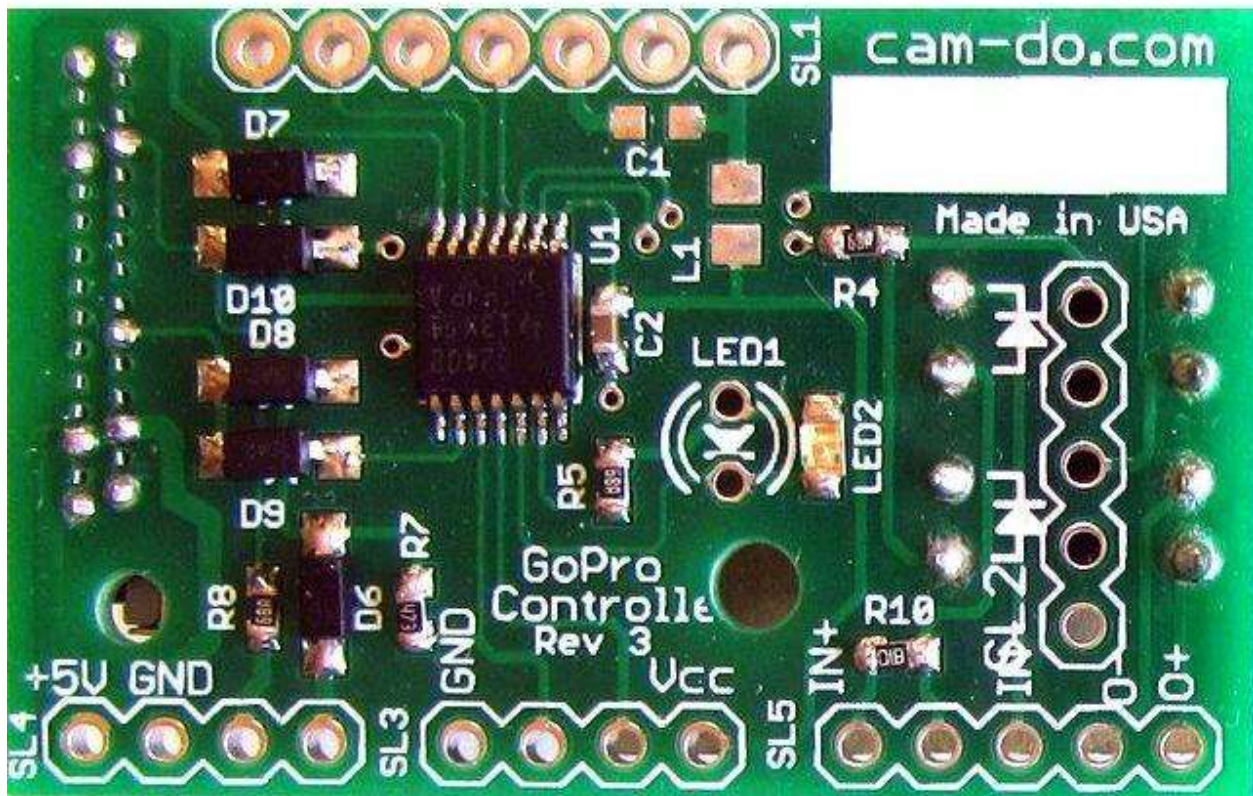


## TL-002 Timer Controller for Hero 3 White, Hero 2 and HD Hero Rev 4

This is the operating manual for the newer, **TL-002** version of the controller board sold between November 1, 2012 and March 16, 2013. Look at your controller board and select which manual you need to use by clicking on the correct image below. The TL-001 is compatible with the HD Hero and Hero 2 cameras. The TL-002 is compatible with the Hero 3 **White Edition** as well as the older cameras. The main difference is the button on the TL-002 used to program the controller.

