

STOPShotTM Studio

Turning ordinary moments into extraordinary pictures



Owner's Manual

Revision 1.0



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Table of Contents

1. SAFETY INSTRUCTIONS	6
2. GETTING STARTED	6
2.1 INSTALLING THE SOFTWARE	6
2.1.1 <i>Windows Installation</i>	6
2.1.2 <i>OS X Installation</i>	7
2.2 THE STOPSHOT STUDIO CONTROLLER	8
2.3 GETTING FAMILIAR WITH STOPSHOT STUDIO	9
2.4 CONNECTING STOPSHOT STUDIO - BEAM SENSOR - (LASER OR IR).....	13
2.5 CONNECTING STOPSHOT STUDIO – MULTIPLE FLASHES	14
2.6 CONNECTING STOPSHOT STUDIO – SHUTTER INTERFACE SWITCH	15
3. BASIC NAVIGATION	16
3.1 OVERVIEW	16
3.2 TOP BAR	17
4. WELCOME TAB	20
5. WATER DROPS TAB	22
5.1 NUMBER OF VALVES	23
5.2 NUMBER OF FLASHES	23
5.3 FLASH DELAY.....	23
5.4 USE SENSOR	24
5.5 CAMERA CONTROL	24
5.6 WATER VALVE SETTINGS	25
5.7 THE OUTPUTS	27
6. ADVANCED TAB	28
6.1 OUTPUT MODE	29
6.1.1 <i>Trigger</i>	29
6.1.2 <i>Delay</i>	29
6.1.3 <i>Manual</i>	30
6.1.4 <i>XBeam A->B</i>	30
6.1.5 <i>XBeam B->A</i>	30
6.1.6 <i>XBeam A B</i>	31
6.1.7 <i>XBeam A & B (Cross-beam)</i>	31
6.1.8 <i>XBeam A</i>	31
6.1.9 <i>XBeam B</i>	31
6.1.10 <i>Ballistics</i>	31
6.2 ACTIVATE	33
6.3 OUTPUT ON.....	33
6.4 INPUT	33
6.4.1 <i>Sensor 1 / Mic</i>	33

6.4.2	Sensor 2.....	34
6.4.3	Sensor 1 or 2	34
6.4.4	QX-Beam	34
6.5	GROUP	34
6.6	DELAY.....	35
6.7	# PULSES, TPULSEON, TPULSEOFF	35
6.8	INCREMENT.....	37
6.9	BLANK	38
6.10	TIMEOUT.....	39
6.11	SYNC	39
6.12	COMMENT.....	41
7.	BALLISTICS.....	41
7.1	SETTINGS.....	42
7.2	THE OUTPUTS	43
8.	TIME LAPSE	45
8.1	ENABLED	46
8.2	INITIAL DELAY.....	46
8.3	# PULSES, ON TIME, OFF TIME.....	46
8.4	DURATIONS AND INTERVALS	47
8.5	SETTINGS CHECKER.....	48
9.	BULB RAMP	49
9.1	PULSES, ON TIME, OFF TIME.....	50
9.2	ON INCREMENT, STOPS, USE STOPS	50
9.3	INTERVAL TIME, INTERVAL INCREMENT, TOTAL DURATION	51
9.4	BULB FEEDBACK.....	51
9.5	SETTINGS CHECKER.....	52
10.	MEASURE	53
10.1	TIMEOUT.....	54
10.2	MEASURE SHUTTER LAG.....	54
10.3	TIME MEASURE	54
11.	MULTI-OUT	56
12.	PLOT.....	58
12.1	ZOOM.....	59
13.	GLOBAL CONFIG	61
13.1	GLOBAL MODE	61
13.1.1	<i>Independent Mode</i>	61
13.1.2	<i>Sequential Mode</i>	62
13.1.3	<i>Dual-Sequential Mode</i>	63
13.2	SENSOR POWER DISABLES	64
13.3	SEQUENTIAL TIMEOUT	65

13.4	SEQUENTIAL LOOPBACK/COUNT	66
13.5	POWER OFF TIME	66
13.6	BALLISTICS MULTIPLIER	66
13.7	SENSOR GAIN	67
13.8	PORT / AUTO-CONNECT / AUTO-WRITE	67
13.9	TOOL TIPS	68
13.10	WELCOME TAB	68
13.11	CONFIGURATION COMMENT	68
13.12	CONTROLLER SOFTWARE VERSION	68
14.	FILE MENU.....	69
15.	WIRING EXTERNAL DEVICES	70
15.1	SENSOR/MIC INPUTS	70
15.2	OUTPUTS.....	71
15.3	ACTIVATING RELAYS.....	72
15.4	CROSS-BEAM SENSOR	72
16.	SETUP EXAMPLES	76
16.1	THE STOPSHOT STUDIO WATER DROP KIT	76
16.1.1	<i>Mounting frame</i>	76
16.1.2	<i>Dripping pan</i>	80
16.1.3	<i>Connection Diagram (3-valve kit)</i>	81
16.1.4	<i>Water Valve / Siphon assembly</i>	82
16.1.5	<i>Configure StopShot Studio</i>	84
16.2	BALLISTICS – TIPS AND TRICKS	87
17.	ANIMATED TIME-LAPSE MOVIES	88
18.	TROUBLESHOOTING	89
19.	SPECIFICATIONS	91
20.	WARRANTY	92
21.	GLOSSARY	93
22.	REVISION HISTORY	95

Table of Figures

Figure 1 - StopShot Studio Controller	8
Figure 2 – Connecting the Beam Sensor	13
Figure 3 - Connecting multiple flashes.....	14
Figure 4 - Shutter Interface Switch (Canon).....	15
Figure 5 - XBS A to B.....	30
Figure 6 - XBS A & B	31
Figure 7 – Ballistics Timing.....	32
Figure 8 - Manual Mode Timing Diagram	37
Figure 9 - Blanking Time.....	38
Figure 10 - Sync.....	40
Figure 11 - Independent Timing Diagram	62
Figure 12 - Sequential timing diagram.....	63
Figure 13 - Power Disable timing diagram.....	65
Figure 14 - Microphone Connection	70
Figure 15 - Sensor Connection	71
Figure 16 - RCA connector	71
Figure 17 - Wiring an external relay.....	72
Figure 18 - Cross-beam connections.....	73
Figure 19 - Laser Diffuser	74
Figure 20 - Mounting Frame	77
Figure 21 - Frame Parts.....	78
Figure 22 - Water valve mounting	79
Figure 23 - 3-Valve connection diagram	81
Figure 24 - Valve / Siphon assembly	82
Figure 25 - A Sucker being Shot with a .22 Caliber Rifle	87

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 Studio module, accessories, and devices (computers, 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

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

The graphics included in this manual may not be identical to the software that you are running. Improvements and adjustments to the software may happen prior to an updated version of the manual.

2.1 Installing the software

StopShot Studio requires FTDI VCP USB Drivers to operate properly. You need to download the latest version of the drivers here: <http://www.ftdichip.com/Drivers/VCP.htm>

Whether you use Windows or OS X, you will **need** Oracle's Java installed for StopShot Studio to load. You can download it here: <http://java.com/download>

2.1.1 Windows Installation

Windows installations should automatically detect and download the USB drivers required. If not, use the above link in section "2.1 - Installing the software". Be sure that Java is installed as well.

Once the USB drivers and Java are installed you can either download the latest software [here](#) or run "StopShotSetup.msi" under the "apps" directory on the CD. This will guide you through the installation process.

Once the installation is complete you will have a “Start Menu” folder called Cognisys. Underneath that you will find the StopShot Studio icon. A Desktop icon for StopShot Studio will also be created:



2.1.2 OS X Installation

StopShot Studio requires Java 1.7 from Oracle. This version of Java requires that your OS X version be 10.7.3 (Lion) or above. It has not been tested with older versions of Java or earlier versions of OS X and is not supported. This is due to Apple no longer developing/supporting newer versions of Java and transitioning to Oracle’s version.

Be sure that StopShot Studio is not plugged into your computer. OS X installations require that the FTDI drivers be installed first. You can download these drivers in the above link in section “2.1 - Installing the software”. There will be two versions of the FTDI drivers. There is one version for 10.3, and then the other for 10.4+. Be sure to install the 10.4+ version.

Once the USB drivers are installed, you can either download the software [here](#) or open the “StopShotInstaller.pkg” file under the “apps” directory on the CD.

Once installation completes you will have a “StopShot” icon on your Launch Pad:



Note: You will have to reboot your computer to finish the USB driver installation. After rebooting the computer you can start using StopShot Studio.

2.2 The StopShot Studio Controller



Figure 1 - StopShot Studio Controller

StopShot Studio features on one side twelve software configurable outputs allowing you virtually endless combinations of timing and coordination. These outputs are identical to the original StopShot in order to maintain compatibility with existing accessories.

The other side of the controller has twelve indicator LED's to show which output is currently active. The "Start" button may optionally be used to start the programmed event(s). It is also useful if you've pre-programmed the controller for a field application. You may use this instead of the "Start" button in the Studio software if it is connected to the computer. StopShot Studio will permanently save its settings when it is powered off (pressing and holding the power button for one second).

The computer interface is via a mini-USB jack.

There are three inputs available: Microphone ("Mic"), "Sensor 1", and "Sensor 2". The two sensor inputs allow you to do complex triggering with dual cross-beams, multiple independent events, or two completely separate sequences of events.

2.3 Getting Familiar with StopShot Studio

After you've plugged in the AC/DC adapter into the StopShot Studio controller, press the power button. The LED's will illuminate briefly. At this point the controller is waiting for the computer software to load the settings you desire.

StopShot Studio is all about timing. It gives you the capabilities to coordinate sensors with your camera equipment and other gear. In the manual you will see a lot of references to inputs and outputs.

What is an "input"? An input to the StopShot Studio controller is going to be a push button, microphone, or a sensor of some kind. The controller is ultimately waiting for something to happen before it goes any further. You can think of these sensors as being the equivalent of a mouse click on a computer. It's a way to tell the controller, "Okay, now GO!".

Now how about an "Output"? StopShot Studio has twelve outputs. Each output can do several different things which we'll discuss in detail in the following sections. If an *input* is the "waiting" for something, then the *output* is the "doing" something. It can take a picture with your camera, fire a flash, or activate a water valve. You can set the output to wait for an input, or simply wait a bit of time before it will activate. You can even have each output activate multiple times. How long an output is "on" or active is also adjustable.

So there you go. The whole idea behind StopShot Studio is waiting for an input, then delaying a certain amount of time, and then activating an output. It's all about timing coordination. Speaking of timing – you'll see a lot of it in the software. Let's briefly discuss the available time durations that StopShot Studio supports.



- us: Micro-second. A millionth of a second. Very fast!
- ms: Milli-second. A thousandth of a second. Fast!
- s: Second. Not so fast.
- min: Minute. Kind of slow.
- hr: Hour. Really slow.

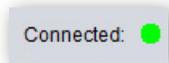
StopShot Studio will let you set the available settings to anything you want but there actually IS a limit inside the controller. The fastest speed is 50us, the slowest is 24 hours. The StopShot Studio controller will do its best to accommodate your setting, but if it falls outside of the above range it will get nudged to either the shortest or the longest. So if you put in "0 us" as the delay

setting, just expect to see a 50 us delay on the output. The controller is quite fast but it does need a little time to think.

Now we're going to walk you through some basic scenarios to get a feel for navigating StopShot Studio. All the settings are discussed in detail starting with section "4 - Welcome Tab". But if you're like us, you're ready to use the new equipment and save reading through the manual for later!

The mini-beam sensor, microphone, or vibration sensor work well for demonstration purposes to get a feel for how StopShot Studio works. If you have any of these sensors please connect one of them now. If you have the microphone, insert it into the "Mic" input. If you have the mini-beam or vibration sensor connect it to the "Sensor 1" input. If you don't have these, skip ahead to section "2.4 - Connecting StopShot Studio - 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.

Go ahead and run the StopShot Studio software. Once it loads it will automatically connect to the controller. The upper-right of the screen will show that you've successfully connected:

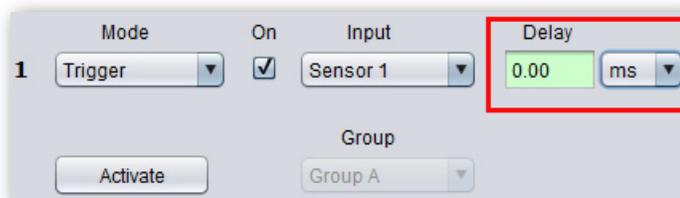


If you don't see the green "Connected", see the section "18 - Troubleshooting".

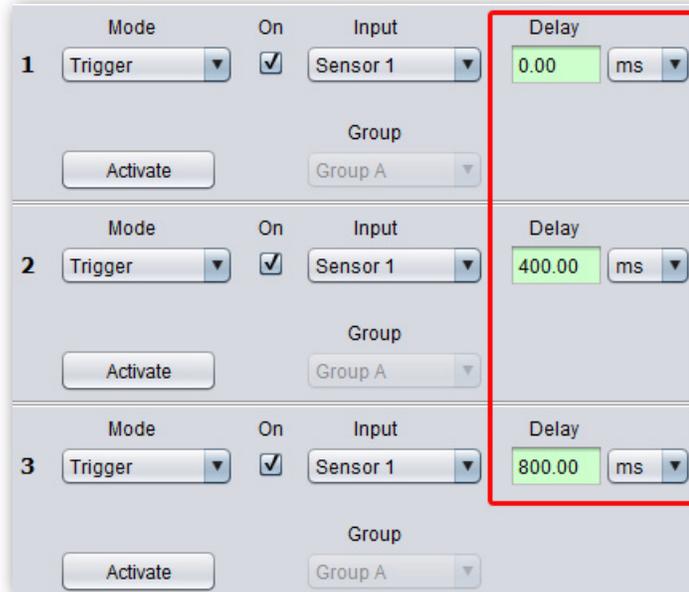
Now click on the "Advanced" tab. We're going to set StopShot Studio to activate all 12 outputs, with the first three staggered in time.

You'll see that each group across the "Advanced" tab has a number "1" through "12". This corresponds to the 12 outputs.

For "Output 1", enter "0" into the "Delay" setting, making sure the pull-down to the right is set to "ms", which stands for milli-seconds (a milli second is 1/1000 of a second):



Now for “Output 2”, enter a “Delay” of “400”. For “Output 3”, enter a “Delay” of “800”. Be sure you’ve changed the time units to “ms” for both of these outputs. You should now have the following:



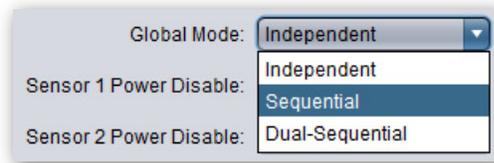
Now swipe your finger through the mini beam sensor or tap the microphone or vibration sensor. Once and you will see the LED indicators cycle from 1, then 2, then 3. Each of the LED’s will illuminate for a half of a second. Notice that if you activate the sensor a couple of times quickly, the LED illuminates only once. If the output is currently active (on), the output will not re-arm until it completes (LED goes out). If this output was connected to a flash, StopShot Studio would fire the flash every time the LED was illuminated, not every time an event occurs at the sensor – a key feature. If you wanted StopShot Studio to fire the flash on *every* event, you would simply decrease the “TPulse On” time to something faster, like 10 ms. Go ahead and give it a try! Change the “TPulse On” for “Output 1” to 10ms and swipe the sensor or tap the microphone or vibration sensor. (For more information on “TPulse On”, see section “6.7 - # Pulses, TpulseOn, TpulseOff”) Before continuing on, change the “TPulse On” back to the 500ms.

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, each with a longer delay.

This is StopShot Studio operating in *Independent Triggering* mode – the default mode (See section “13.1.1 - Independent Mode” for more details). It is very easy to change this behavior in

order to have the second output dependent upon the first output, and the third dependent upon the second. Let's try it:

To configure StopShot Studio to *Sequential Triggering* mode, simply click on the "Global Config" tab. You will see a setting called "Global Mode". Right now it is set to "Independent". Click on the pull-down and change it to "Sequential":



Once "Global Mode" is set to "Sequential", click on the "Advanced" tab to get back to the other settings.

Sequential mode is useful when setting up complex triggering scenarios like synchronizing a camera, flash, and external shutter. See section "13.1.2 - Sequential Mode" for more details regarding Sequential mode.

Tap the sensor again and observe what happens. You will see that "Output 1" activates, but that is it. That is because after "Output 1" activates and completes, "Output 2" is waiting for a sensor input. Tap the sensor. "Output 2" will now activate. Once the "Output 2" LED goes out, tap the sensor again. That will activate "Output 3". You'll probably wonder if StopShot Studio detected the sensor for "Output 3" – that's because of the 800ms delay that it is waiting after the sensor input. The outputs operate in sequence – one after the other. This is the default behavior in Sequential Triggering Mode; however this too can be easily changed for greater flexibility. See section "6.11 - Sync" for details on Delay-Sync mode – a special and useful mode for syncing external flashes with any type of camera.

So you've noticed that we've been using 500 ms (half a second) for the on time of the output. This is the time that each output is energized, and of course is itself completely adjustable (you *did* try the 10ms adjustment, right?). This default value is set to be long enough to fire most contemporary DSLR's *once* if the DSLR is in Single Shot mode. Let's say your camera can shoot at 10 frames per second. If we adjust this output pulse time to be 1 second, then put the camera into continuous shooting mode, guess what? If the camera has no shutter lag you will get 10 frames exposed every time that output that is connected to the camera activates. Again, see section "6.7 - # Pulses, TpulseOn, TpulseOff" for more details on adjusting this output time "Tpulse".

So now you already have a pretty good understanding of the fundamentals of StopShot Studio, 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 Studio offers in capturing whatever events you can dream up.

2.4 Connecting StopShot Studio - Beam Sensor - (laser or IR)

If you purchased a beam sensor for your StopShot Studio 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 StopShot Studio is provided through an AC to DC power adapter. Plug the power adapter into the power-jack next to the label "Power", and plug the adapter into the wall. Once the power button is pressed, the controller will turn on.

⚡ 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 Studio

controller. 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 Studio.

2.5 Connecting StopShot Studio – Multiple Flashes

The easiest way to connect multiple flashes is directly to the controller itself. Flash splitters are not required (but may be used). 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 response times. If you are going to connect multiple flashes, it is recommended that you read section “11 - Multi-Out” to take advantage of the “Multi-Output” feature. This will eliminate any chance of an unwanted delay between flashes being introduced by StopShot Studio.

