



PLUTO TRIGGER USER MANUAL

VERSION 1.0

© 2015 Baicheng Innovations

All rights reserved.

1. INFO

1.1. DISCLAIMER

No parts of this work may be reproduced in any form or by any means-graphic, electronic, or mechanical, including photocopying, recording, taping, or information storage and retrieval systems - without the written permission of the publisher.

Products that are referred to in this document may be either trademarks and/or registered trademarks of the respective owners. The publisher and the author make no claim to these trademarks.

While every precaution has been taken in the preparation of this document, the publisher and the author assume no responsibility for errors or omissions, or for damages resulting from the use of information contained in this document or from the use of programs and source code that may accompany it. In no event shall the publisher and the author be liable for any loss of profit or any other commercial damage caused or alleged to have been caused directly or indirectly by this document.

1.2. WARRANTY

Baicheng Innovations (BCI) warrants this hardware product against defects in materials and workmanship for a period of ONE (1) YEAR from the date of original retail purchase. If a defect exists, at its option BCI will exchange the product with a product that is new or which has been manufactured from new or serviceable used parts and is at least functionally equivalent to the original product. A replacement product/part assumes the remaining warranty of the original product or 60 days from the date of replacement, whichever provides longer coverage for you. When a product or part is exchanged, any replacement item becomes your property and the replaced item becomes BCI's property. To obtain product support for the Pluto Trigger, visit our website

<http://www.plutotrigger.com>.

1.3. FCC/CE COMPLIANCE

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer for help

1.4. SAFETY

In order to prevent damage to the Pluto Trigger and/or a personal injury, please read the following important security precautions.

- Do not disassemble

This unit is a complex electronic device and contains no user-serviceable parts. An unauthorized disassembly or modification may void service warranty on the unit.

- Do not use in the event of malfunction

In case of a smoke or an unusual smell coming from the unit, please immediately turn the unit off and unplug an optional AC adapter if connected. Discontinue further use and forward the unit to an authorized service center.

- Keep it dry

Avoid exposing the unit to the excess water or rain. Exposing unit's internal circuitry to water may result in fire and/or electric shock.

CONTENTS

| | |
|--------------------------------------|-----------|
| 1. Info | 2 |
| 1.1. Disclaimer | 2 |
| 1.2. Warranty | 3 |
| 1.3. FCC/CE Compliance..... | 4 |
| 1.4. Safety..... | 5 |
| 2. Introduction | 8 |
| 2.1. Overview | 8 |
| 2.2. Box Contents..... | 8 |
| 2.3. Features..... | 9 |
| 2.4. Specifications | 9 |
| 2.5. Pluto Trigger hardware | 9 |
| 2.5.1. Shutter Release Button | 10 |
| 2.5.2. LED..... | 11 |
| 2.6. Smartphone App | 11 |
| 3. Quick Start Guide | 13 |
| 3.1. Pluto Setup | 13 |
| 3.2. Camera Setup..... | 13 |
| 3.3. App Usage | 14 |
| 4. Intervalometer Modes..... | 16 |
| 4.1. Shutter Release Mode | 16 |
| 4.2. Time-Lapse Mode..... | 17 |
| 4.2.1. Power Management | 19 |
| 4.2.2. Bulb-ramping Time-Lapse | 19 |
| 4.3. HDR Mode | 21 |
| 4.4. Star trail Mode..... | 23 |
| 5. Pluto sensor Modes..... | 24 |
| 5.1. Laser mode | 25 |
| 5.2. Sound mode | 26 |
| 5.3. Light Mode | 27 |
| 5.4. Lightning Mode..... | 27 |
| 5.5. PIR mode | 27 |

| | |
|---------------------------------|----|
| 5.6. Droplet mode | 28 |
| 5.7. Aux mode | 29 |
| 5.8. Timer mode | 29 |
| 5.9. Fusion mode..... | 29 |
| 6. Phone sensor modes | 30 |
| 6.1. Sound Mode..... | 30 |
| 6.2. Vibration mode..... | 30 |
| 6.3. Distance mode | 30 |
| 6.4. Voice command mode | 30 |
| 6.5. Motion mode | 30 |
| 7. Tools | 32 |
| 7.1. Sun Calculator | 32 |
| 7.2. ND Filter Calculator | 32 |
| 7.3. DOF Calculator | 32 |
| 7.4. Star sky rule | 33 |
| 8. Settings..... | 34 |
| 8.1. Trigger..... | 34 |
| 8.1.1. Pre Focus Time | 34 |
| 8.1.2. Shutter Pulse Time..... | 34 |
| 8.1.3. Trigger Reset Time | 34 |
| 8.2. Infrared | 35 |
| 8.2.1. IR Remote Mode | 35 |
| 8.2.2. Camera Brand..... | 35 |
| 8.4. Burst | 35 |
| 8.4.1. Burst Count..... | 35 |
| 8.4.2. Burst Interval..... | 36 |
| 8.5. LED | 36 |
| 8.6. Reset | 36 |
| 8.7. Firmware Upgrade | 36 |
| END..... | 37 |

2. INTRODUCTION

2.1. OVERVIEW

Thank you for purchasing Pluto Trigger, the most advanced camera trigger solution. To get started with your Pluto Trigger unit, please read the "Introduction" and "Quick Start Guide" sections. In order to get the most of your Pluto trigger, it is recommended to read the sections of different Modes as well.

