there is a forced one millisecond delay.

3.6.2 Manual Trigger

Manual triggering is discussed in the Independent Triggering section 3.5.2. "*Manual*" mode is generally only used on trigger output 1 functioning as the initiating condition (a button press) for a sequence of outputs. It can, however, be used on outputs 2 and 3. Because "*Manual*" mode is initiated by pressing the **UP** or **DOWN** buttons, you will have to press the **SELECT** button so the indicator is next to the proper "Manual" trigger, and then press the **UP** or **DOWN** button.

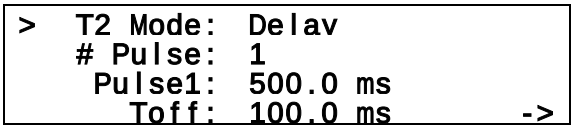
3.6.3 Input Trigger

The "*Trigger"* mode for Sequential Triggering functions exactly like the Independent Triggering mode. See the Independent Triggering section 3.5.3 for more details.

3.6.4 Delayed Trigger

The "*Delay"* triggering configuration is only available in Sequential Triggering mode. It is a simple way to add a delay in activating the trigger output between steps. The "*Delay"* mode is typically used for Trigger 2 or Trigger 3. It may be used on Trigger 1, but in this mode the sequence will start immediately (the delay will initiate the moment it is configured and begin).

To change an output mode to "*Delay"*, from the main screen press the **SELECT** button until the desired trigger output is selected. Press the **CONFIG** button. This will bring up the configuration screen for the specific trigger output. Press the **UP**/**DOWN** buttons until the "*T Mode"* is changed to "*Delay*".



Just like the independent "*Trigger"* mode you have the option of adjusting "*Pulse"* and "*Incrm"* as needed. An additional configuration is "*Sync"*. When "*Sync"* is set to "No", the delay time will start from the falling edge of the previous trigger output (it starts after the trigger output LED is off – so after the "*Pulse"* time has expired). If "*Sync"* is set to "Yes", it will start from the rising edge of the previous trigger output (the moment the output LED turns on).

"Figure 11 - Delay Synchronization" below is using the following configuration:

Note the behavior difference of "*Delay 2*" when "*Trigger 1*" changes its output.

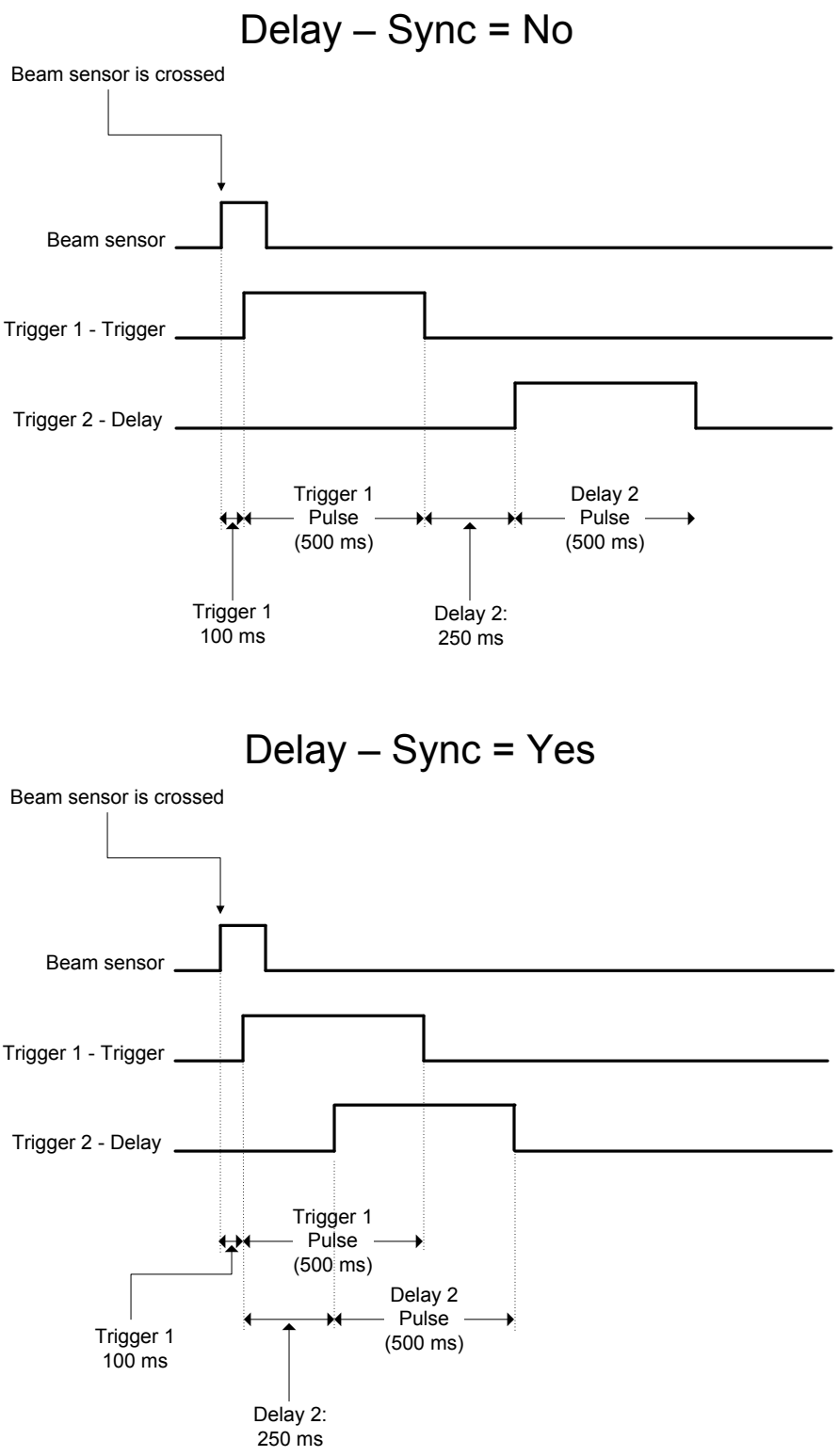


Figure 11 - Delay Synchronization

3.7 Time-Lapse

Time Lapse is another available "Global Configuration". Once this global configuration is selected (described in the "Global Configuration" section 3.3.1) Time Lapse mode will be enabled. This is useful for creating a series of shots for something that changes slowly: A sunrise, clouds traversing the sky, plants growing, or even congress voting.

The time-lapse interval is adjusted via the main screen using the **UP**/**DOWN** buttons. See the example settings below:

```
  == StopShot ==
>    TLapse 1:  2.0 sec
    Remaining:  1.9 sec
        Count:  3
```

You also have the option to adjust the "*Pulse"* configuration. Like other modes, press the **CONFIG** button. It will bring up the following configuration screen:

```
     TLapse Config:
>    Pulse:  500.0 ms
```

In this example, the "*Pulse"* configuration is left at the default of 500.0 ms, and the interval delay is set to two seconds (on the main screen). Since the two seconds is the time between the pulses, there would be 2.0 seconds (interval time on the main screen) plus the 0.500 seconds ("*Pulse*"), for a total of 2.50 seconds between pictures.

As shown in the above display, Time Lapse mode will show the remaining time before the next trigger event ("*Remaining*") and also the number of times ("*Count"*) that the trigger output has fired. "*Count"* will limit itself at 9,999 trigger events. See Figure 12 for a timing diagram. Only trigger output 1 is used for Time Lapse mode.

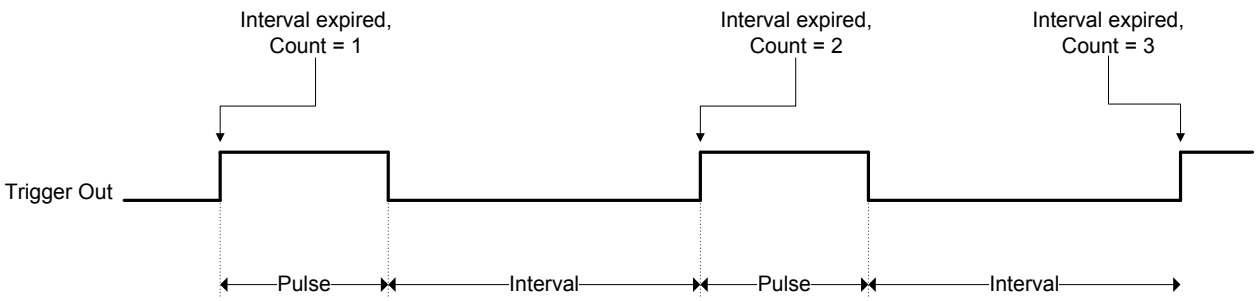


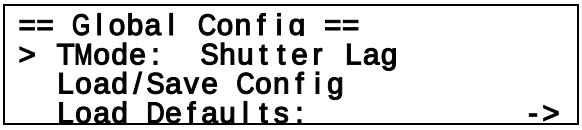
Figure 12 - Time Lapse Timing Diagram

3.8 Shutter Lag Measurement

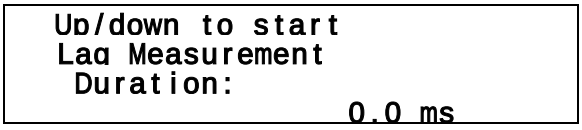
Shutter lag can be the nemesis of high-speed photographers. Knowing the shutter lag of your camera is critical when trying to synchronize the exposure with external flashes. StopShot provides excellent control over timing events, whether it is a camera or a flash. Unfortunately, cameras introduce a significant amount of delay when capturing an event. Shutter lag does vary from one camera manufacturer to another. To make matters worse, the delay is often variable based on the amount of processing that the camera performs and the settings of the camera. Before you can take steps to compensate for the lag it is very helpful to know what that number is, that is where the *Shutter Lag Measurement* ("*Tmode*" set to "*Shutter Lag*") is very useful.

