SmaTrig 2
Documentation

hardware   modes of operation   configuration   schematics   part list   assembly plan   drill aid   label   pcb

February 26, 2010

0.1 Hardware

1. Camera or flash connector
2. Sensor connector (e. g. mirophone)
3. IR sender for remote control
4. Program selector
5. Light(ning) detector
6. Buzzer
7. Presses/time table
8. Push-button

0.2 Modes of operation

0.2.1 0. OFF

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

0.2.2 1-4. HDR-modes

1/8 s (custom) 2. HDR-mode 1/2 s 3. HDR-mode 2 s 4. HDR-mode 8 s

0.2.3 5. Configuration

The possible configuration options are listed in the section Configuration

6. Lighting trigger

== to do ==

7. TTL servo trigger

In this mode the trigger responds to the 2nd flash in the sequence of two flashes as usually generated by TTL-cameras/flashes. The delay between the fist 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.

8. High-speed trigger

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. Nikon and Canon work this way (D60 and 400D at least). This feature only makes sense if taking high-speed images in a dark-room using bulb mode and a flash unit.

9. Sound & light trigger

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 (see electrical data). Typical applications of this function are high-speed photography or servo flash triggering. When no plug is plugged into the sensor connector, the internal photo-diode is used as signal source. The SmaTrig 2 can be used to detect lightnings, flashes, abrupt changes of light intensity or as a light barrier in connection with a laser pointer for example. To use the SmaTrig 2 as a sound trigger, a sound card compatible electret microphone must be plugged into the sensor port. The power supply is integrated in the trigger. The connection of a sensor is described below. 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 "live" continuously, but it's blocked for about one second (default value) after firing. The blocking time can be changed in the configuration. A double press means the trigger is permanently "live". It can be connected to a music signal to trigger a flash at each beat for example.

Presses Description ● Continuous operation, trigger blocked after firing for time X ●● Continuous operation, no blocking

10. Alternating trigger

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 >30 s 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 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...)

11. Long exposure by parts

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 0.5 s 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...

12. Interval trigger

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.

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 1 s setting, but hold it down for more than 1 s (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 12.4 s you get an interval of 12.4 s. 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 to early. To wake up the camera in a controlled manner, the trigger pulls down the focus wire 4 s before the shutter is released (for intervals >4 s). This feature can be also used to control lighting equipment as described here. The shutter wire is pulled down for 4 s. This is long enough to shoot multiple images as needed for HDR time lapse movies.

13. Long self-timer / Long exposure

This mode can be used in two different ways: as an extended self-timer or for taking very long exposures as needed for astro or infra-red photography. The delay or exposure time can be chosen in discrete steps between 1 second and 8 hours. The list of times is printed on the SmaTrig 2. Usage: Press the button multiple times to set the exposure/delay time according to this table. The time setting is beeped back by the SmaTrig 2 for verification. Then, press the button once for the self-timer function or twice for long exposure function. The trigger pulse of the self-timer function lasts for 2 seconds to up the camera reliably from stand-by. The trigger ticks every second while waiting in self-timer mode to signal activity.

14. IR remote release

This function uses the integrated infra-red LED to send a trigger signal to the camera. The SmaTrig 2 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.

15. Manual/Bulb trigger

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...

Mode	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		(gray)•		•		•		•		•		•								
	2		(gray)•		•		•		•		•		•		•		•		•		
	3				•		•		•		•		•		•		•				
	4						•		•		•										
2	1		(gray)•		•		•		•		•		•		•						
	2				•		•		•		•		•		•		•				
	3						•		•		•		•		•		•		•		
	4								•		•		•								
3	1				•		•		•		•		•		•		•				
	2						•		•		•		•		•		•		•		
	3								•		•		•		•		•		•		•
	4										•		•		•						
4	1						•		•		•		•		•		•		•		•
	2								•		•		•		•		•		•		•
	3										•		•		•		•		•		
	4												•		•		•				

Table 0.1: Nominal exposure times for default settings. The gray dots are below the default exposure limit

0.3 Usage

Bracketing

High-speed-Photography

0.4 Configuration

Presses	Beep	Description	Effect on function	Value (✓default)
1		beeps firmware version, 8 bits, MSB first, short beep = 0, long beep = 1		
2	-.-. (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
3	..- (U)	EV step of user bracketing function	1	1 2 (✓) 3 4
4	... (S)	Number of shots priority (first press) of user bracketing function	1	3 5 (✓) 7 9
5	...- (V)	EV step	2-4	1 2 (✓) 3 4
6	-. (N)	Number of shots priority (first press)	2-4	3 5 (✓) 7 9
7	.- -. (P)	Pause between exposures in bracketing modes	1-4	0.25 s 0.5 s 1.0 s 1.5 s (✓) 2.0 s
				Continued on next page

