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1. INTRODUCTION

The ZEB-CAM is a colour camera accessory for GeoSLAM's ZEB-REVO portable laser scanner. ZEB-CAM incorporates a GoPro Hero Session action video camera. The image data collected by the camera can be viewed alongside the 3D point cloud created by the ZEB-REVO and used to extract contextual information.

1.1 SPECIFICATION

Camera Type	GoPro Hero Session
Mode	Video
Video Resolution	1440p
Frames per Second	30
Image Resolution	1920 x 1440
Field of View	Ultra-wide (~120°x 90°)
Logging Medium	Internal SD card
Power Supply	Internal Battery
Battery Life	2 hours continuous use
Image Syncing	Optical flow using integrated inertial sensor

Table 1-1: Specification

1.2 PRINCIPAL OF OPERATION

The operation of the camera on ZEB-CAM is independent from operation of the ZEB-REVO. The camera must be started and stopped manually at the start and end of each scan. The resulting video data is logged directly to an internal microSD card in the camera.

The video data from ZEB-CAM and laser data from ZEB-REVO are combined in the GeoSLAM Desktop processing application. A unique optical flow algorithm is used to determine the relative timing between the video and laser data.

The viewer in GeoSLAM Desktop can be used to view the video data alongside the point cloud data from the ZEB-REVO.

1.3 LIST OF PARTS

Part no.	Description
1 GS_610055	ZEB-CAM assembly
2 a GS_610056 or 2 b GS_610073	ZEB-CAM cable (ZEB-REVO system) or ZEB-CAM cable (ZEB-REVO RT system)
3 EBU_242163	microSD card+ SD adapter
4 EBU_177199	microSD card to USB adapter
5 GS_USB_A_B	USB A to Micro B charging cable
6 GO_PRO_MAN	GoPro Hero Session Starter Guide
7 WEST_M4_8_CAP_3	4 x M4x8mm caps screws
8 RS_609_556	3mm hex key

Table 1-2: List of parts



2. SAFETY

2.1 GENERAL SAFETY

The ZEB-CAM camera accessory should only be used by trained operators. Always follow basic safety precautions when operating the ZEB-CAM to reduce the risk of personal injury and to prevent damage to the equipment. Do not operate the equipment with suspected defects or obvious mechanical damage. Please refer all servicing of the equipment to qualified service personnel. Only use the components and accessories supplied with your system or other accessories recommended by GeoSLAM Ltd. Before operating the system for the first time please read this manual.

2.2 SYSTEM DISPOSAL



When the ZEB-REVO Portable Mapping System reaches the end of its life-cycle please dispose of the equipment in accordance with Directive 2002/96/EC on Waste Electrical and Electronic equipment (WEEE).

GeoSLAM Ltd is prepared to take back the waste equipment and accessories free of charge at the manufacturing unit in Bingham, UK for proper treatment with the objectives of the WEEE.

2.3 INSTALLATION

The ZEB-CAM can only be used in conjunction with a GeoSLAM ZEB-REVO handheld laser scanner. For instructions how to mount ZEB-CAM see Section 3.1 Mounting ZEB-CAM

2.4 FURTHER HELP AND INFORMATION

Contact GeoSLAM by any of the following methods:

Phone: +44 1949 831814

Email: info@geoslam.com

Website: www.geoslam.com

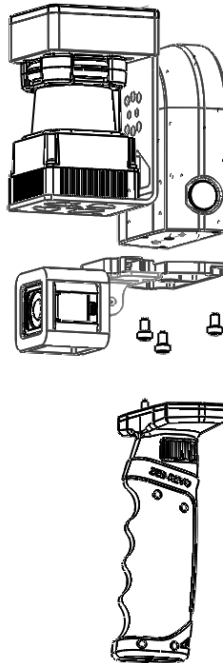
3. DATA CAPTURE

This chapter describes how to mount ZEB-CAM to the ZEB-REVO and how to operate ZEB-CAM during REVO data capture.

3.1 MOUNTING ZEB-CAM

If the ZEB-CAM is not already mounted on the ZEB-REVO, mount the camera by following these steps:

- 1 Remove the ZEB handle by unscrewing the orange knurled wheel at the top of the handle.
- 2 Fit the ZEB_CAM to the base of the REVO using the 3 x M4x8 caps screws supplied with the ZEB-CAM and tighten with the 3mm hex key. Do not overtighten or you risk stripping the threads in the base of the REVO, just nip the screws tight.
- 3 Refit the handle into the underside of the ZEB-CAM mount.
- 4 Connect the Micro-USB end of the ZEB-CAM cable into the socket on the side of ZEB-CAM mount.
- 5 Connect the other end of the ZEB-CAM cable to the AUX (blue) socket on the ZEB-DL2600 data logger.