To perform the shutter lag measurement, you must have a StopShot shutter cable for your camera. Attach the shutter cable to "Trigger 1", and the other end to your camera. The camera will need a flash attached or be a model that has an integrated flash. If using an integrated flash, be sure the flash is already up. Attach the beam sensor receiver or the mini beam sensor to StopShot's "sensor" input. The receiver can be the IR receiver, laser receiver or the cross beam b receiver. The transmitter does not need to be connected.

To configure StopShot to measure the shutter lag of a camera, press and hold the **CONFIG** button for two seconds until the global configuration screen appears. Press **SELECT** until "*TMode"* is selected. Use the **UP**/**DOWN** buttons until "*TMode"* changes to "*Shutter Lag"*.

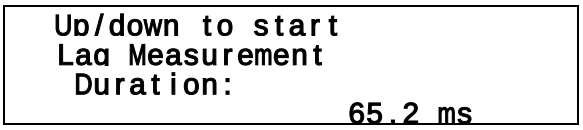


Press the **CONFIG** button to return to the main screen. You will see the following on the display indicating StopShot is waiting for a button press to start the measurement:

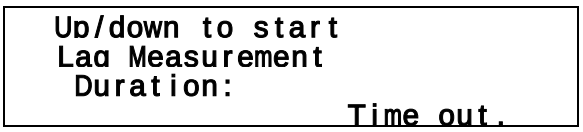


If the gain knob is set too high, it is possible for ambient light to falsely trigger the shutter lag measurement. Adjust the gain to the middle position as this will prevent StopShot from triggering on changes in ambient light.

When you press the **UP** or **DOWN** button to start the measurement, StopShot will activate "Trigger 1" and then measure the amount of time it takes for the camera to fire the flash. This provides an accurate measurement of how long from when a camera is told to take a picture to when it gets around to it.



StopShot will wait up to one second for the camera and flash to fire. If it does not receive a flash input within that one second, you will see the following:



If the flash fired within that one second period, double-check the camera shutter cable. If that appears to be good then re-adjust the sensor and try again.

There are many variables that come into play with shutter lag. Auto-focus, metering, and even the LCD preview being active can affect the duration.
For some cameras (such as Canon) the lag can be significantly reduced by enabling “Mirror Lock-up” in the custom functions settings. In fact this is the only way with a Canon camera to make the shutter lag consistent from shot to shot. For Nikon the LCD preview must be turned off in order to make the shutter lag consistent.

4. Wiring External Devices

One of the design goals of StopShot was to make it simple to add cable extensions and do custom wiring. Nothing is more frustrating than buying a product and finding out that it uses over-priced proprietary cables. All StopShot cables are available at your favorite audio/video equipment supply store. We provide the connection diagrams below so that you have the option of making custom cables or sensors. If you have any questions, please contact us at support@cognisys-inc.com.

⚠**WARNING:** Do not use StopShot to automate the firing of ballistics. Serious injury and/or death may occur.

⚠ **CAUTION:** Only use the power adapter (cube) that came with the StopShot module. Use of other power adapters may damage the module.

4.1 Sensor/Mic inputs

The beam sensors and microphone input all use 3.5mm stereo cables. If the supplied cable does not meet your needs you may purchase a 3.5mm stereo "headphone" extension at any audio store.

The microphone input has a 2.2kΩ pull-up to 4.5 volts internally to StopShot to bias the microphone. This connection is on the tip of the 3.5mm microphone plug. The other conductor (the shaft) is ground. See Figure 13 below for a connection diagram.

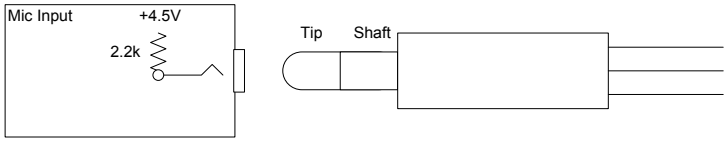


Figure 13 - Microphone Connection

The beam sensor input must also provide power to the sensors. The tip provides 4.5 volts, the center conductor is the signal input, and the remaining conductor is ground. See Figure 14 below for a connection diagram.

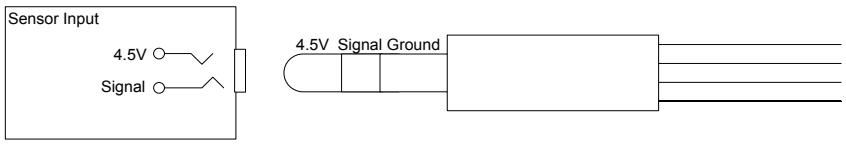


Figure 14 - Sensor Connection

4.2 Trigger Outputs

All the trigger outputs use standard “RCA” jacks. RCA extensions come in all different types, one end as male and the other as female. There are mono (single) extensions which are typically used for video. Stereo/dual extensions are usually for extending audio connections. There are triple extensions for extending audio and video equipment. You also have the option of buying standard RCA cables and using a coupler adapter to connect two male/male cables together.

As with all RCA jacks the outside connector is ground. StopShot outputs are “Low Side Drivers” (switches in ground). This means that when a trigger output fires, it connects the center conductor of the RCA jack to the outside connector (ground) to draw current through the center conductor.

See Figure 15 below for a wiring diagram for the RCA connectors.

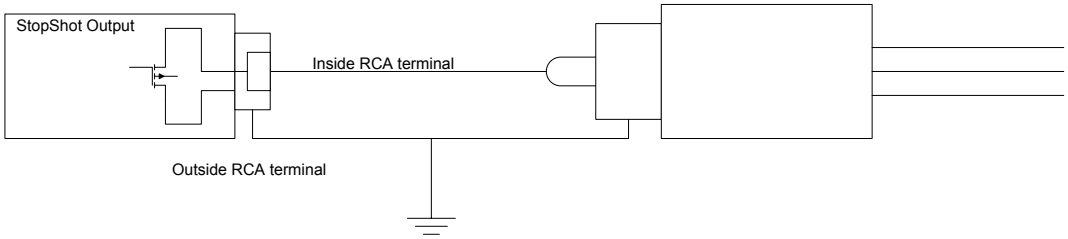


Figure 15 - RCA connector

⚠ **CAUTION:** Do not use “Y” adapters for the trigger outputs to connect more than three electro mechanical devices. These devices can generate significant transients that may damage sensitive equipment such as cameras and flashes. StopShot is protected from these transients but other electronics (such as flashes and cameras) may not be. It is acceptable to use a “Y” adapter to connect more than one device to a trigger output as long as the devices are similar. If you have any questions or concerns about device compatibility, please contact us at: support@cognisys-inc.com.

4.3 Activating Relays

Some applications require activating a relay to enable (or disable) a “load”. Relays allow StopShot to turn on/off a variety of AC and DC devices.

⚠ **CAUTION:** Care should be taken when wiring up StopShot to control AC or high-voltage DC as a mistake in wiring the relay could cause damage to StopShot and other connected devices.

See Figure 16 below as an example of wiring StopShot to control a 12V DC relay.