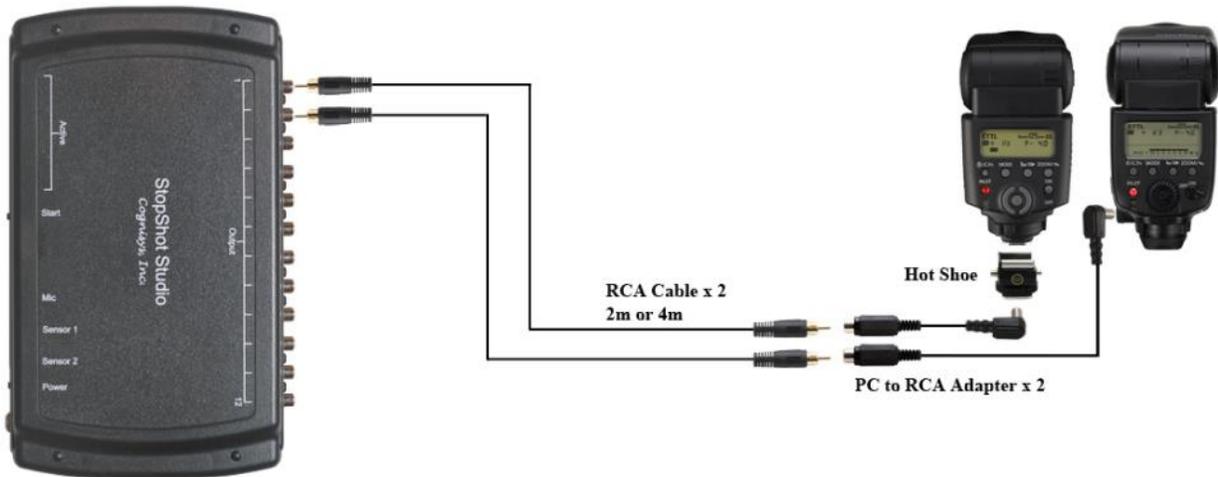


Figure 3 - Connecting multiple flashes

2.6 Connecting StopShot Studio – Shutter Interface Switch



Figure 4 - 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 12 outputs on StopShot Studio. The shutter switch has 3 positions:

Wake – In this position the $\frac{1}{2}$ 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 camera's 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 Studio 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 RangelR to capture mammals.

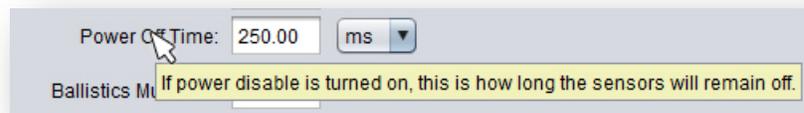
3. Basic Navigation

In this section we'll go into all the capabilities of StopShot Studio. If you find your eyes glossing over with all the technical discussion you can always skip to the "16 - Setup Examples" section to start using StopShot Studio.

3.1 Overview

StopShot Studio 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. We'll walk you through all the available settings in the following section.

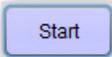
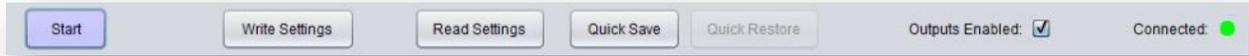
Before we get too far into the settings, StopShot Studio supports "tooltips". What in the world is a "tooltip"? If you hover the mouse pointer above virtually any text, a small pop-up window will appear describing in more detail what the item does. Here is a demonstration:



The "tooltips" are handy for *not* reading the rest of the manual. We hope you *do* read the rest of it – we worked really hard on it. But if you're ready to get started, don't forget the "tooltips"! You can disable the "tooltips" simply by unchecking the "Show Tooltips" checkbox on the "Global Config" tab (See section 13.9 - Tool Tips for more details).

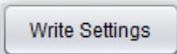
3.2 Top bar

At the top of the screen is a bar containing frequently used features:

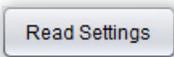


The “*Start*” button is to initiate a “*Manual*” event. If you have “*Output 1*” set to release a water drop, it will likely be set up in “*Manual*” mode. This means that you have to initiate the event somehow. You can either press the “*Start*” button on the screen or the “*Start*” button on the controller. This will also start Time Lapse and Bulb Ramp modes.

The “*Start*” button will also abort any currently active output or sequence of events.



Normally StopShot Studio will automatically send the settings to the controller one second after they are changed or when new settings are loaded. There are a few exceptions, however. If you change to the “*Time Lapse*” tab or the “*Bulb Ramp*” tab, the settings won’t take effect until you click “*Write Settings*”. Why? Let’s say you just plugged in your controller into the computer. Having the software overwrite any settings you previously had saved might lead to extreme frustration – especially if you spent all night working on that ultimate four-valve five-flash setup. The other exception to automatically writing the settings is if you explicitly told the software not to do that. Under the “*Global Config*” page there is a checkbox for “*Auto-write*” (See section “*13.8 - Port / Auto-Connect / Auto-Write*”). It is normally checked which is what you would *normally* want. In the spirit of flexibility we give you the option to turn off the “*Auto-write*” feature.



This will read the current settings from the controller. It will not populate the “*Water Drops*” or “*Ballistics*” tab. This is because these tabs take the settings you want and convert them into settings for the “*Advanced*” tab. Think of them as “*Helper*” tabs.

Quick Save

“Quick Save” takes a snapshot of your current settings. You can use this if you want to make a quick adjustment to a few settings but aren’t sure if they will work. If they don’t, you can click the button below.

Quick Restore

“Quick Restore” will restore the settings that were saved off when you clicked “Quick Save”.

Outputs Enabled:

This will globally turn off any of the outputs from activating. This is useful if you want to look at the LED’s to see if what you *think* you told StopShot Studio to do will actually happen. The outputs won’t activate but the LED’s will still light up for their corresponding output.

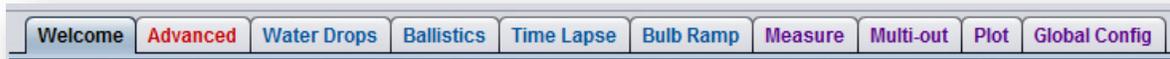
Connected: 

This indicator shows whether or not the StopShot Studio software on your computer is talking with the controller. The “Connected” will also change to “Write Settings” followed by “Write Complete” when the settings have been written. If there was a problem writing the settings it will show “Write Failed”. That can happen if the software is not communicating with the controller or if the controller software does not support some of the settings in the computer software.

 Not communicating

 Communicating

Beneath these buttons are all the different “tabs” for controlling StopShot Studio:



Take a quick look at all the different settings you can control for your photography needs. Simply click on the tab to bring that screen to the front.

The following sections will go through all the different tabs and what their functions are.

4. Welcome Tab

Welcome indeed!



The background on this tab demonstrates the capabilities of StopShot Studio. There are some useful resources on this page – especially when just getting started. There are three clickable options:

Open Manual On Web Page:

This will go to the Cognisys, Inc. website and show the latest version of this manual. It's an easy way for a quick reference. That CD that shipped with StopShot Studio will ultimately end up filed or misplaced. Having an online resource a click away makes it fast and convenient for getting to the manual.

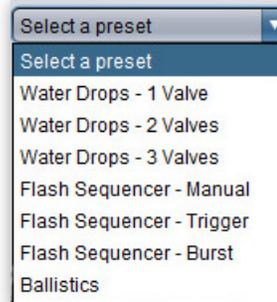
Open Water Drop How-To:

One click will take you to our web-site and walk through water-drop fundamentals. We'll discuss settings, setups, suggestions, and water chemistry.

Open Cognisys Web Page:

Interested in finding out what we're up to? We hope so! We're always show-casing photos and new gear.

There are convenient presets pre-loaded in the software. They are a great way to get started and also help you understand what settings do... what. When you click “Select a preset” you will see the following list:



When you click on a preset, the settings will automatically load. If you would like a description of what each preset does, click on the “Global Config” tab. There is a “*Configuration Comment*” that describes what the preset does. The “Global Config” tab will be discussed in more detail in section “13 - Global Config”.

The last item on this page you can click on is the “*Don’t show this screen next time*” checkbox. If you check this box, the “Welcome” tab won’t show up next time you start StopShot Studio. If you want to get it back in the future, you can always go to the “Global Config” page and click the “Welcome Tab” checkbox.

5. Water Drops Tab

The “Water Drops” tab simplifies water-drop photography. Before getting into the details of the different settings, we should first talk about how this tab works. When you make a change on this page it will fill in the proper settings on the “Advanced” tab. This has two advantages and one drawback. The first advantage is that it hides you from the potentially overwhelming settings in the “Advanced” tab. The second advantage is that it can actually help you get familiar with how the “Advanced” tab works – reducing the overwhelming settings fear. The disadvantage, however, is that you need to pick one tab to work in. If you make changes in the “Water Drops” tab, it will overwrite the settings in the “Advanced” tab. If you make changes in the “Advanced” tab it will NOT make changes back in the “Water Drops” tab. So if you grow out of the “Water Drops” tab into the “Advanced” tab – don’t go back or else you may accidentally overwrite your “Advanced” tab settings.

For the “Water Drops” tab, the sensor you plan to use should be plugged into the “Sensor 1” jack.

After you’ve adjusted your settings, just hit the “Start” button to begin!

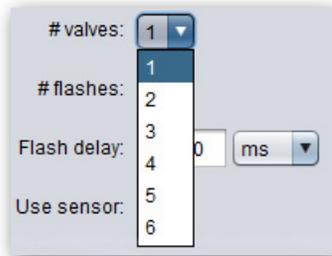
One great feature to keep in mind while you’re adjusting settings is that you can visually see what will happen before you even release your first water drop. Once you’ve adjusted your settings you can go to the “Plot” tab to see what StopShot Studio will do. See section “12 - Plot” for more details on the plotting capabilities.

Let’s take a look at the water drop tab:

The screenshot shows the 'Water Drops' tab in the StopShot Studio software. The interface includes a navigation bar at the top with tabs for Welcome, Advanced, Water Drops (selected), Ballistics, Time Lapse, Bulb Ramp, Measure, Multi-out, Plot, and Global Config. The main content area is divided into several sections:

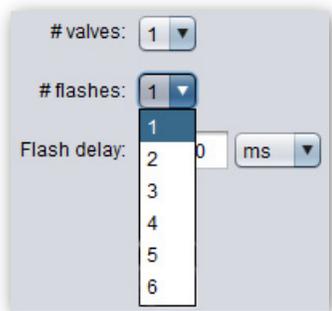
- General Settings:** # valves: 1, # flashes: 1, Flash delay: 315.00 ms, Use sensor:
- Camera Control:** Camera control: , Use bulb mode: , Shutter lag: 100.00 ms, Exposure: 500.00 ms
- Equipment Connection:** A diagram showing 12 output ports. Port 1 is labeled 'V1' and port 2 is labeled 'F1'. A note below states: 'C = Camera, V = Valve, F = Flash. Click to disable/enable. All flashes are grouped with "F1".' A bold note below that says: 'Note: Changes on this tab will overwrite settings in the advanced tab.'
- Valve 1 Settings:** Number of drops: 1, Purge button, Time before drop starts: 0.00 ms, Valve opens for: 16.00 ms, Time until next drop: 100.00 ms, Valve opens for: 12.00 ms, Time until next drop: 100.00 ms, Valve opens for: 12.00 ms

5.1 Number of valves



Use the pull-down menu to select the number of water valves you plan on using with StopShot Studio. You can choose from one to six water valves. As you change the number of water valves, additional windows will appear below for control of each water valve.

5.2 Number of flashes



Use this pull-down to choose the number of flashes you would like to use. If you are used to the original “StopShot” and had to use a flash splitter or RCA “Y” cables to connect your flashes, you don’t have to do that anymore. You can continue to use it if you would like but it isn’t required for operating multiple flashes.

5.3 Flash Delay



The “Flash Delay” is the time from when the first water drop from any valve crosses the sensor to when the flash(es) will fire. If you have disabled the sensor by unchecking the “Use sensor” checkbox, then it will be from when the first water drop valve is activated.

5.4 Use Sensor

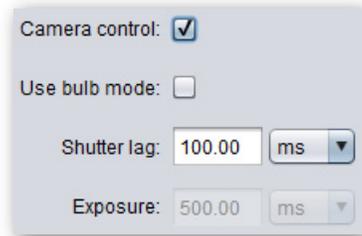
Use sensor:

The precise timing for water drops comes from the use of an infrared sensor. This setting would typically be left checked. You can, however, disable the sensor if you prefer.

5.5 Camera Control

There are several settings under camera control. You may wonder how would you take pictures without camera control? The most common way to photograph water drops is to have the camera in either bulb mode or a long exposure. You would press the shutter button on the camera and then have StopShot release the water drops and coordinate the timing. If you leave the “Camera Control” check-box unchecked, this is exactly how the setup would operate (Shall we say the “traditional” way?).

If you do check the “Camera Control” box, the additional settings become available:



Shutter Lag:

You’ll notice a setting for the camera’s shutter lag. This is the time from when StopShot Studio tells your camera to take a photograph to when it actually does. StopShot Studio can account for this shutter lag in the timing of the water valves and flashes. Unfortunately for some cameras this shutter lag is variable. If it is variable you may want to consider using the “traditional” method or one of our “Shutter Interface Switches” as opposed to the standard shutter cable. The switches have the capability to hold the half-press down on the camera which in most cases makes the shutter lag more consistent.

If you would like to measure the shutter lag of your camera please see section “10.2 - Measure Shutter Lag”. StopShot Studio has the capability to measure it!

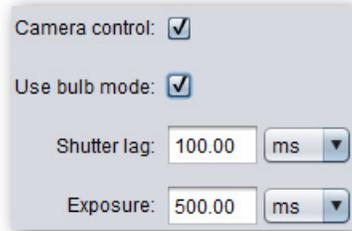
The software does make the assumption that your camera’s shutter lag will be less than the “Flash Delay” setting. If your camera’s shutter lag is longer than the “Flash Delay” setting, you will not be able to use the “Camera Control” feature.

StopShot Studio will open the camera prior to the flashes activating by the “shutter lag” time setting. If you would like to see how this works take a look at the “Plot” tab in section “12 - Plot”.

You will have to adjust your camera’s exposure on the camera as needed.

Use Bulb mode:

When you check the “Use bulb mode”, the “Exposure” setting will become available:



You will still have to enter your camera’s shutter lag but now you have the option available to enter your camera’s exposure duration. You should have your camera in bulb mode for this feature. The exposure time will be affected by how fast your camera responds to shutter activation and de-activation in bulb mode. The camera’s shutter speed is only used to minimize the effect of the ambient light on the photograph. The photograph is actually exposed by the short duration of the flash. Therefore, the exposure should only be considered an estimate and you should minimize the amount of ambient light in your room.

5.6 Water Valve Settings

Here you can adjust all the required water drop settings:



Number of Drops:

Here you can adjust the number of water drops you would like to release. You can release up to three of them per water valve. As you increase the number of drops the additional timing parameters will become available (not greyed out).

Purge:

This will open (and leave open) the water valve. This is good for removing air from the siphon, lines, and valve tip. It is also a good idea to use this when you finish a shoot to clean the equipment with clear warm water. Press the “Purge” button again to stop the valve from purging. A little caution with the “Purge” feature – the water comes out fast so be sure to be ready to click it again to stop the flow!

Time before drop starts:

This is the duration before this water valve will release its first drop. You won’t be able to adjust this for “Valve 1” since it is the first valve to open (it starts at time zero). You can, however, adjust it for any of the other water valves. Here is a screen-shot for “Valve 2” with the number of drops set to three:

The screenshot shows a control panel for "Valve 2" with the following settings:

Parameter	Value	Unit
Number of drops	3	-
Time before drop starts	100.00	ms
Valve opens for	16.00	ms
Time until next drop	100.00	ms
Valve opens for	12.00	ms
Time until next drop	100.00	ms
Valve opens for	12.00	ms

You’ll see above that for “Valve 2” you can adjust the “Time before drop starts”. In this case, “Valve 1” would release a drop at time zero, and 100 ms after that “Valve 2” would start to release its drops.

Valve Opens For:

This is the duration that the water valve will remain open. This setting repeats for the additional water drops from this valve (if the number of drops is greater than one).

Time until next drop:

This is how long before the next drop will be released. This setting will be available if the number of drops is greater than one.

5.7 The Outputs

StopShot Studio will tell you how to connect up the equipment. The outputs are listed horizontally with the equipment listed below:

1	2	3	4	5	6	7	8	9	10	11	12
V1	V2	F1	F2	F3	F4						

In this case two water valves are used. “Valve 1” should be connected to “Output 1”, “Valve 2” connected to “Output 2”. The “# Flashes” is set to four, so the four flashes should be connected to outputs 3-6.

During your setup you may find it convenient to disable certain outputs. If you want to disable a valve you simply click the valve (the “V1” or “V2”) to individually disable them. The flashes are grouped together so if you want to disable them click on the “F1”. This is because the flashes take advantage of StopShot Studio’s “Multi-Out” feature. For more information on the “Multi-Out” feature, see section “11 - Multi-Out”.

Here is an example where “Valve 1” is disabled. You simply have to click on the “V1” to disable it:

1	2	3	4	5	6	7	8	9	10	11	12
V1	V2	F1	F2	F3	F4						

When an output is disabled, it will turn grey. To re-enable the output, click on it again.

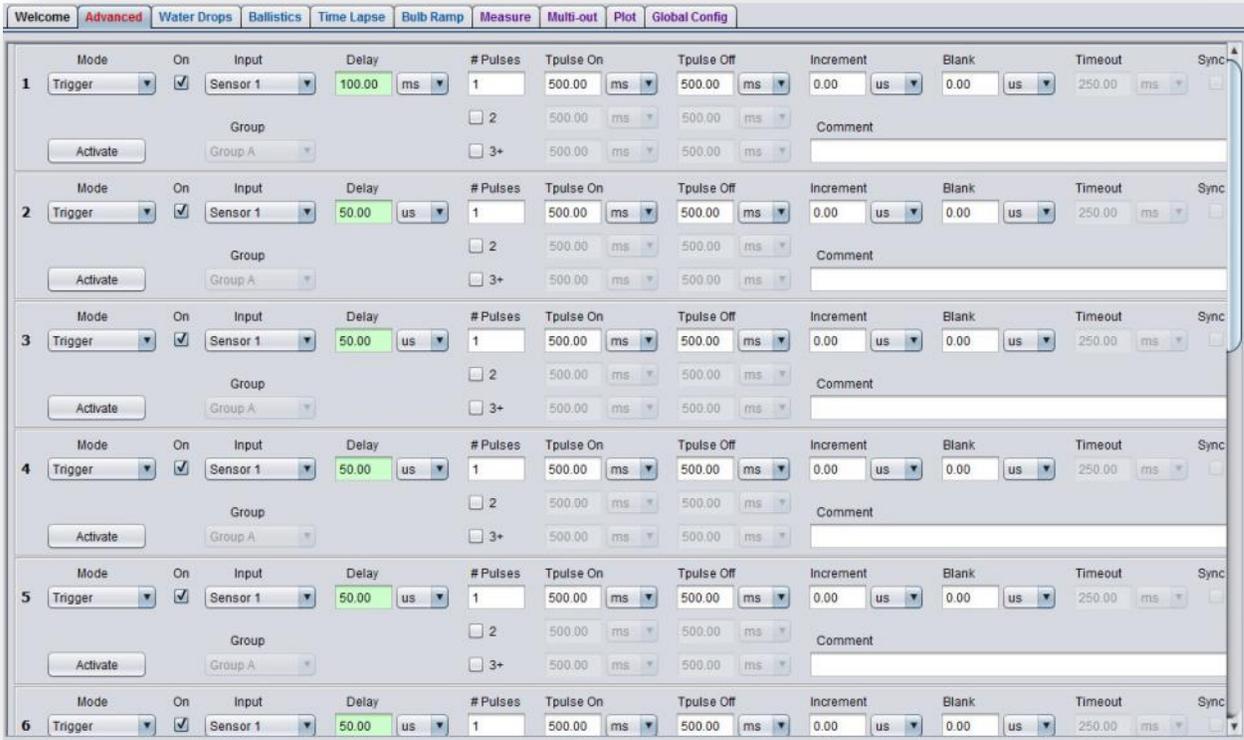
Here is an example when the “Camera control” checkbox is checked:

1	2	3	4	5	6	7	8	9	10	11	12
C1	V1	V2	F1	F2	F3	F4					

In this case the camera would be plugged into “Output 1” and all the other equipment shifted over by one.

