



# SmaTrig 2.1

Firmware: v1, v2

## Documentation

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# 1 Modes of operation

The SmaTrig 2.1 has 15 different functions chosen with the dial wheel. All functions with a red symbol on the label (e.g. interval or long exposure) require a time specification at their activation. The time is set by pushing the button multiple times according to the table below. After the time has been set, the triggers

Presses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Time	1"	2"	4"	8"	15"	30"	1'	2'	4'	8'	15'	30'	1h	2h	4h	8h

Tab. 1: Number of presses vs. time

beeps back the number of presses for verification. Now the function can be started by pushing the button again. You find the table also in the SmaTrig 2.1 label.

## 1.1 IR control

The SmaTrig is able to control cameras via infrared (IR) signals and can be used without a cable. This feature is useful on cameras without a remote release port like the NEX series from Sony as it is the only way to release them remotely. The following table lists the IR supported functions. Note that with firmware v2 the IR support must be activated first in the configuration. Depending on the camera model up to three different release modes are possible. Warning: In firmware v1 the Sony code was buggy!

Function	Firmware v1	v2
0 OFF		
1-3 HDR-modes	✓	✓
4 Configuration		
5 TTL servo trigger		
6 Sound & light trigger		✓
7 Light barrier trigger		✓
8 High-speed trigger	✓	✓
9 Lighting trigger		
10 Alternating trigger		
11 Long exposure by parts	✓	✓
12 Interval trigger	✓	✓
13 Long exposure	✓	✓
14 IR remote release	✓	✓
15 Manual/Bulb trigger		

## 1.2 Funktionen

### 0. OFF

The circuit is disconnected from the battery in this position. Switch the SmaTrig to this position if it's not in use for longer time.

### 1-3. HDR-modes

**Symbol:** ((1/2))<sup>\*</sup> ((2)) ((8))

**Required:** bulb mode, manual focus

**Usage:** 1 to 4 presses

Funct.	Presses	$\frac{1}{1000}$	$\frac{1}{500}$	$\frac{1}{250}$	$\frac{1}{125}$	$\frac{1}{60}$	$\frac{1}{30}$	$\frac{1}{15}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	8	15	30	1	2	4	8	
1	1								•		•		•									
	2						•		•		•		•		•							
	3				•		•		•		•		•		•		•					
	4		•		•		•		•		•		•		•		•		•			
2	1								•		•		•		•							
	2						•		•		•		•		•		•					
	3						•		•		•		•		•		•		•			
	4				•		•		•		•		•		•		•		•			•
3	1										•		•		•		•					
	2										•		•		•		•		•			
	3								•		•		•		•		•		•			•
	4						•		•		•		•		•		•		•			•

Tab. 2: Nominal exposure times for default settings. The gray dots are below the default exposure limit

The nominal center times of the bracketing series for the three modes are 1/2, 2 and 8 seconds. In each mode, 3 to 9 images are shot around the center time, depending on how many times the button has been pressed at start. The number of presses corresponds to the number of 'side images'. One press means 3 images, 2 presses 5 images and so on. The EV step can be selected in the configuration between 1, 2, 3 or 4 EV and is 2 EV by default.

In mode 1, also the center exposure time can also be selected by the user allowing to define a quick-access custom bracketing series.

The bracketing mode supports the mirror lock-up function, as well as the long exposure noise reduction where a dark image is taken internally in the camera after the actual exposure. These optional features are activated by holding down the button for longer time during the last press. The SmaTrig 2.1 beeps every second while the button is held down (up to three times). The beeps correspond to the following options:

hold time	option
> 1 s	mirror lock-up
> 2 s	noise reduction (dark frame)
> 3 s	mirror lock-up + noise reduction

Of course, the camera settings have to be consistent with the chosen option. The SmaTrig 2.1 can't change the camera settings!

## 4. Configuration

**Symbol:**

**Usage:** 1 to 14 presses

In this function, the user steps through a short menu where multiple settings can be made to customise the SmaTrig 2.1. The possible settings and its default values are listed in this table. The table also lists which function is affected by which option. All settings are saved in the EEPROM of the AVR permanently. They can be changed any time. The usage of the configuration function is explained below.

Example: The camera brand is to be changed from Canon (default) to Nikon to allow the usage of the IR remote function with a D5000 for example.

