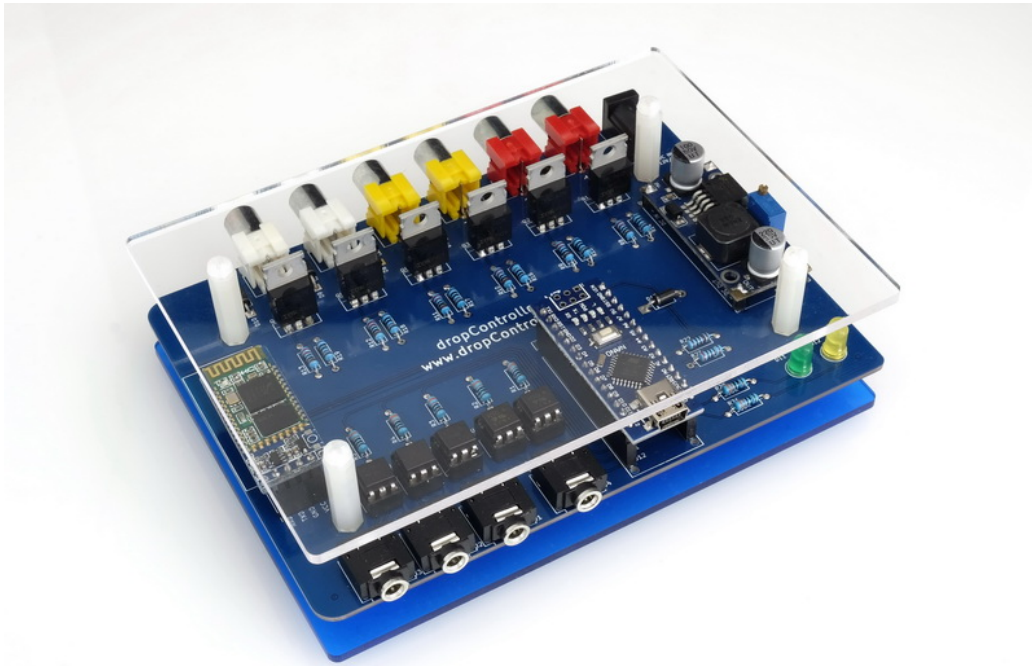


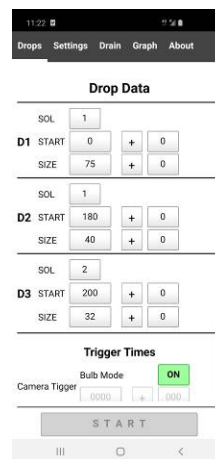
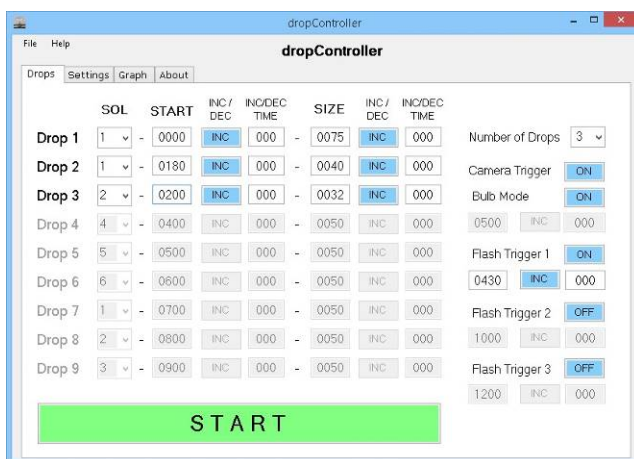
dropController V3



The dropController is a solenoid valve controller used for water drop photography. It is available DIY, as a kit or as a fully assembled device.

Full details for building your own device can be found at www.dropcontroller.com

Control is performed from either a Windows program over USB or an Android app over Bluetooth.



This manual uses images from the Windows program but the Android app has the same functions.

Contents

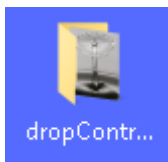
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Getting Started

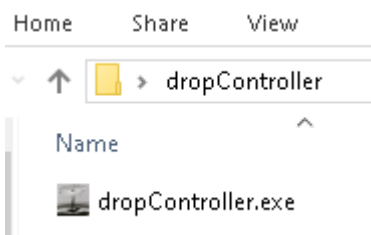
This guide covers connecting and using the dropController device only. It presumes you have a dropController already set up with the firmware installed. If you have not, check out the website.

Get the App

If you haven't already done so, download the latest Windows app. Go to <https://www.dropcontroller.com/downloads/> and scroll down to the **Windows Program** section. Click the link for the latest version to start the download. The download is a zip file containing a folder.

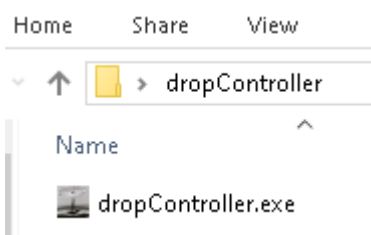


After downloading, unpack the zip archive and place the folder somewhere convenient. Mine is on the desktop. There is no need to install the program; it is run from the folder.

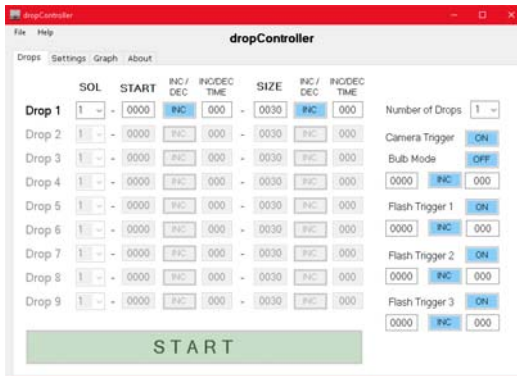


Open the folder and you should see the actual program.

Starting the Windows App for the First Time

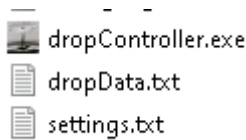


Double click the dropController file to start it.



The program will start and you should see the main Drop Data screen.

When the Windows app runs for the first time it creates 2 text files; dropData.txt and settings.txt.

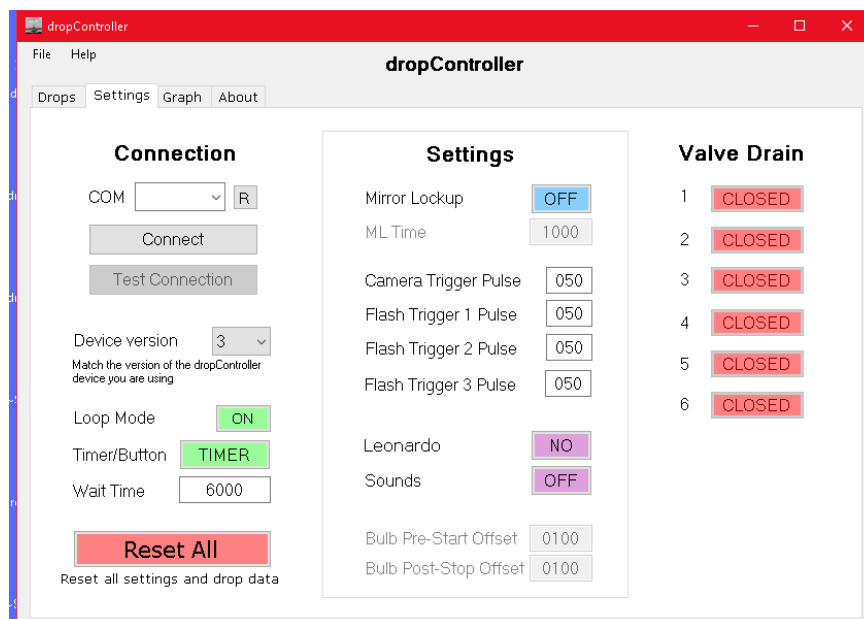


These files hold the apps settings and on start the app will load the settings from the previous session if they are available.

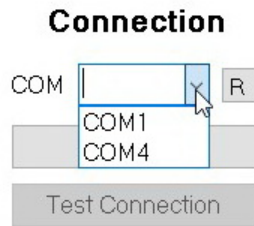
Connect the Windows App to the dropController

Power the dropController and connect it to a computer. No need to connect valves or flashes at this time. The yellow LED should be blinking. This indicates it is on but not connected to the app.

In the app, jump to the Settings tab.



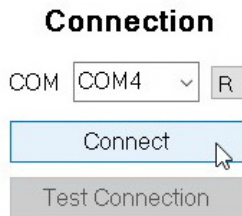
At the top left you can see the connection controls.



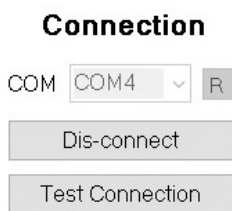
To connect, in the drop down menu select the COM port the dropController is connected to.

In my case it is on COM 4.

The R button refreshes the list of COM ports



click Connect



After the app connects the Connect button will say Dis-connect.



If the app cannot connect it will give you an error message. Just try again.

If you go back to the Drops tab, the large START button should now be green.



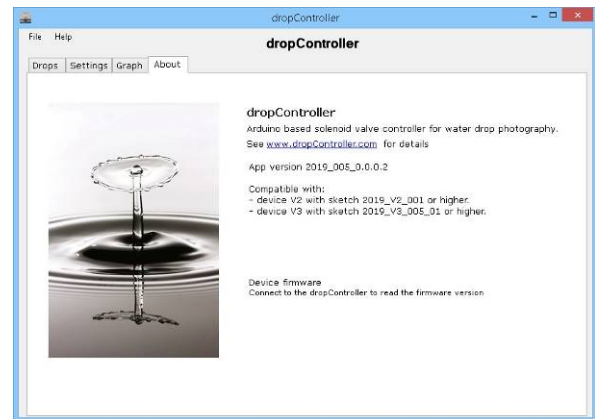
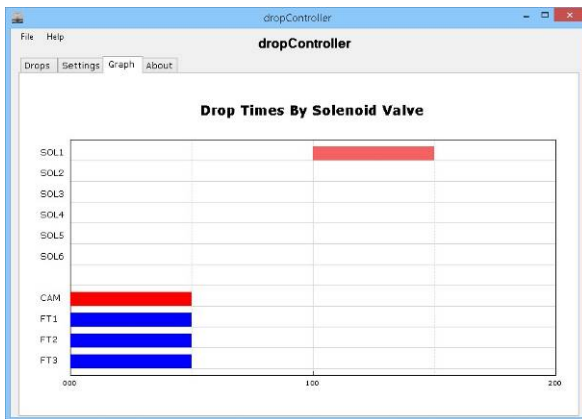
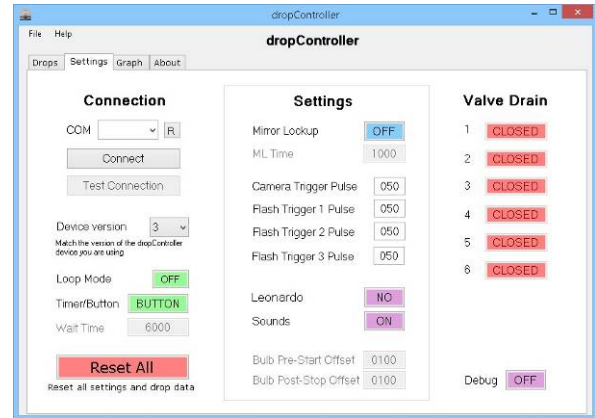
On the dropController, the yellow LED should be on (not blinking).