6. Advanced Tab

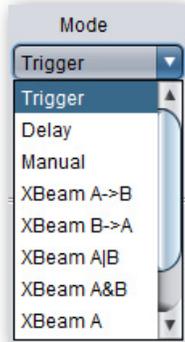
The advanced tab is designed for users who are familiar with the original StopShot or power-users. It gives you complete control over every output. Don't let the number of settings overwhelm or intimidate you though – we'll go through all the settings individually in detail. You'll get comfortable with all of them. Here is the "Advanced" tab.



Before you think that you've been swindled and only have five and a half outputs available – there is a scroll bar on the right-hand side to scroll through the rest of the outputs. Fitting all of them on the screen at the same time would have turned the "Advanced" tab into an eye-chart (more than it already is!). Let's get into the settings.

6.1 Output Mode

There are several different operating modes for each output. Each output can have its own operating mode. To change the operating mode you click on the pull-down below the “Mode” text:



Certain settings are not available in all operating modes. They will be greyed out if they are not supported.

Here are the different modes that can be set for each output.

6.1.1 Trigger

The “Trigger” mode is used to react to a sensor connected to “Sensor 1”, “Sensor 2”, or the “Mic” input. This output won’t start until an input event occurs. This is the mode that is used for any non-cross-beam sensor or microphone. Once a “trigger” input is received, the output will follow the rest of its programmed settings.

6.1.2 Delay

“Delay” mode will wait the specified amount of time before activating the outputs. This would typically be used in “Sequential” global mode. If this is used in conjunction with “Independent” mode, the output will automatically re-arm when it is complete, wait the entered delay, and then activate the output again. One unique feature of the “Delay” mode is that it does not wait its “Tpulse Off” duration if in “Sequential” global mode. This is to facilitate sequences with multiple delays but not having to wait for an off duration – since you are usually just using it for its delay function. If “# Pulses” is set to greater than one, the final “Tpulse Off” will be skipped.

6.1.3 Manual

“Manual” mode requires the press of the “Start” button in StopShot Studio or the “Start” button on the controller before starting the associated output. This is useful for coordinating the start of one or more events. This is the mode typically used for water drops to activate the water valve(s) and to start the whole process. Use this when *you* want to be the one to start the outputs.

6.1.4 XBeam A->B

This mode is specifically for cross-beam applications. It functions similar to the “Trigger” mode, except that the programmed output won’t start until an object crosses from sensor “A” to sensor “B”. It won’t trigger if just “A” or “B” is crossed, or if the object goes from “B” to “A”. Use this mode if you want to trigger on an object only moving in one direction. You’ll notice when you enable this mode the “timeout” setting will become available. This allows you to set a timeout should something cross sensor “A” but never reach sensor “B”. This has an additional benefit. It allows you to set a minimum speed that something has to be travelling before the output will be triggered. You can try this yourself with the cross-beams set up. Set the timeout to “500 ms”. If you move quickly through the sensor pair the output will activate. If it takes you longer than the 500mS to get through both sensors, however, it will not.

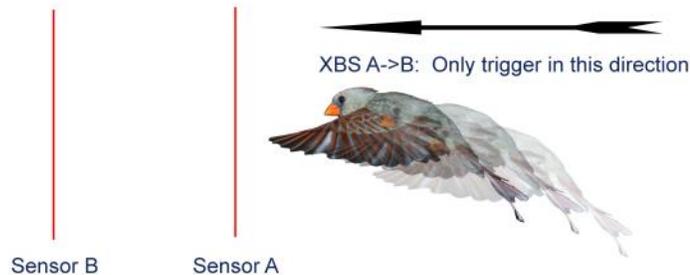


Figure 5 - XBS A to B

6.1.5 XBeam B->A

This mode functions like “A->B”, except the direction is reversed. The object must travel from Sensor “B” to sensor “A”. Having the ability to reverse the direction is useful if changing the sensor setup is difficult or time consuming. If the sensors are using “Xbeam A->B” mode for capturing a bird entering a nest, you can simply change it to “Xbeam B->A” to capture the bird leaving the nest.

6.1.6 XBeam A | B

This mode will trigger if either sensor “A” or sensor “B” is crossed. Any combination will activate the output – “A”, “B”, or both. This can be useful for having two beams at different heights to increase the odds of triggering, or on either side of a feeder.

6.1.7 XBeam A & B (Cross-beam)

This is for cross-beam applications. Both beam sensors need to be broken before the output will activate. Crossing sensor “A” or sensor “B” by itself will not trigger. Use this when triggering on small objects and when using a small field of view. This is the setting used for the [Insect Rig](#). This setting is typically used when the two transmitters cross each other at a point in space:

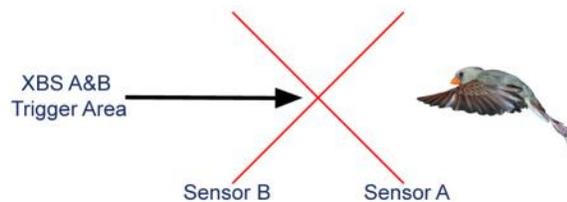


Figure 6 - XBS A & B

6.1.8 XBeam A

This will activate the output when only sensor “A” is crossed. Crossing sensor “B” will have no effect. This allows you to set one output with sensor “A” and potentially another output with sensor “B” -- allowing firing two cameras each with one cross-beam sensor.

6.1.9 XBeam B

This will activate the output when only sensor “B” is crossed. Crossing sensor “A” will have no effect.

6.1.10 Ballistics

Ballistics mode is used to capture projectiles. It requires either a cross beam sensor or two beam sensors. The sensors should be staggered with sensor “A” being crossed first, followed by sensor “B”. The “A” beam and the “B” beam would typically be spaced 8” – 12” (this is the distance between the two beams, NOT the distance between each transmitter and receiver). This mode virtually eliminates the variability involved with capturing something that has an unpredictable (or unknown) speed. In this mode, StopShot Studio measures the time elapsed between the two beam sensors to determine the velocity and then triggers the output a distance past sensor “B”. You can adjust the “delay” setting in this mode, but you would typically leave this set to zero. There is one important setting on

the “Global Config” tab -- It is the “Ballistics Multiplier” discussed in section “13.6 - Ballistics Multiplier”. The distance past sensor “B” that this output will activate is the distance between sensor “A” and sensor “B” multiplied by the “Ballistics Multiplier”. If the two sensor beams are set up 12 inches apart and the “Ballistics Multiplier” is set to “2.0”, the output would activate at 24 inches past sensor “B”.

You can also set the “timeout” field when you select the “Ballistics” mode. If the timeout is set to “250 ms”, StopShot Studio will reset its velocity measurement after that amount of time in the case that only sensor “A” is crossed. This is useful (and pretty much required) when adjusting the sensor/projectile position. Just make sure your projectile will cross both beams within that “timeout” duration.

Despite the name “Ballistics” this mode may also be used to capture wildlife.

Be sure to look at the “Ballistics tips and tricks” in section “16.2 - Ballistics – Tips and Tricks” for setup ideas.

One last note about ballistics. Be safe and aware of your surroundings. Cognisys, Inc. assumes no liability for damages, death, destruction, and/or mayhem. Seriously. Be safe!

See Figure 7 below for a timing diagram for ballistics.

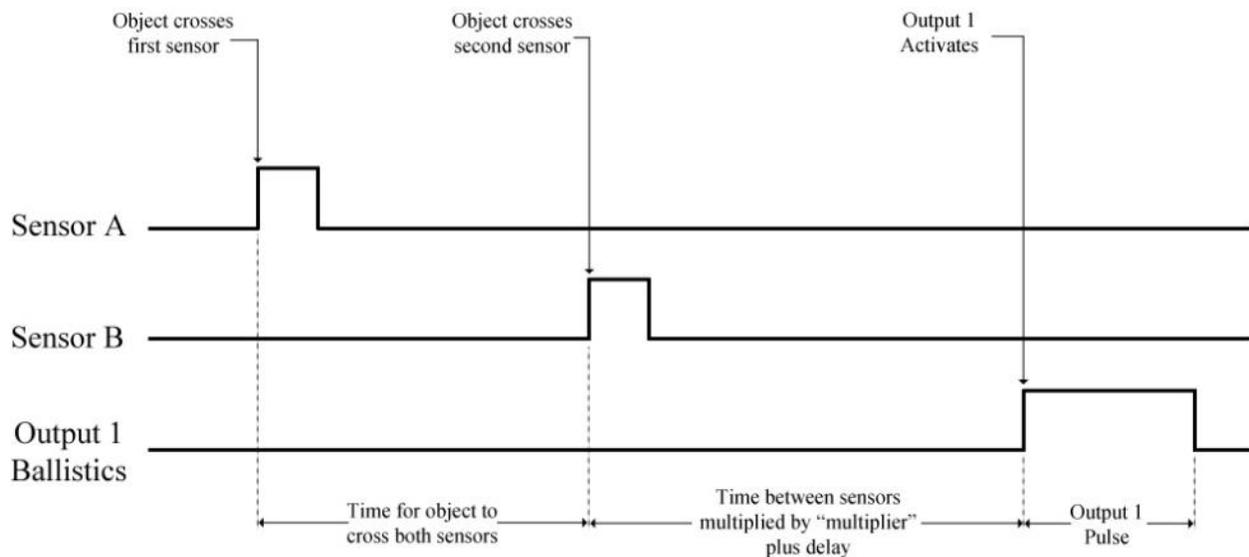


Figure 7 – Ballistics Timing

6.2 Activate



“Activate” is a toggle button. When you press this button it will turn on the output and leave it on. It does not start the outputs mode and/or delay – it simply overrides the behavior of that output and leaves it on. Press it again to turn the output off. This is useful for purging water valves or testing other equipment connections. If your camera is in continuous shooting mode, this would cause the camera to take pictures continuously.

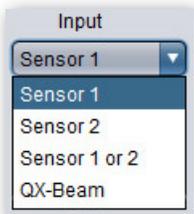
6.3 Output On



If this checkbox is checked, this output will be enabled. If it is not checked, the output will be ignored and will not activate. In global mode “Sequential” this output would be skipped. If you would like to disable all the outputs but still see how they will behave, please see the “Outputs Enabled” feature discussed in section “3.1 - Overview”.

6.4 Input

For trigger “modes” that require an input you can choose which input you would like to use. There are four available:



6.4.1 Sensor 1 / Mic

Select this option if the sensor you are using is attached to “Sensor 1” on the controller. Internally, “Sensor 1” and “Mic” are connected so if you have a microphone plugged into the “Mic” jack on the controller you should select “Sensor 1” as the input.

6.4.2 Sensor 2

Select this option if the sensor you are using is attached to the controller's "Sensor 2" jack.

6.4.3 Sensor 1 or 2

Select this option if you have no preference which sensor this output will trigger on. This way you can use one output if you have two sensors attached. You can even attach two cross-beams for a total of four sensor beams!

6.4.4 QX-Beam

"QX-Beam" stands for Quasi-X-Beam. It allows you to use two standard beam sensors as a cross-beam. The first beam sensor "A" would be attached to "Sensor 1", and the second beam sensor "B" to "Sensor 2". This operating mode is not as robust as a true cross-beam as there are time constraints. The beams must be broken within approximately 20ms of each other if used in the "X-Beam A&B" (true cross-beam) mode. The other cross-beam modes function normally. The QX-Beam input was added to support users who already have two beam sensors. If you plan on doing true cross-beam triggering ("X-Beam A&B"), we highly recommend buying the full cross-beam sensor as opposed to using this mode.

6.5 Group



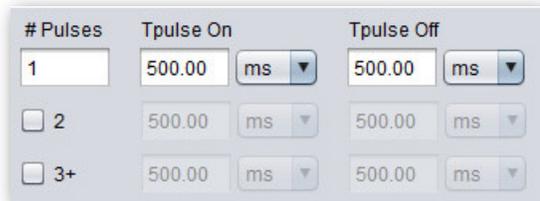
Dual-sequential mode is extremely powerful but it can be confusing since all the outputs can be divided into either group, each operating in a sequence of their own. See section "13.1.3 - Dual-Sequential Mode" for more information regarding the "Dual Sequential" mode. The "group" setting is only available if the "Global Mode" on the "Global Config" tab is set to "Dual-Sequential". You have two options: "Group A" and "Group B". The group defines which sequential mode group this output is in.

6.6 Delay



“Delay” is the second most important setting in StopShot Studio. The first? The output mode in section “6.1 - Output Mode”. Why is “Delay” so important? It is the time from when something happens to when the output will activate. It is valid in all trigger “modes”, even “manual” mode. If you set this to “500 ms” in manual mode, the output will activate 500 ms after you press the “Start” button. We’ll say it again – this is valid in all operating modes. It is what sets the timing from when something happens going “in” from a sensor to when something happens going “out” from the outputs.

6.7 # Pulses, TpulseOn, TpulseOff



What is a “pulse”? That is when the output turns on and turns off. One “pulse” is that complete cycle – on then off. Think of you pressing the shutter button on the camera. Press followed by release. A “pulse” is the same thing. Except here you can enter speeds a *little* faster than your finger can go (a few thousand times faster!).

Pulses:

This is the number of on/off cycles will happen. If you look at the above example, you will get one pulse that is on for 500ms, then off for 500ms. If “# Pulses” was set to “3”, you would get three pulses on the output taking a total of three seconds (500ms on, 500ms off – 500ms on, 500ms off – 500ms on, 500ms off).

Tpulse On:

This is the “On” time of the pulse. This could be the duration that the shutter is held down or the amount of time that the water valve is activated. Just like “Delay” in section “6.6 - Delay” you can choose anything from 50us to 24 hours.

Tpulse Off:

This is the “Off” time of the pulse. If “# Pulses” is set to greater than one, it is the time off between pulses.

Now for the check boxes that are beneath “# Pulses”. In the last example we had “# Pulses” set to “3”. All the on and off times were identical – both set to 500 ms. For some applications, most notably water drops, having identical on and off times doesn’t give you the creative flexibility you need.

If you check the “2” checkbox, you can enter unique timing for the second pulse. Likewise, if you check the “3+” checkbox, you can enter timing for the third and future water drops. Let’s go through another example:

# Pulses	Tpulse On	Tpulse Off
4	500.00 ms	400.00 ms
<input checked="" type="checkbox"/> 2	300.00 ms	200.00 ms
<input checked="" type="checkbox"/> 3+	100.00 ms	50.00 ms

In this example, the timing will be as follows:

Pulse 1: On for 500 ms, off for 400 ms

Pulse 2: On for 300 ms, off for 200 ms

Pulse 3: On for 100 ms, off for 50 ms

Pulse 4: On for 100 ms, off for 50 ms

Note that pulse 4 has the same on and off time as pulse 3. That is because the “3+” checkbox is checked. If neither the “2” or “3+” checkbox was checked, all four “pulses” would have an on time of 500 ms, and an off time of 400 ms.

All of these output pulses happen on whatever output you are adjusting. You can have this level of flexibility on each of the 12 outputs – all 12 with their own unique timing. Wow!

The following is a timing diagram showing the pulses for a “Manual” mode, with the “# Pulses” set to three, and “Tpulse On” and “Tpulse Off” set to the same value.

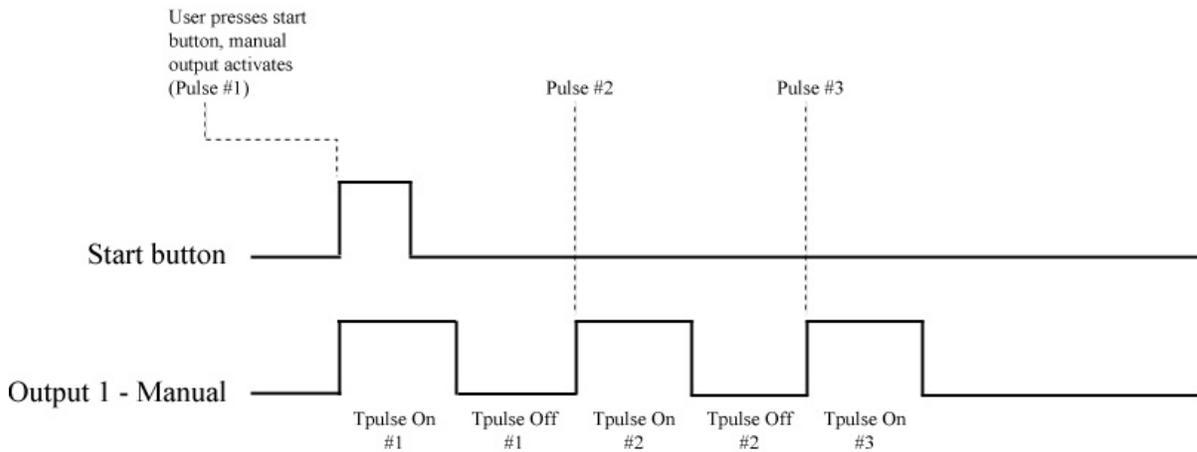


Figure 8 - Manual Mode Timing Diagram

6.8 Increment



Some trigger “modes” allow you to automatically increment the delay each time they are triggered. It defaults to zero since in most cases you don’t want the software automatically incrementing your delay for you. Here is an example:

Trigger mode: “Trigger”

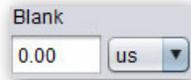
Delay: 100 ms

Increment: 10 ms

Every time the sensor detects something, the “Delay” would be incremented by 10 ms. If you swiped your finger twice through the sensor, the Delay would then be 120 ms.

One thing to note: The computer display will not update the current delay if “increment” is set to something larger than zero. There are two reasons for this. The first is that this increment can happen very fast (if your delay is set to something quick, like 100 us). The software would never be able to read the updated value fast enough to keep up. The second reason is that reading the updated value from the controller would slow down its critical timing tasks. It is a design trade-off favoring precision timing over updating the current delay value. We think we made the right decision. The controller takes great joy in doing what you told it to do. It will obey. If you want to start over with your initial “Delay”, you simply have to click the “Write Settings” button at the top.

6.9 Blank



“Blank” is another excellent feature with perhaps a not-so-intuitive name. It is the amount of time that the input is ignored after an output completes. Think of it as a re-arm time. Here is a real-world example (maybe slightly exaggerated):

You have StopShot Studio controlling a camera with an on-board flash. A very **very** bright flash that has a recharge time of two seconds. It’s bright enough to illuminate the sky at night. You have a laser beam sensor set up to trigger off of moths crossing the beam. (Let’s ignore the fact that your flash may actually ignite the moth.) When the moth crosses the beam, the camera should fire. The first picture is great, but the next moth to go through is a wasted shot. The flash wasn’t fully recharged. If you set the “Blank” time to something large enough to accommodate the recharge time, the controller will ignore the input until that time expires.