Presses	Beep	Description	Effect on function	Value (✓default)
				4.0 s 8.0 s
8	..-. (F)	Bracketing time sequence	1-4	increasing (✓) decreasing
9	-.-. (C)	Bracketing control	1-4	shutter only focus+shutter (✓)
10	.-.. (L)	Shortest exposure supported by camera in bulb mode. Shorter exposure times will be skipped by the trigger during bracketing	1-4	1/250 1/125 s(✓) 1/60 s 1/30 s 1/15 s 1/8 s 1/4 s 1/2 s
11	-... (B)	Camera brand. This setting necessary to generate the correct signal in the IR remote function (* not yet implemented)	2	Canon (✓) Nikon Pentax Olympus Fuji Sigma* Sony* generic
12	. (E)	Sensor edge - Use rising edge for flashes and lightnings, falling edge for light barriers	6-9	falling rising (✓)
13	-.. (D)	Trigger blocking time after firing in sensor modes	9	1 s 2 s (✓) 4 s
14	- - (M)	Microphone power supply via sensor plug (ring contact)	6-9	off on (✓)

0.5 Schematics
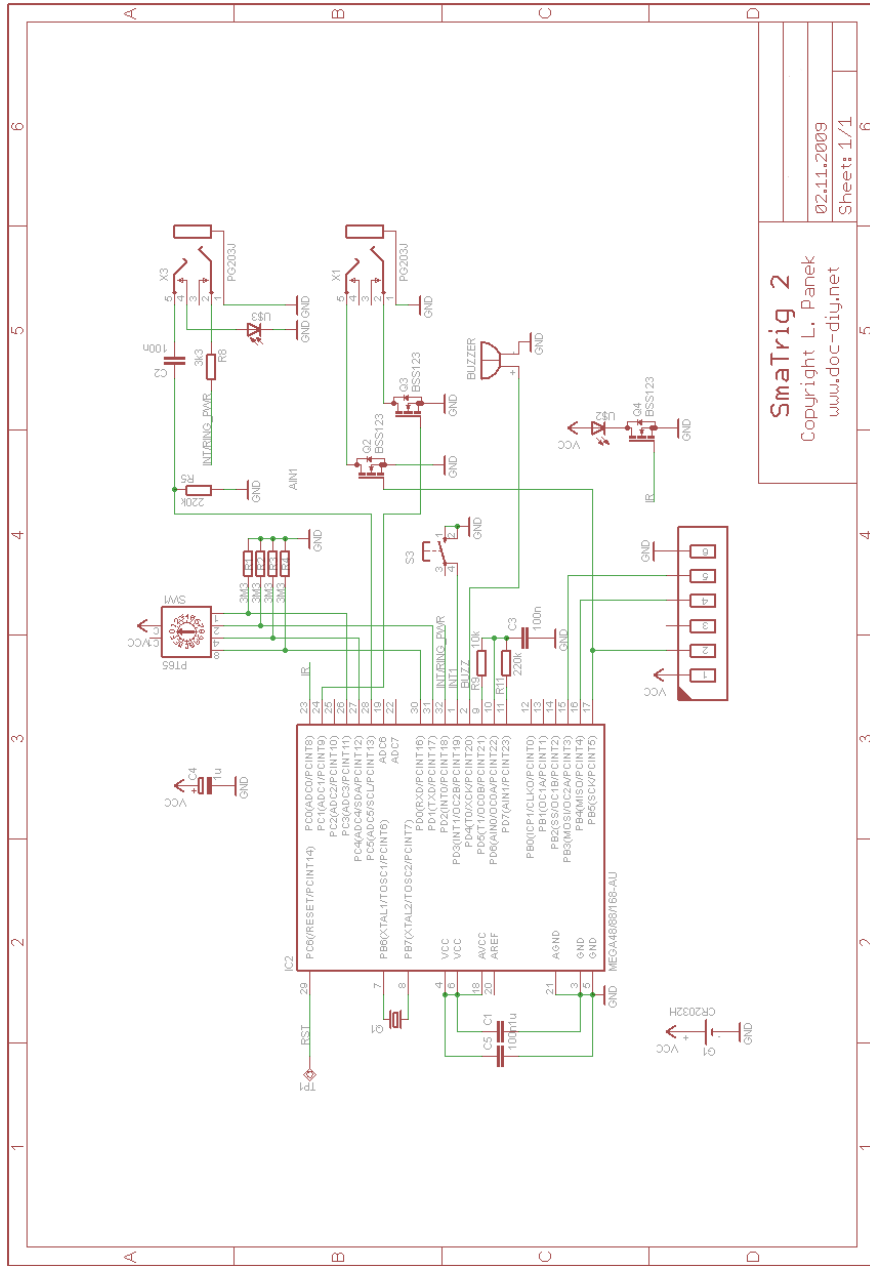
0.6 Part list

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Part      Value            Package
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BUZZER    (no driver type) RM7.5
C1        1u               C1206