3.2 ZEB-CAM SETTINGS

The GoPro Hero Session camera is delivered with configuration settings required for use in ZEB-CAM pre-set. If for any reason the camera settings are changed the settings listed in Table 3-1 must be reset to the values shown in order for the ZEB-CAM data to process correctly.

VIDEO SETTINGS	
Resolution	1440
Frames Per Second	30
Field Of View	Wide
CAMERA SETUP	
Orientation	UP
Default Mode	Video

Table 3-1: ZEB-CAM GoPro settings

3.3 CAPTURING DATA WITH ZEB-CAM

3.3.1 ZEB-REVO SYSTEM

The section covers data capture with a standard ZEB-REVO system. For ZEB-REVO RT (real-time) users please refer to section 3.3.2

Ensure the microSD card is inserted into the card slot behind the cover on the side of the camera (see 5.2 Inserting and removing the memory card).

Ensure there is adequate free space on the SD card.

Ensure the camera battery is adequately charged (see 5.1 Charging the battery).

Connect the ZEB-REVO to the AUX port on the data logger, boot up the data logger. Once booted, the LED on the ZEB-REVO should pulse red twice per second to indicate that the ZEB-CAM has been detected and the system is in standby mode. Without the ZEB-CAM the LED will pulse once per second.

Initiate a scan as described in the ZEB-REVO User Manual.

After the system has initialised and the REVO LED has changed to green and before activating the rotation of the REVO head, [short] press the shutter/select button on the top of the camera. After approximately 2 seconds the camera emits three beeps, and automatically begins recording video. The camera status led flashes red while the camera is recording.

Warning – do not hold down the shutter/select button [long press]. This will switch the camera from video to time lapse mode.

Immediately after starting the video recording, start the REVO rotation by pressing the button on the side of the REVO, pick up the scanner and start the scan.

Perform the scan following the guidelines set out in the ZEB-REVO User's Manual.

At the end of the scan, stop the REVO head rotation and immediately stop the video recording by [short] pressing the shutter/select button on top of the camera. The camera beeps several times and automatically powers off to maximize battery life.

3.3.2 ZEB-REVO RT SYSTEM

The section covers data capture with a ZEB-REVO RT (real-time) system

Ensure the microSD card is inserted into the card slot behind the cover on the side of the camera (see 5.2 Inserting and removing the memory card).

Ensure there is adequate free space on the SD card.

Ensure the camera battery is adequately charged (see 5.1 Charging the battery).

Connect the ZEB-REVO to the USB socket on the REVO RT data processing unit, boot up the data processing unit and initiate the scan in the same way described in the ZEB-REVO RT User Manual.

After the system has initialised and before activating the rotation of the REVO head, [short] press the shutter/select button on the top of the camera. After approximately 2 seconds the camera emits three beeps, and automatically begins recording video. The camera status led flashes red while the camera is recording.

Warning – do not hold down the shutter/select button [long press]. This will switch the camera from video to time lapse mode.

Immediately after starting the video recording, start the REVO rotation by pressing the button on the side of the REVO, pick up the scanner and start the scan.

Perform the scan following the guidelines set out in the ZEB-REVO RT User Manual.

At the end of the scan, stop the REVO head rotation and immediately stop the video recording by [short] pressing the shutter/select button on top of the camera. The camera beeps several times and automatically powers off to maximize battery life.

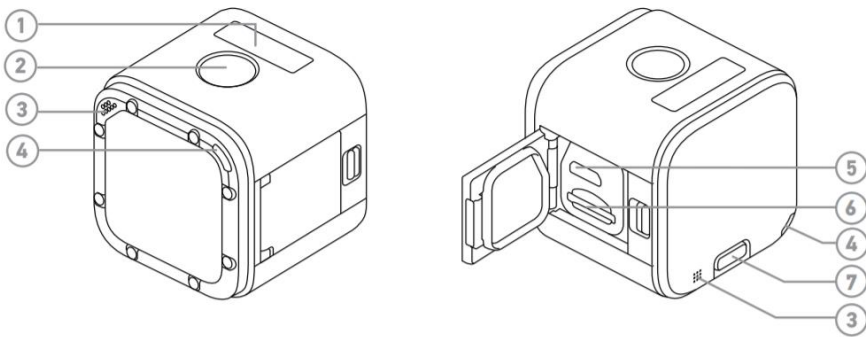
4. DATA PROCESSING

The ZEB-CAM records video data to internal microSD card in MP4 format. Remove the microSD card from the camera and copy the MP4 file(s)* to the processing computer using the microSD to SD or microSD to USB adapter.

