

SeeStar II
Programming Guide, v0.2

Monterey Bay Aquarium Research Institute

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Programming Overview

To program the SeeStar II Imaging System for taking videos or still images, three separate, but simple, tasks need to be performed. These are: configure the GoPro camera in the desired operating mode, install the script file onto the SD card, and set the operating parameters in the Arduino sketch (code). Prior to describing the three steps, the timing of the camera will be discussed. An understanding of the timing diagram will greatly assist with future programming.

Camera Timing

Figure 1 shows a simplified timing diagram of the SeeStar II Imaging System. Below are quick descriptions of the events displayed.

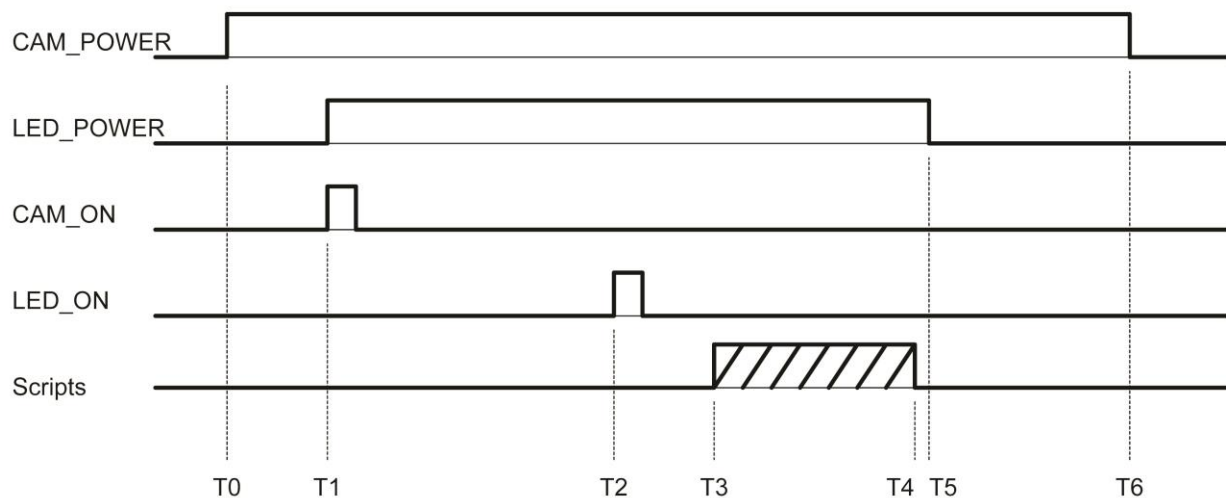
CAM_POWER: Battery voltage is applied to the GoPro (but it is not turned on yet).

LED_POWER: Battery voltage is applied to the LED module (but it is not turned on yet).

CAM_ON: The GoPro is turned on.

LED_ON: The LED is turned on.

Scripts: The script file is activated.



T0: Battery voltage is applied to the GoPro camera.

T0-T1 Delay: An approximate 5 second delay.

T1: Battery voltage is applied to the LED module and the GoPro is turned on.

T1-T2 Delay: An approximate 10 second delay in order for the GoPro to boot up.

T2: The LED is now turned on.

T3: Once the GoPro has booted up, the script file is automatically initiated.

T3-T4: The script file runs. The length is determined by the specific script function.

T5: The battery voltage is removed from the LED module (thus turning off the LED).

T5-T6 Delay: An approximate 6 second delay to ensure the SD card has finished closing files.

T6: The battery voltage is removed from the camera module (thus turning off the GoPro).

Configuring the GoPro Camera

There are many varieties of GoPro Hero cameras. SeeStar II was designed to work with the Hero 3 and Hero 3+. This guide will be specifically referring to the Hero 3+ Black version. Please consult the User's Guide which came with your specific camera for any minor differences.