You are now connected and ready to start.

The Four Tabs

The dropController app has 4 Tabs; Drops, Settings, Graph, and About.



The **Drops** tab is where you set the drop times and sizes. The drops page also has the controls for the camera trigger and flash triggers.

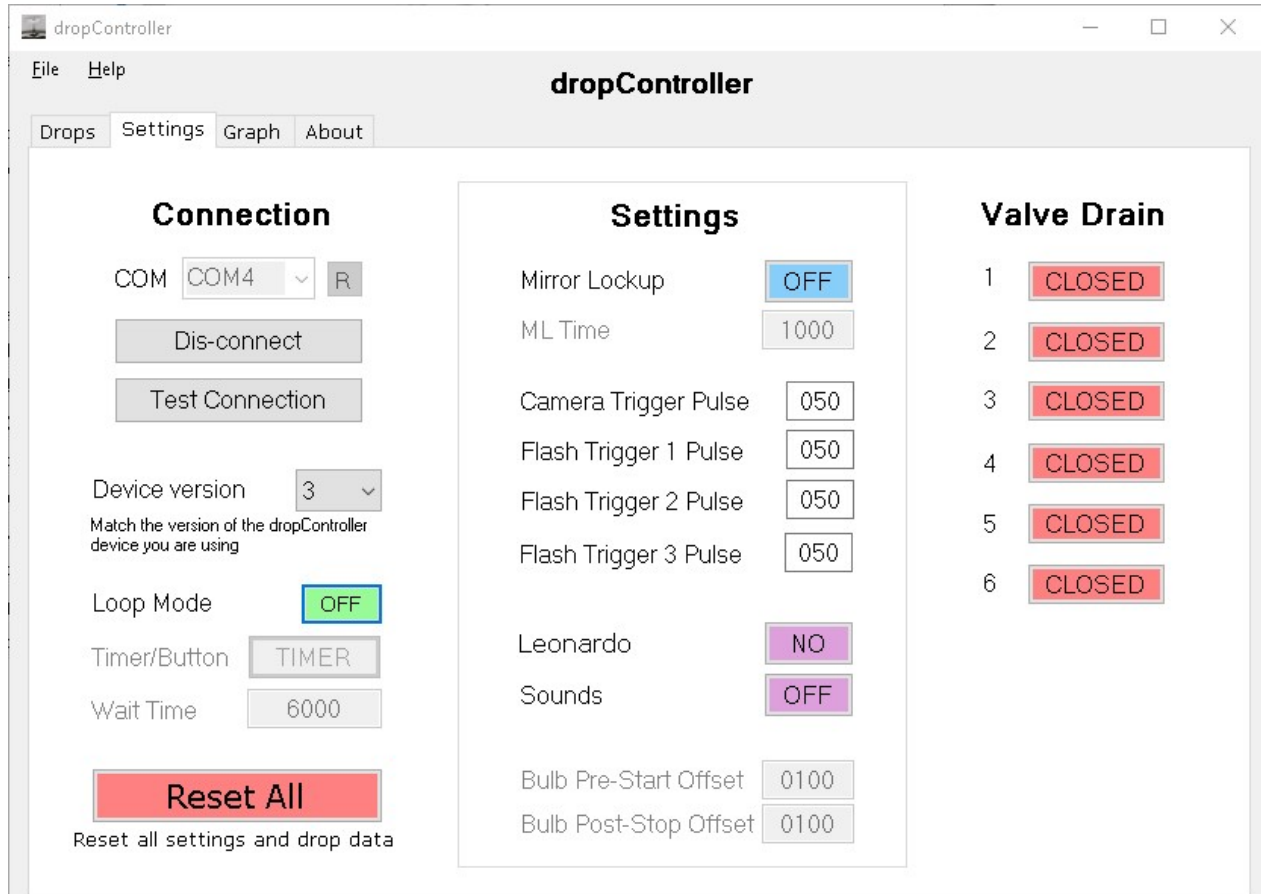
The **Settings** tab contains the general settings (things that normally only need doing once), the connection controls, and the valve drain controls.

The **Graph** tab shows a chart of the drop settings. This helps visualize the drop sequence.

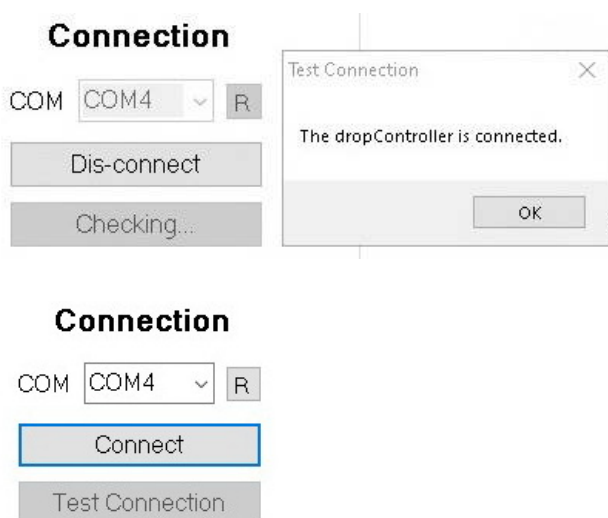
The **About** tab gives basic information about the app version and, after connection is made, the dropController firmware version.

Settings

I'll start with the Settings Tab simply because there are certain things that need to be set before starting with drops.



Connecting to the dropController device has already been covered. In addition to making a connection you can dis-connect and test the connection.



Clicking the Test Connection button checks to see if the dropController is still connected.

This is a debugging function which I left active because it can be useful.

Clicking Dis-Connect breaks the connection to the dropController. After dis-connecting, the yellow LED on the dropController device returns to blinking.

The Settings on the Settings tab.

Settings	
Mirror Lockup	<input type="button" value="OFF"/>
ML Time	<input type="text" value="1000"/>
Camera Trigger Pulse	<input type="text" value="050"/>
Flash Trigger 1 Pulse	<input type="text" value="050"/>
Flash Trigger 2 Pulse	<input type="text" value="050"/>
Flash Trigger 3 Pulse	<input type="text" value="050"/>
Leonardo	<input type="button" value="NO"/>
Sounds	<input type="button" value="OFF"/>
Bulb Pre-Start Offset	<input type="text" value="0100"/>
Bulb Post-Stop Offset	<input type="text" value="0100"/>

Mirror Lockup OFF/ON

Trigger Pulse times.
Times are in milliseconds.

Leonardo NO/YES
Sound OFF/ON

Mirror Lockup

Mirror Lockup is the action of flipping the mirror inside a camera up out of the way. Mirror Lockup may or may not be available on your camera, check the user manual. If you have a mirrorless camera you probably don't have mirror lock up ; -)

On a regular DSLR/SLR there is a small mirror between the lens and the sensor/film that directs the image to the view finder. When the shutter button is pressed the mirror flips up out of the way, the shutter is opened, the photo is taken, and then the mirror drops back down. The mirror moving up can cause minor vibrations. Mirror lock up allows the mirror to be moved and the vibrations to stop before the shutter is opened.

Most cameras require 2 shutter button presses for mirror lock up; the first to activate mirror lock up, the second to take the photo.

Mirror Lockup	<input type="button" value="ON"/>
ML Time	<input type="text" value="1000"/>

When Mirror Lockup is ON, a pre-shutter release signal is sent to the camera. This is the signal to move the mirror. The delay is the time in milliseconds to wait until the shutter trigger signal is sent. 1000ms (1 second) is a good time to wait.

Mirror Lockup must be activated on your camera. If it is not the camera will take the Mirror Lockup signal as a shutter release signal and take a photo.

Trigger Pulse Times

The trigger Pulse Times are the times the trigger signal is active. It is not the time the trigger is performed.

Camera Trigger Pulse	<input type="text" value="050"/>	These are not the times the signals are triggered but how long the trigger signal is on. Times are in milliseconds and 50ms is a good default time. Leave them at 50ms unless you have issues.
Flash Trigger 1 Pulse	<input type="text" value="050"/>	
Flash Trigger 2 Pulse	<input type="text" value="050"/>	
Flash Trigger 3 Pulse	<input type="text" value="050"/>	

Leonardo

The Leonardo OFF/ON settings is for DIY dropControllers that use non ATmega 328P Arduinos.

I recommend using an ATMEGA328P based Arduino such as the Nano but other types of Arduino can be used. Some though, require slightly different controls. For example, the Arduino Leonardo requires additional commands for serial communication to work. This control turns on the additional commands.

Sounds

Turn annoying sounds on and off

Device Version

The dropController App can be used with version 2 and version 3 of the dropController device.

Device version

Match the version of the dropController device you are using

Select the device version you have.

When using the app with a version 2 dropController certain functions and controls are not available.

The dropController V2 device is no longer being developed. Bugs are still being fixed when required.

Valve Drain

The Valve Drain controls allow you to open and close any of the solenoid valves. This is handy when you want to empty the reservoirs/bottles and for cleaning.

Valve Drain	Valve Drain
1 <input type="button" value="CLOSED"/>	1 <input type="button" value="OPEN"/>
2 <input type="button" value="CLOSED"/>	2 <input type="button" value="CLOSED"/>
3 <input type="button" value="CLOSED"/>	3 <input type="button" value="CLOSED"/>
4 <input type="button" value="CLOSED"/>	4 <input type="button" value="CLOSED"/>
5 <input type="button" value="CLOSED"/>	5 <input type="button" value="CLOSED"/>
6 <input type="button" value="CLOSED"/>	6 <input type="button" value="CLOSED"/>

Click a button to open the valve. Click again to close it.

Loop Mode

Loop Mode is explained in the Drops Tab section later.

Loop Mode

Timer/Button

Wait Time

Reset All

Reset All resets the settings and drop data. It's like a return to factory default setting.

Reset all settings and drop data

Drops Tab

Here is where all the action takes place, where the times for the drops are entered, where the camera trigger time is set, and where the flash triggers are controlled.

	SOL	START	INC / DEC	INC/DEC TIME	SIZE	INC / DEC	INC/DEC TIME
Drop 1	1 ▾	- 0000	INC	000	- 0030	INC	000
Drop 2	1 ▾	- 0000	INC	000	- 0030	INC	000
Drop 3	1 ▾	- 0000	INC	000	- 0030	INC	000
Drop 4	1 ▾	- 0000	INC	000	- 0030	INC	000
Drop 5	1 ▾	- 0000	INC	000	- 0030	INC	000
Drop 6	1 ▾	- 0000	INC	000	- 0030	INC	000
Drop 7	1 ▾	- 0000	INC	000	- 0030	INC	000
Drop 8	1 ▾	- 0000	INC	000	- 0030	INC	000
Drop 9	1 ▾	- 0000	INC	000	- 0030	INC	000

START

Number of Drops: 1 ▾
 Camera Trigger: ON
 Bulb Mode: OFF
 0000 INC 000
 Flash Trigger 1: ON
 0000 INC 000
 Flash Trigger 2: ON
 0000 INC 000
 Flash Trigger 3: ON
 0000 INC 000

There are three sections; the drop data settings + number of drops, the START button, and the trigger settings.