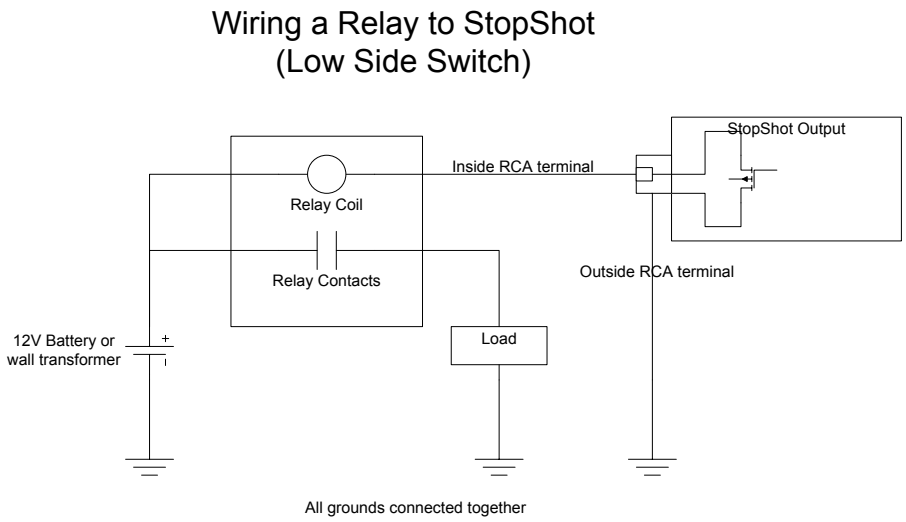


Figure 16 - Wiring an external relay

4.4 Cross-beam Sensor

Both Cross-Beam Receivers are digital sensors. Changing the gain control will not impact the sensitivity of either receiver. The gain should be left in the middle or low position when using the cross beam sensor set. Receiver A is the sensor with 3 jacks and a LED; it is connected directly to StopShot. Receiver B is the secondary sensor; it has two jacks and is connected to Receiver A. The cross beam sensors are wired as shown below in Figure 17 - Cross-beam connections. Just match the colors. No damage can be done to StopShot or any sensor by connecting them incorrectly. Receiver B can also be connected directly to StopShot if a simple Beam sensor is desired.

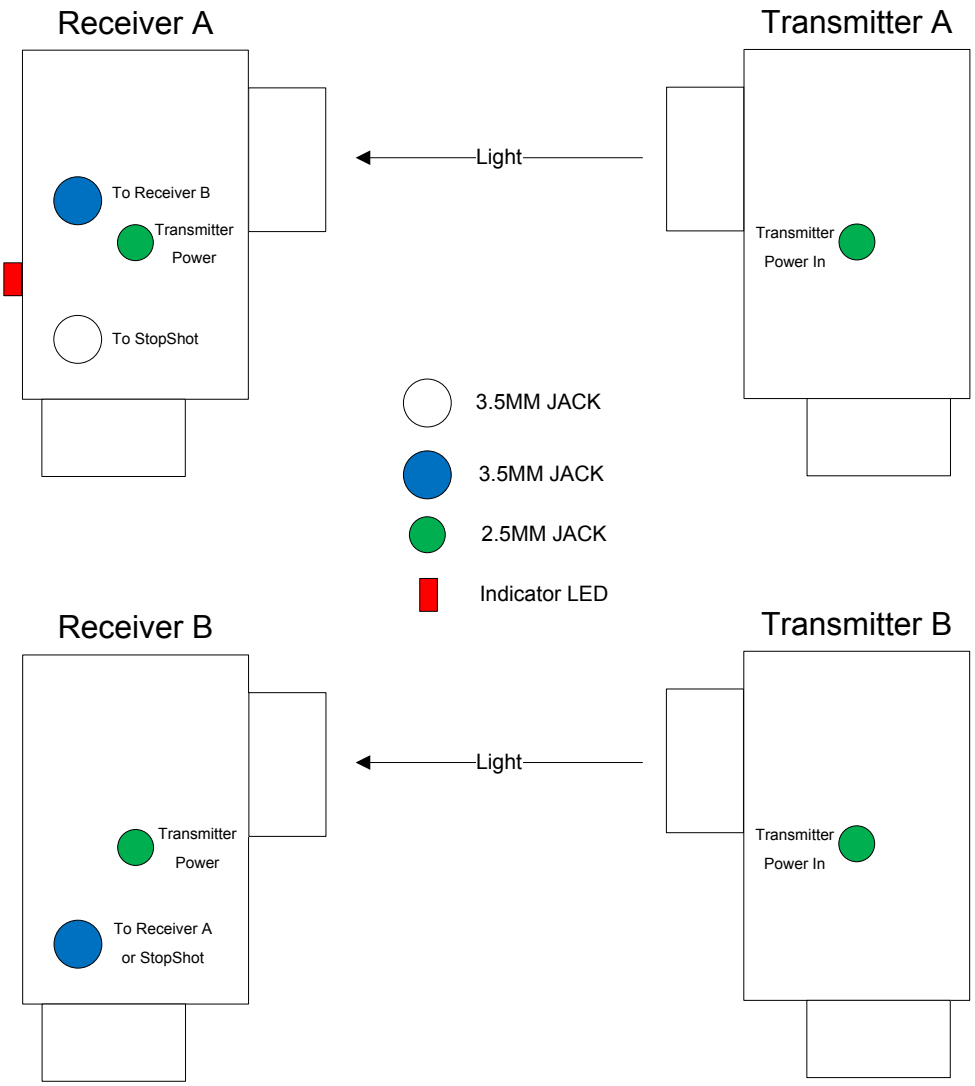


Figure 17 - Cross-beam connections

The cross beam sensor has a tri-colored LED mounted in it to show the status of the sensor. The modes are as follows:

Red – IR or laser light is incident on sensor A or beam B is broken
Green – IR or laser light is incident on sensor B or beam A is broken
Orange – IR or laser light is incident on both sensors

If any of the above lights are on without the corresponding transmitters shining on them there is too much ambient light reaching the sensor. The sensors were designed to be used outdoors but direct sunlight incident on the receiver diodes will cause them to turn on. There is a design tradeoff between good range and ambient light triggering the sensor. To keep response time as fast as possible our sensors do not modulate the infrared transmitters. Modulating a sensor at 20 kHz would add at least 50 microseconds to the response time.

When using lasers as the cross beam transmitters it is best to use the included diffuser (Figure 18) over the both sensors. The diffuser will allow much easier alignment of the laser beams. It will also prevent small movements of either the sensor or the transmitter from causing false triggers. The laser transmitter contains an adjustable lens to focus the beam. When triggering on extremely small objects it is desirable to focus the laser to a narrow beam. Detection of 1 – 2 mm objects is possible.

Figure 18 - Laser Diffuser

When using IR transmitters do not use the diffuser on the receiver as it will attenuate the light too much and seriously degrade range.

Below are some general guidelines for using the sensors:

The sensors work by changes in light produced by objects passing between the transmitter (source) and the sensor (receiver). The object you are trying to capture essentially has to cast a shadow over the small light sensing pin diode internal to the sensor. The diode can be seen inside the sensor (a small black shiny part). If you are trying to capture small objects it is best if the object passes between the receiver and the transmitter as close to the receiver as possible. If you are having trouble triggering on extremely small objects (i.e. 1 -2 mm) it may be necessary to place a small aperture in front of the sensor. Make the aperture as small as possible while maintaining the sensor active light on. The diameter of the aperture will need to be large enough to let enough light reach the photodiode to turn on the photodiode. This diameter will be a function of distance to the transmitter. This technique is more useful for the IR sensor; the laser beam is already very narrow.

If using the laser beams be sure to adjust the beam width for your application using the focusing lens and the end of the transmitters.

When using the infra-red transmitters for cross-beam applications the power-level of the transmitter should be adjusted to the minimum that illuminates the LED indicator for that beam. The power-level is adjusted by turning the knob. Clockwise increases transmitter power while counter-clockwise decreases power. Operating the transmitters with too much power will degrade the sensitivity of the receiver.

5. Setup Examples

5.1 The StopShot Water Drop Kit

Water drops make an outstanding subject for high speed photography, like snowflakes each one is unique. Once you get a basic understanding of StopShot you will find that the lighting is much more challenging than creating at the actual drop collisions. Water drops can be released by something as simple as an eye-dropper, but for maximum repeatability some electronic control is in order. This is where the StopShot water drop kit comes in.