The Pluto Trigger is an advanced, microprocessor controlled portable unit, capable of automatically calculating various exposure sequences, and providing super-fast trigger for high-speed event. The unit is powered from rechargeable Li-ion battery, is equipped with light/sound/PIR sensors, an infrared emitter for triggering cameras without cable, a bottom 1/4-20 inch screw for mounting on tripod, and comes with a flannel drawstring bag for carrying it in the field.

The Pluto Trigger Apps for iOS and Android are easy to use and powerful. Besides the sensors embedded in Pluto Trigger, some advanced sensors on your phone are used to trigger your camera in Phone Sensor Modes. The handy tools like ND Filter Calculator will bring your photography skills to the next level. More features will be added in the future updates.

2.2. BOX CONTENTS



- Pluto Trigger
- Pluto Laser
- Pluto Dongle
- Quick guide leaflet
- USB battery charger
- USB charging cable
- Shutter release cable
- Flash PC sync cable
- Hot shoe adapter
- Drawstring handbag

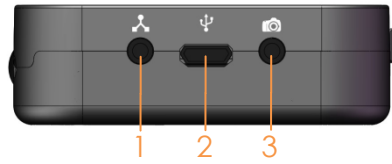
2.3. FEATURES

- Bluetooth 4.0 Low Energy
- Shutter Release Button
- Infrared Remote
- Intervalometer Modes
Shutter Release, Time-lapse, HDR, Star-trail
- Pluto Sensor Modes
Laser, Sound, Light, Lightning, PIR, Aux, Timer, Fusion
- Phone Sensor Modes
Sound, Vibration, Distance, Voice Command, Motion, Face
- Tools
Sun Calculator, ND Filter Calculator, DOF Calculator, Star-scape Calculator
- In-app Firmware Upgrade

2.4. SPECIFICATIONS

- Size: 60*40*19mm
- Weight: 35g
- Bluetooth Range: 10-30 meters
- Battery life: 1-2 days

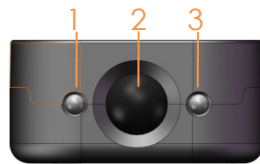
2.5. PLUTO TRIGGER HARDWARE



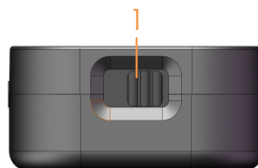
1. Aux sensor port
2. USB charging connector
3. Camera/Flash port



1. Program status led
2. Microphone
3. Battery charging led
4. Shutter-release/Bluetooth button



1. Laser/Light sensor
2. PIR sensor
3. Infrared Emitter



1. Power switch

2.5.1. SHUTTER RELEASE BUTTON

The shutter release button let you trigger your camera manually.

It is also used as a switch to turn on/off the Bluetooth module. To do this, just press the button and hold for **5 seconds** and the Status Led will show notification.

Three short blinks means Bluetooth is turned ON, while **one long blink** means Bluetooth is turned OFF.

Turn off Bluetooth makes the battery life of Pluto Trigger much longer. It is useful when you are taking long time-lapse sequence. You start the program and then turn off Bluetooth. Pluto trigger runs at about half power consumption. When you need to change settings, turn Bluetooth back on.

2.5.2. LED

The Status Led can be set to five modes as follows:

| | | |
|---|-----------------------|---|
| 1 | Off | All led notifications are turned off |
| 2 | Program Start/End | Blink led when Program starts or stops running |
| 3 | Camera Trigger | Blink when Pluto trigger your camera |
| 4 | Periodic Notification | Blink every 5 seconds, indicating Pluto is power on |
| 5 | Always On | Led is always on to show remaining power |

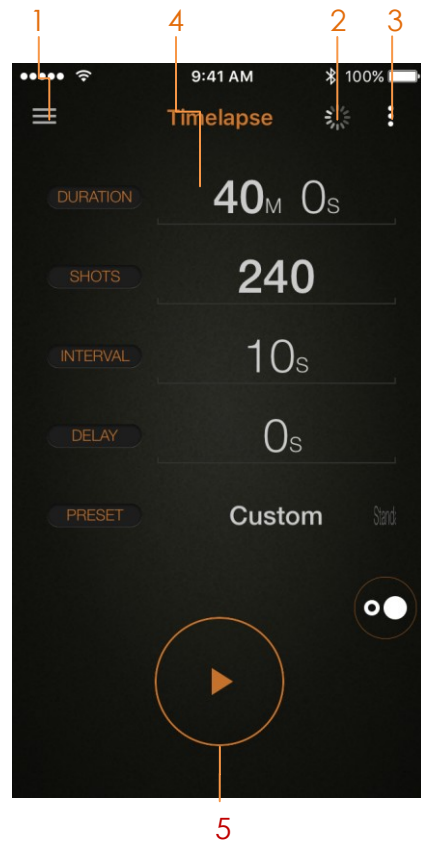
Note: Display mode with high number also covers all led notifications with lower number. For example, if display mode is set to *4-Periodic Notification*, Pluto will show all led notifications, which include *2-Program Start/End*, *3-Camera Trigger* and *4-Periodic Notification*.