Drop Data Settings

	SOL	START	INC / DEC	INC/DEC TIME	SIZE	INC / DEC	INC/DEC TIME	
Drop 1	1 ▾	- 0000	INC	000	- 0030	INC	000	Number of Drops 1 ▾
Drop 2	1 ▾	- 0000	INC	000	- 0030	INC	000	
Drop 3	1 ▾	- 0000	INC	000	- 0030	INC	000	
Drop 4	1 ▾	- 0000	INC	000	- 0030	INC	000	
Drop 5	1 ▾	- 0000	INC	000	- 0030	INC	000	
Drop 6	1 ▾	- 0000	INC	000	- 0030	INC	000	
Drop 7	1 ▾	- 0000	INC	000	- 0030	INC	000	
Drop 8	1 ▾	- 0000	INC	000	- 0030	INC	000	
Drop 9	1 ▾	- 0000	INC	000	- 0030	INC	000	

Each drop has several properties:

SOL	The solenoid valve (from 1 to 6). The number relates to the valve connection port on the dropController.
START	The drop start time in milliseconds.
INC/DEC	Increase or decrease the start time (used in Loop Mode only). When using Loop Mode you can increase or decrease the drop start time on each iteration of the loop.
INC/DEC Time	How much time (in milliseconds) to either increase to decrease the drop start time. 000 if off.
SIZE	This is the amount of time (in milliseconds) the valve is open.
INC/DEC	Increase or decrease the size. Loop Mode only
INC/DEC Time	The amount of time (in milliseconds) to increase or decrease the drop size on each iteration of the loop. Loop Mode only. 000 is off

Number of Drops

Number of Drops 1 ▼

Camera Trigger 2 ▼

Bulb Mode 3 ▼

0000 INC 4 ▼

Flash Trigger 1 5 ▼

0000 INC 6 ▼

7 ▼

8 ▼

9 ▼

You can select from 1 to 9 drops.

After selecting the number of drops the controls for those drops become active.

File Help

dropController

Drops Settings Graph About

	SOL	START	INC / DEC	INC/DEC TIME	SIZE	INC / DEC	INC/DEC TIME
Drop 1	1	- 0000	INC	000	- 0030	INC	000
Drop 2	1	- 0000	INC	000	- 0030	INC	000
Drop 3	1	- 0000	INC	000	- 0030	INC	000
Drop 4	1	- 0000	INC	000	- 0030	INC	000
Drop 5	1	- 0000	INC	000	- 0030	INC	000
Drop 6	1	- 0000	INC	000	- 0030	INC	000
Drop 7	1	- 0000	INC	000	- 0030	INC	000
Drop 8	1	- 0000	INC	000	- 0030	INC	000
Drop 9	1	- 0000	INC	000	- 0030	INC	000

Number of Drops 2 ▼

Camera Trigger ON

Bulb Mode OFF

0000 INC 000

Flash Trigger 1 ON

0000 INC 000

Flash Trigger 2 ON

0000 INC 000

Flash Trigger 3 ON

0000 INC 000

START

After changing the Number of Drops to 2, the first 2 rows become active.

Triggers

Camera Trigger	<input type="button" value="ON"/>	Camera trigger
Bulb Mode	<input type="button" value="OFF"/>	
<input type="text" value="0000"/>	<input type="button" value="INC"/>	<input type="text" value="000"/>
Flash Trigger 1	<input type="button" value="ON"/>	Flash 1 trigger
<input type="text" value="0000"/>	<input type="button" value="INC"/>	<input type="text" value="000"/>
Flash Trigger 2	<input type="button" value="ON"/>	Flash 2 trigger
<input type="text" value="0000"/>	<input type="button" value="INC"/>	<input type="text" value="000"/>
Flash Trigger 3	<input type="button" value="ON"/>	Flash 3 trigger
<input type="text" value="0000"/>	<input type="button" value="INC"/>	<input type="text" value="000"/>

Camera Trigger

Two different modes can be used; shutter or bulb.

Camera Trigger	<input type="button" value="ON"/>	
Bulb Mode	<input type="button" value="OFF"/>	
<input type="text" value="0000"/>	<input type="button" value="INC"/>	<input type="text" value="000"/>

The camera trigger can be turned ON and OFF.

When OFF the controls are inactive and the camera shutter trigger signal is not used.

Camera Trigger	<input type="button" value="OFF"/>	
Bulb Mode	<input type="button" value="OFF"/>	
<input type="text" value="0000"/>	<input type="button" value="INC"/>	<input type="text" value="000"/>

Camera Trigger	<input type="button" value="ON"/>	
Bulb Mode	<input type="button" value="ON"/>	
<input type="text" value="0000"/>	<input type="button" value="INC"/>	<input type="text" value="000"/>

When using Bulb Mode, the camera trigger controls are inactive.

Bulb Mode opens the camera shutter at the start of the drop sequence and closes after the last activity (either a drop or a flash trigger).

To use Bulb Mode your camera must support bulb mode and be in bulb mode.

Camera Trigger	<input type="button" value="ON"/>
Bulb Mode	<input type="button" value="OFF"/>
<input type="text" value="0540"/>	<input type="button" value="INC"/> <input type="text" value="000"/>

When Bulb Mode is OFF the camera trigger controls are active. Enter the time (in milliseconds) you wish to active the camera shutter.

In Loop Mode a delta valve can be used to change the camera trigger time on every iteration of the loop.

Flash Triggers

There are 3 Flash triggers and each trigger works in the same way.

Flash Trigger 1	<input type="button" value="ON"/>
<input type="text" value="0000"/>	<input type="button" value="INC"/> <input type="text" value="000"/>

Each flash trigger can be turned ON or OFF. When OFF no trigger signal is sent to the flash.

Flash Trigger 1	<input type="button" value="OFF"/>
<input type="text" value="0000"/>	<input type="button" value="INC"/> <input type="text" value="000"/>

Flash Trigger 1	<input type="button" value="ON"/>
<input type="text" value="0560"/>	<input type="button" value="INC"/> <input type="text" value="000"/>

When the flash trigger is ON the flash trigger time (in milliseconds) can be entered. In Loop Mode a delta valve can be used to alter the trigger time on every iteration of the loop.

The camera should be in manual mode or bulb mode when used with the dropController.

The START Button

When the app is not connected to the dropController the large START button is a dull green and doesn't do anything. When the app is connected the START button turns bright green and becomes active.



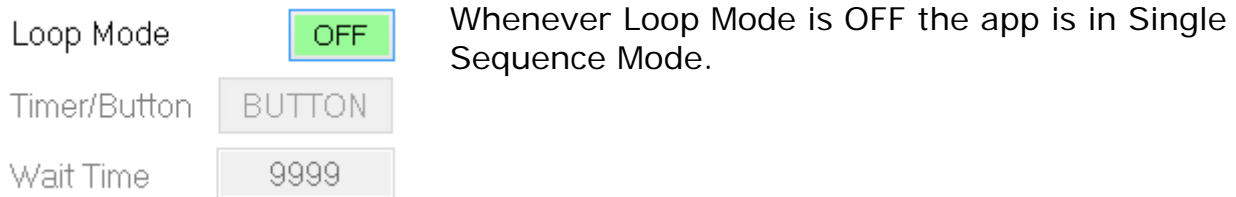
When active, clicking the START button tells the app to send the drop data to the dropController device. Depending on which mode you are using, Single Sequence Mode or Loop Mode, different things happen.

In Single Sequence Mode the data is sent to the dropController and the drops are created straight away.

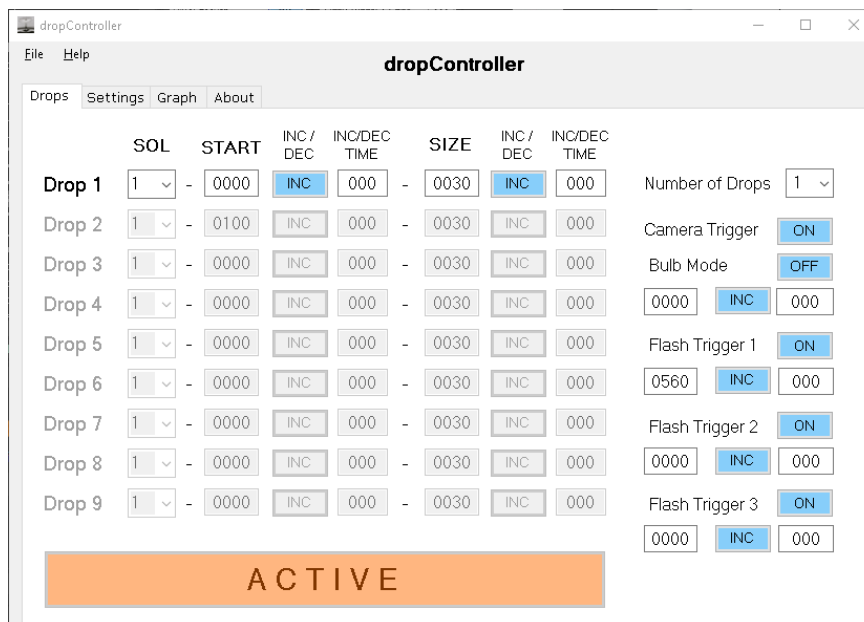
In Loop Mode the Loop Page opens and sits and waits.

Single Sequence Mode

The app is in Single Sequence Mode whenever it is not in Loop Mode.



In Single Sequence Mode, a single drop sequence is started. On clicking the START button the drop data is sent to the dropController and the START button changes to ACTIVE



On the dropController device, the yellow LED turns off and the green LED turns on. The green LED shows that a drop sequence is active on the controller.



When the sequence is finished the green LED goes out and the yellow one comes on again



In the app the large button returns to green "START". You can then make changes to the drop times or redo the same sequence.