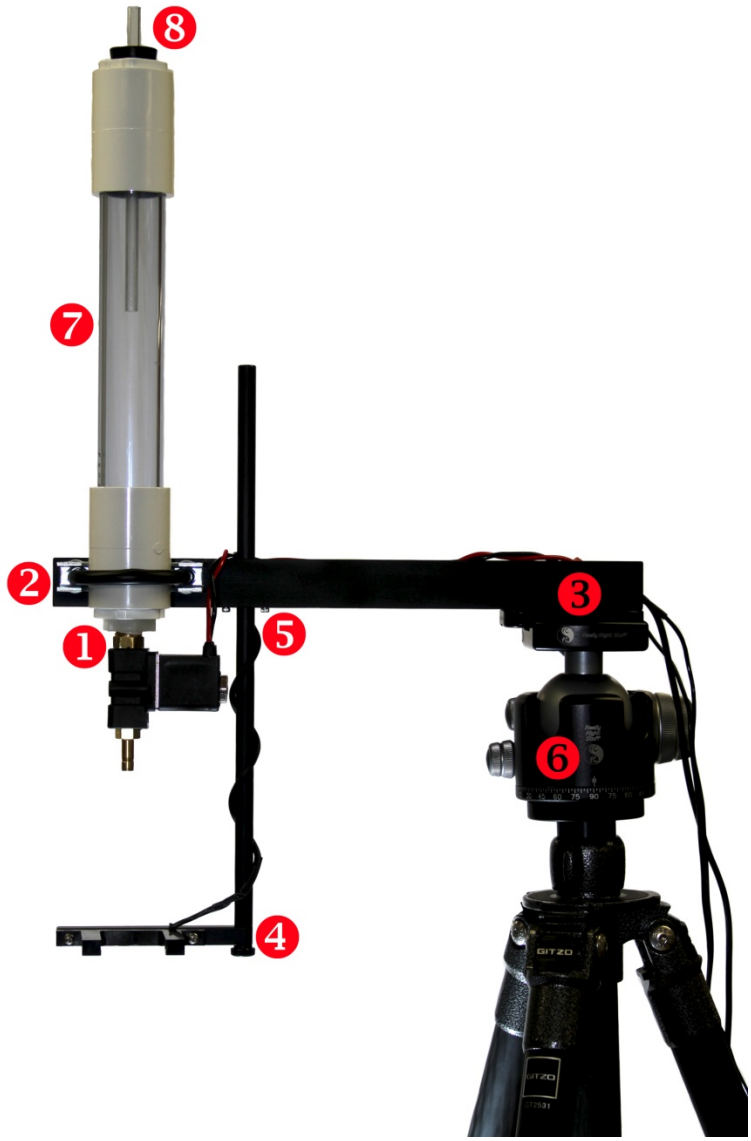
Figure 19 - Water Drop Kit

5.1.1 The Big Picture

1. With the camera in Bulb mode press and hold the shutter button to open the shutter.
2. Press the UP or DOWN button to start the water drop sequence in StopShot.
3. Two water drops will be released by the valve with the timing you have programmed.
4. The Mini Beam Sensor will detect the first drop in free fall and start the Trigger 2 timer.
5. The water drop will hit the pool of water below. It will rebound and is struck with the second drop.
6. The time programmed into trigger 2 elapses and the flash fires to expose the image.
7. Release the shutter button on the camera to close the camera shutter.
8. Review your image. (Cable to connect camera to monitor not shown).

5.1.2 Water Drop Kit Assembly

Follow the steps below to assemble your water drop kit. The diagram below shows the overall placement of all of the components.



1. Thread the Mariotte Siphon to the water valve from the Water Valve Assembly
2. Attach the siphon and the valve to the 12” long aluminum bracket with the supplied U-Bolt. Snug down the nuts for the U-Bolt until the siphon does not easily move from side to side. Do not over tighten the nuts.
3. Attach the Long aluminum L bracket with the siphon and valve on it to your tripod. There are three ¼-20 holes in the bracket for this purpose.
4. Remove the thumbscrew from the supplied rod and attach the Mini Beam Sensor to the end of Long Rod.

5. Loosen the thumb screw in the block on the L bracket and install the long rod holding the mini beam sensor. Adjust the height and snug down the thumb screw.
6. Use the tripod adjustments to plumb up the valve and Siphon.
7. Fill the Siphon with water so the water level covers the small tube coming down from the siphon top – never let the water go below this level or the siphon will not be able to keep constant pressure on the valve.
8. Insert the siphon top.

5.1.3 Water Drop Kit Electrical Connections

1. Connect the supplied AC adapter to your mains and connect the 2.1mm power connector to StopShot. StopShot will go through the power up sequence as soon as power is applied.
2. Connect the 3.5mm connector from the Mini Beam Sensor to the Jack labeled “Sensor” on StopShot.
3. Plug in the Water Valve Assembly power supply to your mains and connect the RCA connector to Trigger 1. This will be the channel to control your water valve.
4. Connect the flash - with the supplied 2m RCA cable connect one end to Trigger 2 on StopShot and the other end to the short PC to RCA adapter cable.
5. Connect the pc sync end of the adapter cable to the pc sync connection on your flash. If your flash does not have this connection you will need a hot shoe adapter. The hot shoe has a couple of pc sync connections and your flash will slide into the top of it.

   [**Note**: You will notice there is no camera connection to StopShot for this setup. We highly recommend you do not connect the camera when first getting started. Automating the firing of

the camera is very doable but it makes the configuration much more complex. We recommend people start out by shooting in a dimly lit room with StopShot firing the flash. There is no need to be in complete darkness – I generally work with a 60W bulb underneath the table I am working on. This will give plenty of light to work by but having the light source under the table will prevent any direct ambient light getting into the photographs.

5.1.4 Configure StopShot

StopShot has presets saved off as configurations to simplify the water-drop capture process. To take advantage of these settings, refer to section 3.3.2 for loading the desired configuration. These presets make certain assumptions about the physical setup. The sensor bottom must be 19" (48.3 cm) above the surface that the water will fall into. Additionally, the black base of the solenoid valve bottom must be 24" (61 cm) above the surface. Some minor adjustments may be necessary but those presets will save you time in configuring StopShot. If you want to configure StopShot step by step, the instructions follow below.

Step 1: A Single Drop

The first step is getting consistent pictures of single water drop. Be sure to keep the valve and Mariotte siphon plumb. The setup is as shown above but we are not quite ready for the camera just yet. First we want to start out with StopShot in a known state; either load the single drop preset or reset the controller to its default configuration. Resetting StopShot to its defaults can be done by holding down the **DOWN** button while applying power to StopShot. This will restore all of the default settings but it will not delete any setups you have saved. After the reset you will see this:

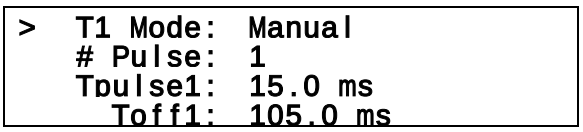
```
    == StopShot ==
>   Trigger 1:  Off
    Trigger 2:  Off
    Trigger 3:  Off
```

Now that StopShot is in a known state we need to put it into Sequential Mode. To do this press and hold the **CONFIG** button for 2 seconds until "*Global Config*" is displayed. The cursor will be next to "*TMode*". Press **UP** once, "*Sequential*" is displayed. Press the **CONFIG** button to exit to the main screen. You will then see this:

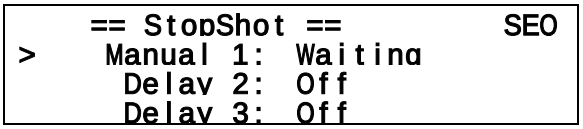
```
    == StopShot ==          SEQ
>   Trigger 1:  Off
      Delay 2:  Off
      Delay 3:  Off
```

Next we need to get the valve set up to trigger on a button press – this happens in the Manual Trigger Mode. So with the cursor next to "*Trigger 1*", press and release the **CONFIG** button. This will let you change the settings of just that one output. The display should say "*T1 Mode: Trigger*". Use the **UP**/**DOWN** buttons until it changes to "*Manual*". Now press the **SELECT**

button to move the cursor down to "*Pulse1*". Now use the **DOWN** button to adjust this to "*15 ms*". This is the time that the valve will be open to allow water to flow. Adjust "*Toff1*" to "*105 ms*". This is the time between valve openings for multiple drops (the valve will be closed for this duration). For now leave "*# Pulse*" set to "*1*". "*# Pulse*" defines the number of drops or output pulses that will be generated. When finished making the adjustments your display will look like this:



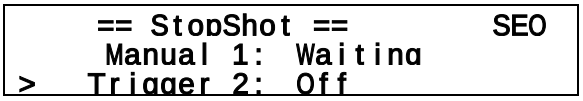
Press the CONFIG button to return to the main screen. You will see this:



To activate the water valve you need to have the cursor (>) next to the "*Manual 1*" line as shown above. Go ahead and press the **UP** or **DOWN** button and watch the valve. You may need to press it a few times to work out any air in the valve. Each time you push the **UP** or **DOWN** button you will hear a click and you should get a drop released from the valve. If you press **UP** or **DOWN** button 10 times you should get 10 drops. If you do then Step 1 is complete! If you don't always get a drop when you press the button then the "*Pulse1*" time is too short – the valve needs to be open a bit longer. Increase the "*Pulse1*" time by 1ms or 2ms and try again (some fine tuning required for a given fluid at a given pressure). When the timing is dialed in you should be able to get a single drop every time. This is very important for getting consistent drop collisions later. You need to make sure that for every button press you get exactly one drop, no more, no less. You can adjust the size of the water-drops by increasing or decreasing the "*Pulse1*" setting – just be sure you don't adjust it so far that you don't get one drop consistently.