Three short blinks always means Start; one long blink always means Stop.

The color of the Status Led shows the battery level of Pluto Trigger.

| | |
|--------|------|
| Green | 100% |
| Yellow | 75% |
| White | 50% |
| Red | 20% |

2.6. SMARTPHONE APP



1. Menu
2. Device (Scan/Battery)
3. Settings
4. Parameters
5. Start/Stop

3. QUICK START GUIDE

3.1. PLUTO SETUP

Use the following workflow to get started:

1. Connect the 2.5mm headphone stereo plug to the Pluto Trigger camera port located next to its USB port. Connect the camera plug to the camera shutter release port. You may want to consult your camera user manual on where the shutter release port is located.
2. Turn Pluto Trigger on by sliding the power switch to the right. The Status Led should blink for three times, indicating system starts.
3. Make sure Bluetooth on Pluto Trigger is turn on. Bluetooth is on by default. But if it was turned off accidentally, you can toggle the Bluetooth state by pressing and hold the shutter release button on Pluto Trigger for 5 seconds. When Status Led emits three short blinks, Bluetooth is turned on, while one long blink means Bluetooth is turned off.

3.2. CAMERA SETUP

Your camera may also require a minor set up process prior to using the Pluto Trigger. We recommend the following camera settings to get the most out of your Pluto Trigger:

1. Turn your camera on.
2. Set your camera to Manual Exposure mode unless recommended otherwise.
3. Set your camera to Manual Focus mode unless recommended otherwise.
4. Set your camera to Single drive mode. Operating your camera in Continuous drive mode with Pluto Trigger may lead to unexpected results, such as extra pictures being taken. Alternatively, you can use Quiet or Silent drive mode, if available on your camera. With Quiet or Silent drive mode the frame rate

may be slower, but shutter will generally sound more quiet and soft, which may be preferable in certain situations.

Should you have any problems when using Pluto Trigger with your camera, resetting your camera to the default settings may help. Please consult your camera user manual for details on how to reset camera settings.

3.3. APP USAGE

To get started, take "Time-lapse" mode as an example. Go through the following steps:

1. Turn on Bluetooth on your phone
2. Start Pluto Trigger App for iOS or Android.
3. Connect with Pluto Trigger. On first app launch, the Device button is a spinner that means no Pluto is connected. Now make sure Pluto Trigger is turned on; click the Device button. A Device Scan screen slides in, and the app is scanning for Pluto Trigger in your environment. All Pluto Triggers with Bluetooth turned on will show up in seconds; click the icon of the found device and app will connect to it. Now navigate back to the Time-lapse screen. A battery icon replaces the spinner, which means a Pluto Trigger is connected; the battery icon shows the battery remaining in your Pluto Trigger. If the app has connected to your Pluto Trigger before, skip this step since it will automatically make the connection on app launch.
4. Change time-lapse settings, as you need.
5. Finally, make sure your camera is properly connected to Pluto Trigger and set up as described in the **PLUTO SETUP** and **CAMERA SETUP** chapters. With your camera in Manual exposure and Manual focus, press the "Start" button to start program. Pluto Trigger displays the current image sequence step and the time remaining.
6. If you want to cancel an exposure sequence before it completes, press the "Start" button again. Pluto Trigger App will return to the mode settings screen.

7. When finished using the Pluto Trigger, slide power switch to the left to turn the unit off. Pluto Trigger memorizes your current settings as it powers off and restores them the next time it powers back on.

Your Pluto Trigger offers a multitude of camera trigger modes that will help in your daily photography needs; you can easily navigate through available modes using the top left Menu. Refer to following sections to learn more about each mode.

4. INTERVALOMETER MODES

4.1. SHUTTER RELEASE MODE

Use this mode when you only need to take a single picture manually. Depending on the mode settings, the Pluto Trigger either simply instructs the camera to release the shutter with the current in-camera settings, or attempts to time an arbitrary exposure by using camera's Bulb mode.

You can choose one of the following release modes to take a picture:

- **Single**: press to take a single picture
- **Focus**: press to focus, release to take a picture
- **Hold**: press to open shutter, release to end exposure
- **Lock**: press to open shutter, press again to end exposure
- **Bulb**: set exposure time, press to take a picture
- **Burst**: set interval, press to start a exposure sequence
- **Timed**: set countdown and start, take a picture when countdown finishes

For "Hold", "Lock" and "Bulb" release modes, set your camera to **BULB** mode. For others, you may use any exposure mode on the camera, including fully automatic exposure modes. Please note that Manual focus mode should still be used.

Usage

1. Make sure your camera is connected and set up.
2. Make sure Pluto Trigger is connected.
3. Select "Shutter Release" from app's menu.
4. Select a release mode; set the time if needed.

5. Press the "Start" button to take a picture.

NOTE 1: If you would like to pre-focus before exposure, switch your camera to Auto focusing; and select appropriate focus time in app's "Settings" menu, depending on the lightning condition and your camera model.

NOTE 2: Depending on your camera model and chosen mode, select appropriate shutter pulse length in app's "Settings" menu. For example, you may need to choose longer pulse length when Live View is turned on.