This is also useful for anything that may “flutter” in the beam. The controller will keep seeing trigger inputs that (after the first one) you really don’t want things to happen for a while. That is where the “Blank” time comes in handy.

The “Blank” feature is not available in all trigger “modes”. Setting it to zero is an acceptable value (re-arm the output immediately).

See the timing diagram in below for an example of “Blank” and the overall timing of an output.

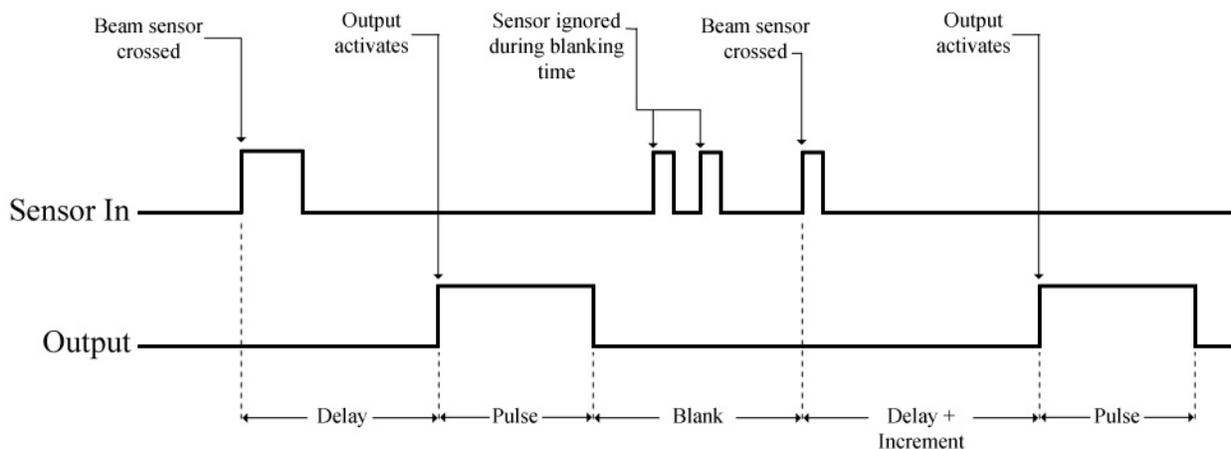
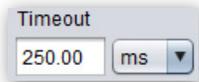


Figure 9 - Blanking Time

6.10 Timeout



“Timeout” is available in trigger modes that use more than one beam (some cross-beam modes and ballistics). These trigger modes expect one sensor to be broken, followed by another sensor. Usually you would want the trigger mode to timeout after a certain amount of time.

Here is an example:

Trigger mode: X-Beam A->B

Timeout: 250 ms

With these settings, an object would have to cross sensor “A” and get to sensor “B” within 250 ms. If it doesn’t, then the output would reset waiting for sensor “A” to be crossed again. If the object eventually made it to sensor “B”, it would have no effect, since the output is back to waiting for sensor “A”.

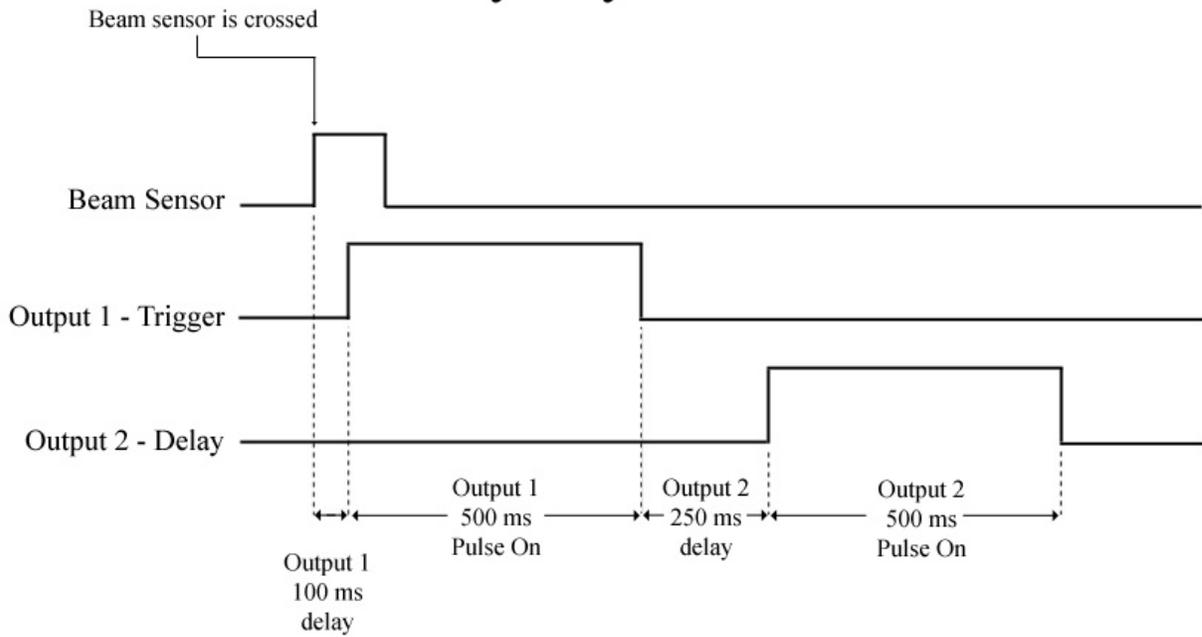
You can also set the “timeout” to zero. Let’s consider the above example but with the timeout set to zero. If something crosses sensor “A”, the output will continue to wait indefinitely for something (anything!) to cross sensor “B”. Since “A” has already been detected, any object crossing “B” would activate the output. It may not have been the first object that crossed sensor “A”. So yes, you *can* set the timeout to zero, but it would likely be used for special circumstances.

6.11 Sync



Despite the fact that “Sync” is tucked in the far right side, it is a very useful feature. It is only available in trigger mode “Delay” and only applies when the “Global Mode” is set to “Sequential” or “Dual-Sequential”. Normally “Delay” in a sequence will wait until the previous output’s “Tpulse On” time expires. That’s how a sequence typically works – one followed by the next. If, however, you turn “Sync” on by checking its box, the “Delay” output will begin the moment the previous output’s pulse turns on. When we say “begin”, we don’t mean its output will start. The “Delay” time entered will start. See Figure 10 below for a graphical example. See how the timing for “Output 2” shifts when “Sync” is turned on? It’s “Delay” time starts as soon as “Output 1” activates.

Delay - Sync off



Delay - Sync on

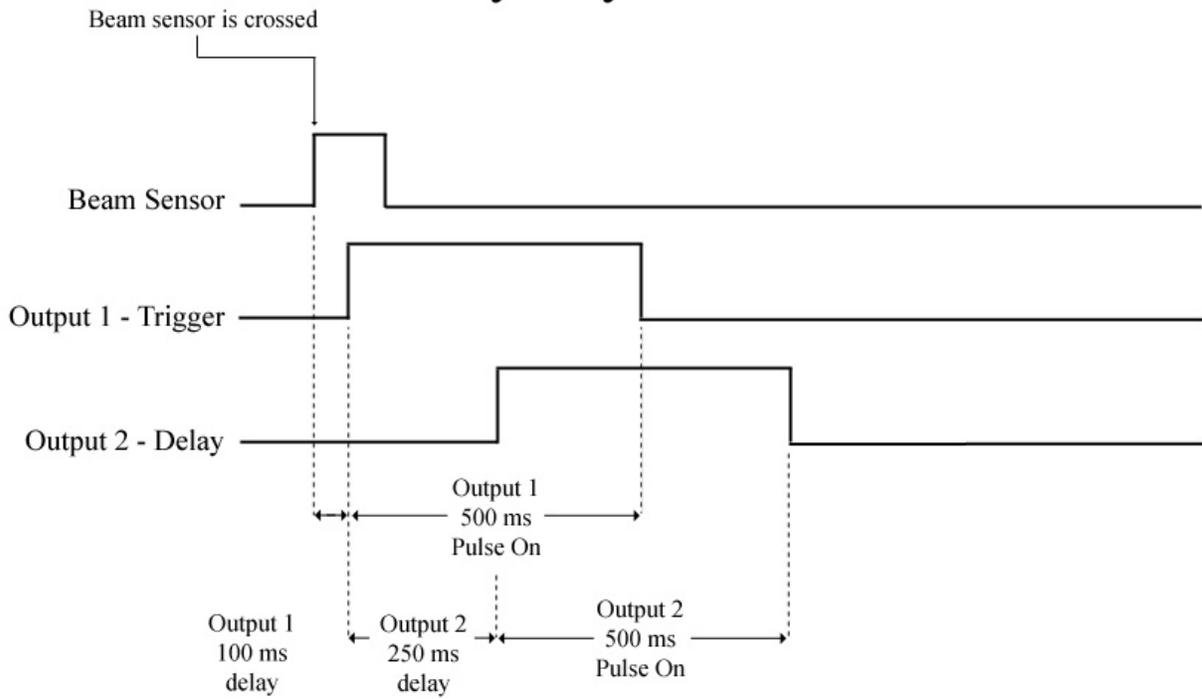


Figure 10 - Sync

Here is a mind-bender: If “Output 1” had a long enough “Tpulse On”, it’s possible to actually have “Output 2” complete before “Output 1” has. The sequence would still wait for “Output 1” to complete before moving on through the rest of the sequence (starting at “Output 3” if it is enabled).

6.12 Comment

The comment field is just to help remind you of how you have used these settings in the past. You can enter anything you like here. Each output can have its own comment.

One nice feature is that the comment is stored into the controller (if you shut it down by pressing the power button for one second). This way if you haven’t used it in a while you can click the “Read Settings” button as a reminder of what the controller was used for last.

In addition to each output having a comment field, you can also add a global comment for the configuration. This is under the “Global Config” tab. See section “13.11 - Configuration Comment” for more details.

7. Ballistics

The “Ballistics” tab simplifies photographing projectiles. Before you jump into this be sure to keep your (and everyone else’s!) safety in mind. Shattering objects can cause serious bodily damage. Ricochets can too. Ballistics should only be performed under controlled environments with proper safety equipment. We want repeat customers! Be safe.

We recommend for most applications using infrared cross-beams for ballistics applications. They are much easier to align the projectile through the beam because of their increased beam width (when compared to lasers). There are some uses for the ballistics mode that aren’t exactly what one would consider “projectiles” where the laser cross-beams are better. First, lasers are much better suited for outdoor photography since the sun may make infrared sensors un-usable (since the sun is a large infrared radiator). Secondly, since the beam is visible it makes aligning them easier when the receiver and transmitter are further apart. So what “projectile” would you use lasers for? Golf swings, Frisbees, etc. Outdoor activities exposed to sun or where there may need to be a large distance between transmitters and receivers.

Similar to the “Water Drops” tab, any changes made here will overwrite settings on the “Advanced” tab. Try and only use one tab or the other. Mixing of the two may result in your settings being overwritten.

Now let’s take a look at the “Ballistics” tab:

The screenshot shows the 'Ballistics' tab selected in a software interface. The top navigation bar includes tabs for Welcome, Advanced, Water Drops, Ballistics, Time Lapse, Bulb Ramp, Measure, Multi-out, Plot, and Global Config. The main content area is divided into two sections. On the left, there is a configuration panel with the following settings: Sensor type: X-Beam (dropdown), # flashes: 1 (dropdown), Distance between sensors: 12.00 (text input), Distance after sensor: 24.00 (text input), Calculated multiplier: 2.00 (text input), and Flash delay: 0.00 (text input) with a unit dropdown set to ms. On the right, there is a section titled 'This is how you should connect the equipment to the outputs:' followed by a row of 12 numbered output indicators (1-12). Below this, it says 'F1' in red, and 'F = Flash. Click to disable/enable. All flashes are grouped with "F1".' A bold note states: 'Note: Changes on this tab will overwrite settings in the advanced tab.' Below these sections, there is a text box with instructions: 'For X-beam use, insert the X-Beam sensor into the Sensor 1 jack. The projectile should go through "Sensor A" first. If using infrared sensors (recommended), you should increase the transmitter power just until the receiver detects it and you don't receive false triggers. This will maximize receiver sensitivity.'

7.1 Settings

This is a close-up of the configuration panel from the 'Ballistics' tab. It shows the following settings: Sensor type: X-Beam (dropdown), # flashes: 1 (dropdown), Distance between sensors: 6.00 (text input), Distance after sensor: 6.00 (text input), Calculated multiplier: 1.00 (text input), and Flash delay: 0.00 (text input) with a unit dropdown set to ms.

Sensor Type:

You have two selections for the sensor type: X-Beam, or QX-Beam. X-Beam is using one of the cross-beam sensors. QX-Beam is a “Quasi-X-Beam” trigger mode (see section “6.4 - Input”) where a non-cross-beam sensor is plugged into “Sensor 1”, and another into “Sensor 2”. We recommend using a standard cross-beam instead of the QX-Beam for ballistics.

Flashes:

This is the number of flashes you would like to connect to the controller.

Distance between sensors:

This is the distance between sensor “A” and sensor “B”. For most applications this should be around 6 inches (it makes adjusting height easier when they’re closer together). Keep this in mind when building a mount for your cross-beams. This distance is from the center to center of the two sensors. It is NOT the distance between the transmitter and receiver.

Distance after sensor:

This is the distance past sensor “B” that you would like to fire the flash(es) – where your camera will be focused. The distance is from the center of the receiver’s opening. It should be at least the distance between your sensors.

Calculated multiplier:

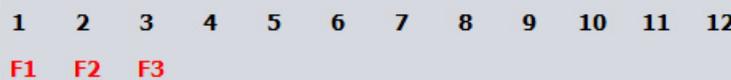
The StopShot Studio controller “thinks” in multiplier distance. You can’t adjust the multiplier on this tab – it is only shown to give you the idea of what the multiplier would be if you were using the “Advanced” tab. If you look on the “Global Config” tab you will see the “Ballistics Multiplier” setting. When you make a change on the “Ballistics” tab it will also change on that tab.

Flash Delay:

This is the delay in time after the “Distance after sensor” has elapsed before the flash(es) will fire. Typically you would set this to zero but you can adjust it to fine-tune the position of the projectile.

7.2 The Outputs

Similar to the “Water Drops” page, the screen shows you how the outputs should be connected. In ballistics mode it is simplified -- only flashes are controlled. The user is responsible for the camera and the projectile.



You may click on “F1” to disable all the flashes. Because ballistics mode uses the “Multi-output” feature of StopShot Studio (discussed in section “11 - Multi-Out”), they are all grouped together.

8. Time Lapse

StopShot Studio gives you the ultimate time lapse setup. The twelve outputs can each be configured independently.

Once you have entered your settings press the “Write Settings” button to send the settings to the controller. At that point either press the “Start” button at the top of the screen or the “Start” button on the controller to start the time lapse sequence. When you’re done with the time lapse mode just press the “Start” button again to abort it.

The “plot” feature is not functional for Time Lapse since there is no end – It continues indefinitely.

Here is the “Time Lapse” tab:

	Initial Delay	# Pulses	Pulse On Time	Pulse Off Time	Duration	Interval	Duration 2	Interval 2
1 <input checked="" type="checkbox"/>	0.00 ms	1	500.00 ms	500.00 ms	1.00 hr	10.00 min	0.00 hr	0.00 min
2 <input checked="" type="checkbox"/>	0.00 ms	1	500.00 ms	500.00 ms	1.00 hr	10.00 min	0.00 hr	0.00 min
3 <input checked="" type="checkbox"/>	0.00 ms	1	500.00 ms	500.00 ms	1.00 hr	10.00 min	0.00 hr	0.00 min
4 <input checked="" type="checkbox"/>	0.00 ms	1	500.00 ms	500.00 ms	1.00 hr	10.00 min	0.00 hr	0.00 min
5 <input checked="" type="checkbox"/>	0.00 ms	1	500.00 ms	500.00 ms	1.00 hr	10.00 min	0.00 hr	0.00 min
6 <input checked="" type="checkbox"/>	0.00 ms	1	500.00 ms	500.00 ms	1.00 hr	10.00 min	0.00 hr	0.00 min
7 <input checked="" type="checkbox"/>	0.00 ms	1	500.00 ms	500.00 ms	1.00 hr	10.00 min	0.00 hr	0.00 min
8 <input checked="" type="checkbox"/>	0.00 ms	1	500.00 ms	500.00 ms	1.00 hr	10.00 min	0.00 hr	0.00 min
9 <input checked="" type="checkbox"/>	0.00 ms	1	500.00 ms	500.00 ms	1.00 hr	10.00 min	0.00 hr	0.00 min
10 <input checked="" type="checkbox"/>	0.00 ms	1	500.00 ms	500.00 ms	1.00 hr	10.00 min	0.00 hr	0.00 min
11 <input checked="" type="checkbox"/>	0.00 ms	1	500.00 ms	500.00 ms	1.00 hr	10.00 min	0.00 hr	0.00 min
12 <input checked="" type="checkbox"/>	0.00 ms	1	500.00 ms	500.00 ms	1.00 hr	10.00 min	0.00 hr	0.00 min

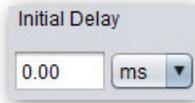
Settings Checker:

Let us take a closer look at the available settings.

8.1 Enabled

The checkbox next to the output indicates if the output is enabled or not. Each output operates independently from each other. There is no harm in leaving unused outputs enabled.

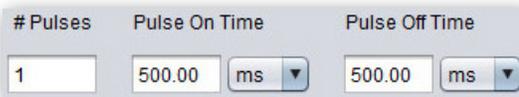
8.2 Initial Delay



The “Initial Delay” is the duration this output should wait before starting the time lapse sequence. This delay will only happen once – once the time lapse sequence restarts this delay will not occur. The purpose behind this delay is to stagger the outputs to do different things. This way you could coordinate the time lapse photograph with other events. Here is an example of what we ran into:

We wanted to generate a time lapse video of an orchid blooming. We had grow lights on a timer and needed to make sure the lights were on and warmed up before taking the picture. If we had StopShot Studio at that time we could have easily used this initial delay to shift the photograph from when the lights would turn on to guarantee the lights were at a consistent light level.

8.3 # Pulses, On Time, Off Time



Pulses:

The “# Pulses” is the number of times that the output will activate at each interval. For time lapse this would typically be left at “1”, but you can adjust it for your specific application. One “pulse” is a complete “Pulse On Time” and “Pulse Off Time”.

Pulse On Time:

This is the duration that the output will be active/on.

Pulse Off Time:

This is the duration that the output will be off.

In the above example, the total “pulse time” would be one second: 500ms on and 500ms off. If the “# Pulses” was set to “2”, you would get two output pulses, both 500ms on and 500ms off for a total time of two seconds.

8.4 Durations and Intervals

Duration	Interval	Duration 2	Interval 2
1.00 hr	10.00 min	0.00 hr	0.00 min

These are the “real” time lapse settings. There are two groups of time lapse settings. They operate in pairs. Duration/Interval are grouped together, and then Duration 2/Interval 2. This lets you set up two separate time lapse settings per output. Here is what they do.