<u>Step 2: The flash Timing</u>

Press the select button to get the cursor down to "*Delay 2*". In Step 1 we have a water drop falling. Now we need to set up the timing for the flash. You will want to dim the lights so you can clearly see the flash illuminate the water drop. (We're still in eye-ball mode here). First we need to change the timing mode of Trigger 2 from "*Delay*" to "*Trigger*". If the mode was left as "*Delay*", the sensor would not be used (StopShot would simply wait after the valve released the drops before firing the flash). So with the cursor on "*Delay 2*" press the **CONFIG** button. Then press the **DOWN** button to change the "*T2 Mode*" to "*Trigger*". After you press the **CONFIG** button again to go back to the main screen your display will look like this:



```
      Delay 3:  Off
```

Then use the **UP** button to adjust the delay. For the above mentioned distances a good starting point would be 300ms. Your final display will look like this:

```
    == StopShot ==          SEO
     Manual 1:  Waiting
>   Trigger 2:  300ms
      Delay 3:  Off
```

Press the **SELECT** button twice to get the cursor back up to "*Manual 1*", and press the **UP** or **DOWN** button to release the drop of water.

Your display will show one of two things depending on your setup. If the drop was detected by the mini beam sensor the flash will go off and your display will appear as shown below. If this is the case everything is aligned and you are in good shape:

```
    == StopShot ==          SEO
>    Manual 1:  Waiting
    Trigger 2:  300ms
      Delay 3:  Off
```

If the drop was not detected by the mini beam sensor your flash will not go off and your display will look like this:

```
    == StopShot ==          SEO
>    Manual 1*  Active
    Trigger 2:  300ms
      Delay 3:  Off
```

At this point we need to make some adjustments in the setup. StopShot shows "*Active*" in the display to indicate that it is waiting for an input from the sensor before moving to the next state. Also note the "*" next to "*Manual 1*". The "*" indicates that this step of the sequence is complete. There are two ways to get out of this mode. The first is to pass your finger through the mini beam sensor. If you do this you will see the flash go off and the display will go back to Waiting. The other method is to press the **UP** or **DOWN** button to abort the sequence. If you choose this method the flash will not go off but the mode will be reset to "*Waiting*" – and the system is ready for the next drop.

As you have probably already figured out the issue is the sensor is not aligned with the water drop. Observe the water drop falling through the sensor and twist the mini beam sensor so the drop falls between the active area of the sensor. The active area of the sensor is about 10mm behind the front of the arms where you can see the two spherical sensor elements on each side.

At this point you should be able to see the column of water suspended when the flash fires. If the flash does not fire then something is not right with the setup. Double check the flash and make sure it is turned on, not in sleep mode, and that the wiring is properly connected. If the flash fires when dropping the water and you don't see anything that likely means the delay is not set properly. The flash firing means the water-drop was detected. If you're not seeing it then it's probably already hit or is outside the flash range.

At this point you should have it set so every time you press the **UP**/**DOWN** button that a drop of water comes out and the flash fires reliably. Adjusting the delay for "*Trigger 2"* on the main screen will change the vertical position of the water drop.

Step 3: Camera Control

Now it is time to get the camera dialed in. You'll need to be in manual focus. Use a pencil or something else small at the same position the water drop hits to adjust the focus. Set your aperture to f/14 or greater. This will give you a reasonable depth of field and keep the ambient light out of your shots.

Set the camera for bulb mode. Hold the shutter button on the camera and press the **UP** or **DOWN** button to release the water drop, releasing your shutter button as soon as the flash fires. Now you should have a picture of a single water drop. At this point your photos should be very consistent from one picture to the next.

Step 4: Drop-on-drop

Now it is time to get a picture of a drop collision. Multi-drop is really just going back into step 1 and adjusting two parameters. So with the "*>*" cursor next to "*Manual 1*", press the **CONFIG** button and adjust the "*# Pulse*" to "*2*". The trickery comes into play with adjusting "*Toff*". This is the time between releasing the water-drops. Shorter durations means the drops will be closer together, so the rebounding drop will collide with the falling drop very low in the water. Longer durations will have the drop falling into a void created when the first drop is sucked back into the pool from surface tension. Go ahead and leave this the same as you set earlier for now and adjust it as necessary to get the desired effect. Now comes the fine tuning, you will need to adjust the amount of time between the drops and the delay on the main screen to fine tune your setup and get that drop collision photo you are after.

Step 5: Synchronizing the camera (Optional)

First, you will need to physically move the connector of the flash from the Trigger 2 output to the Trigger 3 output. Plug the shutter cable into the Trigger 2 output (you did buy a shutter cable, right?). Now it gets kind of tricky. Each camera and model has a shutter lag associated with it. That is the time that it takes from when you tell your camera to take a picture to when it actually does. This lag needs to get subtracted from the delay you had previously used. So if the delay you had entered for "*Trigger 2*" previously was 150ms and your camera's shutter lag is

50ms, then you would want to put in 100ms (150 – 50 = 100ms by using the **UP**/**DOWN** buttons). If your camera is set to "Bulb" mode, it will leave the shutter open for the duration that StopShot tells it to. Now that the camera is connected to the Trigger 2 output you can press the **CONFIG** button when the cursor is on "*Trigger 2*". The amount of time that StopShot will keep the output active (holding the shutter open) is the "*Pulse1*" setting. In "Bulb" mode, this will control the duration of the exposure. You may also set the exposure time in your camera – provided you know the shutter lag for your camera.

Next we need to configure "*Trigger 3*" for your flash. Press the **SELECT** button so the cursor is on "*Trigger 3*", and then press the **CONFIG** button. Press the **UP** or **DOWN** button to change the "*Mode:*" to "*Delay*". Press the **SELECT** button until the cursor is on the "*Sync*" line. Press the **UP** or **DOWN** button to turn this to "*On*". What this does is tell this output to synchronize with the previous output ("*Trigger 2*"). That means when the previous output first turns on, this output will start. See section 3.6.4 for more details regarding the synchronization feature. Press the **CONFIG** button to get back to the main screen. Almost there! Now the screen should show "*Delay 3:*" Go ahead and adjust this value now. This output will be from when the camera is told to open until the flash fires. So this delay could be very short – but it has to be at least your shutter lag duration. Now when you adjust the delay for "*Trigger 2*" the shutter lag/flash timing will stay the same. You'll only be adjusting the position of the water-drop. If you don't see the water drop in the picture then you may not have the proper shutter lag value. Increase it until you reliably see an exposed picture.

There are other settings that would work just as well. StopShot is extremely configurable.

5.2 Water Drop Kit Quick-start

1. Fill siphon so that at least one inch of fluid is above the clear tube that comes down from the top. This will keep the pressure on the valve constant.
2. Make sure the siphon/valve assembly is as vertical as possible.
3. Plug the water valve power into an outlet.
4. Connect the RCA jack from the valve to StopShot "Trigger 1".
5. Connect the infrared sensor to the "Sensor" input on StopShot.
6. From the surface of the water, adjust the valve height (measured from the bottom black body above the nozzle) to 24 inches (61 cm).
7. Adjust the sensor so that the center of the beam is 19 inches (48.25 cm) from the surface of the water.
8. You may either use the pre-stored defaults (global config->load settings) to load the required configuration or enter the following:

   Global Config Mode set to Sequential

   Trigger 1: Manual

   # pulses: 1 (or 2 for drop-on-drop). This is the number of pulses that StopShot will give the valve. Each pulse will create one water-drop.

   Pulse 1: 15ms – This is the time that the valve will be open.

   Toff: 80ms – This is the time between pulses / water drops.

   Trigger 2: Trigger 315ms

   A triggered input with a main-screen delay of 315ms. Connect the flash to "Trigger 2". The 315ms is the time from when the water-drop crosses the sensor before the flash is fired. For drop-on-drop you may want to adjust this to 290ms depending on the effect you are interested in.

9. Purge any air from the valve by having the cursor next to "Trigger 1: Manual" and press/hold the UP or DOWN button until all air has been removed.

5.3 Ballistics – Tips and Tricks

First we would recommend using the IR sensors (either the single beam or the cross beam) instead of the microphone for ballistics. There is a surprisingly large amount of variability in timing when using audio (at 1,200 feet per second – a millisecond goes a long ways!). The laser sensors can be complicated to properly align since the beam size is so small.

Use or make a large card-board box to contain whatever you plan to shoot. Cut a small hole for your camera, but protect the lens with a piece of Plexiglas. The box serves a couple of purposes, the first is to keep out unwanted light and the second is to contain the mess from whatever you are shooting. The flash should also be protected. Always be aware of your surroundings and who or what is down range. Safety first!

Using a reflective surface on the inside of the box will improve the lighting conditions of the target object. The backdrop for the object will vary depending on what is being shot. If there is a spray of moisture (fruit, vegetables, etc), a black background may be required to see the droplets.

For Ballistics shots like this we built a fixture for the rifle. A fixture makes both hitting the target and triggering StopShot very repeatable. This picture was taken with a Xenon flash (duration = 2uS).

Figure 20 - A Sucker being Shot with a .22 Caliber Rifle

⚠ **WARNING**: Always use a remote trigger for your camera (wired or wireless) when shooting ballistics photos. Never stand down range from any loaded gun. Seriously. We like repeat customers.

5.4 Wildlife

Capturing wildlife takes on a new dimension with StopShot. There are several sensors available to simply the process of less than cooperative critters.