**Choose the Correct Manual for your Controller Board**

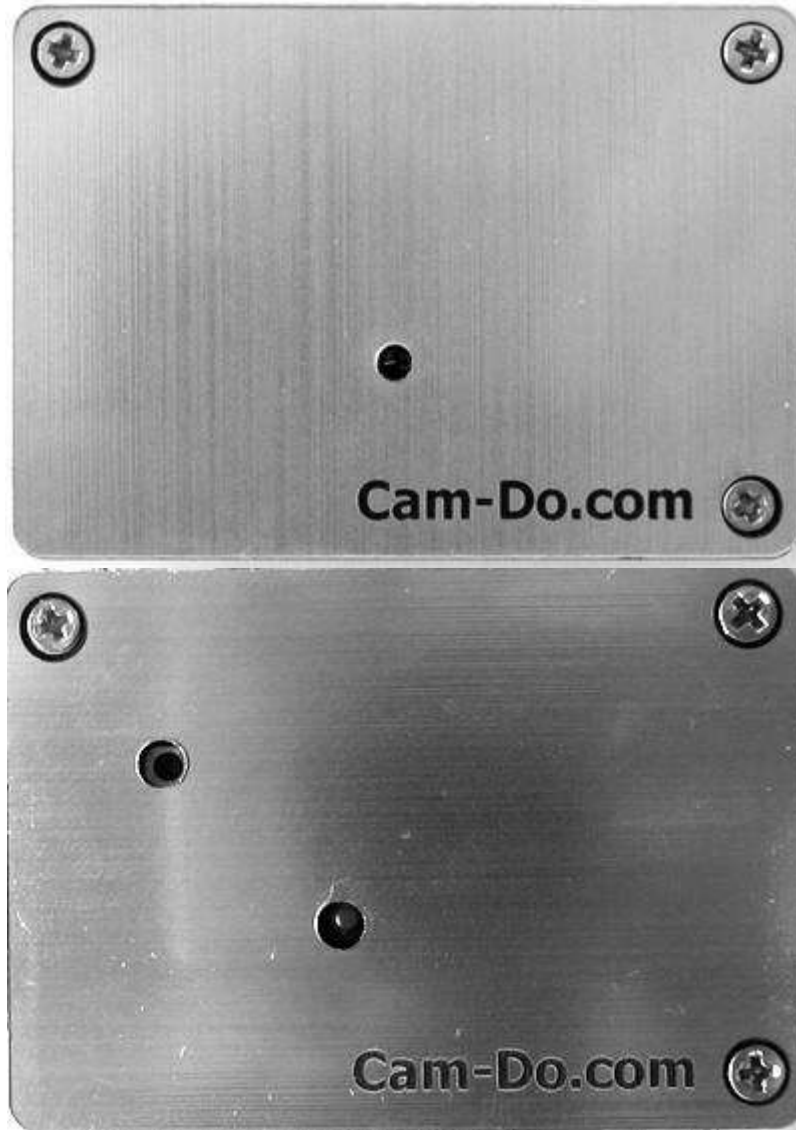
### TL-001



button

TL-002





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The timer controller is used to take time lapse photographs and control the times the camera is off and on. No batteries are required. The negligible amount of power required is provided by the camera battery.

### **GoPro One Button Mode**

The Cam-Do controller can only turn the camera on and off. It has no control over the shutter. To use the controller, the GoPro camera must be set to operate in **One Button Mode**. In One Button Mode, turning the camera on causes the

camera to immediately begin taking photos or recording video without pressing the shutter.

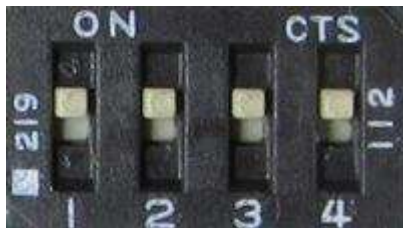
To use One Button Mode on the **HD Hero**, scroll through the settings and change **OnF** (the default) to **OnO**. Next, choose the default operating mode at power up, choose **F** for video (film), **P** for single shot, **3** for triple shot, or **PES** for sequential shots every few seconds. Skip several settings and choose from P1, P2, P5, P30 or P60 for one photo every 1,2,5,30 or 60 seconds while the camera is on.