C2        100n             C1206
C3        100n             C1206
C4        1u               C1206
C5        100n             C1206
G1        CR2032H          CR2032H
IC2       MEGA88V          TQFP32
Q1        32.7kHz          TC38H
Q2        BSS138           SOT23
Q3        BSS138           SOT23
Q4        BSS138           SOT23
R1        3M3              R1206
R2        3M3              R1206
R3        3M3              R1206
R4        3M3              R1206
R5        220k             R1206
R8        3k3              R1206
R9        10k              R1206
R11       220k             R1206
S3        tactile sw.      B3F-10XX
SW1       PT65 / ERD216    A1353HEX
U$2       SFH484 (IR)      LED5MM
U$3       SFH203 daylight  LED5MM
X1        PG203J           PG203J
X3        PG203J           PG203J
```
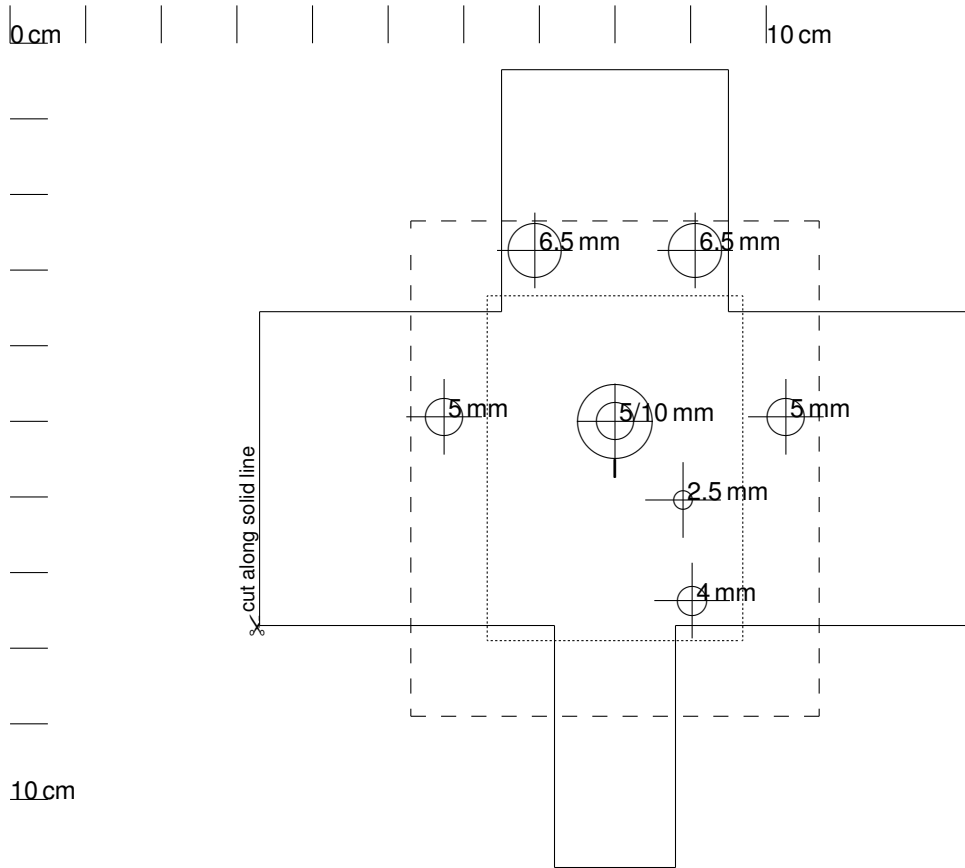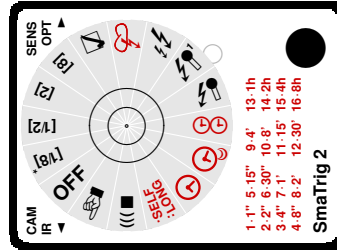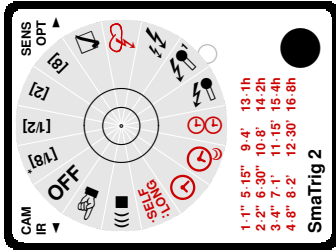
0.7 Assembly plan

0.8 Drill aid

1 mm = 0.254 inch, print without scaling!

0 cm   10 cm

6.5 mm   6.5 mm

5 mm   5/10 mm   5 mm

2.5 mm

cut along solid line

4 mm

10 cm

0.9 Label

0.10 PCB