Hero 3+ Overview

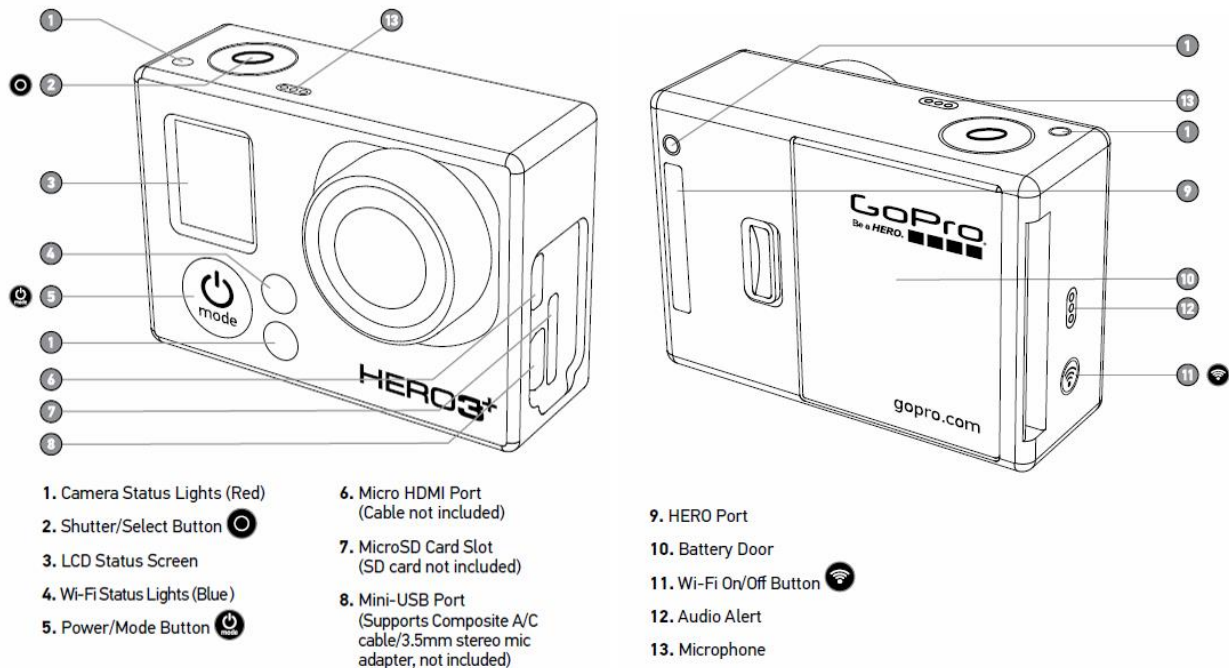


Figure 1: Physical features of the GoPro Hero 3+ Black camera

To Power ON: Press the Power/Mode button (5).

To Power OFF: Press and hold the Power/Mode button (5).

The Hero 3+ has several modes; to cycle through them, press Power/Mode button (5) once the camera is on.

Hero 3+ Imaging Modes

PHOTO RESOLUTION MODES	
The HERO3+ can capture photos at 12MP , 7MP and 5MP resolutions. Any change to photo resolution also affects photos captured in Photo , Photo Burst and Time Lapse modes.	
Photo Resolution	Field of View (FOV)
12MP	Ultra Wide (Default)
7MP	Ultra Wide, Medium
5MP	Medium

Figure 4: GoPro Hero 3+ Imaging modes

Hero 3+ Video Modes

The HERO3+ Black Edition offers the following Video Capture modes:

Video Resolution	NTSC fps	PAL fps	Protune	Field of View (FOV)	Screen Resolution
4K / 4K 17:9	15 12	12.5 12	Yes	Ultra Wide	3840x2160, 16:9 4096x2160, 17:9
2.7K / 2.7K 17:9	30 24	25 24	Yes	Ultra Wide Medium	2704x1524, 16:9 2704x1440, 17:9
1440p	48 30 24	48 25 24	Yes	Ultra Wide	1920x1440, 4:3
1080p	60 48 30 24	50 48 25 24	Yes	Ultra Wide Medium Narrow	1920x1080, 16:9
1080p SuperView*	60 48 30 24	50 48 25 24	Yes	Ultra Wide	1920x1080, 16:9
960p	100 60 48	100 50 48	Yes Yes No	Ultra Wide	1280x960, 4:3
720p	120 60	100 50	Yes Yes	Ultra Wide Medium** Narrow	1280x720, 16:9
720p SuperView*	100 60 48	100 50 48	Yes Yes No	Ultra Wide	1280x720, 16:9
WVGA	240	240	No	Ultra Wide	848x480, 16:9

*SuperView delivers the world's most immersive field of view.