Duration:

This is how long this time lapse sequence will last.

Interval:

Interval sets how often the output should activate its “# Pulses” within the duration. In the above screen shot there would be a picture every 10 minutes. You would get six pictures before the sequence would repeat.

Duration 2:

The second set of Duration/Interval settings let you have two unique time lapse settings. If “Duration 2” is set to zero then this second group of settings is disabled and only the first “Duration/Interval” will be used. When would you use a second time lapse group? In our orchid example the lights had to be off most of the night (orchids don’t care for continuous light). They were on most of the day but then had to be turned on at night prior to photographing them. One duty cycle during the day and then a different duty-cycle during the night. So if we had a use for it we figured you might as well!

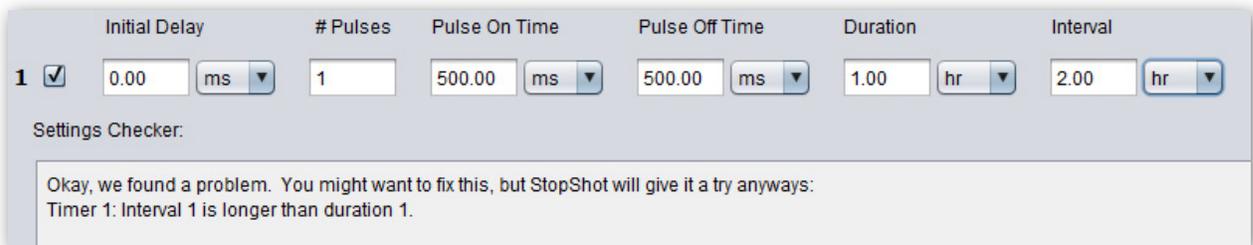
Interval 2:

This is the interval that the output will fire during the “Duration 2” setting. If “Duration 2” is set to zero then “Interval 2” will have no effect – both will be skipped.

8.5 Settings Checker

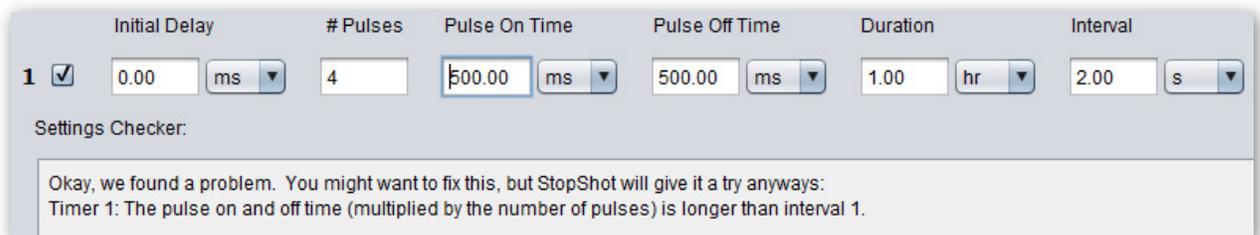


The “Settings Checker” is a very useful tool. It will try and save you from yourself. Since you can enter any times you want into any of the settings it is possible to *try* and break the laws of physics. The “Settings Checker” will kindly remind you that this is not a good idea and point out which settings are incorrect. What does a bad setting look like?



In this case the interval is longer than the duration. The duration is the “big” time, and the interval is how many times a picture will be taken within that duration. If the interval is larger than the duration then you’ll be disappointed with the results. The “Settings Checker” kindly reminds you of your mistake. As you see in the results, however, the settings will still get sent to the controller – just in case you think that what you want is *really* what you want.

Here is another slightly more subtle error:



Here we have a quick time lapse with a two second interval over a period of an hour. No problem there. The gotcha is that each total pulse time is one second and the output is configured for four pulses. That means the total output cycle will be four seconds but your interval is set to two seconds. StopShot will still use the settings, and it will *sort of* work – you’ll get two shots each interval.

To summarize: Listen to the “Settings Checker”. Time lapse photography is making a commitment and we want StopShot Studio to do exactly what you expect it to do.

9. Bulb Ramp

Bulb Ramping (or “bramping”) is the process of using the bulb mode in your camera and having an external device (such as StopShot Studio) control the duration of the exposure. This allows you to adjust for changes in lighting conditions such as during a sunrise or sunset.

Not all cameras support bulb ramping. Nikon camera’s tend to round the bulb-mode duration, which will cause flicker in the final picture sequence.

The trick is determining your shutter duration in the first place. You will want to take a photograph at your desired (fixed) aperture at both ends of the lighting conditions. Pay attention to the shutter duration. Shutter duration is specified in seconds. 1/250 is just that – one divided by 250, which is 0.004, or 4ms. 1/60 is 16.666ms. You’ll need to be comfortable with that in order to use bulb ramping.

Here is the “Bulb Ramp” tab:

The screenshot shows the 'Bulb Ramp' settings panel in StopShot Studio. It features a list of controls on the left and a 'Settings Checker' box on the right. The controls include:

- Pulses:** 1
- On Time:** 500.00 ms
- On Increment:** 0.00 ms
- Stops +/-:** 2
- Off Time:** 500.00 ms
- Interval Time:** 10.00 s
- Interval Increment:** 0.00 ms
- Total Duration:** 1.00 hour
- Bulb Feedback:**
- Use Stops:**
- Evaluate:** Button

The 'Settings Checker' box contains the text: "BulbRamp will have 360 intervals." Below the main controls, there are explanatory labels: "Output 1 active for this duration", "Increments this amount per interval", and "Adjust this many stops over the duration".

9.1 Pulses, On Time, Off Time

These settings are similar to other tabs in StopShot Studio except that the “on time” in this case will be the exposure duration.

Pulses:

The “Pulses” is the number of times that the output will activate at each interval. For bulb ramping this would typically be left at “1”, but you can adjust it for your specific application.

On Time:

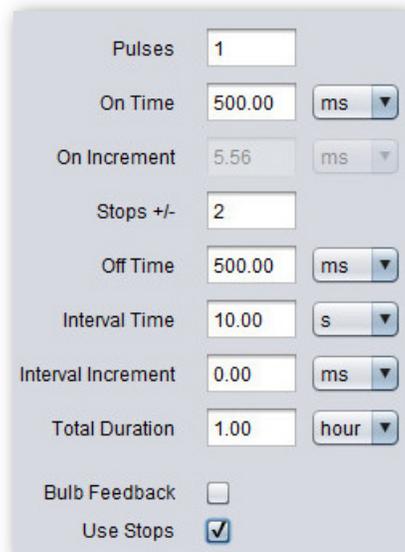
This is the duration that the output will be active/on. Since this will be attached to the camera, this “on time” will determine your exposure duration. This is just the starting exposure since the whole idea behind bulb ramping is to adjust this over time. You will have to add in the camera’s shutter lag in this duration unless you’re using the “Bulb Feedback” feature discussed in section “9.4 - Bulb Feedback”.

Off Time:

This is the duration that the output will be off.

9.2 On Increment, Stops, Use Stops

The “On Increment” setting is how much the “On Time” (your exposure) is increased or decreased per interval (picture). If you’re comfortable with specifying the time you can adjust it here. If you’d rather use “stops” instead of time, simply check the “Use Stops” checkbox at the bottom:



The screenshot shows a settings panel with the following fields and options:

Pulses	1	
On Time	500.00	ms
On Increment	5.56	ms
Stops +/-	2	
Off Time	500.00	ms
Interval Time	10.00	s
Interval Increment	0.00	ms
Total Duration	1.00	hour
Bulb Feedback	<input type="checkbox"/>	
Use Stops	<input checked="" type="checkbox"/>	

Now that the “Use Stops” box is checked you can see in this example that the “On Increment” is calculated for you – 5.56ms per interval. You may find this more convenient than calculating the “On Increment” yourself.

9.3 Interval Time, Interval Increment, Total Duration

These settings determine how many pictures will be taken and how long the bulb ramp will last.

Interval Time:

This is how often a picture will be taken for this bulb ramp. Make sure that this interval time (including any increment or decrement in its time) leaves your camera enough time to write the picture to its storage device. If using “Bulb Feedback” mode, this interval time will have to account for shutter lag time as well.

Interval Increment:

If you want to adjust over time how often a picture is taken you can enter a positive or negative increment here. At each interval, the interval time will be adjusted by this value. Leave at zero if you do not want the interval time to be adjusted.

Total Duration:

This is the total duration of the bulb ramp.

9.4 Bulb Feedback

This feature allows closed loop exposure control. That’s a fancy way of saying that StopShot Studio can monitor exactly how long the camera takes to open up and properly control the exposure. This does require a cable (and possibly an adapter) and that the camera is set for front curtain sync.

If your camera has a PC sync connector for an off-board flash, you will need to connect it to the “Sensor 1” jack on StopShot Studio. If your camera does not have a PC sync connector, you will need to add a hot-shoe to the top of your camera and then run a PC sync cable from the hot-shoe to the “Sensor 1” jack.

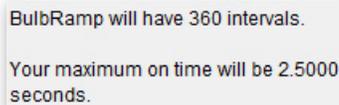
So what does this cable do? When the controller tells the camera to take a picture there is an inherent shutter lag in the camera (and quick likely variable!). This can cause significant exposure variations. The cable solves this issue. Once the controller tells the camera to open the shutter, it begins monitoring the “Sensor 1” jack for the flash trigger generated by the camera. Since the camera is set for front curtain sync this should happen as soon as the camera’s shutter is open. At this point the controller starts its exposure duration.

Using the “Bulb Feedback” is definitely recommended for consistent exposure control.

9.5 Settings Checker

Similar to the “Time Lapse” tab, the “Settings Checker” will look for possible mistakes in your settings. It’s pretty easy to make an error since there are a lot of things changing at the same time. The camera’s shutter duration is changing and the interval could be increasing or decreasing. There is potential for overlap and once that happens – the bulb ramp process will fail. To check the settings press the “Evaluate” button. If the settings look good you will see how many intervals will happen. The number of intervals may not be entirely obvious if you are adjusting the interval time using the “Interval Increment” setting.

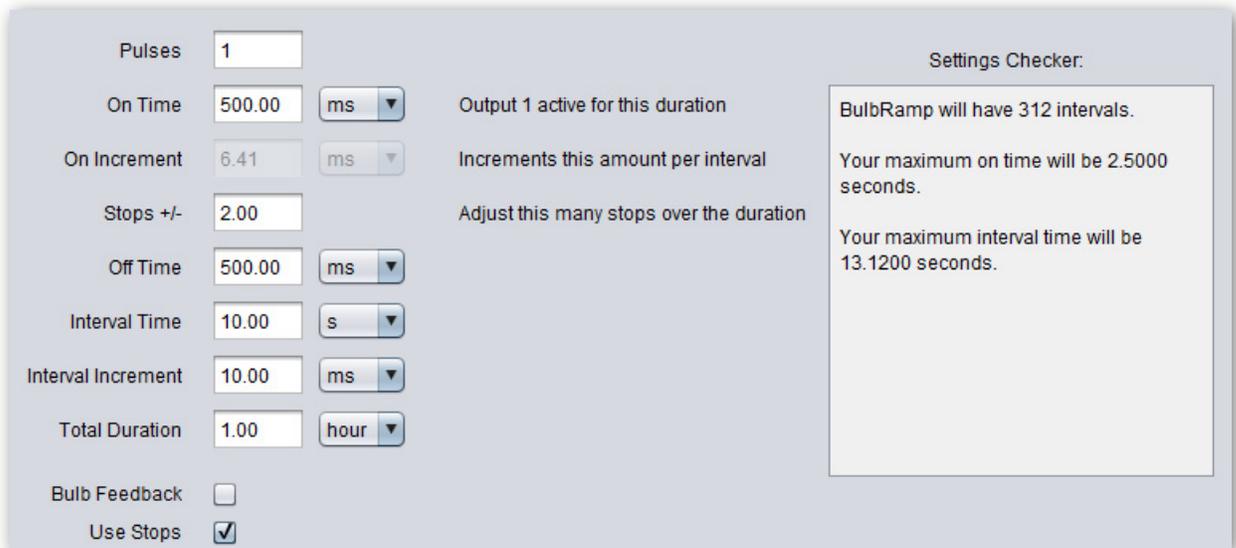
Using the settings in the above two sections results in the following results:



BulbRamp will have 360 intervals.
Your maximum on time will be 2.5000 seconds.

Changing two stops over that duration increased the exposure time from 500ms to 2.5 seconds. Our interval time is 10 seconds, so we’re safe!

Here is an example of using the interval increment feature:



The screenshot shows a settings panel with various controls and a “Settings Checker” pop-up. The settings are as follows:

Setting	Value	Unit
Pulses	1	
On Time	500.00	ms
On Increment	6.41	ms
Stops +/-	2.00	
Off Time	500.00	ms
Interval Time	10.00	s
Interval Increment	10.00	ms
Total Duration	1.00	hour

Additional settings: Bulb Feedback (unchecked), Use Stops (checked).

Settings Checker pop-up text:

Settings Checker:
BulbRamp will have 312 intervals.
Your maximum on time will be 2.5000 seconds.
Your maximum interval time will be 13.1200 seconds.

The interval time is only being increased by 10 thousandths of a second – not much! But look at the number of intervals! It decreased from 360 down to 312. That 10ms increment significantly impacted the number of total intervals (pictures). The “Settings Checker” will also tell you what the maximum interval time will be – just as a sanity check.

Now let's look at some "trouble" settings:

Pulses: 1

On Time: 500.00 ms Output 1 active for this duration

On Increment: 6.94 ms Increments this amount per interval

Stops +/-: 5.00 Adjust this many stops over the duration

Off Time: 500.00 ms

Interval Time: 5.00 s

Interval Increment: 0.00 ms

Total Duration: 1.00 hour

Bulb Feedback:

Use Stops:

Settings Checker:

BulbRamp will have 720 intervals.

Your maximum on time will be 5.5000 seconds.

Because you're adjusting the pulse duration, your total cycle time will exceed the interval time. Try increasing the interval time or decreasing the on time adjustment.

Here the interval time was decreased to five seconds and the number of stops increased to five. The "Settings Checker" found a problem. Adjusting five stops ended up pushing the "On Time" up to 5.5 seconds – larger than our interval time.

You can also easily run into trouble decreasing the interval time. Trust the "Settings Checker"!

10. Measure

The "Measure" tab contains two measurement buttons discussed below.

Measurement Timeout (60sec max): 1.00 s

Measure Shutter Lag: Measure

Time Measure: Measure

Result: us ●

For the shutter lag measurement, have your camera (with a flash on it) attached to Output 1. Plug an infrared sensor into Sensor 1. Point the flash toward the infrared sensor. Then click the "Measure" button next to "Measure Shutter Lag".

Time measure will measure the amount of time between two sensor events. This can be used to measure the speed of an object between a cross-beam. Insert the cross-beam sensor cable into Sensor 1.

If the measurement is successful, the circular indicator next to Result will turn green. If not, it will be red.

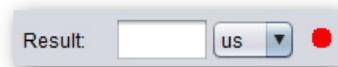
10.1 Timeout

This is how long StopShot Studio should wait for a measurement. For “Shutter Lag” measurements one second is plenty long enough. For “Time Measure” you can adjust this for your requirements. There is a 60 second maximum for the measurement.

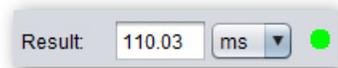
10.2 Measure Shutter Lag

This is an extremely useful measurement for determining your camera’s shutter lag. Why should you care? Shutter lag is the bane of high-speed photography. You should have a feel for your camera’s shutter lag and especially if it is variable.

To measure your camera’s shutter lag insert your shutter cable into your camera and the other end into “Output 1”. Attach a flash to your camera or use the on-board flash if it is available. Set your camera for manual mode with auto-focus off. Point the flash toward an infrared sensor (any Cognisys, Inc. IR sensor will work, including the mini-beam sensor). You can also use a laser sensor receiver as long as you remove the filter/diffuser from the front. Once that setup is complete press the “Measure Shutter Lag” button. The controller will tell the camera to take a picture and then measure how long it takes before the flash fires. If the camera’s flash doesn’t fire, you will get a timeout, a red indicator, and the following will be displayed as the result:



If the flash does fire you will see the following:



In this case, the camera’s shutter lag is 110.03ms. It would be a good idea to wait different intervals after taking each measurement to see if your camera suffers from variable shutter lag. The camera above had a shutter lag of over 200ms the first measurement, but if the button was pressed in quick succession the results were consistent at 110ms.

10.3 Time Measure

“Time Measure” lets you measure the duration between two sensor activations. You can use this to measure velocity if the sensors are a known distance apart. We recommend using cross-beam sensors since they don’t have “bounce” in their outputs. “Time Measure” should not be used with microphones. Simply connect the cross-beam to “Sensor 1”, set the “Timeout” to something appropriate for what will be crossing the sensor’s path. Press the “Time Measure” button. If a measurement is detected it will look similar to the shutter lag result.

You don't have to use both cross-beam sensors either – the event can be twice through the same sensor beam.

The "Timeout" won't start for "Time Measure" until the first beam is crossed.

11. Multi-Out

The “Multi-Out” tab allows you to set multiple outputs when one output activates. This is a handy feature for two reasons. If you want to set more than one output simultaneously you don’t have to worry about a delay between them. The second reason is that now you won’t have to use several of the output timers to activate more than one output. This feature is used in the “Water Drop” tab when you select more than one flash. This way it only uses up one output timer but can fire multiple flashes (and most importantly – at the same time!)

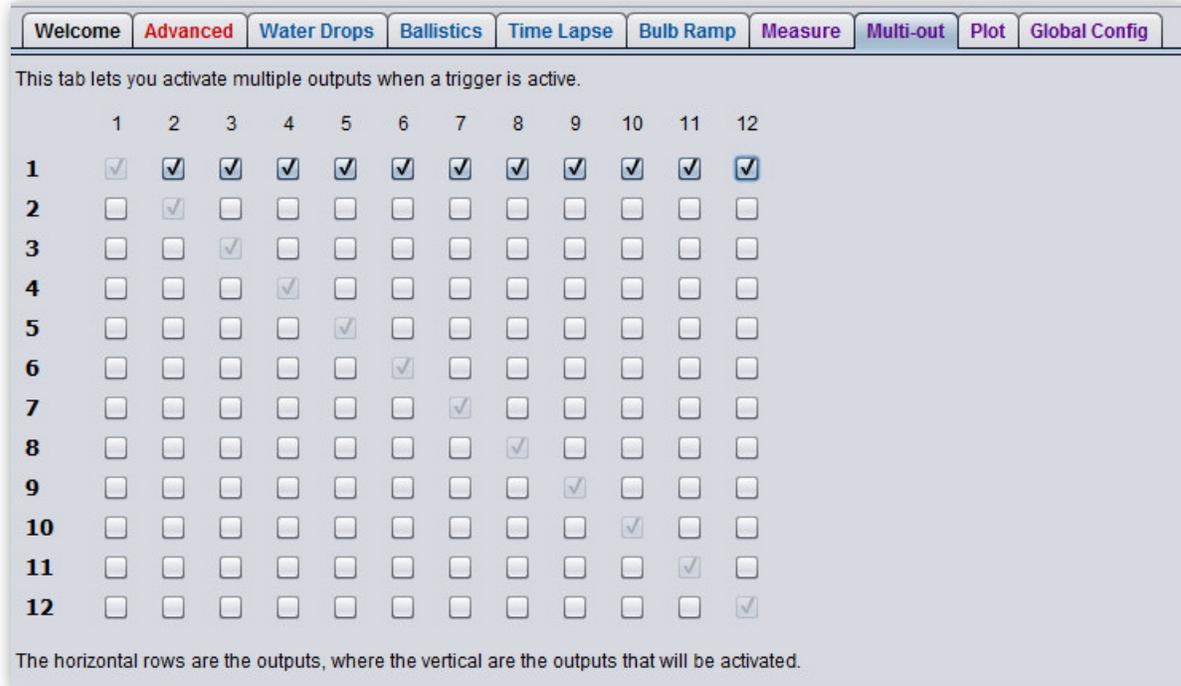
This tab lets you activate multiple outputs when a trigger is active.