Select the corresponding video MP file(s)* when requested to do so by the GeoSLAM Desktop application.

*ZEB-CAM video files are limited in files size to 4GB due to a limitation of the FAT32 disk format. Videos in excess of 4GB (approximately 9 minutes) are split into multiple MP4 files or chapters, each with a common file name plus index number to differentiate each chapter. All chapters must be selected at the start of processing in order for the data to process correctly.

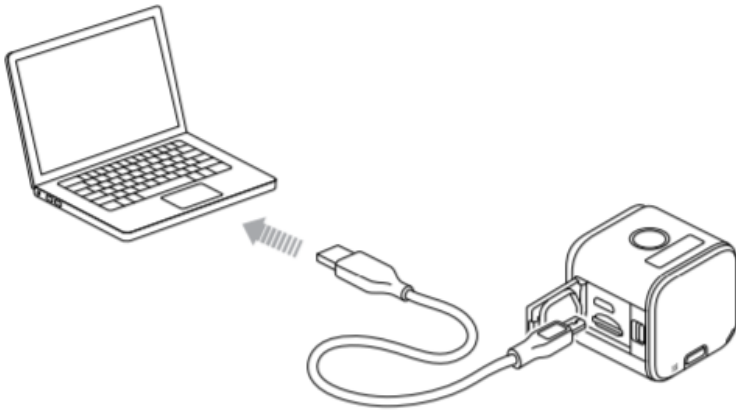
5. GOPRO BASICS



1	Camera Status Screen
2	Shutter/Select Button
3	Microphone
4	Camera Status LED (red) / Wireless Status LED (blue)
5	Micro-USB Port
6	microSD Card Slot
7	Info/Wireless Button

Table 5-1: ZEB-CAM GoPro

5.1 CHARGING THE BATTERY

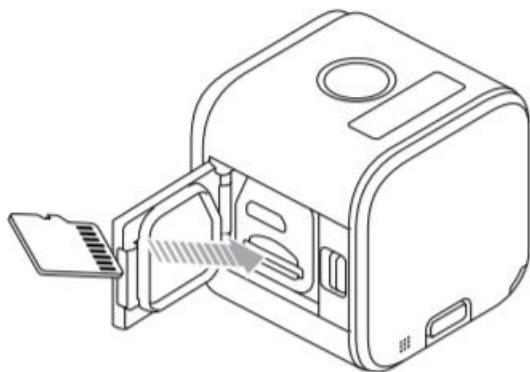


The integrated battery comes partially charged. No damage occurs to the camera or battery if used before being fully charged. To Charge the Battery:

- 1 Open the side door.
- 2 Connect the supplied USB cable to the Micro-USB port.
- 3 Connect the other end to a 5V 1A USB power source, e.g. a standard USB port on a computer.

The camera status led turns red during charging and turns off when charging is complete. When charging the camera with a computer, be sure that the computer is connected to a power source. If the camera status lights do not turn on to indicate charging, use a different USB port.

5.2 INSERTING AND REMOVING THE MEMORY CARD



To insert the memory card:

- 1 Ensure the camera is powered off.
- 2 Open the side door.
- 3 Insert the microSD memory card into the card slot at a downward angle with the label facing down.
- 4 Press the card in until it latches in place

To remove the memory card

- 1 Ensure the camera is powered off.
- 2 Open the side door.
- 3 Gently press the memory card in to unlatch it.
- 4 Carefully extract the memory card

5.3 WIRELESS SETTINGS

The GoPro can be used remotely using the free GoPro App for Mobile via a WiFi connection. We do not recommend using in this mode since it significantly reduces the battery charge life.

The camera WiFi settings have been pre-set to the last eight digits of the camera serial number. The serial number can be found on the inside of the side door:

SSID NNNNNNNN

Password NNNNNNNN

Where NNNNNNNN is the last eight digits of the camera serial number.