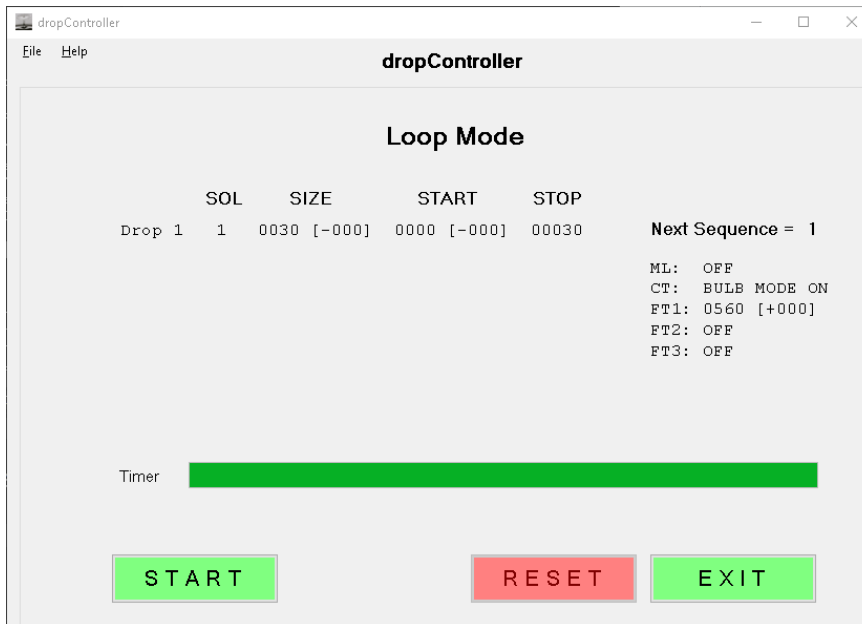
On clicking the START button, the drop data is sent to the dropController and the drops are created. While the drops are being made the app remains on the drop data page with the START button disabled. After the drops are finished the START button becomes active again.



In Single Sequence Mode delta values are ignored

Loop Mode and Delta Values.

In Loop Mode, the Loop Page opens when the main START button is clicked.



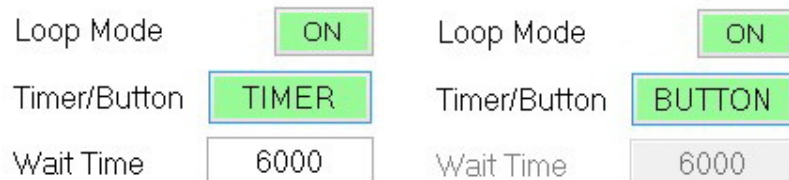
Loop Mode is the heart of the dropController and it is Loop Mode that makes getting collisions so easy.

To activate Loop Mode, on the Settings Tab set the Loop Mode OFF/ON button to ON. The Loop Mode controls become active.



In Loop Mode there are 2 methods used to start the next sequence, either a timer or a button click.

Clicking the Timer/Button button toggles between the 2.



When TIMER is selected a timer is used to delay the next drop sequence. When BUTTON is selected, the next sequence is held until the user clicks a button in the app.

Timer/Button

The Timer/Button button sets the delay method.

Timer/Button

Timer/Button

Wait Time

When using TIMER, a count down delay is used. The Wait Time is how long the app waits before starting the next sequence.

The time is in milliseconds and there are 1000 milliseconds in a second. So 6000ms is 6 seconds.

You will need to experiment to see what wait time suits you. I generally use 8 or 10 seconds (9.999 seconds). This allows time for the water in the tray to settle and also allows time to move any bubbles out of the way.

Loop Mode

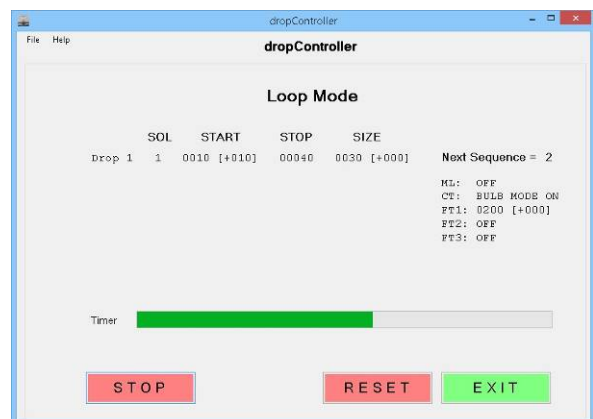
Timer/Button

Wait Time

When using BUTTON, the app waits for the user to click the Loop Page START button

When using a timer, a countdown is displayed on the Loop Page. On the first sequence the timer is not used and the sequence starts as soon as you click the START button.

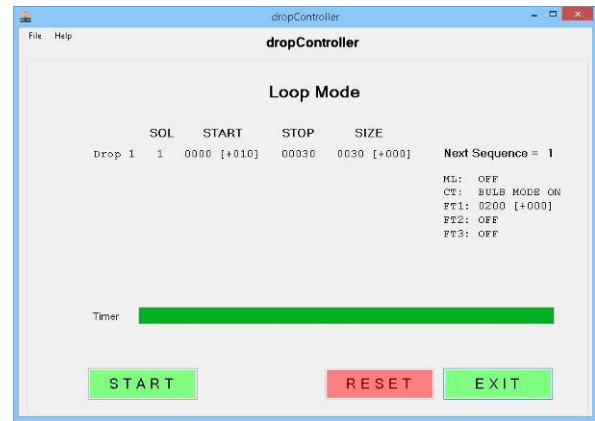
After the first sequence is completed the timer will start a countdown, and when it reaches zero the next sequence will start automatically.



While the timer is counting down, clicking the STOP button pauses the app at the current sequence number. Click START to continue. To reset the sequence number back to 1 click the RESET button.



The app has been paused at Sequence 4



Clicking RESET resets the sequence number to 1 and all drop data is reset.

Delta Values

Delta values are values that change inside a loop on every iteration of the loop. For the dropController, this is the drop start times, the drop sizes and the trigger times. Any value that has a INC/DEC control has a delta value.

The INC/DEC button allows you to either add to or subtract the delta value. INC for increase and DEC for decrease.

For example, on every iteration of a loop you can change the drop start time, make the drop smaller or bigger, and move when the flash fires.

	SOL	START	INC / DEC	INC/DEC TIME		SIZE	INC / DEC	INC/DEC TIME
Drop 1	1	- 0000	INC	000	-	0030	INC	000

Here, even though Loop Mode is ON, the INC/DEC times are set to 000 so they have no effect. The drop sequences will loop but the times will not change.

Give it a try. Change the start time INC/DEC Time to 10

	SOL	START	INC / DEC	INC/DEC TIME		SIZE	INC / DEC	INC/DEC TIME
Drop 1	1	- 0000	INC	010	-	0030	INC	000

This means Drop 1 will start 10 ms later every sequence (or iteration of the loop).

On the first time, the drop will start at 0 ms,
on the second sequence it will start at 10 ms, and
on the third it will start at 20 ms.

On the Settings page, set the Timer/Button to
Button.

Loop Mode

Timer/Button

Wait Time

This means we will need to click a button to start
the next sequence.

Jump back to the Drops page and set the number of
drops to 1

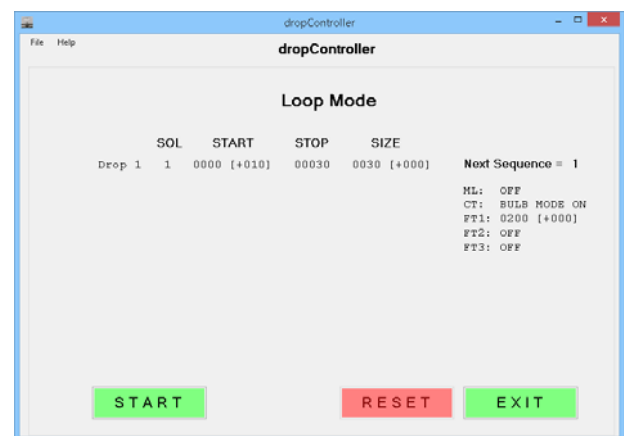
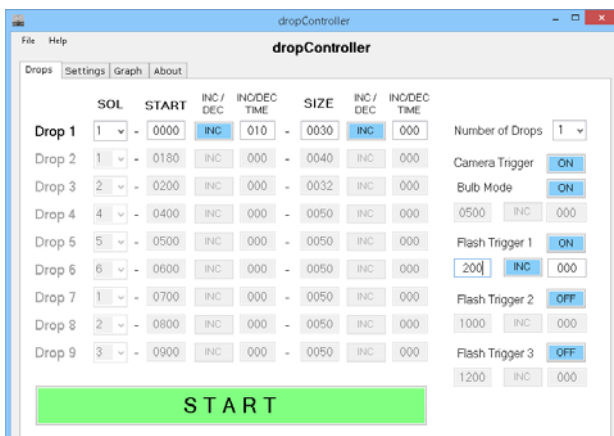
Number of Drops

Set drop 1 to start at 0000, set the start INC/DEC to INC and a delta value
(INC/DEC TIME) to 10. SIZE to 30 and no size delta (set to 000).

	SOL	START	INC / DEC	INC/DEC TIME	SIZE	INC / DEC	INC/DEC TIME
Drop 1	1	0000	INC	010	0030	INC	000

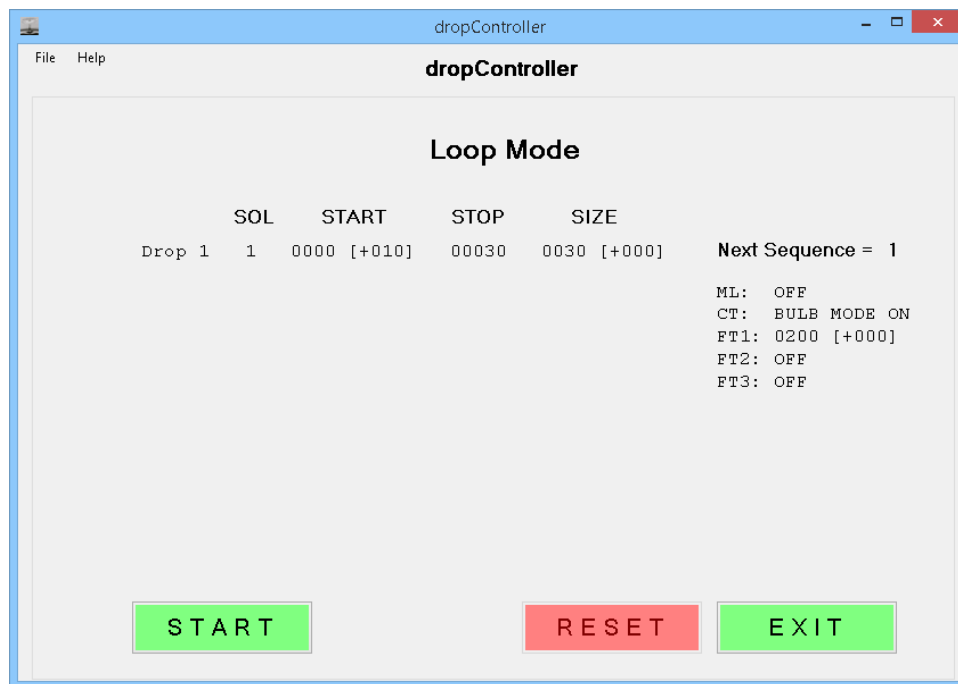
I have also set Flash Trigger 1 to 200, no delta.

Click the START button and the Loop Page will open.



Click the START button and on the Loop Page you can see the delta values in
action.

We only have one drop so that is all we can see.