To use One Button Mode on the **HD Hero 2**, scroll through the settings and change **One Button Mode** to **On** and press the shutter button to confirm. Next, choose the default operating mode at power up, choose **Video** for video or **Time Lapse** for sequential shots every few seconds. Skip several settings and choose from the **Time Lapse Modes** for 0.5, 1,2,5,30 or 60 seconds while the camera is on.

To use One Button Mode on the **HD Hero 3 White**, scroll through the settings and change **One Button Mode** to **On**. Next, choose the default operating mode at power up, choose **Video** for video, **Time Lapse** for sequential shots every few seconds. Set the **Time Lapse Modes** for 0.5, 1,2,5,30 or 60 seconds while the camera is on (5 seconds is recommended for one shot per interval). Turn OFF WiFi. One Button Mode and WiFi cannot be used at the same time.

There are [dozens of videos on YouTube](#) showing how to set up One Button Mode for the different GoPro cameras.

## Time Lapse Operation



**1111**. When you receive the controller it will be preprogrammed for one photo every 60 seconds.

1. Use the menus to set up **One Button Mode** P5 (Time Lapse 5 seconds) on the camera.
2. Turn the camera **OFF**.
3. Set the dip switches on the controller board to **1111** - all 4 switches ON.

4. Insert the board in the socket on the back of the camera. If the camera comes on when you insert the board, do not turn it off manually. Allow the controller board to take control and turn off the camera.

The default cycle is 60 seconds. The camera will come on, take a picture and turn off again. A minute later, it will repeat this process. When you are done, simply remove the controller from the camera.

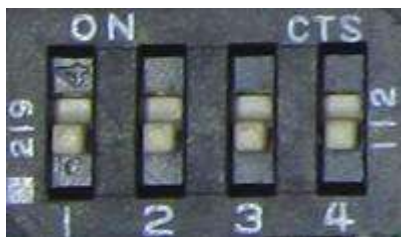
The timing cycle can be custom programmed by following the instructions below:

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## Changing the Shoot Time and Repeat Cycle Time.

To set up the way the controller will work, **set the dip switches** to **0000** (0100 or 0101 for longer times), **turn the camera on**, (turn off One Button Mode if it is on), and then plug the controller into the camera. The LED on the controller board will flash rapidly for 5 seconds to indicate that commands can be entered using the button on the board. If you do nothing, the controller program will be unchanged and the camera will turn off.

If you press the button, the controller will take commands depending on the settings of the 4 dip switches on the back of the controller board. Do not hold the button in. Press it briefly but firmly (about a quarter second). Watch the green LED on the controller board, ignore the camera LEDs and LCD display while programming the controller board.



**0000.** Program a new time lapse cycle.

A cycle consists of a **shoot time** and a **wait time**. During the shoot time, the camera is on. During the wait time, the camera is off. The total time for both the shoot and wait is the **cycle time**.

1. Set the dipswitches to **0000** - all OFF.
2. Turn on the camera.
3. Plug the controller into the back of the camera. The green LED on the controller board will blink rapidly. You have 5 seconds to start

programming. If you take too long, the camera will turn off and you will have to unplug the board from the camera and start over. Watch the green LED. Ignore the LCD on the camera.

4. **Shoot Time:** Press the button once to begin programming the **shoot time**, the length of time the camera is on for photos or video clip shooting. The green LED will flash on once per second. Wait for the length of time you want the camera to be on (count the flashes or use a stopwatch to determine the time). The minimum shoot time is 3 seconds. There is no maximum.
5. **Cycle Time:** Press the button again to indicate the end of the shoot time and the beginning of the **wait time**. The green LED will flash off once per second for the new cycle time. When you have waited the desired time...
6. Press the button one last time to end the cycle. The green LED will come on continuously and the camera will turn itself off.
7. Unplug the controller and **reset the dip switches to 1111** to run the time lapse cycle using the new timer settings.