**720p120 and 720p100 only support Ultra Wide and Narrow FOV.

NOTE: *Protune* mode is only possible in select **Video** resolutions.

Figure 5: GoPro Hero 3+ Video modes

Deployment Configuration

Prior to deployment, the Hero 3+ camera needs to be properly configured.

Disable Camera LEDs

Enter the camera menu and select the Camera Settings icon. 

Select the Setup icon  and then the LED icon.  Choose OFF.

Disable Camera Sounds

Enter the camera menu and select the Camera Settings icon. 

Select the Setup icon  and then the Sounds icon.  Choose OFF.

Choose Default Power Up Mode

Enter the camera menu and select the Camera Settings icon. 

Select the Setup icon  and then the Default Power Up icon.  Choose Video  or Imaging. 

Choose Video Resolution

Enter the camera menu and select the Camera Settings icon.  Choose the Video Resolution icon  and set desired parameters.

Choose Imaging Resolution

Enter the camera menu and select the Camera Settings icon.  Choose the Image Resolution icon  and set the desired imaging resolution.

Formatting the SD Card

Insert a blank MicroSD card into the Hero 3+ camera and power it on. Enter the camera menu and select the Camera Settings icon.  Select the Delete icon  and then choose ALL to format the SD card.

Script Writing

The script is a simple batch file that is initiated every time the GoPro is powered up. Simple script functions such as button presses allow software control of the GoPro. Below are two sample scripts. The first takes one image and then powers down. The second takes a 30 second video and then powers down. In each case, the GoPro must be setup to the correct Default Power Up Mode (Imaging vs Video)

```
#####  
# Hero3+: wait 5, Take one image, wait 5 seconds and power down #  
#####  
sleep 5  
t app button shutter PR  
sleep 5  
poweroff yes  
reboot yes
```

```
#####  
# Hero3+: wait 5, Take a 30 sec video, wait 5 seconds and power down #  
#####  
sleep 5  
t app button shutter PR  
sleep 30  
t app button shutter PR  
sleep 5  
poweroff yes  
reboot yes
```

The script files need to be saved in Unix format, meaning they only have a line feed (\n). (no carriage return \r). The filename of the script must be autoexec.ash and it must reside in the root folder of the SD card (Figure 4).

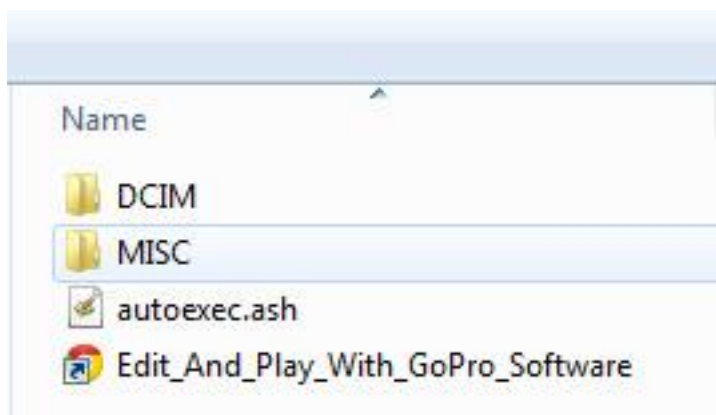


Figure 6: Location of script file on the SD card

Arduino Programming

Primary testing of the Arduino firmware has been accomplished using the codebender [www.codebender.cc], a free website which compiles, verifies, and loads the sketch onto the Arduino Pro-Mini.

1. If the Arduino is plugged onto the Controller Shield, install a jumper shunt on J4.
2. Hook up the FTDI cable between the computer and the Arduino.

On codebender

3. Login and choose your Arduino (SeeStar) project.
4. Choose the COM port associated with your FTDI cable.
5. Choose the style of Arduino to be programmed.
6. Press 'Save sketch'.
7. Press 'Verify Code'.
8. Press 'Run on Arduino'. If successful, a message will be displayed confirming the sketch download.