5.4.1 Lions, Tigers, and Bear

The "Passive IR sensor" is a single-sided sensor (no reflector or other part required) with a range of about 16 feet (5m). A simple setting example is shown below:

```
    == StopShot ==
>   Trigger 1:  100.0 ms
    Trigger 2:  Off
    Trigger 3:  Off
```

With these settings, "Trigger 1" output would fire 100ms after the sensor detects movement in its beam. Unfortunately the sensor may continue to fire if the creature pauses, moves slowly, or decides it is time to graze. To prevent the sensor from re-triggering StopShot you may want to adjust the "blanking time" so that StopShot ignores the sensor for a period of time. "Blanking time" is discussed in more detail in section 3.5.3.

This sensor uses passively radiated heat from objects to detect movement. It's ideally suited for capturing larger animals. Small fast-moving critters may not be detected – but don't worry. We have them covered as well with other sensors.

"Laser transmitters" allow a much further distance between the receiver and transmitter than it's infrared (IR) counter-part. This beam, tested at 60 feet (18.3m) before we ran out of room, gives maximum range for the less-scripted wildlife. If you know an area that they may be traveling in but can't pin down exactly where the laser transmitter would be a perfect weapon in your sensor arsenal. These settings would be the same as those above. The transmitter can be powered by the 2.5mm cable from the receiver but for long distances it would be wise to consider using a laser transmitter battery pack.

5.4.2 The Catch-All

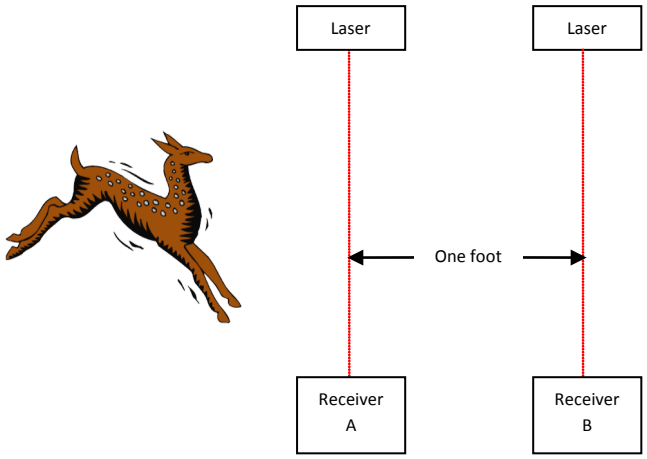
Cross-beam sensors. It's for the birds. No Really. And bats. Snakes. Bees. Wasps. Deer. Antelope. Cantaloupe. Anything that moves. The cross-beam sensor isn't simply for triggering in a pin-point spot in space (which it excels at!). It allows you to also stage the two beams so that it will only trigger if the subject of interest is moving in a specific direction.

Section 3.5.4 of this manual describes many of the operating modes of the cross-beam sensors. Now let's discuss a couple of real-world scenarios.

<u>The Deer:</u>

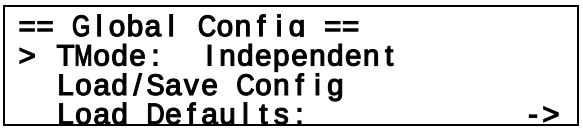
The upper-peninsula of Michigan has more deer than humans. Clearly they are a threat to our very existence and their nefarious activities must be documented with photos and film. In this example we want to capture a deer running at full speed. Grazing deer aren't much of a concern – it's the running ones that are up to no good. For this situation, the cross-beams will be staggered. After thorough research on the internet (which never lies), the maximum speed of a White Tail Deer is 30 mph (48 kph). We'll configure StopShot to trigger on a deer running at 15 mph or faster.

Here is the physical setup:

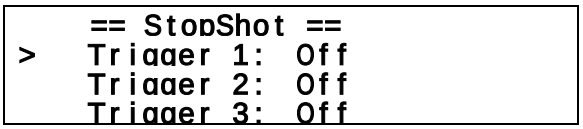


So let the StopShot configuration begin.

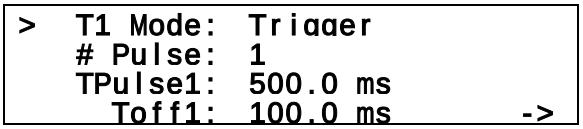
We'll be using independent mode for this capture. By holding down the **CONFIG** button, make sure that the global configuration mode for StopShot is set to "*Independent*".



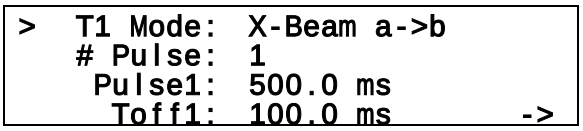
Press the **CONFIG** button again to get back to the main screen:



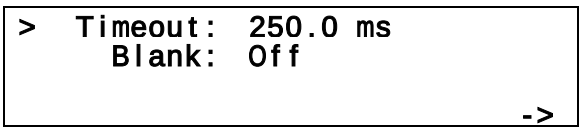
Now we want to change the "Trigger 1" output to the cross-beam sensor. In this case we want the sensor to trigger when the deer runs across sensor A to sensor B, so we'll choose the "*X-Beam a->b*" mode. Since the cursor is already on "Trigger 1", press the **CONFIG** button quickly to bring up the configuration for that output:



Using the **UP** or **DOWN** buttons, change the "*T1 Mode*" until it says "*X-Beam a->b*":



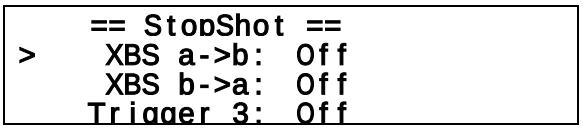
We're not quite done yet though. Now we need to adjust the timeout for this trigger. To simplify the math, let's say the two sensor beams are one foot away. 15 mph is (15 * 5280) = 79,200 feet per hour. The sensor's timeout is in seconds, so one more calculation: 79,200 feet per hour / 60 / 60 = 22 feet per second. That's pretty fast. If my sensors were spaced 22 feet apart, I would set the timeout to one second. But they aren't – they are one foot apart. So if the deer goes 22 feet in one second, it would take them (one second / 22 feet) to go one foot, or 45ms. Now we have a magical number to feed StopShot. Press the **SELECT** button until the "Timeout" field shows:



Use the **DOWN** button to adjust the "*timeout*" to "*45.0 ms*". The **CONFIG** button will take you back to the main menu.

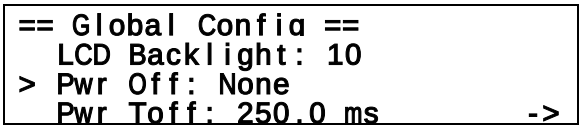
There we go! We now have a cross-beam configured to capture a deer running at 15 mph. One problem. We don't know which direction the deer is going to come from (they're pesky that way), and this channel is only configured for "*X-Beam a->b*". If the deer comes from the other direction, the sensor won't fire (by design). That's one of many reasons that StopShot has multiple outputs. All you have to do is configure "*Trigger 2*" for "*X-Beam b->a*" with the same settings. This will require an external RCA "Y" cable to tie the two StopShot outputs together, and then run it to your camera via a shutter cable.

So now on the main-screen you should see:



Use the **UP** button to change the "Off" for both outputs to something reasonable, like 1.0 ms. This will be the delay from when the sensor has detected something to when the output is activated. Why 1.0ms instead of 50us? We need to give a little time for the sensors to turn off.

One last improvement is to get rid of the laser beam from the pictures. To accomplish this we'll use the "Power Off" feature in StopShot (see section 3.3.5 for more details). After holding down the **CONFIG** button to get to the global configuration, press the select button until the "*Pwr Off*" field is shown:



Use the **UP** or **DOWN** buttons until "*All*" is displayed. 250ms will be reasonable enough for the camera to take a picture with the laser light off.

So there we have it. A bi-directional speed-sensitive setup to capture deer traveling at least 15 mph.

6. Animated Time-Lapse movies

By using the "Time Lapse" global configuration you can generate a sequence of pictures. There are some freely available programs that can convert a series of JPEG pictures into an MPEG or AVI movie. For information on these programs and the latest links to the software, please visit our website at: http://www.cognisys-inc.com.

When taking a series of time-lapse pictures, you may or may not want to disable the auto-exposure feature of your camera. If capturing a sunset, you may want the light to progressively dwindle into nothing, instead of the camera increasing the exposure time to compensate for the low-light. Some experimentation may be required.