	1	2	3	4	5	6	7	8	9	10	11	12
1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
7	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
8	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>						
9	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>							
10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>								
11	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>									
12	<input type="checkbox"/>	<input checked="" type="checkbox"/>										

The horizontal rows are the outputs, where the vertical are the outputs that will be activated.

The bold text on the left is the output channel. As you can see there are check-boxes that you can’t disable. When “Output 1” activates, it will always activate “Output 1”. That is true for all the outputs.

Here is an example of setting all the outputs:



In this example any time “Output 1” activates, all twelve outputs will activate simultaneously.

You can, however, get yourself into a little trouble with the “Multi-Out” tab. Here is an example:

“Output 1” is configured in “Trigger” mode with a 0ms delay, and a 500ms pulse on time.

“Output 2” is configured in “Trigger” mode with a 100ms delay, and a 50ms pulse on time.

When a sensor input occurs, “Output 1” will become active, and because “Multi-Out” is selected on all 12 outputs, all 12 outputs will turn on (with the intent of staying on for 500ms).

A 100ms later, “Output 2”'s delay will expire, so it will turn on “Output 2” – which is already on from “Output 1” (no change). Since “Output 2” is set for a 50ms pulse time, 50 ms later it will turn off “Output 2”. That may not have been what was intended, since “Output 1” really wanted “Output 2” to stay on for 500ms.

The rule with “Multi-Out” is whoever gets to the output next wins.

12. Plot

Wouldn't it be nice to be able to see if what you *think* you told StopShot Studio to do is what it will really do? This is where the "Plot" tab comes into play. You can use the "Plot" feature for "Advanced", "Water Drops", and "Ballistics" modes. When you first click on the "Plot" tab, there will be just the "Plot" button. Because plotting is resource intensive you will need to click the "Plot" button to plot the current settings. That's worthy of a repeat. You have to click the button to view your current settings – don't get stuck looking at old settings on accident!



Plotting does make a key assumption. When an output is configured to trigger off of one of the sensor inputs the plot doesn't know when (or if) that input will be detected. The assumption that it makes is that as soon as the output is looking for an input it will receive it.

Here is an example of what a plot looks like of a three valve water drop with one flash:



Output 1 is set up to release three drops, Output 2 releases a single drop after Output 1 completes, and Output 3 releases a drop at the same time as Output 1. Coming in last place is Output 4, which is going to fire the flash.

The outputs are on the vertical and time on the horizontal.

12.1 Zoom

Sometimes it may be necessary to zoom in on a location. This could be from multiple events happening close together or a significant difference in time scale (really long durations mixed with short durations). To zoom in on a specific area simply hold down the mouse button and move to the right. This will highlight the area:



When you release the mouse button it will zoom in on the highlighted section:

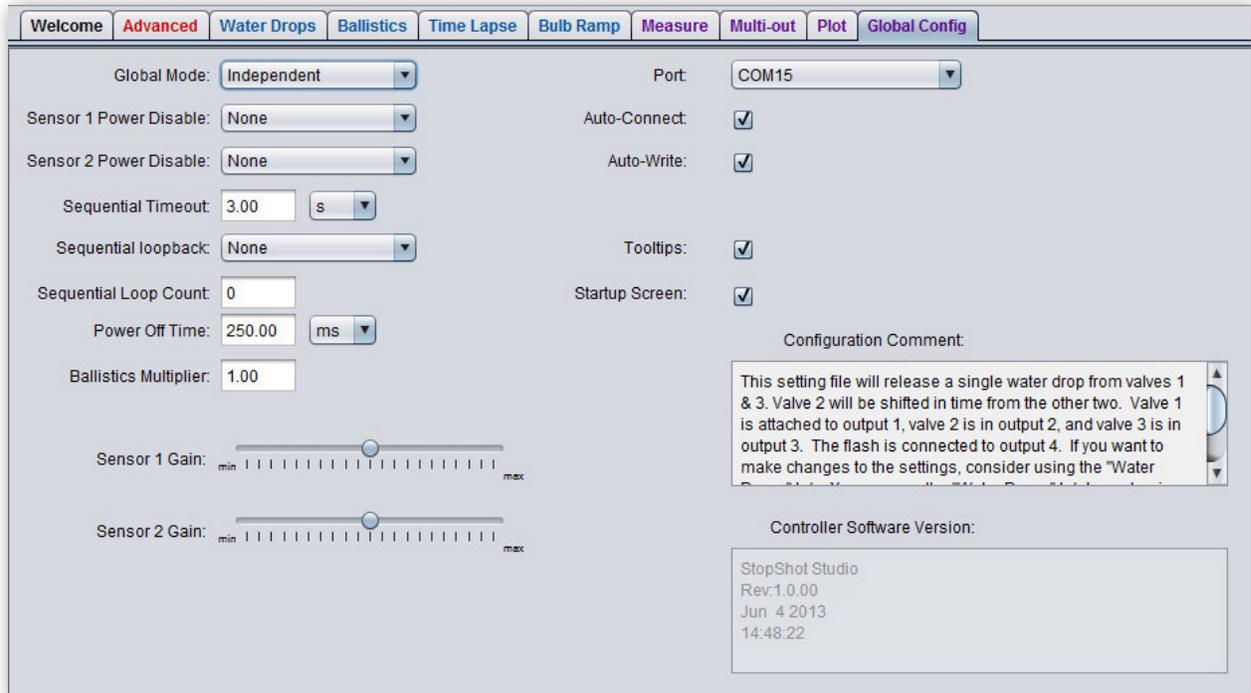


You can continue to zoom in by repeating the process.

If you would like to zoom out, you do the reverse process of zooming in: Hold down the mouse button, slide to the left, and then release the button.

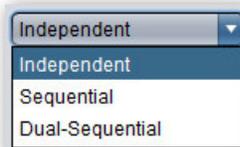
13. Global Config

The “Global Config” tab (short for Global Configuration) contains settings that affect the overall operation of StopShot Studio or are general in nature.



13.1 Global Mode

There are three global operating modes. These modes change the behavior of the outputs.



13.1.1 Independent Mode

Independent mode means that the outputs operate completely independent of each other. Any given output doesn't know and doesn't care about the other outputs. Their behavior is completely autonomous and simultaneous.

Here is a timing diagram of independent mode. Both “Output 1” and “Output 2” are set to “Trigger” mode – they are looking for a sensor input. Because the global mode is set to

“Independent”, every time the sensor beam is broken (active) the outputs activate after a short delay.

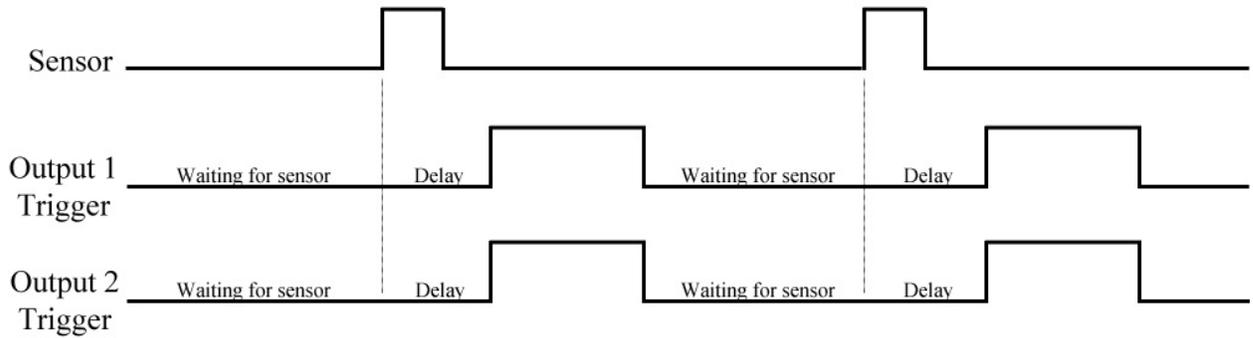


Figure 11 - Independent Timing Diagram

13.1.2 Sequential Mode

Sequential mode is essentially a *dependent* mode. Outputs operate in sequence, from 1 – 12. Output 2 won't start unless Output 1 is finished. If an output is disabled (It's "on" checkbox is not checked) it will be skipped. This global mode is useful for stacking a series of events. Unlike Independent mode which does everything all at once, Sequential mode processes one step at a time. Each step may do multiple things (activate its specified output several times), but the other outputs won't start until the current output completes.

The one twist to the sequential mode is when using the "Sync" feature discussed in section "6.11 - Sync". This lets certain outputs get a head-start. In that case only one event starts at a time, but the sync'ed output may run at the same time as a previous output.

Let's take a look at the timing diagram for Sequential mode using the exact same setup previously used for Independent mode:

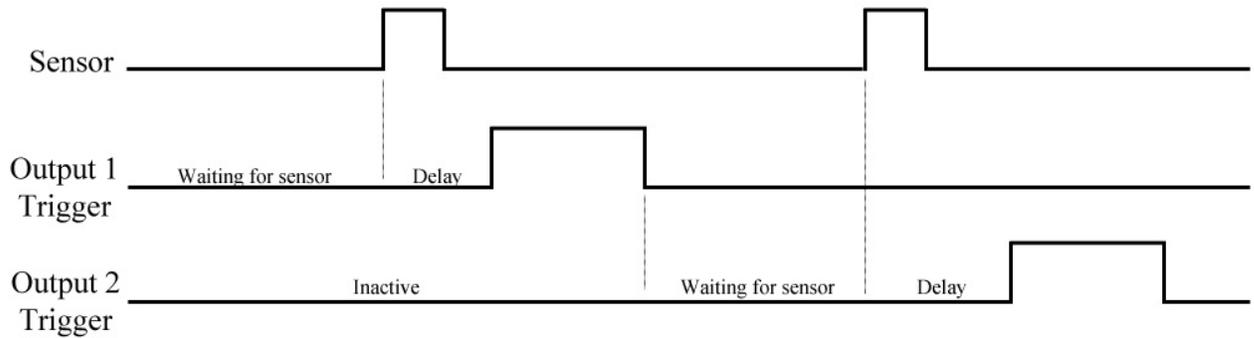


Figure 12 - Sequential timing diagram

See how “Output 2” is inactive? It is waiting for “Output 1” to complete before it becomes active. Once “Output 1” completes, the next sensor input will cause only “Output 2” to activate. The outputs are functioning sequentially, not simultaneously.

13.1.3 Dual-Sequential Mode

“Dual-Sequential” mode behaves similarly to “Sequential” mode. This is for the power users! In the “Advanced” tab there is a “Group” selection (discussed in section “6.5 - Group”). This allows you to set the outputs into two groups – “Group A” and “Group B”. All the outputs selected as “Group A” operate as one sequence, and all the outputs selected as “Group B” operate as the other. You could almost call it an independent sequential mode but that would be entirely too confusing. The two groups **do** operate independently of each other.

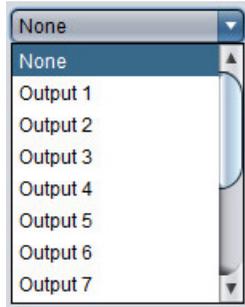
This mode would be like having two StopShot Studio’s operating in sequential mode.

The groups still operate numerically (the sequence runs from the lowest number to the highest). The groups don’t have to be together (meaning that outputs 1-6 are in “Group A”, and 7-12 in “Group B”). You can mix the outputs and groups any way you like – but that may just add to confusion. The “Group A” sequence will execute from lowest output number to the highest, and likewise for “Group B”.

Speaking of confusion – We did say this is for power users, right?

13.2 Sensor Power Disables

The two sensor inputs have a “Power Disable” feature:



These outputs in the pull-down menu correspond to the outputs in the “Advanced” tab. When that output starts (not when its output becomes activated but as soon as it starts) the power to that sensor will be turned off. Keep in mind the sensors will not function while they are disabled.

If you scroll down to the bottom of the listed outputs in the “Power Disable” pull-down you will see a selection called “All”. This means that if any output activates the sensor’s power will be turned off.

So now you may be wondering, “That’s great! I can turn off the sensor’s power. Why would I want to do that?!?” This is especially useful for beam sensors that use lasers. If the laser transmitter is being powered by the receiver, once StopShot Studio turns off the sensor power the lasers will go out. No laser light in your photograph! The “Power Disable” feature is typically used in global “Sequential” mode.

There are two “Power Disable” pull-downs, one for each sensor.

Below is a timing diagram for the “Power Disable” feature.

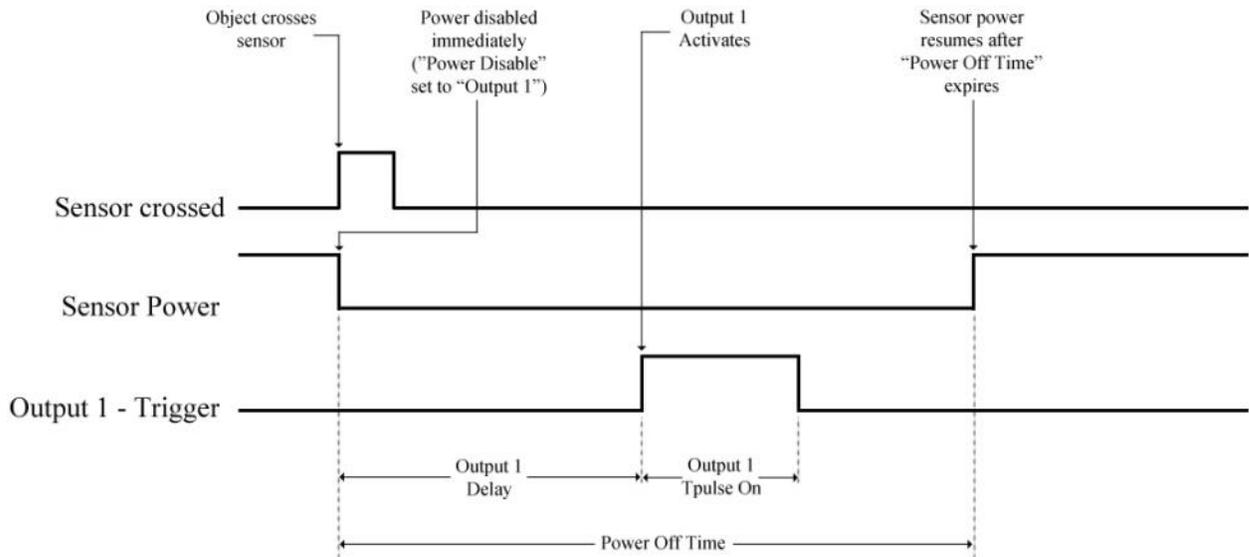


Figure 13 - Power Disable timing diagram

13.3 Sequential Timeout

“Sequential Timeout” is the maximum time a sequence is allowed to wait on a given input for something to happen. It 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 output in the sequence. **NOTE:** “Sequential Timeout” may cause some “curious” behavior which may appear as StopShot Studio 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 output (turning it off immediately).

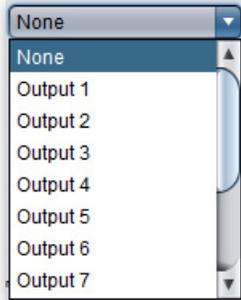
Setting “Sequential Timeout” to zero disables the timeout. This means the sequence would wait indefinitely to complete.

When a “Sequential Timeout” actually *does* timeout, all 12 LED’s will flash to indicate that the sequence did not complete. The outputs will not activate during this LED flashing. This is to indicate that a timeout condition occurred.

13.4 Sequential Loopback/Count

When using “Sequential” mode, you have the option to “loop back” or go back to an output once the sequence completes.

To enable this feature, simply select the output you would like to loop back to from the “Sequential Loopback” pull-down:



After selecting the desired output to loop back to then enter the “Sequential Loop Count”. This is the number of times that the sequence will loop back to the specified output. If this value is set to zero, StopShot Studio will loop indefinitely.

The sequence of all enabled outputs must complete once before the loopback becomes active.

To disable “Sequential Loopback”, select “None” as the loop back output.

13.5 Power Off Time

“Power Off Time” is the duration the sensor’s power will be turned off. See section “13.2 - Sensor Power Disables” for more information regarding sensor “power disable”.

The sensors will not function during this time.

13.6 Ballistics Multiplier

“Ballistics Multiplier” is a distance multiplier for when an output is configured for “Ballistics” (See section “6.1.10 - Ballistics” for setting an output for “Ballistics” mode). This multiplier determines when the flash(es) will fire after the last cross-beam sensor is crossed. If your sensors are spaced 12 inches apart and the multiplier is set to “2.0”, the flashes will fire 24 inches past the last sensor. The “Ballistics” tab helps simplify the settings – see section “7 - Ballistics” for additional details.

13.7 Sensor Gain

These two sliders adjust the sensitivity of the inputs:



“Sensor 1 Gain” also adjusts the gain of the Microphone input.

If using the microphone and the gain is set to minimum, it would take a louder noise to cause StopShot Studio to trigger (because the sensitivity is turned down). If the gain is set to maximum, then quieter noises will trigger an output. If ambient noise is triggering StopShot Studio then turn the gain down (toward “min”).

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 it is always best to keep the gain at the lowest setting while still reliably triggering. If the output is triggering when it shouldn't be try turning the gain down to correct this issue. You may see this if you have a sensor cable attached to the controller with no sensor plugged in and the gain turned all the way up.

13.8 Port / Auto-Connect / Auto-Write

“Port” displays the current communication/serial port that StopShot Studio is using to communicate with the controller.

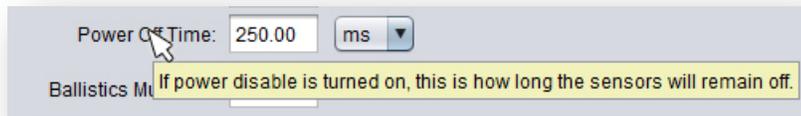
If the “Auto-Connect” checkbox is checked, StopShot Studio will scan all the available ports looking for a StopShot Studio controller. This is generally acceptable but if there are other serial devices connected to your computer it may cause undesirable effects until the software finds the controller. If you notice other serial devices behaving strangely then you can uncheck the “Auto-Connect” box. If this box is unchecked you will have to manually select the desired port from the “Port” pull-down menu.

If you do not see any “COM” ports (for windows) or “usbserial” ports (for OS X), see the section “18 - Troubleshooting”.