The minimum shoot time is 5 seconds, just enough time to turn the camera on, take a photo and turn the camera off. The minimum cycle time is 10 seconds. For shorter cycles, it is more efficient to use the camera's own time-lapse mode.

To program longer wait times, there is a short cut:

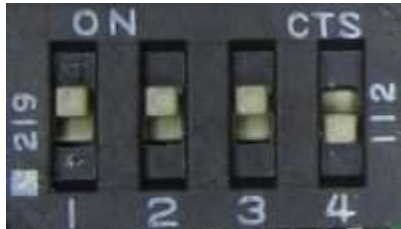
**0101.** Use this setting instead of 0000 to record a cycle time multiplied by **60**. When the camera is running, the cycle time between each shot will be 60 times the setting recorded using the method above. For each LED flash, the cycle will be played back as 60 seconds. The *shoot time* is not changed, but recorded as above. Only the wait time is changed. Don't forget to reset the dipswitches to **1111** when done.

**0100.** Use this setting instead of 0000 to record a wait time multiplied by **600**. When the camera is running, the delay time between shots will be 600 times the setting recorded using the method above. For each second, the delay will be 10 minutes. If you set up a cycle of 3 seconds on, with a cycle time of 6 seconds (6 flashes of the LED), the controller will play this back as 3 seconds on, once an hour. Don't forget to reset the dipswitches to **1111** when done.

This can be a little difficult to understand at first. The video below shows how to program a 15 minute cycle with a 5 second shoot time using the **0101** mode to program the 15 minute wait time in 15 seconds.

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## Light Sensitive Options



**0111. Inhibit night photos.** If you set the dip switches to 0111 instead of 1111 when you plug the controller into the camera, the controller will not take photos if there is not enough light falling on the *sensor at the back of the camera*.

This setting is useful for taking long time lapse series over several days without wasting battery power and filling the SD card with black images from the night time. Remember that it is the light hitting the back of the camera that matters.

If a light comes on during the night, triggered by a motion sensor or manually turned on, the camera will begin taking photos immediately on the programmed cycle.

The light trigger could also be used with the camera in a closet or dark room to capture images when the door is opened or the light turned on. It could even be used to incriminate the person who is opening the refrigerator door in the middle of the night.

The actual operation of the light sensitive threshold is dependent on ambient temperature and the camera battery level. Before making use of this option, you should test it carefully in your application. While some users have reported great success using it, others have found it to be unreliable, particularly when the temperature varies. Because of the possibility of missing shots, we do not recommend use of this option in circumstances where a missed shot would be important. It is easier to delete the unwanted shots than to risk losing a wanted shot.

If you want to shoot during certain hours, the best solution is to use the [Programmable Scheduler](#), which lets you set up to 18 programmed shooting times.

### Setting the Light Sensitive Threshold

The correct setting for the light detector cannot be set in advance because there is a huge difference in low light sensitivity between the Hero 2 and the original HD Hero. In addition, the camera's light sensitivity will vary with temperature, battery level, and camera settings.

It is necessary to calibrate the sensor for your situation, depending on what you want to do.

In the minimum amount of light you want the camera to come on, set the dip switches to 0111. Turn on the camera. Plug the controller into the camera. Press the button on the board while the green controller LED is still flashing (within 5 seconds). The LED will slow down and flash once per second. Press the button again to confirm and save the setting to memory. The LED will flash 4 times and glow while the camera turns off. Remove the board and plug it in again. Do not touch the button while the green LED is flashing.