4.2. TIME-LAPSE MODE

Use "Time-Lapse" mode to take a number of pictures separated by a preset time interval with an optional start delay before starting the sequence. The resulting pictures can be used to create a fast motion video.

The basic Time-Lapse mode will use your camera exposure settings. Your camera should be set to Manual mode. Besides the basic Time-Lapse, Bulb-ramping Time-Lapse is available. If Bulb-ramping is enabled for your time-lapse sequence, set your camera to Bulb mode for Pluto Trigger to time an arbitrary exposure.

Usage

1. Connect Pluto Trigger to your camera with shutter release cable.
2. Turn on Pluto Trigger and make sure Bluetooth is turned on.
3. Turn on your camera. If Bulb-ramping is enabled, put your camera in Bulb exposure mode. Otherwise, set your camera to any exposure mode other than Bulb mode.
4. If your memory card allows, set your camera to RAW image format. This will make post-processing much easier. If you change image quality setting, re-check that your camera can still fit the planned number of images.
5. Start Pluto Trigger app on your phone; connect to Pluto Trigger with Bluetooth; navigate to Time-lapse mode.
6. Use "Duration" setting to specify how long the time-lapse will take. This setting uses HH:MM:SS format. The maximum duration is 99:59:59.

7. Specify how many "Shots" or images should be taken in total. Make sure your memory card can fit that many images.
8. Use "Interval" setting to specify how often a picture should be taken.
IMPORTANT: your camera may not be able to take images as fast as the interval setting may suggest. The maximum frame rate is determined by the image type/size selected in the camera, memory card speed, presence of shutter cable and other factors. If your camera cannot keep up with the Time-Lapse interval you set, some images may be skipped.
9. Use "Start delay" setting if you wish to delay the beginning of the Time-Lapse image sequence. This setting uses HH:MM:SS format.
10. If you would like to enable Bulb-ramping, refer the following section for instruction. Otherwise skip this step.
11. Press the "Start" button to start Time-Lapse program. If you specified a start delay above, a countdown will begin; otherwise Pluto Trigger will take the first image and continue with the sequence as programmed.
12. When the Time-Lapse program finished, it will return to the settings screen. While Time-Lapse is running, at any moment you can press the stop button to stop the sequence.

Note 1: When the Time-Lapse program has been started, Pluto Trigger can work alone without your phone; all timing and calculations are done on the Pluto Trigger unit. You can disconnect the Bluetooth connection, hide app in background or even close the Pluto Trigger app. Have fun with your phone when taking long and tedious Time-Lapse sequences.

NOTE 2: Turning all of your DSLR settings like exposure, white balance, and focus to manual will eliminate most flickers. However, you may still get a case of "aperture flicker". Aperture flicker is caused by a DSLR's inability to open and close the aperture blades of a lens the exact same amount every time. To avoid that, try lens twist:

1. While holding down the depth of field preview button (DOF Preview) press the lens release button. The aperture blades will be closed down to your selected aperture.
2. Now while holding down both buttons twist the lens as if you were removing it. The twist should be a very small turn. You should now see a "00" where your aperture information used to be.
3. Take a few pictures to make sure you do not get an error. Re-attach the lens and try again if you get an error.

NOTE 3: If your camera is set at an angle, and your lens is prone to unexpected zoom/focus changes due to gravity, you may want to use scotch tape to fix the zoom/focus rings. On ultrasonic lenses focus setting will not move, but zoom setting may change.

4.2.1. POWER MANAGEMENT

Your camera battery may not be able to withstand a long term Time-Lapse without being powered by an AC adapter. However, you can minimize camera power draw by enabling automatic meter-off timeout in your camera settings. The camera will then go to sleep between Time-Lapse shots. When needed, Pluto Trigger will wake it up and continue its work. With a properly chosen camera meter time-out, you may be able to run hundreds of frames through your camera before its battery is depleted.

You can turn off Bluetooth module of Pluto Trigger after a long Time-Lapse sequence has been started. Just press and hold the shutter release button on Pluto Trigger for 5 seconds. The downside is that you will not be able to check the progress of the Time-Lapse sequence.

If you plan on running Time-Lapse sequences for more than a day, you may want to power your Pluto Trigger from the USB charger. Unlike camera, your Pluto Trigger cannot afford to sleep between Time-Lapse sequences, and thus requires a source of external power for long Time-Lapse sessions.

4.2.2. BULB-RAMPING TIME-LAPSE

The Bulb-ramping mode is intended for Time-Lapse users who would like to take Time-Lapse videos in changing light conditions, such as a sunset or a sunrise, which is also known as Holy-Grail in Time-Lapse. It works by gradually changing camera Bulb exposure, achieving a nearly flicker-free exposure transition from bright to dark, or dark to bright. This section assumes familiarity with basic Time-Lapse concepts.

A bulb-ramping sequence consists of taking a set of pictures with constant exposure, then changing exposure in very small increments or decrements for a certain period of time, and then taking another set of pictures with constant exposure.