The “Auto-Write” checkbox determines if StopShot Studio automatically sends any settings changes to the controller. This would typically be checked. If it is not checked, you will have to click the “Write Settings” button to send the new settings to the controller.

13.9 Tool Tips

A “Tool tip” appears when the mouse pointer is over the text of a setting:



They are useful for getting a feel of what a setting does without having to open up the manual. If, however, you find them annoying and would rather not see them again, uncheck the “tooltips” box. They won’t be displayed the next time you load StopShot Studio.

13.10 Welcome Tab

The “Welcome Tab” shows up when you first start StopShot Studio. It has a few presets and several important links to our website. If you would rather not see this tab at startup you can uncheck the “Welcome Tab” box. The next time you start StopShot Studio, the “Welcome” tab will be gone and the “Advanced” tab will be displayed.

13.11 Configuration Comment

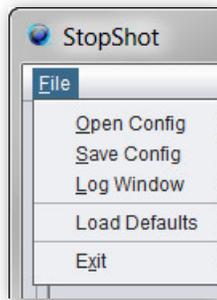
In this box you can enter a comment for the current settings you are using. This comment will be stored in the settings file when you save it. It can help you remember what your setup is, what you were trying to do, and other useful information like camera settings. The more information you enter here the less you have to remember down the road! See section “14 - File Menu” for saving configuration settings.

13.12 Controller Software Version

There are two software versions for StopShot Studio. There is the software on your computer and then the software on the controller. You can view the computer software version by going to Help->About. The controller software version is shown in this window. It includes the software name, version, and the date/time it was built.

14. File Menu

The “File” menu is in the upper-left corner of the StopShot Studio application.



Open Config:

This is how you open previously stored configurations. Navigate to where you stored your settings previously to open them.

Save Config:

Select this option to save the current settings to a file for later use. Note: You can only save configurations to “writable” directories. For most installations you won’t be able to store the settings in the same directory as the application. You should choose a location that you have write permissions, like the “Documents” directory.

Log Window:

The “Log Window” will bring up a small window showing information about your computer and any possible problems that StopShot Studio is having. This is useful for helping us to help you. Normally you wouldn’t need the log window open.

Load Defaults:

This is for when you know that you really *really* made a mess out of things. Nothing is working like you expected and you just don’t know what setting change you made that is giving you grief. By selecting “Load Defaults” all your current settings will be lost and loaded with the stock settings.

You can also load the defaults on the controller itself. With the controller off, hold down the “Start” button on the controller. While continuing to hold down the “Start” button, press and release the “Power” button. Once the LED’s have cycled, you can release the “Start” button.

Exit:

This will exit the StopShot Studio application.

15. Wiring External Devices

One of the design goals of StopShot Studio 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. Virtually all StopShot Studio 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 Studio 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 Studio module. Use of other power adapters may damage the module and/or sensors.

15.1 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 2.2k Ω pull-up to 4.5 volts internally in the controller 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 14 below for a connection diagram.

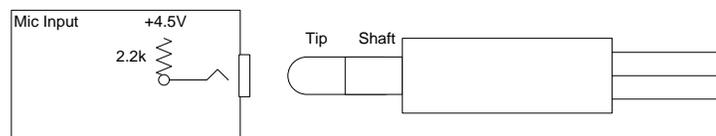


Figure 14 - Microphone Connection

The sensor inputs 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 15 below for a connection diagram.

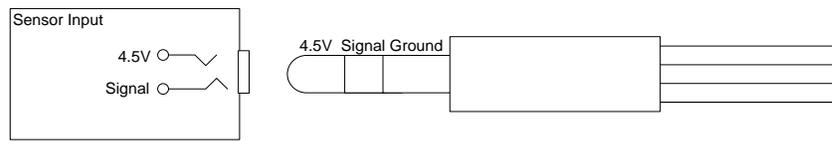


Figure 15 - Sensor Connection

15.2 Outputs

All the 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 Studio 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 16 below for a wiring diagram for the RCA connectors.

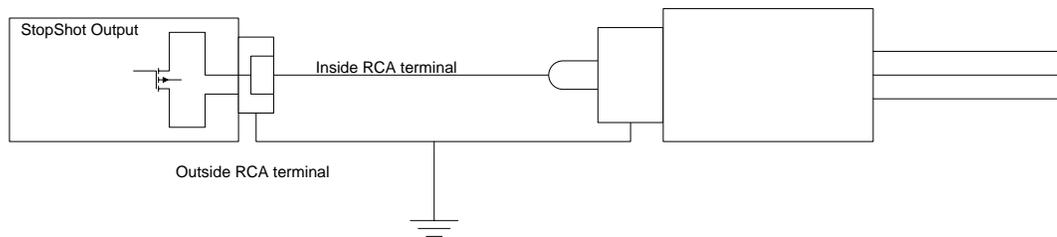


Figure 16 - RCA connector

⚠ 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 Studio 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.

15.3 Activating Relays

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

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

See Figure 17 below as an example of wiring StopShot Studio to control a 12V DC relay.

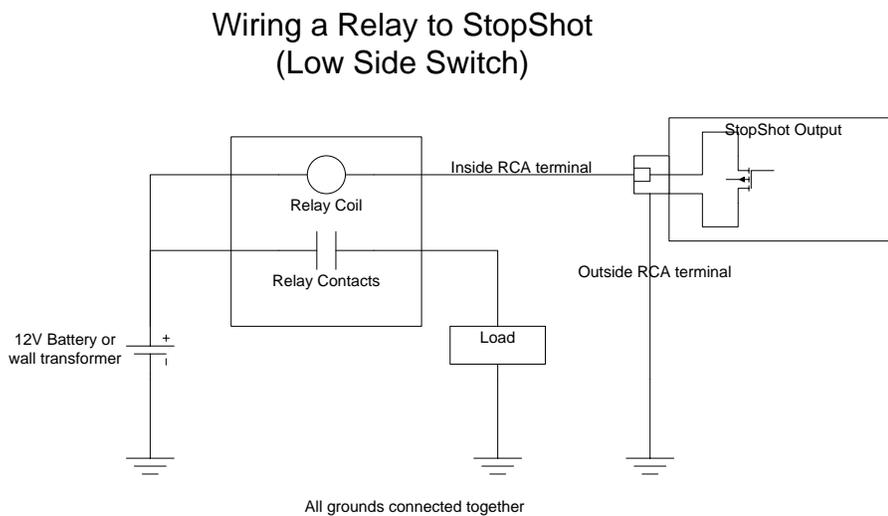


Figure 17 - Wiring an external relay

15.4 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 Studio. 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 18 - Cross-beam connections. No damage can be done to the StopShot Studio controller or any sensor by connecting them incorrectly. Receiver B can also be connected directly to StopShot Studio if a simple beam sensor is desired.



Receiver A LED Key

- Off - Sensor A and B are out of alignment
- Orange - Both Sensor A and B are aligned
- Green - Sensor A is aligned - B needs alignment
- Red - Sensor B is aligned - A needs alignment

The Cross Beam connection diagram pictures the IR transmitters. The laser transmitter wiring is identical. If using lasers transmitters replace the sensor shades with the laser filter/diffuser.

The base of transmitters and receivers can be unscrewed from the sensor body and be replaced with tripod mounts (shown below).

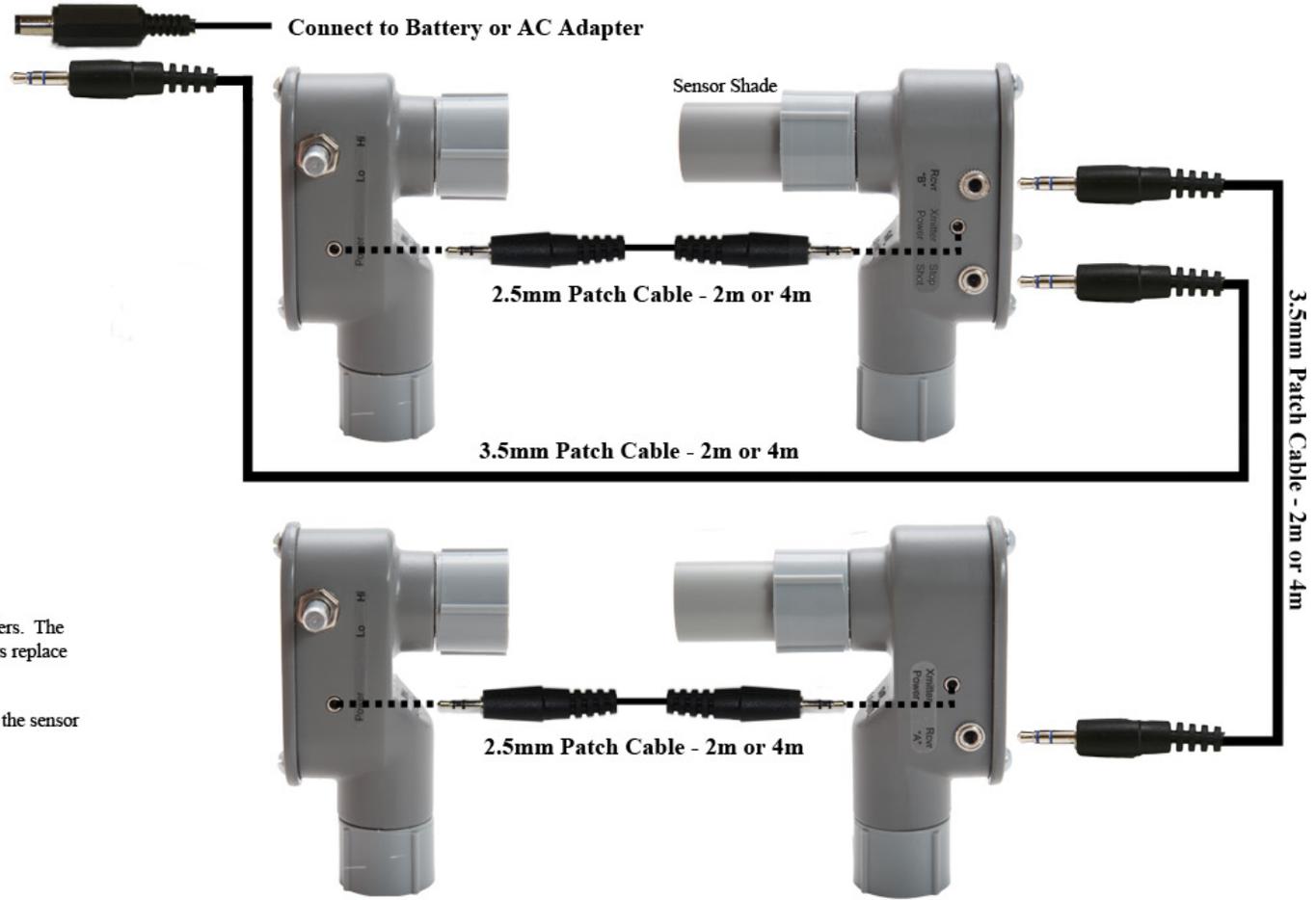


Figure 18 - Cross-beam connections

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 19) over the both receivers. The diffuser will allow much easier alignment of the laser beams and also includes a band-pass filter to eliminate non-laser light from reaching the detector. 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 19 - 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.

16. Setup Examples

16.1 The StopShot Studio 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 Studio water drop kit comes in. Here is the equipment that is included in the kit:

- StopShot Studio Controller
- AC Adapter (US, EU, UK, or AUS)
- 3 – High precision water valves
- 3 – Marriotte siphons
- 3 – Siphon extensions
- 3 – Water valve mounting brackets
- 2 – PC sync flash cables
- USB cable
- Power supply for three water valves
- Triple RCA cable
- Mini-beam sensor

16.1.1 Mounting frame

The siphons and valves will need a mounting frame constructed. The frame is not included in the water drop kit since the photographic requirements change from person to person. Below are some guidelines for the placement of the equipment and frame dimensions. These are also available online [here](#).

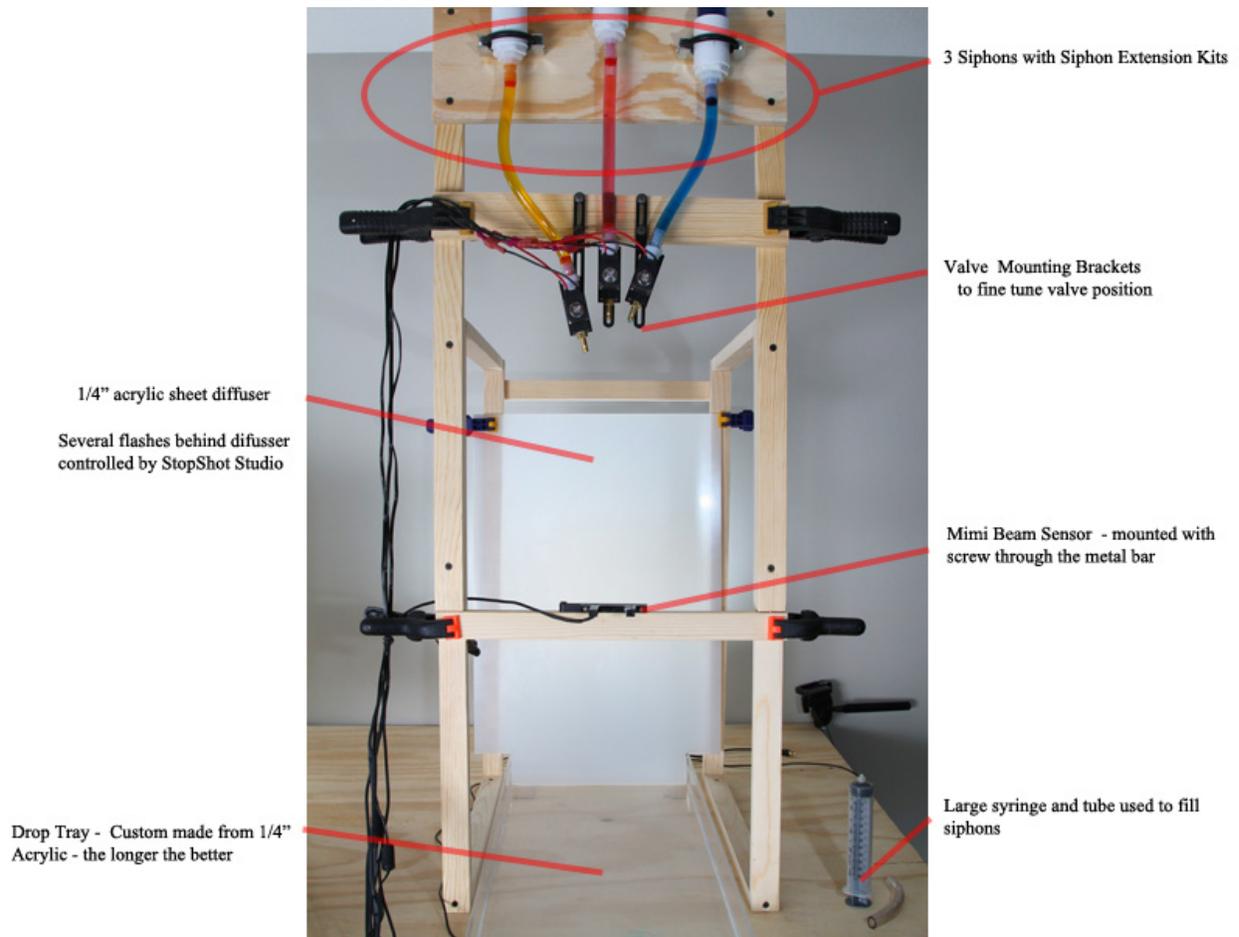


Figure 20 - Mounting Frame

Here is the cut list for the pieces you will need to build the fixture. The 3 valve fixture pictured above is made from standard 1x lumber, except the Siphon support which was made from 3/4" Plywood.

Here are the dimensions of the frame:

Legs (x4) - 3/4" x 1 1/4" x 27"

Horizontal Supports (x4) - 3/4" x 1 1/4" x 18 1/2"

Cross Braces (x2) - 3/4" x 1 1/4" x 16"

WV Uprights (x2) - 3/4" x 1 1/4" x 27 1/2"

WV Support (x1) - 3/4" x 2" x 16"

Siphon Support (x1) - 3/4" x 6" x 16"

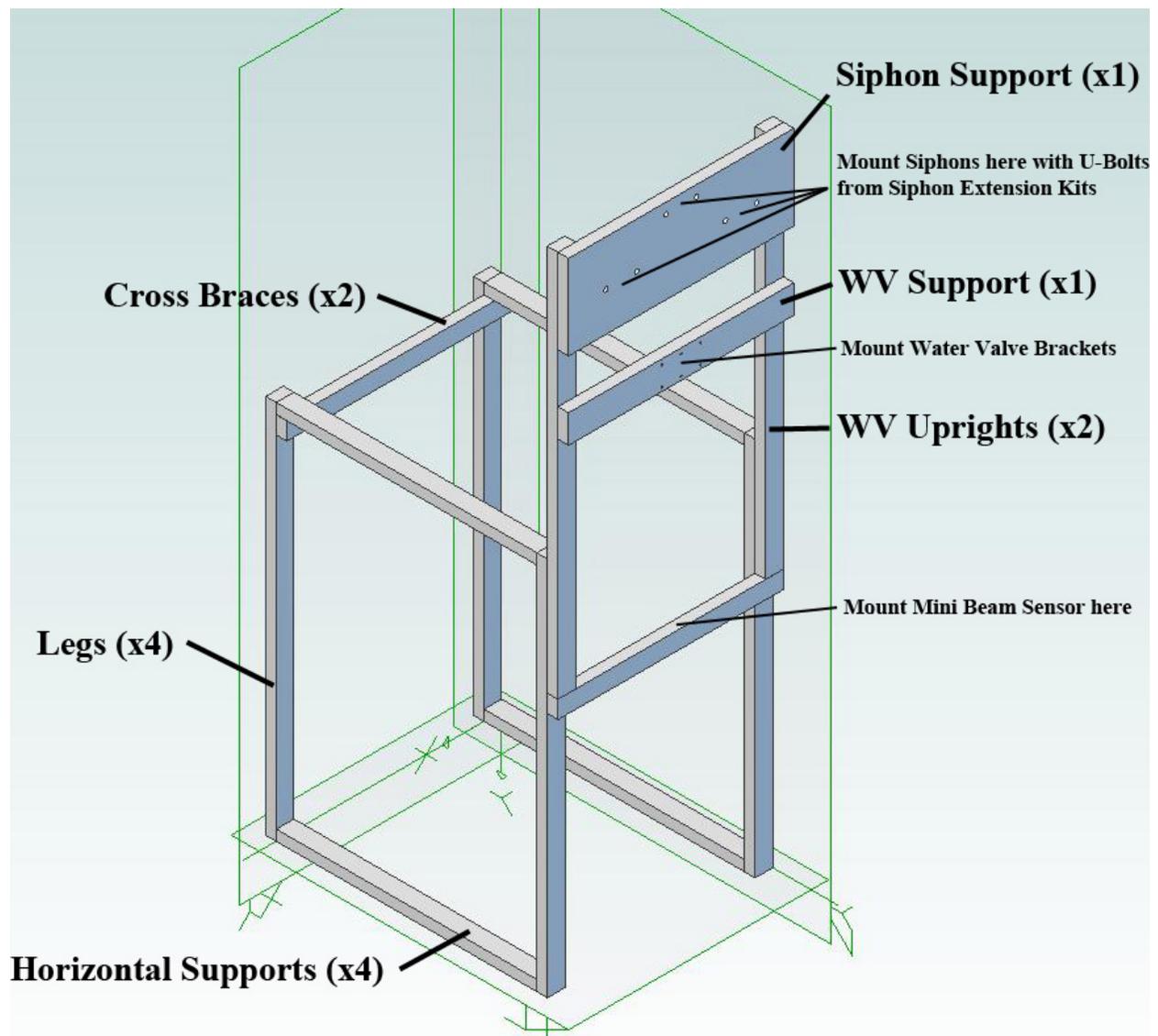


Figure 21 - Frame Parts

After construction screw the entire fixture to the working table as it is **very front heavy**. If you don't want to screw it down then you will want to make the base pieces extend past the front of the fixture to prevent it from tipping forward. Also see how in "Figure 20 - Mounting Frame" how the cross-support for the sensor and the water valve support are not screwed into the frame. They are simply held in place using a clamp. This allows adjustment if necessary.