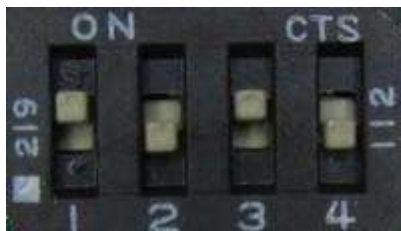
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## Delayed Start Timing

**1000.** Delayed Start. One Shooting Period. Using 1000 instead of 1111 will run the controller in the delayed start, one cycle, no repeat option. The cycle will not repeat. The camera will turn on after the programmed delay, capture one sequence, and turn off after the pre-programmed shooting interval.

**1001.** Delayed Start. **Infinite shoot** requiring manual turn off. The camera will be turned on after the programmed delay and stay on until you turn off the camera, the SD card is full, or the battery runs out. If the battery runs out the photos or videos may be lost or corrupted. External power is recommended when using this option.

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**1010.** To reset the **factory defaults** and remove all user programming:

1. Set the switches to 1010.
2. Turn on the camera.
3. Plug in the controller card. The green LED will flash about four times and then go solid on while the camera turns off.
4. Unplug the card from the camera and



5. **Don't forget to reset the switches to 1111** for normal operation.

*Video showing what you should see when you reset the controller*

Any setting other than 1111 will cause the green LED to flash for 5 seconds after the camera is turned on. Do not press the button during this period or you may inadvertently change one of the program settings. If you should happen to do this, or if you programmed custom time intervals the last time you used the card, use the 1010 setting to reset everything to the factory defaults.

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## External Trigger

The Cam-Do controller board includes an opto-isolated external input for triggering the camera from external sources such as an interval timer, various types of motion detectors, magnetic reed switches, thermostats, radio control, computer control, phones, tablets, Android devices, arduinos, and more. More information on how to connect and use the external trigger is presented in the [Application Notes for Advanced Users](#).

The trigger can be also configured as an enable signal for time lapse photography, allowing the use of a simple timer with an AC adapter to be used to set up complicated sequences such as shooting 9am to 5pm on weekdays. If you plan to use this setup, we can provide the board with a USB cable in place so no soldering will be necessary.

Use of the external trigger requires some knowledge of electronics as it is necessary to solder wires to the PCB. We can also provide custom solutions at reasonable prices for users needing assistance.

Our [motion detector](#) products use a PIR sensor or an X-Band radar detector to trigger the camera when motion is sensed in front of the camera.