Usage

Bulb-ramping Time-Lapse may greatly benefit from some preparation work. Before you taking the Time-Lapse, you'd better get exposure metering of a scene at a time of day when you bulb-ramping is planned to be finished. For example, if you plan to shoot a sunset Time-Lapse, get an exposure of the same scene the night before. Set your camera ISO setting to a fixed value, remember the final exposure time, aperture and ISO values used.

Use the following workflow to prepare for bulb-ramping time-lapse:

1. Navigate to the "Solar Calculator" screen from app's Menu. Remember the official sunset time (for sunset session) or civil sunrise time (for sunrise session).
2. Set up a basic Time-Lapse sequence as described above; make sure the duration will cover the whole sunset/sunrise period. Use interval of 10 seconds for general bulb-ramping. Higher interval values will result in faster time-lapse videos. Lower interval values will result in slower time-lapse videos. Note that a too short interval may limit your exposure range.
3. Make sure your camera ISO is not set to "Auto". Doing so may interfere with bulb-ramping.
4. Disable Mirror Lock-Up mode on your camera. Pluto Trigger cannot ensure correct exposure timing in Bulb-Ramping mode with Mirror Lock-Up enabled.

5. Disable automatic focusing on your camera, choose a fixed aperture and set ISO to the same fixed value you used when measuring your end exposure as described above. If you did not pre-meter your end exposure, use any ISO setting such as 200. Do NOT use automatic ISO feature, if available in your camera.
6. Set your camera to Manual exposure mode, take a few test pictures and pick a shutter speed that yields an acceptable picture.
7. Click the Bulb-Ramping button on the upper-right of the "Start" button. The Bulb-Ramping screen slides in.
8. Turn on Bulb-Ramping and the parameters will show up.
9. Specify a delay to start the exposure ramping using "Start Time" setting.
10. Use the "Duration" setting to set how long the exposure takes. Most sunsets/sunrises take about 30 minutes.
11. Set the current shutter speed as "Start exposure".
12. Enter the "End Exposure". Make sure the end exposure is shorter than the Time-Lapse Interval.
13. Press the "Start" button to start. The image sequence will begin immediately.

NOTE: In many circumstances your start exposure will be shorter than what Pluto Trigger allows you to choose. This case would require installing ND filters in front of your camera lens to make exposures longer than 1/20 second.

4.3. HDR MODE

High dynamic range imaging (HDR) is a process in which a greater dynamic range of light is captured throughout the lightest and darkest areas of an image. HDR Photographs are generally created by shooting multiple photographs using exposure bracketing. After that, they are merged back together into a single HDR image.

With Pluto Trigger, you can shoot up to 19 photos in a HDR sequence. And the exposure step can be set a value from 1/3 to 3 stops.

Due to using Bulb mode, the shortest exposure that can be used in HDR is limited depending on your camera model. In addition to that, exposure close to the shortest limit may be slightly less accurate and may vary in brightness.

Usage

1. Connect Pluto Trigger to your camera with camera release cable.
2. Turn on Pluto Trigger and make sure Bluetooth is turned on.
3. Turn on your camera. Set your camera to Bulb exposure mode.
4. If your memory card allows, set your camera to RAW image format. This will make post-processing much easier. If you change image quality setting, re-check that your camera can still fit the planned number of images.
5. Disable Mirror Lock-Up mode on your camera. Pluto Trigger cannot ensure correct exposure timing in Bulb HDR mode with Mirror Lock-Up enabled.
6. Disable automatic focusing on your camera. You may also need to set it to Single drive mode. Quiet or Silent mode is also acceptable, if available on your camera.
7. Start Pluto Trigger app on your phone; connect to Pluto Trigger with Bluetooth; switch to HDR mode.
8. Choose the Mid Exposure and other sequence parameters. However, in HDR mode extra care needs to be taken. As you make changes to the settings, the exposure from the HDR sequence may fall out of possible range. Due to using Bulb mode, any exposure faster than 1/20 second will be inaccurate and Pluto Trigger will use 1/20 second instead. When shooting daylight photography and other bright scenery, ND filters may be used on your camera to darken the scene and make the resulting exposures longer.
9. Press "Start" button and a series of images will be taken.

You can use image-processing software to combine these pictures and create an HDR image.

4.4. STAR TRAIL MODE

Star Trail Mode can be used to take long-exposure image sequences of the night sky. These long-exposure images can later be combined using image processing software to create a night sky picture with beautiful star trails.

Usage

1. Connect Pluto Trigger and set up your camera as described in "HDR" mode section.
2. Start Pluto Trigger app on your phone; connect to Pluto Trigger with Bluetooth; switch to "Star Trail" mode.
3. Choose number of shots, exposure time, and gap time and start delay.
4. Press the "Start" button and a series of images will be taken.

5. PLUTO SENSOR MODES

Pluto trigger is an advanced MCU controlled device, which has several sensors embedded in. These sensors are ideal for high-speed photography and trigger traps.

High-speed photography usually uses light/laser sensor and sound sensor can respond to the light or sound change in a minimum delay (less than 1 millisecond).

The goal of the high-speed photography is capturing objects in motion. In all cases you want to be able to detect a trigger, wait for an event and take a picture. There are two methods for performing high-speed photography. The first method uses a shutter of a camera. The second method uses an electronic flash.