Here is a close-up of the water valves after being mounted:

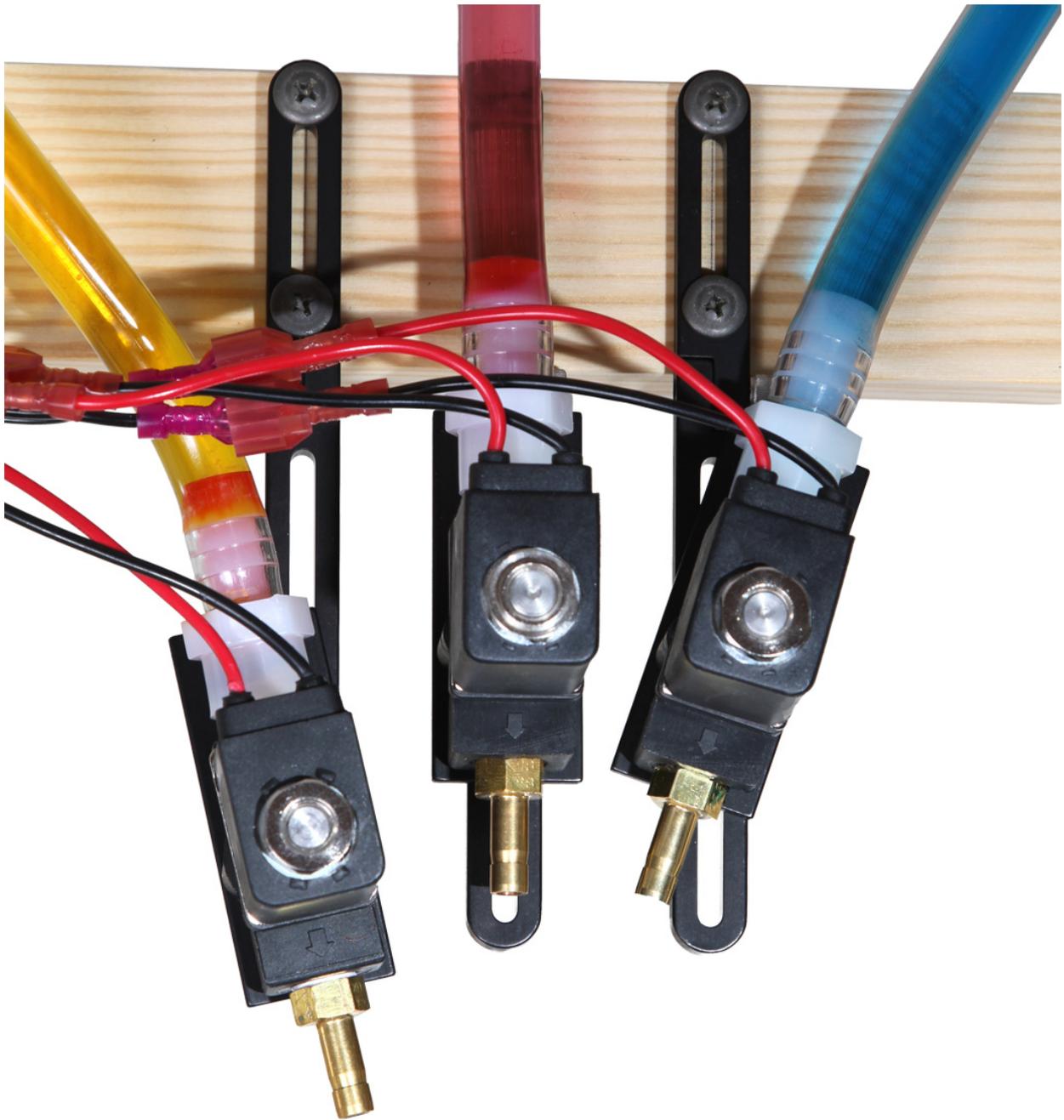


Figure 22 - Water valve mounting

Note how the two outer valves are pointed slightly inward. This slight adjustment will allow the drops to collide by the time they reach the dripping pan.

16.1.2 Dripping pan

The dripping pan in the above setup photographs is 12" x 32" x 1 1/2". It is constructed from 1/4" thick Plexiglas sealed with silicone. The longer the dripping container the better. The long dimension (32") makes it easier to keep the pan edges out of the photographs. You will notice the back of the frame allows the tray to slide right on through. You may be able to find a suitable dripping pan locally.

16.1.3 Connection Diagram (3-valve kit)

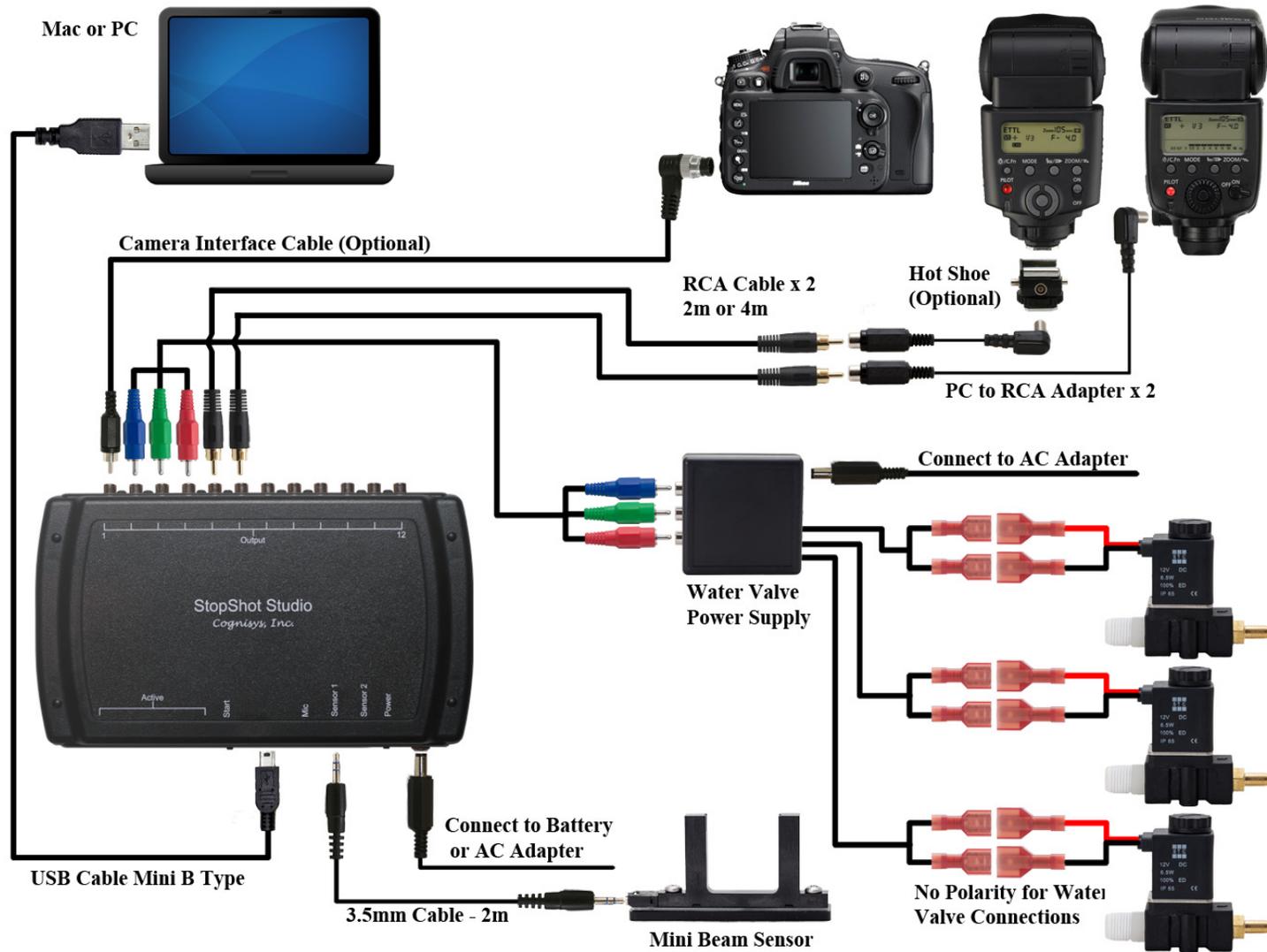


Figure 23 - 3-Valve connection diagram

16.1.4 Water Valve / Siphon assembly

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

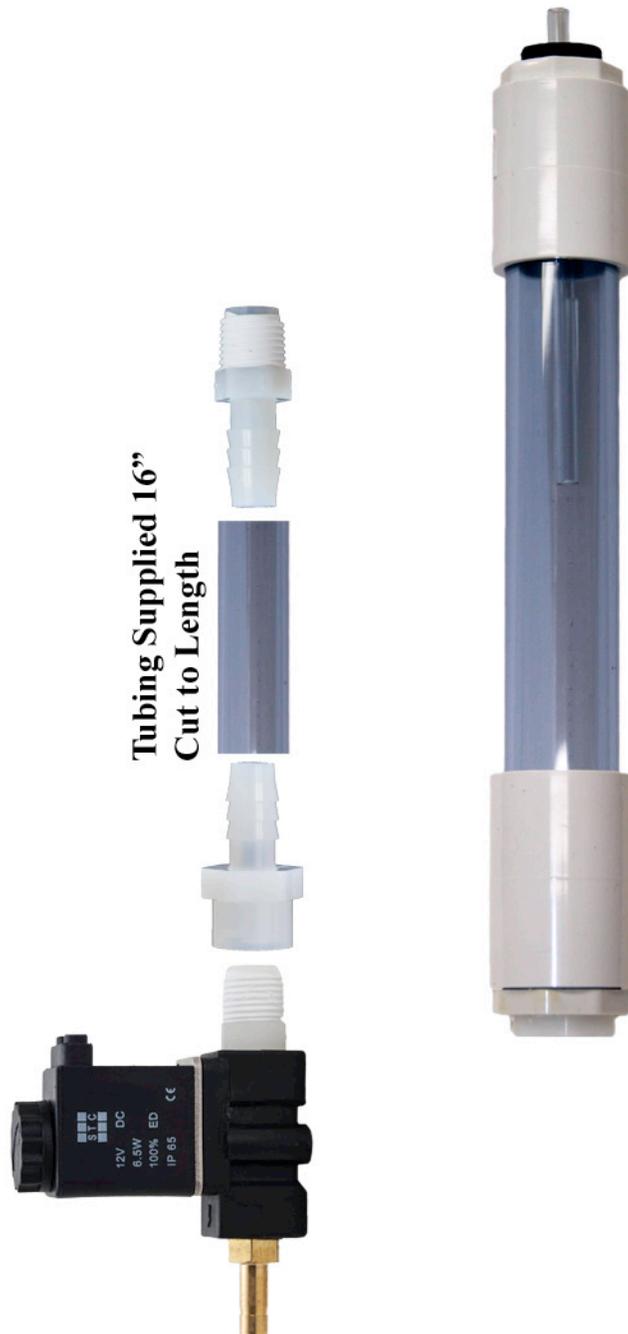


Figure 24 - Valve / Siphon assembly

1. Thread one barbed fitting onto the water valve.
2. Thread the other barbed fitting into the Mariotte Siphon.
3. Push on the clear tubing between the water valve and the siphon.
4. Be sure the siphon is plumb (vertical) when mounting it to the frame.
5. 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.
6. Insert the siphon top.

16.1.5 Configure StopShot Studio

We highly recommend you do not connect the camera when first getting started. Automating the firing of the camera is possible but it makes the configuration more complex. We recommend people start out by shooting in a dimly lit room with StopShot Studio firing the flash. There is no need to be in complete darkness – A 60W bulb underneath the table won't affect the final result. 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.

StopShot has presets saved off as configurations to simplify the water-drop capture process. To take advantage of these settings, refer to sections “4 - Welcome Tab” and “14 - File Menu” 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 Studio. All the settings will be on the “Water Drop” tab, discussed in section “5 - Water Drops Tab”.

If you want to configure StopShot Studio step by step, the instructions follow below.

Step 1: The Water Drop

The first step is getting consistent pictures of single water drop from a single valve. 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.

To activate the water valve you need to press the “Start” button. You may need to press it a few times to work out any air in the valve (or use the “Purge” feature discussed in section “5.7 - The Outputs”. Each time you press the “Start” button you will hear a click and you should get a drop released from the valve. If you press “Start” 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 “Start” then the “*Valve opens for*” time is too short – the valve needs to be open a bit longer. Increase the “*Valve opens for*” 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 “Start” press you get exactly one drop, no more, no less. You can adjust the size of the water-drops by increasing or decreasing the “*Valve opens for*” setting – just be sure you don't adjust it so far that you don't get one drop consistently.

Step 2: The flash Timing

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).

For the above mentioned distances a good starting point would be around 300ms for the "*Flash delay*" setting.

Now press the "Start" button. If the drop was detected by the mini beam sensor the flash will activate. If this is the case everything is aligned and you are in good shape. If the drop was not detected by the mini beam sensor your flash will not go off -- at this point we need to make some adjustments in the setup. 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/adjust 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 (Flash into "Output 2", the sensor into "Sensor 1"). 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 "Start" button that a drop of water comes out and the flash fires reliably. Adjusting the "*Flash delay*" 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 "Start" 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. Using the “Number of drops” pull-down, change it to “2”. The trickery comes into play with adjusting “*Time until next drop*”. 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 “*Flash delay*” to fine tune your setup and get that drop collision photo you are after.

Step 5: Synchronizing the camera (Optional)

For synchronizing the camera, you will need to check the “Camera control” check-box. You should wait on doing this until you’ve patted yourself on the back for successfully completing steps 1-5. There are a few more settings required and they are discussed in section “5.5 - Camera Control”.

16.2 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 25 - 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.

17. **Animated Time-Lapse movies**

By using the “Time Lapse” tab (See section “8 - Time Lapse”) 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. We highly recommend LRTimeLapse.

We have a how-to page as well [here](#).

18. Troubleshooting

Problem	Cause	Solution
Can't communicate	Power not turned on	Press the power button. The power LED next to the power jack should light up.
	USB cable not attached	Plug in USB cable
	Plugged into a USB 3.0 port	Some computers do not handle USB 2.0 devices properly in a USB 3.0 port. If you have a USB 2.0 port use that instead.
	USB hub used	Do not use a USB hub. Try and plug the controller directly into your computer
	Driver software not installed	Follow the driver installation directions in section "2.1 - Installing the software"
	Other program is using the serial port	Don't run other programs that may open up serial ports such as the one used to communicate with the controller.
	Power LED is not lit.	Power cord is not inserted properly into the power jack.
	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 Studio module: 12VDC 1amp
Output LED's are constantly on or flashing.	The wrong timer mode is selected.	Please verify that the outputs are being used correctly. If you need to reset the settings to the factory default, see the section "14 - File Menu".
	The gain is set too high.	If the output is using the input trigger, slide the gain slider to "min" on the "Global Config" tab.
Camera or flash does not	Equipment in sleep mode.	Ensure equipment is in ready

trigger		mode.
Computer locks up	Removing USB while program is running	Some operating systems (OS X) do not play nice with removing active USB devices. Close the StopShot Studio application prior to removing the USB connection or allowing the computer to go to sleep.
Connected flickers from green to red	Intermittent communication	This has been noticed on Mac computers after the computer has gone to sleep with the USB port opened. Either unplug the USB port prior to going to sleep or prevent the computer going to sleep while using StopShot Studio.
Program doesn't load after clicking on it	Java is not installed on your computer	Go to http://java.com/download And download the latest version of Java.

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

19. 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	12	14	Vdc
Input Current - No Sensors Connected (12Vdc 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
Crystal Tolerance @ 25C		± 10		PPM
Operating Temperature	-20	25	50	C

- Fully programmable 12 channel intervalometer.
- Powered by a high-speed ARM Processor
- All outputs are open drain (Can be used for Flash Trigger or Shutter Trigger).
- Microphone Input for standard electret microphone.
- Input sensor jacks 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 to use graphical computer interface.
- Adjustable gain for microphone and sensor inputs.
- Standard 3.5mm microphone jack.
- RCA output cables (easy and affordable to extend).

20. Warranty

Limited Warranty

The StopShot Studio computer software is provided by Cognisys, Inc. "as is" and "with all faults." Cognisys, Inc. makes no representations or warranties of any kind concerning the safety, suitability, lack of viruses, inaccuracies, typographical errors, or other harmful components of StopShot Studio. There are inherent dangers in the use of any software, and you are solely responsible for determining whether StopShot Studio is compatible with your equipment and other software installed on your equipment. You are also solely responsible for the protection of your equipment and backup of your data, and Cognisys, Inc. will not be liable for any damages you may suffer in connection with using, modifying, or distributing StopShot Studio.

All electronic 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.

21. Glossary

Term	Description
# Pulses	Number of output pulses that a trigger output will generate.
Ballistics	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 Studio will ignore the input. This may be useful to ignore second drops, transients, or flashes.
Distance Multiplier	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.
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).
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.
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 the checkbox is checked, the delay will start when the output of the previous trigger goes high. StopShot Studio typically starts the next trigger when the output goes low (Sync mode unchecked).
Timeout	The time an input mode will wait for a specific event.
Toff	The time off between output pulses.
Output	This is what you attach the equipment to. StopShot Studio controls these outputs to do various tasks.
us	Abbreviation for microseconds. A millionth of a second.
X-Beam	Short for “cross-beam”. Two beams are set in an X formation that allows for pin-point detection. StopShot Studio’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 Studio will fire when only the “A” sensor is crossed.

XBS A&B	Cross-beam sensors A and B. StopShot Studio will fire only when both sensors are crossed simultaneously.
XBS A B	Cross-beam sensors A or B. StopShot Studio will fire when either A or B are crossed.
XBS A->B	Cross-beam sensor A followed by B. StopShot Studio 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 Studio will fire when only the "B" sensor is crossed.
XBS B->A	Cross-beam sensor B followed by A. StopShot Studio 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.

22. Revision History

Revision	Date	Change
1.0	06/20/13	Initial Release