SOL
1

The valve being used

START
0000 [+010]

The drop start time with the delta value in square brackets

STOP
00030

The drop stop time. This is calculated by the app

SIZE
0030 [+000]

The drop size with the size delta value in square brackets

You can also see the status and times for the triggers

Next Sequence = 1
ML: OFF
CT: BULB MODE ON
FT1: 0200 [+000]
FT2: OFF
FT3: OFF

Next Sequence: The loop number.

ML: Mirror Lockup (not being used)

CT: Camera Trigger (in BULB mode)

FT1: Flash Trigger 1 (set to trigger at 200ms. No delta).

FT2: Flash Trigger 2 (OFF)

FT3: Flash Trigger 3 (OFF)

Click START.

The START button turns to ACTIVE.

START

ACTIVE

On the dropController device, the yellow LED turns off and the green LED turns on. The green LED indicates drops are being made.

When the drop has finished, the button in the app returns to START, the green LED on the dropController turns off and the yellow LED turns back on.

Click START again. The same thing happens, except, you should notice the drop start time changes. Click START again...

	SOL	START	STOP	SIZE
Drop 1	1	0000 [+010]	00030	0030 [+000]

The drop start time increases by 10 ms every sequence.

	SOL	START	STOP	SIZE
Drop 1	1	0010 [+010]	00040	0030 [+000]

Since the size does not change the stop time also increases.

	SOL	START	STOP	SIZE
Drop 1	1	0020 [+010]	00050	0030 [+000]

Next Sequence = 1

The sequence number also increases to show what sequence is next

Next Sequence = 2

Next Sequence = 3

To explore delta values further see the Photographing a Worthington Jet Guide and the 2 Drop Collision Guide on the website.

Delta Value Limits

The times that are changed due to a delta value cannot go outside of their normal range. If the value exceeds these limits it is set to the limit.

For example, the drop start time has a minimum start value of 0 and a maximum of 9999. If a delta value tries to make the start time lower than 0 then it is set to 0. If a delta value tried to take the start time beyond 9999 then the start time is set to 9999.

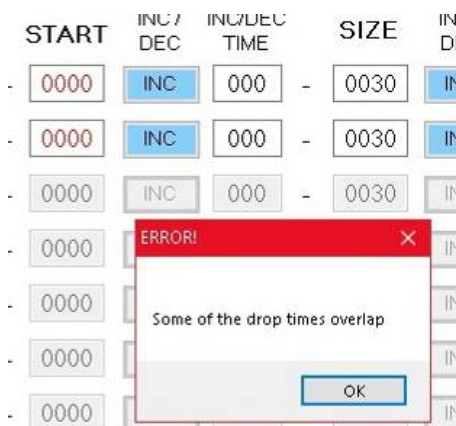
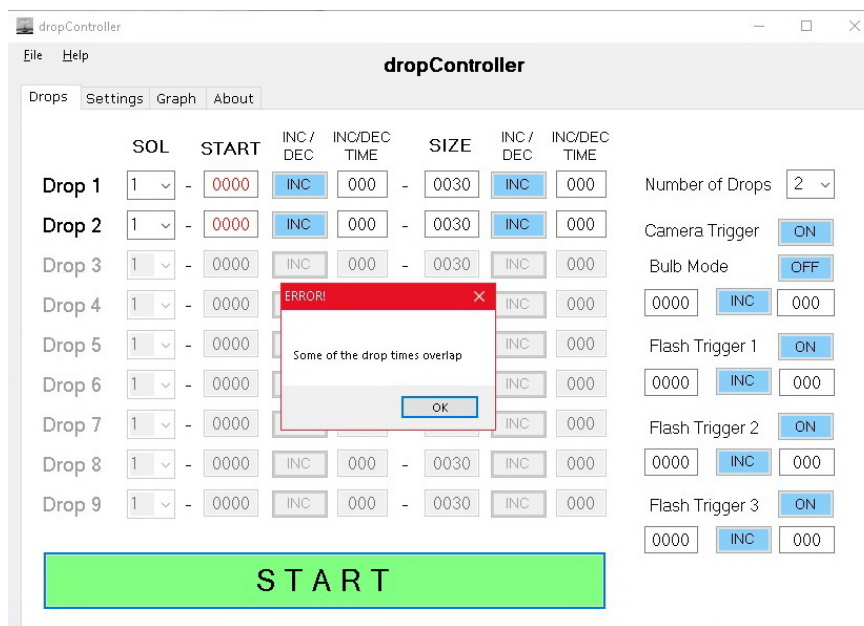
Drop Data Check

The dropController App has basic error checking and will notify you if there are any issues with the drop data

	SOL	START	INC / DEC	INC/DEC TIME	SIZE	INC / DEC	INC/DEC TIME
Drop 1	1 ▾	- 0000	INC	000	- 0030	INC	000
Drop 2	1 ▾	- 0000	INC	000	- 0030	INC	000
Drop 3	1 ▾	- 0000	INC	000	- 0030	INC	000

For example, in the above, both drop 1 and drop 2 uses the same valve and start at the same time. You cannot do this.

When the START button is clicked the drop times are checked and if there are any problems an error message is displayed and the problem times are highlighted in red.

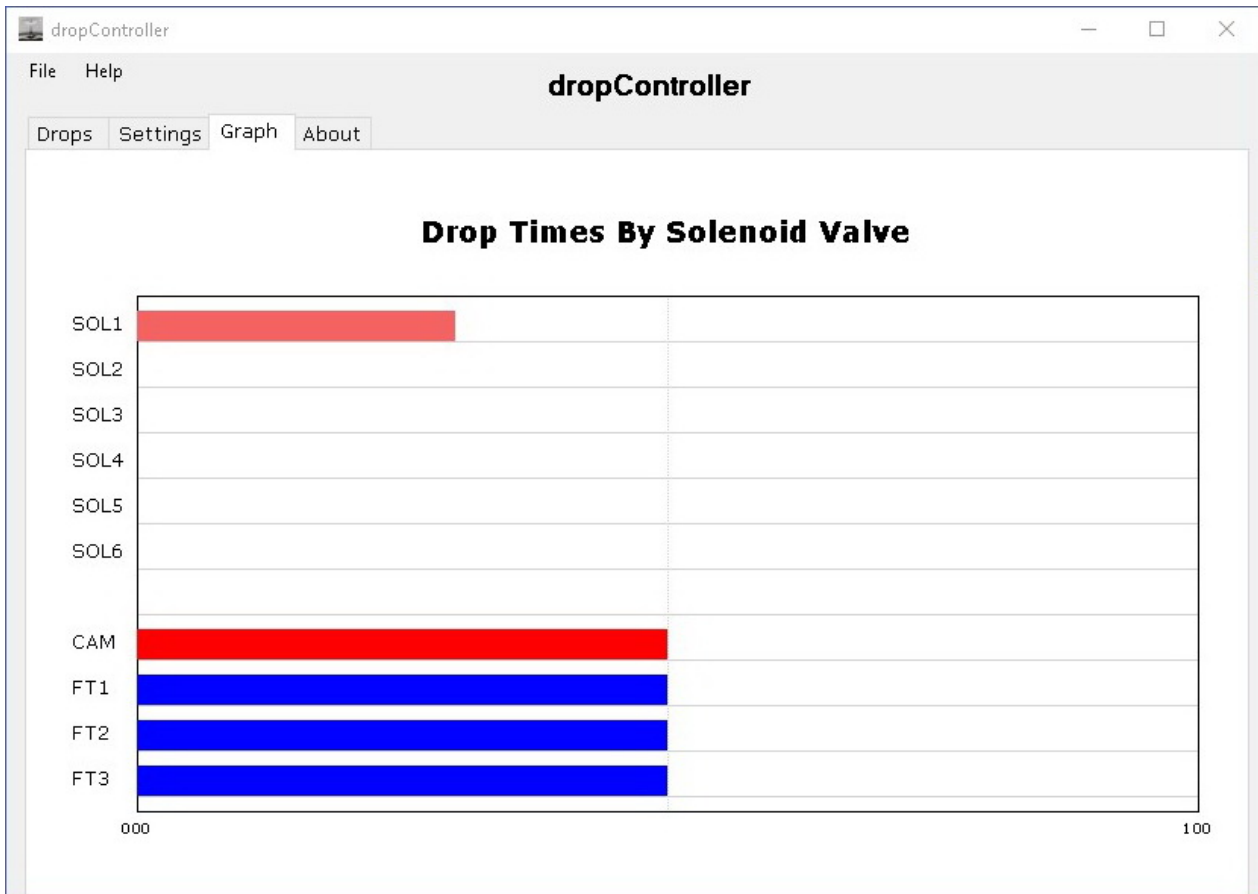


You need to clear the error before you can proceed

Graph Tab

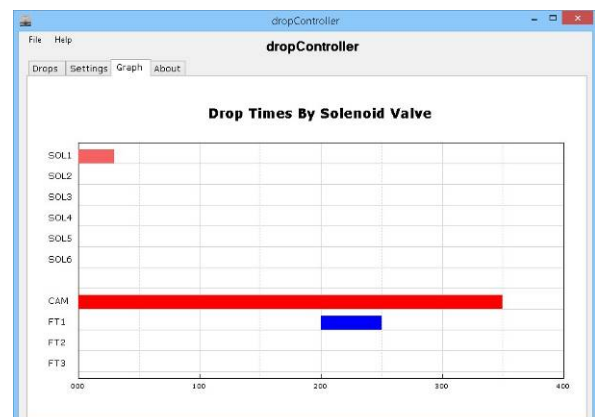
The Graph page shows the drop times and trigger times in chart form. This aids visualizing the drop times and is especially useful for more complex sequences.

The first time you use the app the drop times are very basic.

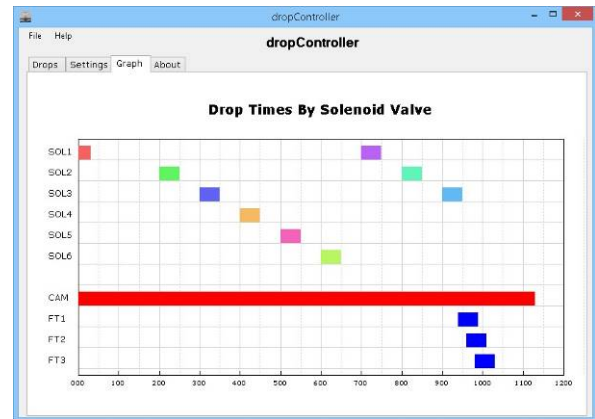
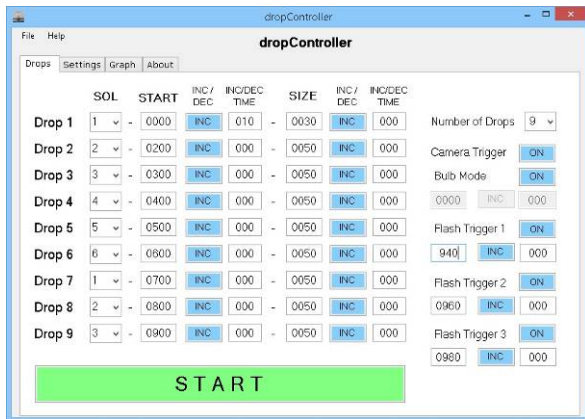


The screenshot shows the 'dropController' application window with the 'Settings' tab selected. It displays a configuration table for a drop sequence with 9 drops. The 'START' column shows times from 0000 to 0900 in 0100 increments. The 'SIZE' column shows a constant value of 0050. The 'INC/DEC' column is set to 'INC' for all drops. The 'Number of Drops' is set to 1. On the right, the 'Camera Trigger' is set to 'ON', 'Bulb Mode' is 'ON', and 'Flash Trigger 1' is 'ON'. 'Flash Trigger 2' and 'Flash Trigger 3' are set to 'OFF'. A large green 'START' button is at the bottom.