SHUTTER METHOD

The main advantage of the shutter method is that it can be used outdoors. The subject and the background can be fully illuminated. Since the shutter is used to freeze the motion of the subject, it offers a limited speed. Maximum speed of a shutter could range from 1/4000sec to 1/8000sec, in some cases it may not be fast enough.

Moreover, in cameras that have a focal plane shutter, a small slit moves across the photographic plane at much slower speeds (1/250), thus exposing different parts of the photographic plane at slightly different times.

Finally, there is a delay between the shutter release and the actual exposure. It could be as much 100ms or more (depending on camera). In addition there could be a small variation in timing, each time the camera takes a picture. Therefore this method should not be used when high timing accuracy is required.

FLASH METHOD

The second method of high-speed photography is the flash method. The picture is taken by opening the shutter of the camera, activating the flash and closing the shutter. The picture needs to be taken in a dark room. Because the room is dark, the long exposure time will not have any effect on the final output. The flash light

duration now becomes the actual exposure time. The main advantage of the flash method is the exposure speed and better timing consistency. Electronic flashes are capable of light strobes with durations of 1/10,000 or faster (lower the power setting of the flash, the shorter the flash duration).

The lag between the trigger and the flash strobe is insignificant. The disadvantage of this method is that the picture needs to be taken in a dark room to avoid the over exposure. Also since the flash is used to make the exposure, it may be more difficult to provide a uniform lighting or to illuminate the background.

5.1 . LASER MODE

Caution: Laser beam is dangerous. Avoid eye contact. Use the laser source at your own risk.

Usage

1. Connect Pluto Trigger to your camera with shutter release cable.
2. Turn on Pluto Trigger and make sure Bluetooth is turned on.
3. Turn on your camera. Set your camera to Manual exposure mode.
4. Disable automatic focusing on your camera. You may also need to set it to Single drive mode. Quiet or Silent mode is also acceptable, if available on your camera.
5. Start Pluto Trigger app on your phone; connect to Pluto Trigger with Bluetooth; switch to "Laser" mode.
6. Point you laser beam on to the laser sensor on front side of Pluto Trigger (the transparent led). Check the sensor value in the app to make sure laser is aligned.
7. Adjust the "sensitivity" setting using the slider. Make sure the sensor value is greater than the threshold (middle of the arc) when laser beam is feed to the laser sensor. And also make sure the sensor value is smaller than the threshold when you break the laser beam.

8. Use the "trigger mode" button to switch between "High trigger" and "Low trigger". In "High trigger" mode, the trigger fires when the laser beam is feed to the sensor. Whereas in "Low trigger" mode, the trigger fires when you break the laser beam.
9. Use the "trigger speed" button to switch between "High speed" and "Power save". In "High speed" mode, the trigger fires with the response time less than 20 microseconds. Whereas in "Power save" mode, the trigger is slowed down to a response time of 1 millisecond to save battery power. One millisecond response time is still very fast comparing with the shutter delay of your camera, which is usually tens of milliseconds. In one millisecond, Usain Bolt can only run a distance of 1 cm. As a rule of thumb, use "High speed" when trigger flash, and use "Power save" when trigger camera.
10. Use the "delay" setting to delay the triggering of your camera or flash. The unit can be set to microsecond, millisecond and second.
11. Press the "Start" button to run the program.

5.2. SOUND MODE

Rather than using sound mode as a normal non high-speed sound trigger, here we will mainly focus on using it for high-speed photography.

The sound mode is used for high-speed photography where your regular DSLR camera is too slow to take pictures of popping balloons, breaking glasses, exploding items etc. The idea behind using a sound trigger is very simple. Instead of triggering your camera, you are going to trigger the flash unit. Your camera will be in bulb mode in a completely dark room. Whenever the flash is triggered, you will capture a single frame. Instead of taking many pictures with a high-speed camera, you will capture a single frame with your regular DSLR camera. In this setup, the speed of the flash unit is also very important. The faster the flash unit, the sharper will be the image.

The sound mode has two parameters. These are Sensitivity and Delay. The sensitivity can be set to a value between 1 and 100 using the dial. Setting the sensitivity to a high value will let you to capture more sound events. If you want to

capture only high level sound events, you need to set the sensitivity to a lower value. You can try and see which sensitivity level fits your needs. The second parameter is delay. The sound event may be captured too early. So, you need to add some delay. The flash unit will be triggered after the delay you specified and this will allow you to capture the picture at the exact moment.

5.3. LIGHT MODE

Light mode is similar to sound mode, but use ambient light as the signal to trigger the camera.

Besides the Sensitivity and Delay parameters, Trigger Mode needs to be adjusted before starting the trigger. Trigger mode has two options: "Trigger High" and "Trigger Low". "Trigger High" means taking photo when the light value is higher than the set threshold (light condition), while "Trigger Low" means taking photo when the light value is lower than the set threshold (dark condition).

5.4. LIGHTNING MODE

Lightning mode is really helpful for photographers who want to take photo of lightning strikes.

Since lightning strikes happen in a short period of time, about 100ms. Human cannot act fast enough to capture the event manually. Normally, to take photo of strikes, you will need to take a lot of long exposure photo and hope to have the luck to capture a good one. This method is limited in two aspects: you take a lot of useless photos and light condition should be dark enough. Pluto trigger addresses this with lightning mode by using the embedded high-speed light sensor and the fast processing program.