7. Troubleshooting

Problem	Cause	Solution
Display is not lit.	Power cord is not inserted properly into the power jack.	Insert the power cord properly into the power jack. It needs to be fully seated in the connector.
	Power cord is not plugged into the wall.	Plug power adapter into the wall.
	Wrong AC/DC adapter used.	Be sure to use the AC/DC adapter that was included with your StopShot module: 12VDC 1amp
	Backlighting is turned down too low.	If the backlighting was turned down to use in the dark, you may not be able to see it in bright light. In a room with less light, adjust the backlighting per the manual.
Trigger LED's are constantly on or flashing.	The wrong timer mode is selected.	Please verify that the timers are being used correctly. If you need to reset the settings to the factory default, see the section "Global Reset".
	The gain is set too high.	If the timer is using the input trigger, turn the gain towards the MIN indicator (CCW).
	The trigger output has a short circuit.	Disconnect the load (flash, accessory, etc) from StopShot and see if the light goes out. If it does, something is wrong with the load.
	Your load (flash, accessory, etc) is not powered up.	The load may have a slightly resistive path to ground. Power up the load.
Camera or flash does not trigger	Equipment in sleep mode.	Ensure equipment is in ready mode.

If you cannot resolve a problem with the StopShot module, please contact us at support@cognisys-inc.com. We want to make sure that you are completely satisfied with our product.

8. Specifications

Specifications are intended for reference only. The design may be modified to improve features or functionality without notice.

Specifications	MIN	NOM	MAX	UNITS
Input Voltage	6	7.5	14	Vdc
Input Current - No Sensors Connected (9Vdc in)	-	75	100	mAdc
Output Current Sink	-	-	1	Adc
Sensor Supply Output Voltage	4.0	4.5	5.0	Vdc
Sensor Supply Output Current	-	-	100	mAdc
Max Voltage on Trigger Out Port (Steady State)	-	-	60	Vdc
Timer Tolerance @ 25C (standard module)		1		%
Timer Tolerance @ 25C (Precision Timing Opt)		50		Ppm
Operating Temperature	-20	25	50	C

- Fully programmable 3 channel intervalometer.
- 4x20 LCD Display with adjustable blue backlighting.
- Powered by a high-speed Freescale Digital Signal Processor
- All outputs are open drain (Can be used for Flash Trigger or Shutter Trigger).
- Microphone Input for standard electret microphone.
- Input sensor jack with external power for IR LED's, Lasers or other 5Vdc loads.
- Outputs have enough current capability to energize relays or electronic valves (Outputs are protected from inductive loads).
- All outputs short circuit protected.
- Accepts DC Input 2.1mm power jack.
- Simple 4 button interface.
- Adjustable gain for microphone and sensor inputs.
- Standard 3.5mm microphone jack.
- RCA output cables (easy and affordable to extend).
- Durable extruded aluminum housing.

9. Accessories

IR Beam Sensor [IR_S04]

Features:

- Invisible beam will not show up in photographs
- Great for water-drops and ballistics
- May be used to measure shutter lag
- Excellent sensitivity
- Adjustable transmitter power
- Focusing lens included
- 6 ft (1.8 m) IR range (with lens)
- 6 ft 3.5mm and 6 ft 2.5mm cable included

This IR (infrared) Curtain for StopShot contains both an IR transmitter and receiver. It can be used to capture anything that moves between the elements. It works great for water drops and ballistics. It is sensitive enough to be triggered by a .22 caliber bullet. The sensor set includes two ¼-20 tripod mounts and the IR lens assembly. This lens should not be used when the sensors are close together as it will saturate the receiver and negatively impact the sensitivity. The transmitter for this sensor set has a power control knob to adjust the power output. The lowest setting (counter-clockwise) should be used when the transmitter and receiver are placed close together. This setting will maximize sensitivity at this short distance. If the sensor is used with more distance between the elements the knob may be moved clockwise to a higher power setting to increase the range. The lowest power-level possible that successfully triggers should be used to maximize sensor sensitivity.

This is the senor set that is included with beam kits.

Infrared Beam Sensor - Transmitter/Receiver Specifications				
	Min	Typical	Max	Units
Input Voltage (Transmitter)	4.0	4.5	5.0	V
IR Transmitter Current		47		mA
Range (no lens)		1.0		Ft
Range (with lens)	6ft			Ft

Cross-Beam Infrared Transmitter/Receiver [XBS_IR_01]

- Two transmitters and two receivers
- 6+ feet (182 cm) IR range
- Dual-axis triggering
- Conditional triggering (**A** followed by **B**, but within a certain time)
- Optional tripod mount available for sensors
- LED indicator for sensor alignment
- Two 6 ft 3.5mm and two 6 ft 2.5 mm cables included.

Cross beam sensors add a whole new dimension to your triggering capability (literally). The IR cross beam sensor set is perfect for ballistics or any other studio work. They are not suitable for use outdoors in bright sunlight. See section 3.5.4 for all of the different triggering modes for these sensors.

Receiver A includes a tri-colored LED (mounted on the back) to indicate when each receiver is lined up correctly. See section 4.4 for details. The infrared version of this sensor has the advantage of having an invisible beam (unlike the red laser light of the laser cross beam set). The disadvantage of IR sensor set is that it is not effective in bright sunlight. A lens (included as shown above) on the IR transmitters will yield a range in excess of six feet. For short distances the lens should be removed. The lens focuses the IR beam and if it remains attached at short distances it will saturate the receiver with IR light reducing its sensitivity. This may cause the receiver to not detect small objects crossing the beam. The transmitters have an adjustable power-level. The power-level should be set to the lowest possible that still activates the LED. This will improve the sensors sensitivity.

Cross-Beam Infrared Transmitter/Receiver Specifications				
	Min	Typical	Max	Units
Input Voltage	4.0	4.5	5.0	V
Output Voltage		Vin		V
IR Transmitter Current		47		mA
Total Current			100	mA

Cross-Beam Laser Transmitter/Receiver [XBS_L01]

- Two transmitters and two receivers
- 100+ feet (30.5 m) laser range
- Dual-axis triggering
- Conditional triggering (**A** followed by **B**, but within a certain time)
- Optional tripod mount available for sensors
- LED indicator to aid in alignment
- Works well in bright sunlight
- Two 6 ft 3.5mm and two 6 ft 2.5 mm cables included.

The laser cross-beam sensor provides the same feature set as the IR sensor set above. It also offers the benefit of additional range when compared to the infrared version. It is a great choice for insects or other small subjects. Works well in bright sunlight. The beam of the sensors is visible red allowing for easier alignment.

Both the laser and IR cross beam sensors have a near instantaneous response time – neither are modulated. Diffusers are included for the two receivers. The diffusers make aligning the sensors much easier. The lasers have a focusable beam that can be adjusted for the size of the object you are trying to capture.

Cross-Beam Laser Transmitter/Receiver Specifications				
	Min	Typical	Max	Units
Input Voltage	4.0	4.5	4.7	V
Output Voltage		Vin		V
Laser Transmitter Current		13		mA
Total Current			30	mA

Beam Receiver [RCVR_02]

This sensor is the receiver half of the Beam Sensor. It can be used with an IR or Laser transmitter. Use with LSR_TMTR_01, shown below.

When using the laser transmitter the diffuser will prevent small movements of the receiver or the “speckle” in a laser beam from falsely triggering StopShot. What’s “speckle”? It’s a phenomenon that occurs in lasers when a correlated light beam experiences interference from waves with different phases. This is often noticed when shining a laser on a surface – It seems to shift and twinkle on its own. Imperfections in the surface can cause the laser light to slightly phase shift resulting in a variance in amplitude. The diffuser also reduces the alignment precision between the transmitter and receiver.

Features:

- 6 ft (1.8 m) IR range
- May be used with Laser or IR transmitters
- Use to detect lightning
- Use to measure shutter lag
- 6 ft 3.5mm cable included

4.06” x 2.47” x 1.37” (10.31cm x 6.27cm x 3.73cm)

Laser Transmitter - [LSR_TMTR_01]

Laser Transmitter Features:

- Long Range (100+ ft)
- 2.5mm Power Jack
- Battery Pack available for Power
- Focusable beam (hand-adjusted)
- 5mW laser Class II Laser Beam
- 650 nm wavelength (red)
- 13mA @ 4.5V
- 6 ft 2.5mm cable included
- 4.06” x 3.40” x 1.37” (10.31cm x 8.64cm x 3.73cm)

⚠ Never look into the laser beam, shine it at someone else, or reflect it off a surface that could bounce back into your (or others) eyes. Laser light damages eyes – which would defeat the purpose of photography.

The laser transmitter is great for increasing the range between the transmitter and receiver. This makes it very suitable for capturing anything from fruit flies to elephants. The laser transmitter contains an adjustable lens to focus the beam. When triggering on extremely small objects it is desirable to focus the laser to a narrow beam. Detection of 1 – 2 mm objects is possible.