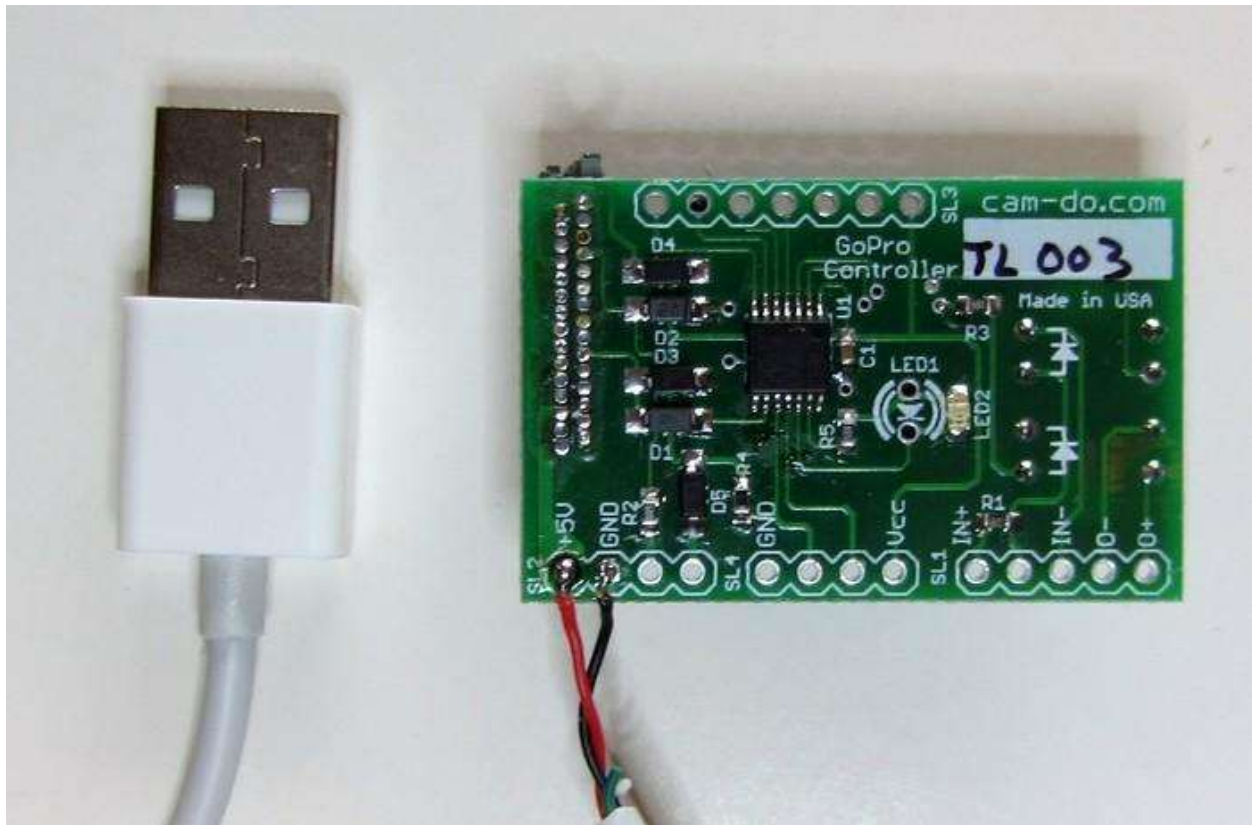
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## Optional External Power for Prolonged Operation

For time lapse photography extending over several months, or when recording long video clips on each shoot interval you may wish to power the camera from a USB charger for longer battery life.

You can use the normal mini-USB charging jack on the side of the camera or for the **Hero 2 only** power can be applied to the +5 and GND connections on the PC board, which allows you to run the cable from the back of the camera and use the normal GoPro housing with the LCD skeleton bacpac.

The power supply must never exceed 5.5 volts. The power supply should be rated at a minimum of 1 amp (1000 mA).



Power is not required for the controller board. This connection is identical to connecting a USB charger to the mini-USB jack on the side of the Hero 2 camera.

On the Hero 3 White cameras, external power via the controller board has worked for some cameras and not for others. It may depend on when the camera was made and what firmware it is running. In general, for recent shipments of the Hero 3 we now recommend that you only apply external power via the camera USB connector.

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## Notes

Timing is approximate because the camera startup time varies from shot to shot. In addition, the controller clock timing will vary slightly with camera battery voltage and the ambient temperature.

Please suggest new features and tell us about anything you find difficult to follow in the instructions so we can improve the manual for future users.

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DIP	Function
1111	Normal time lapse using SHOOT time and CYCLE time.
0000	Program a new SHOOT time and CYCLE time.
0101	Program a new SHOOT time and CYCLE time x60.
0100	Program a new SHOOT time and CYCLE time x600.
0111	Time lapse with light sensor enabled.
0111	Set light sensor threshold (insert with camera on).
1000	Delayed start of length WAIT time. Single cycle of SHOOT time.

1001	Delayed start of length WAIT time. Shoot until battery dies or SD card is full.
1010	Reset all user programmable settings (insert with camera on).
0110	Turn camera on when external input is triggered.
1110	Shoot time lapse when external input is triggered.
0010	Test external input by lighting LED when input is triggered.
1011	Enable external output. (Insert card with camera on).