	SOL	START	INC/DEC	INC/DEC TIME	SIZE	INC/DEC	INC/DEC TIME
Drop 1	1	0000	INC	010	0030	INC	000
Drop 2	2	0200	INC	000	0050	INC	000
Drop 3	3	0300	INC	000	0050	INC	000
Drop 4	4	0400	INC	000	0050	INC	000
Drop 5	5	0500	INC	000	0050	INC	000
Drop 6	6	0600	INC	000	0050	INC	000
Drop 7	1	0700	INC	000	0050	INC	000
Drop 8	2	0800	INC	000	0050	INC	000
Drop 9	3	0900	INC	000	0050	INC	000



Here is the one drop sequence from some of the examples. The camera is in bulb mode. Only FT1 is ON



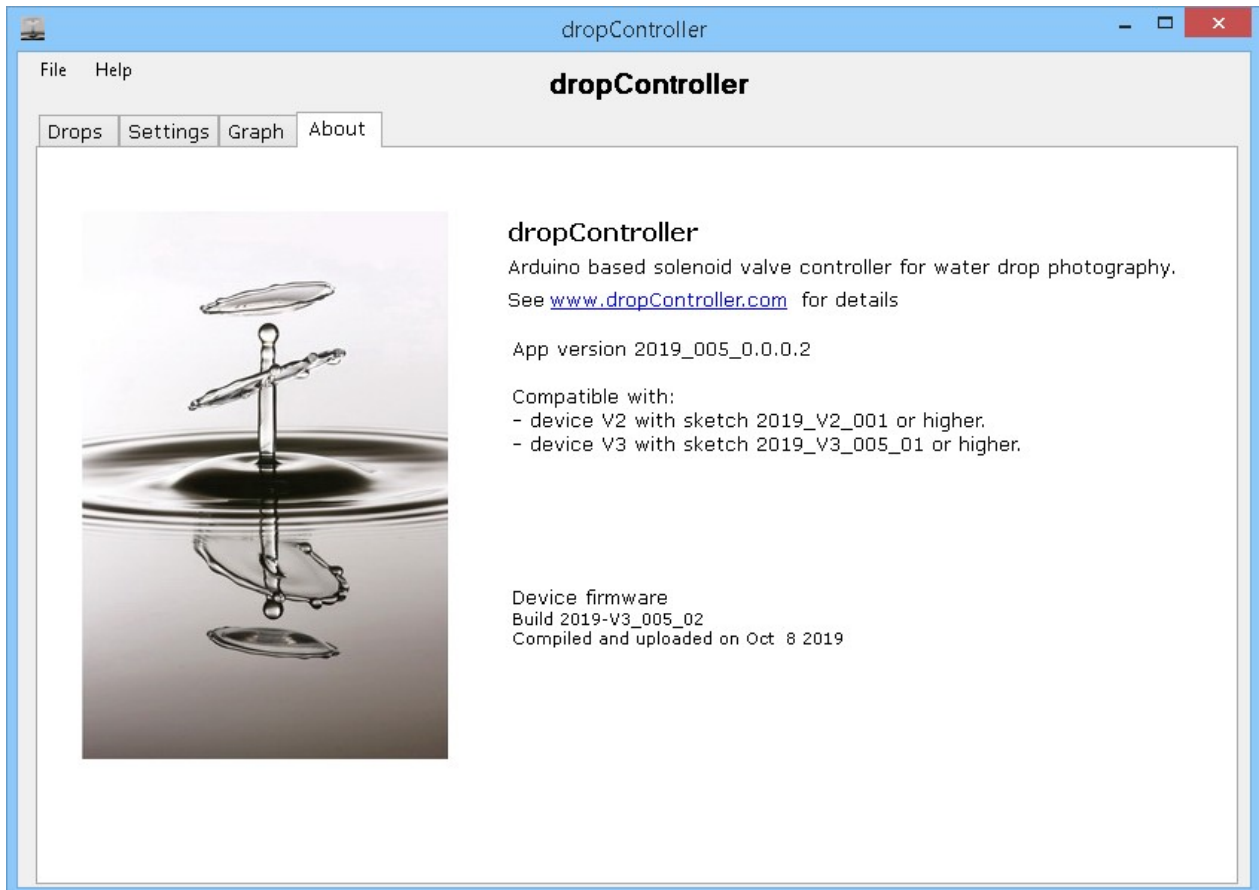
Here are 9 drops across 6 valves with all triggers active.

When the camera is in bulb mode the shutter opens before the first drop and closes after the last drop or flash (whichever is last).

About Tab

The About Tab shows the app version, the dropController device firmware version.

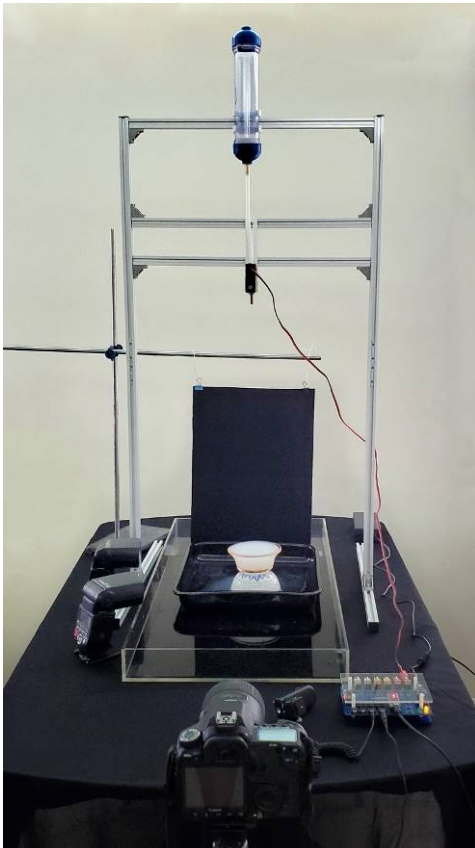
I really need to update the images. These are some of the first shots I was pleased with. I had been trying for ages to get a nice glassy texture to the collisions and had been trying many different mixtures.



First Drops

Let's get started with making drops.

I don't explain the set up in any detail here as I have another guide covering getting started called Water Drop Set Up.



Here is the set up I am using while writing this guide:

One valve which is connected to valve port 1 on the dropController.

I have 2 flash guns, both at the front, and both pointing towards where the drop hits the water. The flash guns are triggered wirelessly.

In the drop bottle at the top I have milk.

In the bowl at the bottom I have water with nothing added. I have the valve about 55cm from the water (this is quite high, lower can be better).



The camera is in manual mode, aperture set to F18, shutter set to 1 second. The flash guns are set to 1/64. The wireless flash trigger and the camera are connected to the dropController FT1 and CAMERA ports respectively.

Milk

Milk has a thicker consistency than water which makes it a good getting started liquid, not perfect but good when starting.

Milk is opaque and with opaque liquids you illuminate the liquid. With transparent liquids you light the background. I have both flash guns aimed at where the drops hit the water.

To get a good contrast I am using a black background but at this point the actual background is not important.

Note: Milk goes sour. After using it make sure to wash the valve, the bottle, the tube, and the tray well.

Camera Set Up and Focus

The next step is position and focus the camera. The camera position is up to you and depends largely on the lens you are using, what kind of shot you want and how close you want to be to the drop.



I am using a 105mm macro lens on a Canon camera in landscape and I have it level with the top of the bowl.

To focus the lens use a focus aid. I am using spare nozzles, 2 nozzles taped together, but anything that sits still in water will do. I am using a small bowl so I placed the aid in the centre of the bowl.



Make a drop and either move the focus aid to the impact position, or like me, move the bowl. Make another drop to confirm. If the drop hits the aid you are ok and can focus the camera on the focus aid.

Nearly there.

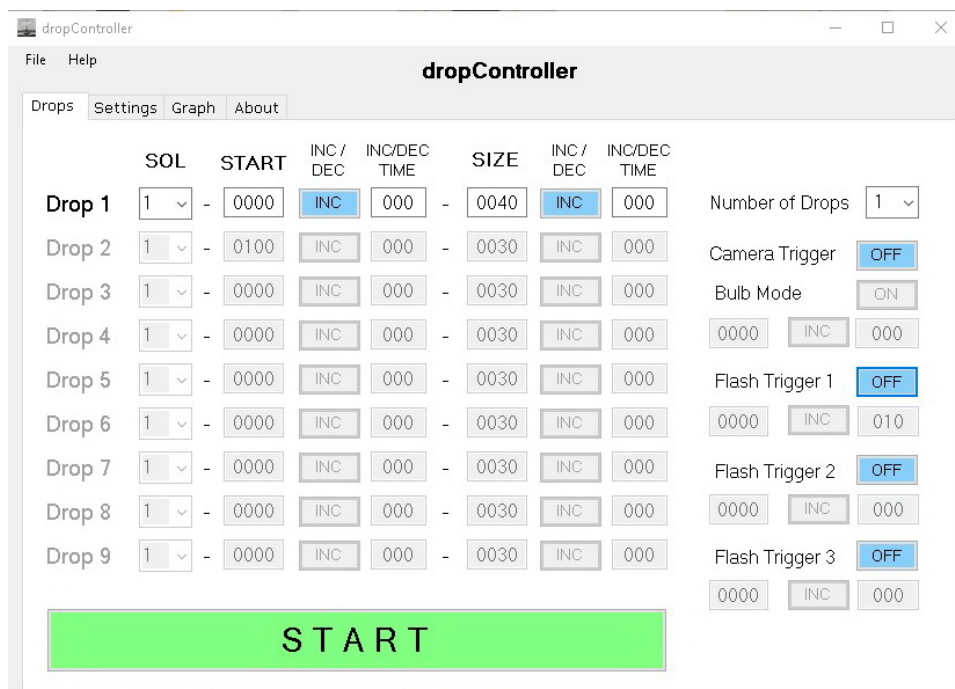
Connect the app to the controller and enter the following drop data:

Number of drops	1
SOL	1
Drop 1 START	0000
Drop 1 START INC/DEC	INC
Drop 1 START INC/DEC TIME	000
Drop 1 SIZE	0040
Drop 1 SIZE INC/DEC	INC
Drop 1 SIZE INC/DEC TIME	000

Camera Trigger	Camera Trigger = OFF
Flash Trigger 1	Status = OFF
Flash Trigger 2	Status = OFF
Flash Trigger 3	Status = OFF

And on the Settings Page set Loop Mode to OFF

Loop Mode	Status = OFF
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Hit the START button and note where the drop hits and move either the focus aid or the bowl so that the focus aid is where the drop hit.