Laser Transmitter Specifications				
	Min	Typical	Max	Units
Operating Voltage	4.0	4.5	4.7	V
Current Draw		13		mA
Laser Power		5		mW
Beam wavelength		960		nm

Battery Pack for Laser/IR Transmitter - [BAT_PAK_01]

Battery Pack Features:

- Holds 3 AA Batteries (Alkaline recommended)
- On/off switch
- Includes a 3ft cable with a 2.5mm plug (fits Laser and IR transmitters)
- 130+ hour life for laser transmitters
- 50+ hour life Infrared transmitters
- 2.72” x 1.90” x 0.72” (6.90cm x 4.83cm x 1.83cm)
- Short-circuit battery protection

⚠ Make sure this battery pack is switched off when not connected to a laser sensor. If the 2.5mm plug is shorted out excessive heat may be generated and battery life with be greatly diminished.

Battery Pack for StopShot - [BAT_PAK_02]

Battery Pack Features:

- Holds 8 AA Batteries (not included)
- Includes a 16” cable with a 2.1mm plug
- 24+ hour life for StopShot using 2450mAh NiMH batteries
- 2.83” x 2.57” x 1.46” (71.8mm x 65.28mm x 37.08mm)

Hot Shoe Adapter - [HS01]

Features:

- Standard hot shoe with PC connector
- PC connector to RCA adapter included
- ¼" tripod mount on bottom

This adapter lets you connect a flash with a hot shoe to the StopShot module. You will need a RCA to RCA patch cord to complete the connection. The StopShot deluxe kit includes one RCA cable. This hot shoe features a switch to test fire the flash that is connected to it. If everything is connected properly and the button on the hot shoe is pressed, the flash should fire and the corresponding LED on StopShot should be illuminated for the duration of the button press. The hot shoe also has two PC connections on it so additional flashes can be daisy chained.

Microphone - [MIC01]

The microphone is ideal for impact triggers at close range (a football being kicked or a wine-glass dropping onto a floor). Its trigger sensitivity can be adjusted by the gain control and can detect very faint sounds such as the pop of a soap bubble. This is a condenser microphone and has a 3.5mm mono connector.

Water Valve Assembly - [WVA02]

- Precision Water Valve is fully controllable via StopShot
- 12V DC Power Supply Included
- 1/4” MPT for mating with siphon
- Mounting screw holes

This valve assembly can be connected directly to StopShot to create precision controlled drops of water. This valve was used to create many of the "drop crashing into drop" photos in our gallery. It includes a power supply and the cable assembly required to connect it to StopShot.

This valve has a very good response time. When being driven by StopShot this valve is capable of delivering a drop of water with a 10mS pulse. StopShot may be configured to put virtually any delay between drops giving you maximum flexibility when trying to capture water drop photos.

The threads on this valve are 1/4 inch (intended for mating with the Mariotte siphon), and it is powered by 12VDC (supply included). The output nozzle is 1/8 inch.

This valve is also available without the power supply. See the StopShot category on our website for details.

10. Warranty

Limited Warranty

All products are warranted to be free from defects in materials or workmanship for one (1) year from the date of purchase. Within this period, Cognisys Inc. will, at its sole option, repair or replace any components which fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation cost. This warranty does not cover failures due to abuse, misuse, accident or unauthorized alterations or repairs.

THE WARRANTIES AND REMEDIES CONTAINED HEREIN ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS, IMPLIED OR STATUTORY, INCLUDING ANY LIABILITY ARISING UNDER ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, STATUTORY OR OTHERWISE. THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, WHICH MAY VARY FROM STATE TO STATE.

IN NO EVENT SHALL COGNISYS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE OR INABILITY TO USE THE PRODUCT OR FROM DEFECTS IN THE PRODUCT. SOME STATES DO NOT ALLOW THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

Cognisys retains the exclusive right to repair or replace the product or offer a full refund of the purchase price at its sole discretion. SUCH REMEDY SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY BREACH OF WARRANTY.

11. Glossary

Term	Description
# Pulse	Number of output pulses that a trigger output will generate.
Ballist	Ballistics mode. This will measure the time it takes to cross two sensors and fire the output a configurable distance multiplier (“Dist Mult”) from the last sensor.
Blank	The blanking time is the duration where StopShot will ignore the input. This may be useful to ignore second drops, transients, or flashes.
Dist Mult	For ballistics mode, this is the distance multiplier used for when it should fire the trigger output. If the sensors are six inches apart and “Dist Mult” is set to four, the output would fire when the object is 24 inches from the last sensor.
F Duration	Flash Duration. A global triggering mode. This will measure the duration of a flash provided it is less than 3 ms.
Gain	Amount of amplification applied.
Incrm	Abbreviation for increment. The increment value will be added to the delay setting every time there is an input event.
Independent	A global triggering mode where all the triggers operate independent from each other.
Latched	When an output stays in a given state (on or off).
LCD Backlight	The backlighting for the LCD allows the text to be visible. It is adjustable so that for low-light conditions it won’t ruin long exposures.
Load Defaults	Load the factory defaults for all the settings.
ms	Abbreviation for milliseconds. A thousandth of a second (1/1000 seconds).
Pwr Off	Power-Off. This lets you choose which trigger output will disable the sensor power. The moment an event is detected the power will be turned off. This is useful for eliminating red laser light from being in pictures. You can choose from no outputs, all of them, or each individual output to cause the disabling of the power.
Pwr Toff	Power Time Off. This is the duration that the sensor power will be disabled.
SEQ	The global configuration is set to “Sequential Mode”. This means that the trigger configurations will follow in sequence. The opposite is independent mode where they all function at the same time.
Sequential	A global triggering mode where the triggers operate sequentially. That means that the following trigger won’t start until the current one completes.
Short Circuit (short)	To connect two wires together. Provide a path for current to flow with low resistance.
Shutter lag	This is the delay from when a camera is told to take a picture and when it actually takes it. The camera performs several functions prior to taking the picture (focusing, metering, etc) which can all add a delay. To make matters worse it may even be a variable delay.
Sync	Synchronization mode. This is only available for the “delay” setting in sequential mode. When this is set to “Yes”, the delay will start when the output of the previous trigger goes high. StopShot typically starts the next trigger when the output goes low (Sync mode set to “no”).
Timeout	The time an input mode will wait for a specific event.
TLapse	Time-lapse. A method of taking pictures at a given interval.

TMode	Trigger Mode. This is a global configuration that lets you choose the behavior of StopShot. Examples are: Independent, Sequential, Time Lapse, Flash measurement, etc...
Toff	The time off between output pulses.
Trigger	When one of the three channels is configured as “Trigger”, it will fire the output after a configurable delay after seeing an input.
Trigger Output	One of the three outputs of StopShot. The Red LED’s correspond to the three outputs.
us	Abbreviation for microseconds. A millionth of a second.
Waiting	Displayed when an output is configured for “Manual” mode. Pressing the UP or DOWN buttons will start the manual output, changing the displayed text to “Active”.
X-Beam	Short for “cross-beam”. Two beams are set in an X formation that allows for pin-point detection. StopShot’s cross-beams may also be used in a staggered method so that beams have to be crossed in a specific direction.
XBS A	Cross-beam sensor A. StopShot will fire when only the “A” sensor is crossed.
XBS A&B	Cross-beam sensors A **and** B. StopShot will fire only when both sensors are crossed simultaneously.
XBS A|B	Cross-beam sensors A **or** B. StopShot will fire when either A or B are crossed.
XBS A->B	Cross-beam sensor A followed by B. StopShot will only fire when A is triggered followed by B. A timeout is selectable to reset this mode should B not happen within a reasonable amount of time.
XBS B	Cross-beam sensor B. StopShot will fire when only the “B” sensor is crossed.
XBS B->A	Cross-beam sensor B followed by A. StopShot will only fire when B is triggered followed by A. A timeout is selectable to reset this mode should A not happen within a reasonable amount of time.

12. Revision History

Revision	Date	Change
1.0	06/02/08	Initial Release
1.1	11/21/08	Updated product portfolio and additional sensor modes.
1.2	12/19/08	Added X-beam A/B mode, sequential mode timeout, and StopShot battery pack. TX power switch added to IR beam sensor.
1.3	02/17/09	StopShot 1.0.06 SW features: Ballistics mode Sensor Power Disable Adjustable infrared transmitter power for single and x-beam.
1.4	03/09/09	StopShot 1.0.07 SW features: User settings may be stored into 10 locations. Output pulse setting may be “latched on” in sequential mode StopShot 1.1.00 SW features: Delay allowed as first trigger mode in sequential operation
1.5	03/20/09	Multiple pulses added to all timer modes.
1.6	05/29/09	Water-drop “How-To” added.
1.7	11/12/09	StopShot 1.1.04 – 1.1.06 features: Valve priming simplifies water-drop set-up Shutter-lag measurement Tpulse2+ added as a new configurable Presets loaded for out-of-the-box water drop photography
1.8	08/05/10	StopShot 1.1.07 features: Added Tpulse3, Toff3. All trigger modes communized for configuration (3+ pulses for all) Manual mode now available for all triggers in sequential mode
1.9	12/1/10	Added Water-valve quick-start section
1.10	01/22/13	Added water-drop kit walk-through