## Frequently Asked Questions

### ***I want to shoot a 4 minute video of a 4 month construction job. How do I do that?***

You want each month to be one minute of video. That is about 2 seconds per day, or 60 frames at 30fps. Shooting 24 hours a day, that is one shot every 24 minutes, or about one shot every 10 minutes if you only care about the daytime. [Program the TL-001](#) for one shot every 10 minutes. At 144 shots per day, the internal battery will last almost 2 weeks. A 32GB SD card will hold 5-10,000 shots, depending on the complexity of the picture, and the resolution selected. You can put 35-70 days on each card.

So much for theory. In practice, things go wrong. The camera can stop working. The battery might not have been fully charged. The SD card may have a flaw. A bird

dropping might block the lens. We never recommend leaving the camera unchecked for more than a few days. Always assume that what can go wrong, will go wrong.

***I set the camera up to shoot one picture every minute for a week. It worked perfectly for 4 days, but after that I didn't get any pictures. What am I doing wrong?***

First, make sure you are using the latest firmware in the camera. Some Hero 2 cameras were shipped with a version of firmware that ate batteries in as little as 4 hours. This was fixed by GoPro.

If running out of power was not the issue, the problem is likely to be that as the SD card filled up, the camera took longer to come on in one button mode, take a shot and store it to the SD card. Make sure your *shoot time* is long enough for the worst case. The camera also takes longer to shoot and store an image when the light is low, which is another reason images might not be captured.

It is necessary to experiment with the camera and SD card you are using. We have discovered from our customer feedback that there is a considerable difference from one camera to the next, so there is no single "right answer" to the optimum settings. In one case, a customer had six identical cameras with identical SD cards, yet one of the cameras was slower to respond than the other five.

***Can I use the camera manually while it is doing time lapse?***

Yes, you can shoot photos during the waiting interval using the GoPro buttons. The controller will continue when it is time to shoot again.

***Does the controller board fit inside the waterproof case?***

The board does not fit in the standard case. The board **fits in the extended backdoors** provided with the GoPro accessories such as the [GoPro LCD Bacpac](#) or the [GoPro Battery Backpac](#).

A simple means of securing the camera with the controller board in the standard case for use indoors or in good weather, is to use a rubber band to hold the camera in the case with no backdoor.



### ***Can a solar panel be used to extend the operating time?***

Definitely. After 10 days at one shot per minute, the battery on the GoPro Hero 2 showed as full using the test setup shown below. The 9cm x 4cm panel, which includes a 1350 mAH battery and regulated USB output was [purchased on eBay](#) for less than \$10.



### ***I know how to write code for the MSP430 processor. Can I reprogram the chip with my own firmware?***

Yes. The SBW interface is brought to the edge of the board, so you can use the Texas Instruments Launch Pad (\$4.30) to program the device. There is a tutorial: [Use your launchpad as a programmer](#). Let us know if you come up with something really brilliant!

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*The Cam-Do Timer Control is designed for use with GOPRO® products. GOPRO® is a registered trademarks of Woodman Labs, Inc. in the United States and other countries.*

The PCB version of the Go Pro Timer Control is a naked circuit board. As such, it is vulnerable to static electricity. Always discharge yourself to a metal object before touching the board. Always handle the board with care and by grasping the edges. Avoid touching the copper pads or the devices on the board.

WARRANTY: For a period of up to 90 days from the date of purchase Cam-Do agrees to replace the product in the event of failure due to defects in materials or workmanship. This warranty does not cover malfunctions caused by misuse or force majeure.

LIMITATION ON LIABILITY. THE REPLACEMENT WARRANTY IS THE WHOLE AND SOLE LIABILITY FOR THE PRODUCT. THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED. YOUR USE OF THIS PRODUCT CONFIRMS AGREEMENT THAT CAM-DO AND ITS DISTRIBUTORS WILL NOT BE LIABLE FOR ANY DAMAGES ARISING FROM OR RELATING TO CAM-DO PRODUCTS.