Procedure: Set the dial wheel to Configuration (function 4). First we're going to check the current settings. Push the button 2 times to go into the camera brand menu. The trigger beeps the code for the camera brand menu: long, short, short, short (B in Morse alphabet). This allows you to verify you are in the right menu. Then it steps automatically through all possible options beeping twice for the option currently set and only once for all others. If your SmaTrig has the default settings you will hear a double beep followed by 7 single beeps, because Canon is set as default and is the first option in the list. The list consists of 8 brands. After going through all options the trigger restarts. Nothing has been changed until now. Now,

a look into the configuration table tells you that Nikon is the second option in the list. To choose it, you have to push the button after the second beep. We go through the menu again. Push again 11 times, wait for the menu code and then for the second beep. Push the button after the second beep within 1 second. You will hear a special sound. Now Nikon is set as the camera brand in use. Go through the menu again to verify the change. All other menus work this way.

If you want to interrupt the configuration, simply turn the rotary switch forth and back. The EEPROM will not be corrupted.

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## 5. TTL servo trigger

**Symbol:** 

**Usage:** 1 press

In this mode the trigger responds to the 2<sup>nd</sup> flash in the sequence of two flashes as usually generated by TTL-cameras/flashes. The delay between the first and the second flash must be less than 0.5 sec. This mode is primarily intended for servo flash control, so you will need a cable with a jack plug on one end and a PC sync plug for the flash at the other.

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## 6. Sound & light trigger

**Symbol:** 

**Usage:** 1 or 2 presses

In this mode, the attached camera or flash unit is triggered by the integrated photo-diode, a microphone, or another external sensor connected to the sensor connector (right, top view). Typical applications of this function are high-speed photography or servo flash triggering.

When there is no plug in the sensor connector, the internal photo diode is used as signal source. The SmaTrig can detect lightnings, flashes, flames, etc.

To use the SmaTrig as a sound trigger, a sound-card-compatible microphone (stereo 3.5 mm jack) must be plugged into the sensor port. The power supply is integrated in the trigger.

Two modes of operation are available depending on how often the button was pressed during the activation of the function.

Activation with one press means the trigger is blocked for about one second after firing. A double press means the trigger is permanently "live", there is no dead time. It can be connected to a music signal to trigger a flash to the beat for example.

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## 7. Light barrier trigger

**Symbol:** 

**Usage:** 1 or more presses

This mode allows to set up a light barrier using a laser (pointer). All you have to do is point the laser beam at the built-in photo diode and press the button. With the barrier you can detect water drops, animals or use it for surveillance purposes. This function has a built-in delay function for water drop photography. Depending on the number of presses at activation the trigger delay will be different. The formula is

$$\text{delay} = (\text{presses}-1) / 16 \text{ s}$$

so each extra press adds a delay of 1/16s. Please do not point too strong (5mW or more) lasers at the photo diode! Be careful!

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## 8. High-speed trigger

**Symbol:** 

**Usage:** 1 press for activation

This mode was explicitly designed for high-speed photography. It's a one-shot trigger, meaning that it will deactivate itself after firing to prevent unintended multi-triggering. The self-deactivation is of particular importance when triggering with sound, where falling objects can cause a series of sound peaks after the main triggering event.

Another key feature of this mode is the possibility to control the camera via the integrated IR-LED. The trigger sends out an IR signal after activation (push-button) and another one at (self-)deactivation. This allows you to start the bulb exposure automatically with the trigger and terminate it right after firing. This trick will only work if your camera has an IR sensor which can start and stop the bulb exposure when receiving the IR signal. Several Nikon and Canon cameras work this way. This feature only makes sense if taking high-speed images in a dark-room using bulb mode and a flash unit.

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## 9. Lighting trigger

**Symbol:** 

**Requirements:** Manual focus, fixed exp. time or bulb mode

**Usage:** 1 to 16 presses for time sitting + 1 press for activation

Contrary to the popular opinion, it is possible to photograph lightnings by light-triggering the camera directly. If the shutter lag (the delay between lightning detection and exposure start) isn't too long, the results can be fairly good. The lower the shutter lag, the better the results. This trigger mode is similar to the sound and flash trigger mode, but it minimises the shutter lag of the camera. It reduces the lag by keeping the mirror up in a smart way while waiting on the lightning. In case of a detection, the mirror does not need to be lifted before the shutter opens. In the case of the Canon EOS 400D, the pre-release of the mirror reduces the shutter lag by half – from about 120 ms to 60 ms (see measurements) Users of non-Canon cameras should use Mode 6.

The operation is explained in more detail in the following description. The function is tailored to Canon cameras where the mirror is raised with an extra release pulse and released automatically after 30s if the shutter-button wasn't pressed for the second time.