Only one parameter needs to be adjusted and that is sensitivity. You will need to try and see which value fits the light condition.

5.5. PIR MODE

PIR mode is for wildlife photographers. It detects the infrared emissions from the body of animals and triggers your camera automatically.

No parameter needs to set. Pluto will trigger your camera whenever there is some change of infrared emissions. And the trigger signal will be last for 2-3 seconds. You can change the “Burst” settings in the Settings Menu to take several photos every time animal enters.

PIR mode is not limited to take photo of animals; you can use it to take photo of each passenger on the street automatically.

What's more, you can use it as a non-contact shutter release button. Just wave your hand in front of the dome of Pluto Trigger, and the camera takes a photo.

5.6. DROPLET MODE

Droplet Mode is a mode to help you to take photos of water drop collision easily. You will need a Valve Kit to use this mode. The instructions of how to make a Valve Kit can be found on our website.

In Droplet Mode, you have to decide the size and delay of two consecutive water drops and when to trigger the flashgun.

Usage

1. Make sure Pluto Trigger is connected to your flashgun.
2. Make sure Valve Kit is connected to Aux port of Pluto Trigger; and supply power to Valve Kit.
3. Make sure to connect your phone to the camera with the Pluto Dongle. Set your camera to Manual mode; set shutter speed to 1 sec.
4. Select "Droplet" from app's menu.
5. Set “Drop 1 Size” as you want.
6. Calibrate the “Flash Delay” to make Drop 1 bounce back from the surface of water and to its max height. To use the auto calibration, click on the button to the right of “Flash Delay” parameter and calibration dialog appears. Set the “Time Step” and “Repeat Interval” parameters, then click the auto calibrate button. Pluto trigger will start to release water drops and trigger flash with incrementing delay. Each time a photo is taken, you have to check the

screen of your camera to see if the delay is suitable. If yes, stop the auto calibration immediately. The calibrated value will be saved to the "Flash Delay" parameter.

7. Set "Drop 2 Size" as you want.
8. Calibrate the "Drop 2 Delay" to make Drop 2 collide with Drop 1 at appropriate height. The auto calibration procedure is similar to "Flash Delay".
9. When all parameters are OK, you just press the "Start" button to take photos.

5.7. AUX MODE

Aux Mode is for DIYers. You can add other sensors that are not included in Pluto Trigger, such as ultrasonic sensor, smoke sensor or temperature sensor.

You will need a 2.5mm audio cable to connect your DIY sensor to the Aux port of Pluto Trigger. The tip of the cable connector is 3.3V and the base sleeve is Ground. Pluto Trigger just samples the signal that is fed into the middle sleeve of the connector. Please make sure the voltage of this input signal is in the range of 0-3.3V.

5.8. TIMER MODE

Timer Mode is used to take photos or record video at certain time period of each day. This is usually useful for Time-lapse of infrastructure projects or growing plants. You need to supply power to camera and Pluto Trigger with AC adaptor for that long period.

You can set the Start Time and End Time to take photos or record video. To take photos, you have the option to set the interval to take photo.

5.9. FUSION MODE

Fusion Mode is more advanced. It lets you combine the sensors available to make it suitable for your special use case.

You have the Fusion method of "AND" and "OR" to combine the sensors. You have to set the parameters of each sensor in its own Mode.

6. PHONE SENSOR MODES

Phone sensor modes use various sensors on your smart phone to trigger your camera.

6.1. SOUND MODE

This mode is similar to the Sound Mode in the Pluto Sensor Modes. The difference is that it uses the microphone on your smart phone, and it may not be as fast as the sound sensor of Pluto Trigger.

6.2. VIBRATION MODE

Vibration Mode uses the accelerometer of your smart phone to detect vibrations. And if the vibration exceeds the set threshold, Pluto Trigger fires your camera.

6.3. DISTANCE MODE

Distance Mode is good to take photos when you travel in your car. Compared with taking photo at a specific interval, using distance parameter will make you get better output footage. It will not take a lot of photos when you just stop your car waiting.

6.4. VOICE COMMAND MODE

While Sound Mode only takes sound volume into account, Voice Command Mode is much smarter. It recognizes the voice command "Pluto" and fires your camera. Other noise will be filtered out, no matter how loud it is.

6.5. MOTION MODE

Motion Mode uses the camera of your smart phone to detect motions.

You can zoom in/out your camera to define the field of view. This is really useful if you want to take photos only when the subject enter into a certain small area, and don't want to put your phone too close to it.

You can adjust the sensitivity, as you need. To detect small subject, make the sensitivity higher. A value bar above the preview indicates the real-time level of motion.

7. TOOLS

7.1. SUN CALCULATOR

Sun Calculator calculates the time of official sunrise/sunset and civil sunrise/sunset based on your location and local time. The period between civil sunrise and official sunrise, together with the period between official sunset and civil sunset, are called civil twilight. The sun is below the horizon, but its light is visible because it illuminates the upper layers of the atmosphere. Due to diffused light and different shades of color in the sky, civil twilight is ideal for portrait and landscape photography.