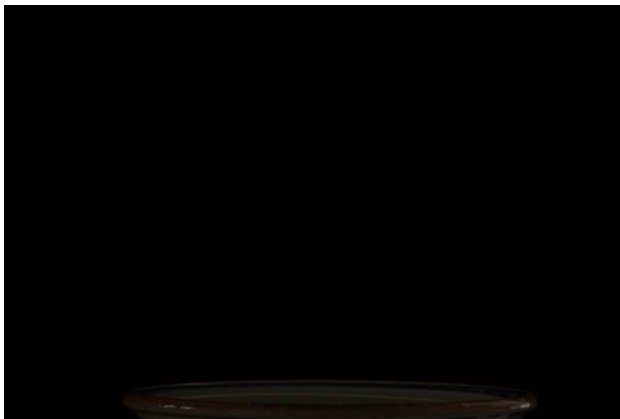
Make another drop and if required keep adjusting the position until you are happy.

Ambient light

To enable me to take photos for this user manual I have the room lights on, however, I would normally shoot with them off. I don't normally shoot in a totally dark room though and have found that as long as I am not in bright light the photos come out OK.

Because I am using a small aperture with flash it is the flash that produces the photo and this is a standard method for high speed photography.

To test you environment, take a photo without the flash (use the camera shutter button). If the image is dark you are OK. If it is bright or has too much detail either lower the ambient light or decrease the shutter size. You are looking for a dark photo at a 1 second exposure.



This shot at F11 is a little too bright



This one at F18 is better.

Both photos were taken is daylight

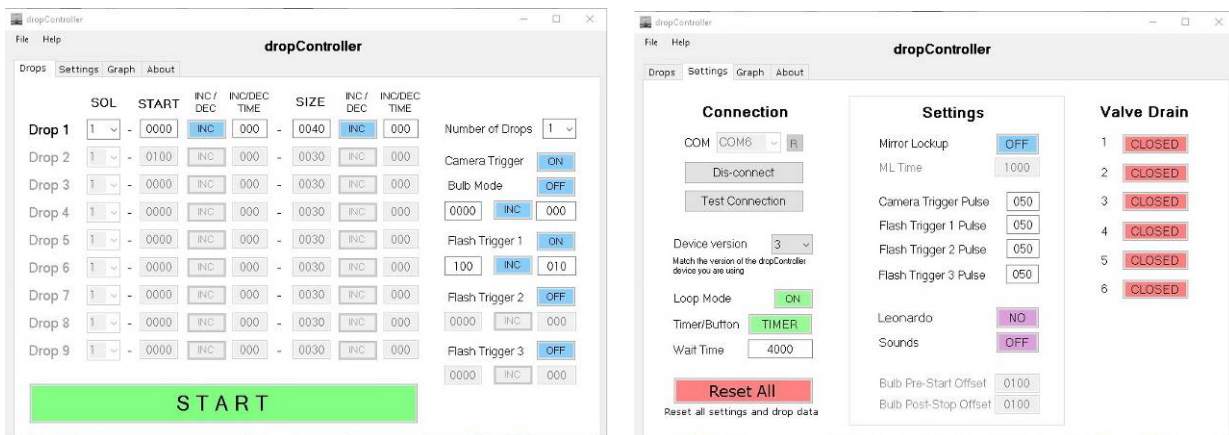
Make Some drops

You should be ready to start photographing drops. In the app we need to turn the camera and flash on. The camera is in manual mode with an aperture of F18 and a shutter speed of 1 second. This means as long as the flash fires within the 1 second we will be OK. You can of course use bulb mode if your camera supports it. In bulb mode you don't need to worry about shutter times.

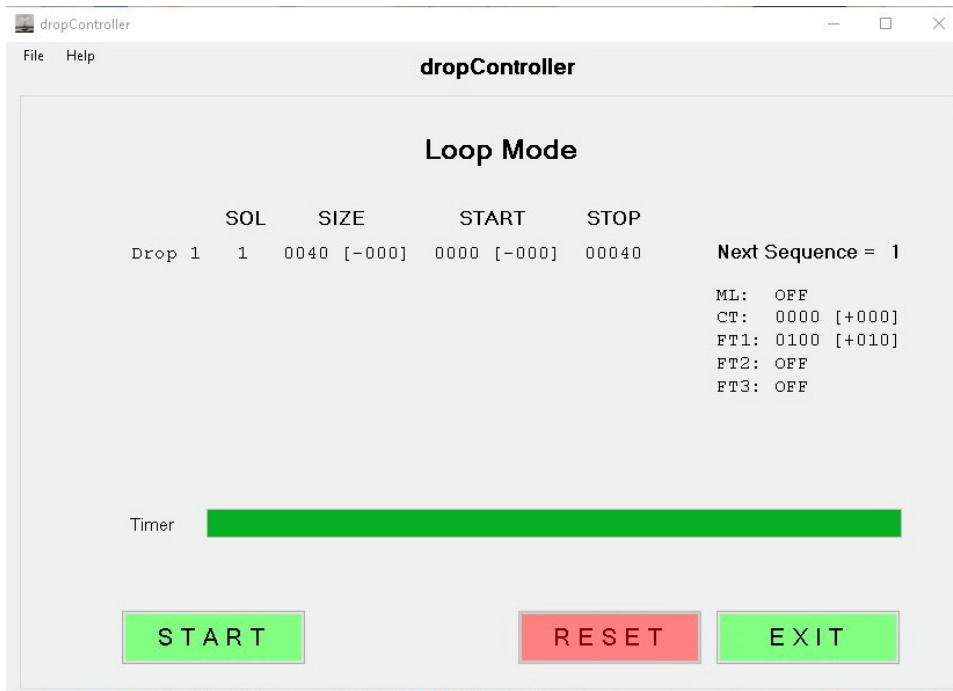
Setting the flash trigger time is not so simple and there is no correct time to start with. It is a case of trial and error. As an example of using delta values I am going to photograph a series of shots showing a drop slowly descending. This is a good exercise as it can be used to find out how long it takes before a drop hits the water.

To start set the flash trigger to 100ms and enter a delta value to INC 10ms. Why 100ms? No reason, I have to start somewhere. The delta value will increase the flash trigger time by 10ms every sequence.

On the Settings Page, turn on Loop Mode, select TIMER with a delay of 4000ms.



Jump back to the Drop Data page and click START and the Loop Page will open.



Click the Loop Page START button, if everything is connected correctly the camera shutter should open, a drop should be produced and slightly afterwards the flash should fire. If none of this happens check your set up.

Depending on the camera and flash guns the first shot may not work, it may just wake up the equipment.

Monitor the camera and wait for the drop to appear in the screen. Make a note of the trigger time used on this particular shot.

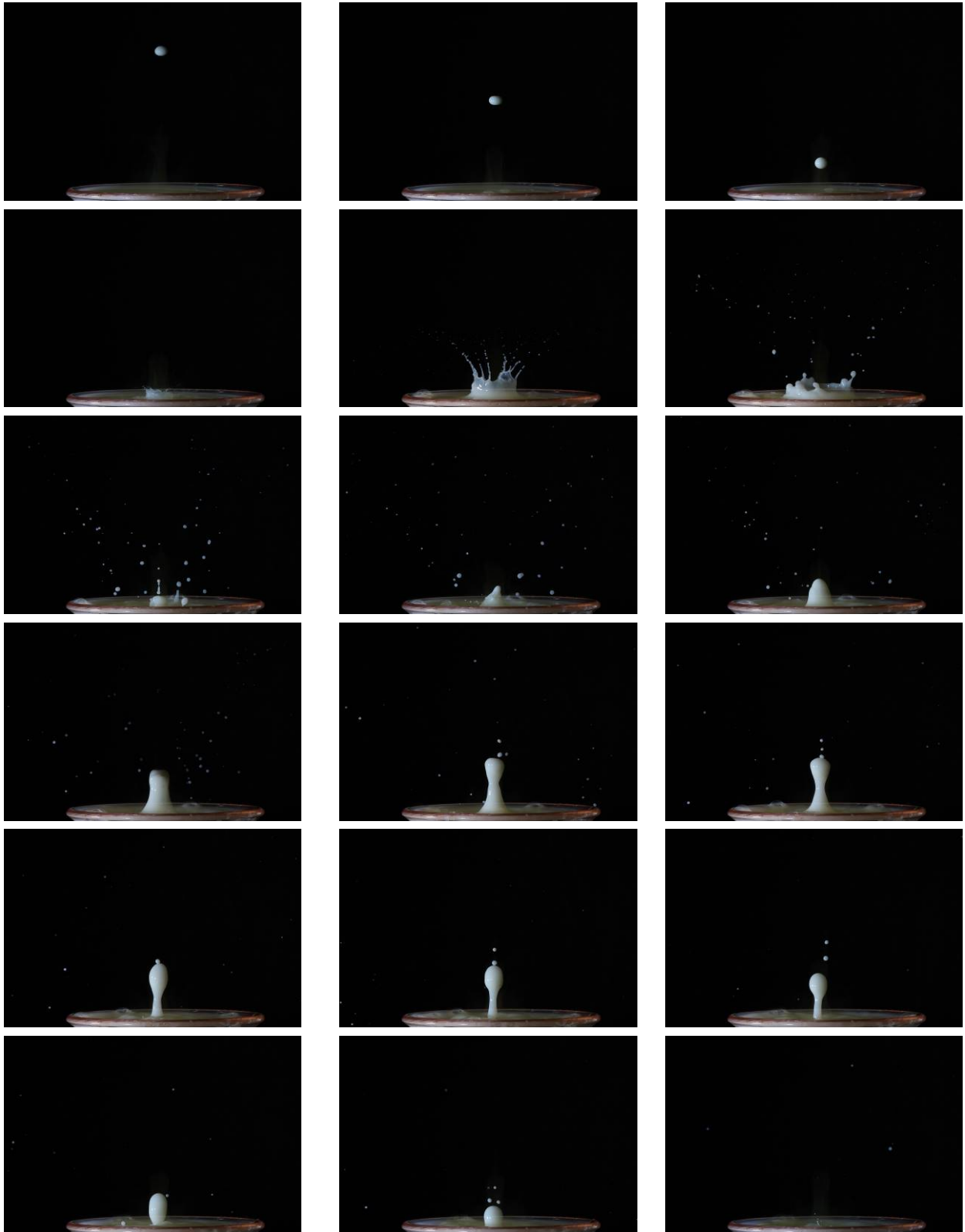


Flash trigger at 350ms

As it turns out 100ms wasn't a particular good place to start the flash trigger. I didn't see the drop until the flash trigger reached 350ms. This is not really a bad thing though and one of the main benefits of the dropController. With a manual system it would have taken a fairly long time to find what time the drop entered the frame. With the dropController you just use a delta value on the flash trigger, set the device going and monitor the images.