- Set the camera to mirror lock-up mode and the SmaTrig to the lightning mode.
- Push the button multiple times to tell the SmaTrig how long the camera will expose after triggering. This avoids triggering a busy camera or missing a lightning while waiting too long after triggering. Look up the number of presses in the presses/exposure table or the trigger label. After pressing the button the trigger operation starts immediately. The camera is triggered once and the mirror goes up. If a lightning is detected within the next 30 seconds, the camera is triggered for the second time and the exposure starts - a lightning was captured! The exposure "time slot" corresponds to the number of times the button was pushed at activation
- After the exposure, the camera is triggered again and the mirror goes up as in step 2. The trigger waits again for a lightning...

- If no lightning was detected within 30 seconds the mirror is released automatically by the camera. One second later the camera is triggered by the SmaTrig 2 again and waits for a lightning as in point 2.
- Pushing the button again will deactivate the function.

Effectively the camera is waiting for a lightning with a locked-up mirror. The SmaTrig tries to minimise the time where no capture is possible. During the second in which the camera is "reloaded" no lightning can be captured. This results in a theoretical probability of 1/31 of missing a lightning flash. You can also set the exposure time by holding the button down for longer than 1 s (you'll hear a beep) like in the interval mode. The exposure time is then equal to the holding time. This mode is not limited to capturing lightnings. It can be used whenever a reduced shutter lag is necessary, also with a microphone.

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## 10. Alternating trigger

**Symbol:** 

**Usage:** 1 to 16 presses for time sitting + 1 press for activation

If you try to capture very rare events like falling meteoroids or want to shoot lightnings like a pro, this option may be something for you. It allows a 100% interruption-free capturing of events by overlapped exposing using two cameras. The cameras are triggered in a way that each exposure overlaps 1/8 or 12.5% with the previous and the subsequent one. The camera timing is shown in the picture below.

The exposure time can be chosen starting from 1 second to 8 hours. The camera can be used in bulb mode or manual mode (times >30s bulb mode only). If used in manual exposure mode the exposure time in the camera must agree with the time set in the trigger, otherwise the timing will be incorrect. To start the function the exposure time must be entered first by pressing the button multiple times (see presses/exposure table in interval section). After the entered time is acoustically verified the triggering can be started by pressing the push-button again.

To connect two cameras to the SmaTrig 2.1 you will need a cable which connects the focus wire in the trigger with the shutter of cam 1 and the shutter wire of the trigger with the shutter of cam 2. The wiring is shown below. The dashed focus wire is necessary for some camera types (Sony a300, Nikon D80, D90, Canon 40D...)

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## 11. Long exposure by parts

**Symbol:** 

**Usage:** 1 to 16 presses for time sitting + 1 press for activation

This mode is based on a slight but significant variation of the standard interval mode (mode 12.). It might be interesting for astro-photographers or (night-)time lapse fans. The only difference is that the output of the trigger is inverted compared to the standard operation described above. Instead of giving a short pulse once per period, it triggers constantly and makes a short break of 0.5s once per period. If you set the camera to BULB now, it's possible to do very long exposures spread over different images. To merge these multiple images to one you can average them or better apply a "maximum of" operator. This way you can prevent the images from overexposure and better control long exposure noise. Imagine a scene with a lit house with stars in the background. If you try to make the star trails visible using long exposure, you'll definitely "burn" the house. Exposing "by parts" and applying the max operation (or locally max or avg) to the image stack will give better results. This mode should also be useful night traffic photography, airplane trails, ferris wheels etc...

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## 12. Interval trigger

**Symbol:** 

**Usage:** 1 to 16 presses for time sitting + 1 press for activation

As the name implies, the camera (or flash) is triggered periodically at different time intervals. This mode can be used to shoot time-lapse movies of growing flowers, moving clouds, traffic, construction and demolition of buildings, melting ice, parties, rotting food, crowds of people, sunrises, sunsets. Capturing lightnings, surveillance, astronomy, time stamping, scientific experiments, stop-motion movies, averaging (noise reduction) or tourist removing are possible application etc. All this in Full HD or better!

In the second version of the SmaTrig the clock precision has been greatly improved by using a quartz oscillator (see clock movie below). The timer allows 16 different intervals listed in the following table, where " stands for seconds, ' for minutes and h for hours. The table is also printed on the label of the SmaTrig 2.1.

Presses	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Interv.	1"	2"	4"	8"	15"	30"	1'	2'	4'	8'	15'	30'	1h	2h	4h	8h

To activate the timer proceed as follows: Press the button N times to set the interval according to the table above. The trigger will verify the user entry by beeping N times (the beeps come in pairs to simplify counting). Now press the button again to start the timer. It can be stopped anytime by pushing the button again.