The sunrise/sunset time is also very useful if you are taking sunrise/sunset Holy Grail time-lapse. You will need to set the start time of Bulb-Ramping based on sunrise/sunset time.

For convenience, two countdown clocks are provided to show the forthcoming sunrise/sunset events.

7.2. ND FILTER CALCULATOR

ND Filter Calculator is a utility that helps you determine the correct exposure time/shutter speed when using Neutral Density Filters. Set the filter you are using and the shutter speed without the filter and the calculator calculates the new shutter speed with your filter(s) fitted. Press the button to start the camera exposure.

7.3. DOF CALCULATOR

Depth of Field (DOF) is the range of distance in a photo that appears to be in sharp focus. Depth of field is a creative decision and one of your most important choices when composing nature photographs.

Based on the focal length, aperture and camera type you have entered, DOF calculator calculates the hyper focal distance. This is the focus distance where everything from half the hyper focal distance to infinity is within the depth of field.

This is useful when deciding where to focus such that you maximize the sharpness within your scene,

Use the actual focal length of the lens for depth of field calculations. The calculator will automatically adjust for any "crop factor" for the selected camera.

7.4. STAR SKY RULE

When taking pictures of the sky with stars at night, a long exposure time is preferred in order to get as much light as possible onto the image sensor of your camera. However, there is a limit if you are not taking star trail pictures. To get sharp dot stars, you should not cross this limit. The exposure time limit is calculated with a formula called Rule of 500.

You select camera model and actual focal length; the slowest shutter speed is calculated automatically with the crop-factor of your camera already accounted. Press the button to start the camera exposure.

The stars near the equator move much faster than the stars near the poles. You can choose Rule of 500 or 400 for fast moving stars.

8. SETTINGS

8.1. TRIGGER

Change these settings to control the timing of trigger signals.

8.1.1. *PRE FOCUS TIME*

Default: 0 - Manual Focus

Depending on the mode Pluto Trigger is running, you should choose different focus time.

For high-speed photography, fast response is critical. Your camera is set to manual mode. You should choose "0-Manual focus" to tell Pluto Trigger no need to focus before release shutter.

If you set your camera to Auto-focus mode and want the camera pre focus before exposure, then choose appropriate focus time depending on the lightning condition and your camera model. Please be noted in auto-focus mode camera will not take picture if it doesn't get focus. You are not guaranteed to have your camera triggered in the mode.

In time-lapse mode of timer mode, you may like to put your camera into sleep mode during the long interval to save a lot battery power. Then you can set pre focus time to "0.5" - Pre Wake Up" in order to wake your camera up before taking next picture.

8.1.2. *SHUTTER PULSE TIME*

Default: 150ms – Camera

Shutter Pulse Time setting depends a lot on what device your want to trigger. For speed flash, a shot pulse works fine. For normal cameras, 150mm is adequate. If that is not enough to trigger you camera, choose longer time.

8.1.3. *TRIGGER RESET TIME*

Default: 3"

Trigger Reset Time is very important in those sensor trigger modes. It determines how often the trigger can be fired. The default value is 3", which means the trigger will not fire in the 3" period after trigger fires. Using this setting, you can purposely ignore some unwanted trigger event (like camera shutter sound), and also set the minimum trigger interval.

8.2. INFRARED

Pluto Trigger can control your camera via infrared. Many popular camera brands are supported. For some camera models, you can even start/stop video recording using infrared signal. For cameras without shutter release port, infrared control can be a good option. And this makes Pluto Trigger support many more cameras.

8.2.1. IR REMOTE MODE

Default: Off

Use this setting to make Pluto Trigger emit different type of infrared signal. Available options are: Off, Single, 2S and Video. Certain mode may not work, depending on the setting "Camera Brand" below.

8.2.2. CAMERA BRAND

Default: Off

Change this setting to match your camera brand. Infrared remote of different brand emit different signal.

You can set this setting to "All brands", then Pluto Trigger will emit infrared signal of all brands. Thus, you can use Pluto Trigger as an infrared remote for all supported brands.

8.4. BURST

Change this setting if you want to take multiple pictures when trigger is fired. This setting only applies in "Pluto Sensor Modes".

8.4.1. BURST COUNT

Default: 0

Set this value to the number of pictures you want to take when Pluto Trigger is fired. This setting only applies in "Pluto Sensor Modes".

8.4.2. BURST INTERVAL

Default: 0.5"

Change this setting to set the time interval, at which multiple pictures are taken.

8.5. LED

Default: "Periodic blink"

Change this setting to set when the Status Led show notifications.

| | | |
|---|-----------------------|---|
| 1 | Off | All led notifications are turned off |
| 2 | Program Start/End | Blink led when Program starts or stops running |
| 3 | Camera Trigger | Blink when Pluto trigger your camera |
| 4 | Periodic Notification | Blink every 5 seconds, indicating Pluto is power on |
| 5 | Always On | Led is always on to show remaining power |

8.6. RESET

Reset all the settings to default values.

8.7. FIRMWARE UPGRADE

When new version is available, you can upgrade the firmware in Pluto Trigger over the air.

To upgrade firmware, follow the instructions in the app.

Note:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and

(2) This device must accept any interference received, including interference that may cause undesired operation.

Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

END