Worthington Jet

Continue shooting and you should see a Worthington Jet form. In my case it is a short fat one.



Try different drop sizes and see what effect it has.

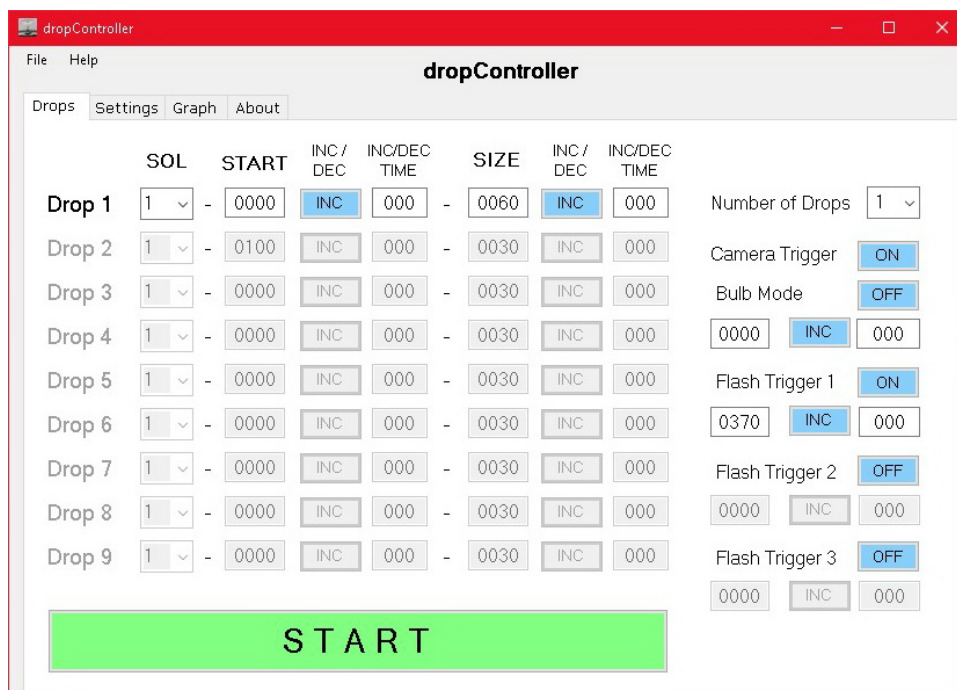
Taller Worthington Jets

A common way to get a taller jet is to over load the first drop. This is done by making the drop larger and larger until it splits in to 2. The second drop will follow the first very closely and push it deeper in to the pool. This results in a stronger force pushing the drop back up which means a taller jet.

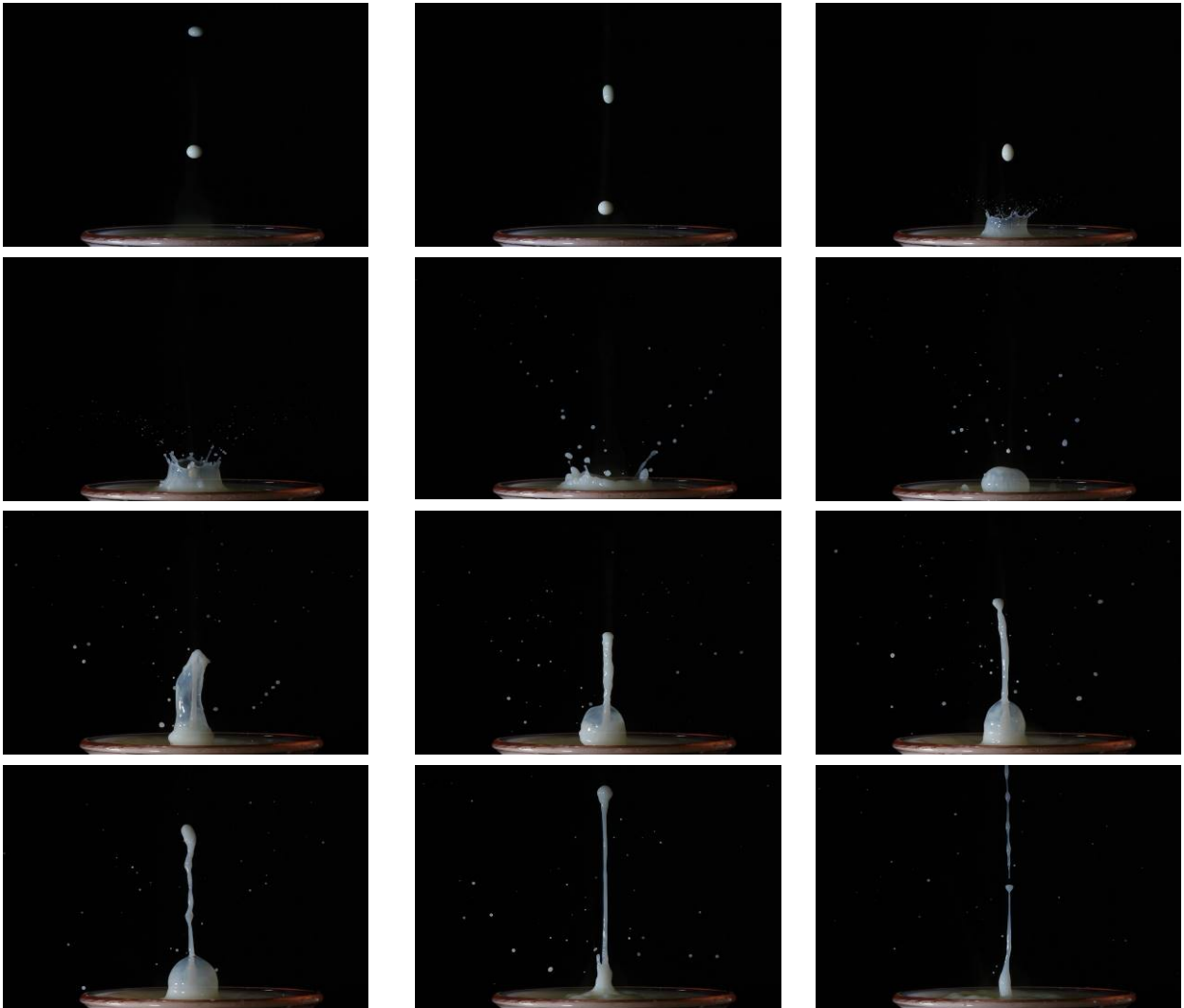
After some playing around I found 60ms works for the valve and nozzle I am using. It is likely to be different for you.

You can use a size delta value to find out the best drop size for the valves and nozzles you are using.

In the dropController, I changed the drop size to 60ms and set the sequence going.



60ms turned out to be fairly good. Maybe too good. The jet was so tall it went out of frame and I had to move the camera back.



Here you can see the second drop.

First Collision

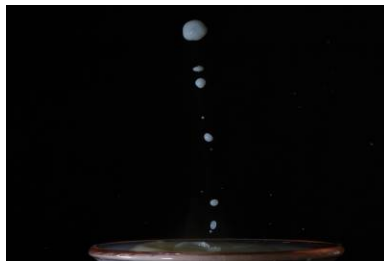
While you are shooting the Worthing Jet look for a good jet and note the flash trigger time. In the above images the jet that was produced when the trigger was at 540ms was pretty good.



This jet was shot when the flash trigger was at 540ms

I wanted to use this jet so I set Flash Trigger 1 to 540ms and removed the flash trigger delta value.

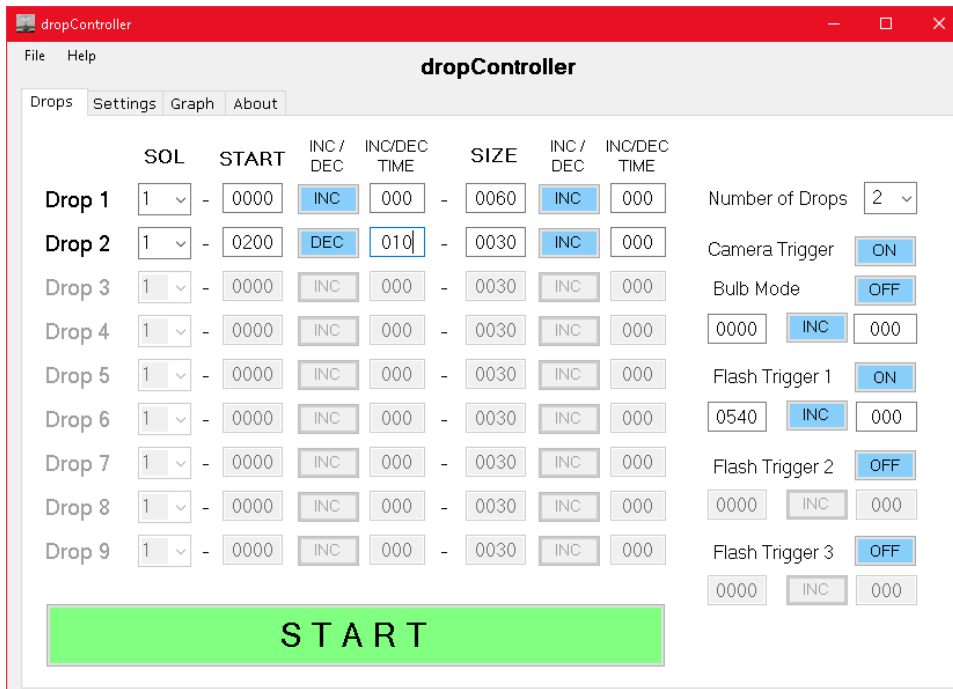
To check 540ms is a good time, I ran the sequence without the delta value.



Here is the type of shot I got. Not sure what happened with the middle one, maybe the AC got it. I included it to show that you do not get exactly the same image every time.

I now want to hit this jet with a second drop at or ideally sometime before 540ms. You can guestimate this or you can use a delta value. Using a delta value I can start a second drop and then move the start time until it collides with the column. The easiest way is to start the second drop too late and then walk the drop start time backwards until you see a collision.

Add a second drop, start time 200ms, a start time delta of 10ms and set INC/DEC to DEC. This means the drop will start at 200ms and then get 10ms earlier every sequence; 200ms, 190ms, 180ms...



Click START and monitor the images. When you see (if you see) a collision, remember the drop 2 start time.

In my case I didn't have to wait too long. Here are the drops for 180ms.



In the above examples I used 10ms as a delta value. This allowed me to quickly find the approximate time of the collision. Once I had the approximation I could then fine tune by reducing the delta.

I now know that 180ms is a fairly good starting collision so the next stage would be fine tuning. Start the second drop around 185ms and then set a delta value of DEC 1ms and then run the sequence again.

After this, experiment with different drop sizes, different flash trigger times, and maybe try adding a third drop.

The video on the website also covers delta values. The video uses an older app but the method is exactly the same.