There is another "hidden" mode: If you push the button once as for the 1s setting, but hold it down for more than 1s (you will hear a beep), the variable interval trigger will be activated. The button hold time will be converted to the interval time. Example: If you press the button for 12.4s you get an interval of 12.4s. The duty cycle of this function is about 50%, meaning that if you set your camera to bulb it will expose for 50% of the interval time and wait for the remaining 50%. After setting the time by holding down the button, the button must be pressed again to activate the function. The timer can be stopped anytime by pushing the button again.

At very long interval times, the camera battery life becomes a problem. The camera should fall asleep between the shots to avoid exhausting the battery too early. To wake up the camera in a controlled manner, the trigger pulls down the focus wire 4s before the shutter is released (for intervals >4s). This feature can be also used to control lighting equipment as described here. The shutter wire is pulled down for 4s. This is long enough to shoot multiple images as needed for HDR time lapse movies.

## 13. Long exposure

**Symbol:** 

**Usage:** 1 to 16 presses for time sitting + 1 press for activation

This mode can be used for taking very long exposures as needed for astro or infra-red photography. The exposure time can be chosen in discrete steps between 1 second and 8 hours. The times are listed on the SmaTrig or in Tab. 1. Usage: Press the button multiple times to set the exposure time. The time setting is beeped back by the trigger for verification. Then, press the button once to activate the function. Holding the button for more than 1s (beep) generates an additional trigger pulse for mirror lock-up.

## 14. IR remote release

**Symbol:** 

**Usage:** 1 press

This function uses the integrated infra-red LED to send a trigger signal to the camera. The SmaTrig 2.1 replaces the Canon RC-1 / Nikon ML-L3 / etc... remote control. Because each camera brand needs

a different IR code, the camera type must be specified in the configuration. Besides the normal usage for taking pictures remotely, many cameras allow to start and stop the bulb exposure with the IR remote control, so you don't have to keep the shutter-button pressed. It's also possible to shoot a bracketing sequence at once instead of pressing the shutter-button three times, very useful for HDRs. The following functions are available:

Presses	Release mode
1	Immediate release
2	Delayed release (firmware v2, only Canon and Sony)
3	Start/Stop video recording (firmware v2, only Sony)

The delayed release can be used to start/stop a video with Canon cameras.

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## 15. Manual/Bulb trigger

**Symbol:** 

**Usage:** press to trigger camera, hold button to lock

This is the simplest mode of operation. The push-button works as an extension of the shutter button in the camera (only the fully pressed state is available: focus + shutter). If the button is pressed for longer than 1 second, the trigger locks up allowing continuous (bulb) exposure without keeping the button pressed. The lock-up is signaled by a beep. The continuous exposure is terminated by pressing the button again. The lock-up function in connection with the continuous shooting option of a camera can be also used to capture lightnings, etc...



## 2 Configuration

Button presses	Beep	Description	Effect on function	Value (✓ default)
1		beeps firmware version: v1: -----, v2: -----		
2	... (B)	Camera brand. This setting is necessary to generate the correct IR remote signal ) not implemented	1-3, 6-8, 10-14	Canon (✓) Nikon (Fuji Sx) Pentax Olympus Sigma* Sony generic
3	...- (V)	EV step	1-3	1 2 (✓) 3 4
4	... (C)	Center time of user bracketing function	1	1/60 s 1/30 s 1/15 s 1/8 s 1/4 s 1/2 s 1 s 2 s 4 s 8 s 15 s 30 s 1 min 2 min
5	... (P)	Pause between exposures in bracketing modes	1-3	0.25 s 0.5 s 1.0 s 1.5 s (✓) 2.0 s 4.0 s 8.0 s
6	... (L)	Shortest exposure supported by camera in bulb mode. Shorter exposure times will be skipped by the trigger during bracketing	1-3	1/250 1/125 s(✓) 1/60 s 1/30 s 1/15 s 1/8 s 1/4 s 1/2 s
7	.. (R)	Shortest exposure per IR in bracketing mode	1-3	1/60 s 1/30 s 1/15 s 1/8 s 1/4 s 1/2 s (✓) 1 s
8	.. (K)	Release mode of additional IR pulse ) only Canon and Sony. Mode starts video for Canon ) only Sony	1-3, 6-8, 10-13	v1: immediate (✓) no IR v2: no IR (✓) immediate delayed* video**
9	... (F)	Bracketing time sequence	1-3	increasing (✓) decreasing
10	... (C)	Bracketing control	1-3	shutter only focus+shutter (✓)
11	.. (D)	Trigger blocking time after firing in sensor modes	6	1 s 2 s (✓) 4 s
14		<b>Reset configuration</b> to default settings (v2 only)		