

User Manual Camera / Stitcher / Viewer

September 22th, 2020

For device firmware versions 5026 and above For Stitcher/Viewer software versions 21.01.5008 and above

The latest version of this manual can always be downloaded from: www.lizardq.com/cdn/docs/LizardQ User Manual.pdf

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Getting help

In case you have a question or require help either with the LizardQ device or LizardQ software, please do not hesitate to contact us. Your first point of contact should be the reseller or distributor you have purchased the system from. In many cases this will be the LizardQ company itself.

LizardQ can be reached equally fast by phone or by email. We are located in Germany/Europe.

Phone: +49 6837 69 29 69 - 0

Email: info@lizardq.com

If nobody picks up the phone right away, please leave a message and your contact details on the answering machine. It may be outside business hours or a public holiday in Germany (remember: there may be a time difference from your time zone). In any case: We will contact you as soon as possible.

Please be sure to mention your name, your phone number and any relevant information.

In case you are inquiring about a specific panoramic image or a Stitcher problem, please include the image itself and the Stitcher log file (same filename as the image, ending in .log) with your email. You may also use the "Problem Report" menu item under "Help" in the Stitcher software itself.

Please do not direct support inquiries to an individual member of LizardQ (e.g. by emailing axel/stefan@lizardq.com or calling an extension other than -0).

In case your LizardQ device does not function properly, please see the **troubleshooting checklist** a few pages down.

Note: We reserve the right to alter this user manual at any time without prior notification. The current version can be downloaded at (see front page).

Safety instructions

The LizardQ product is intended for use with a Canon digital camera for capturing spherical images while mounted on a photographic tripod. It must be operated by qualified personnel under the environmental conditions specified under <u>www.lizardq.com/technical-specifications</u>. The product is not intended for home use. Only use the LizardQ within the operating conditions, operating procedures and limitations described in this manual.

Read the complete user manual prior to use. Make this instruction manual easily accessible to all users at all times. Always include this instruction manual when passing the LizardQ on to third parties.

Do not open the LizardQ device housing. There are no user-serviceable parts inside.

The LizardQ has moving parts which carries the risk of injury (e.g. bruises). Keep your hands clear of the device while capturing images.

Always use a stable tripod on even ground and ensure the LizardQ is securely mounted to the tripod. Do not use the LizardQ in heavy wind, as the tripod may be overturned by wind force. Consider using a heavier tripod or to add tripod stabilizer weights if unsure.

Do not allow water to enter the LizardQ device, the batteries or the attached camera.

Solvents or cleansing agents can damage the LizardQ, its batteries or the attached camera. Only use a soft, slightly damp cloth to clean the LizardQ. Refer to Canon for instructions on cleaning and servicing the Canon EOS camera.

The LizardQ uses removable Lithium Ion batteries for operation. Always observe the proper precautions and procedure when charging, handling, transporting or operating Lithium Ion batteries. Inspect batteries for damage before using. Protect unused batteries against short circuit. See "Battery Safety Datasheets" on your LizardQ USB stick.

WEEE reference of disposal WEEE-Entsorgungshinweis

weee-encorgungsninweis

In accordance with European regulations, used electrical and electronics devices must not be disposed of as unsorted waste. The symbol of the waste bin on wheels refers to the necessity of separate collection.

Guideline 2012/19/EU of the European Parliament and the Council of July 4th, 2012.

LizardQ is registered with the European WEEE registers network, registration number DE 10954760.

Gebrauchte Elektro- und Elektronikgeräte dürfen gemäß europäischer Vorgaben nicht mehr zum unsortierten Abfall gegeben werden. Das Symbol der Abfalltonne auf Rädern weist auf die Notwendigkeit der getrennten Sammlung hin.

Richtlinie 2012/19/EU des Europäischen Parlaments und des Rates vom 4. Juli 2012.

LizardQ ist bei der Elektro-Altgerätestiftung unter der Nummer DE 10954760 registriert.

LizardQ Battery Information

As per international transport safety regulations (IATA and other), we ship LizardQ batteries at no more than 30% of full charge. You should fully charge your batteries as soon as convenient.

When traveling, LizardQ Lithium Ion batteries may not be packed in your checked luggage. They must be carried with you in your carry on bag. For current regulations and advice on how many batteries you may travel with, we recommend you consult safetravel.dot.gov.

As per EU regulations, you can return LizardQ batteries to LizardQ at no cost. Please contact LizardQ for more information on proper procedure.

LizardQ batteries are of the Inspired Energy NF2040HD or RRC 2040-2 type. For more information, including safety, operation and available chargers, please see www.inspired-energy.com or www.rrc-ps.com

LizardQ handling instructions for transport and travel

Your LizardQ must be handled properly when being shipped, transported by car or by air, hand-carried or when using the suitcase as a wheeled trolley. Failure to follow the procedure outlined below can result in damage to the lens or other parts of the system.

A) When **carrying by hand** (or when **rolling the trolley on flat surfaces** only):

- 1. Handle carefully.
- 2. Avoid shocks.
- 3. Place the suitcase on the ground gently.
- 4. The Canon camera may be left attached to the lens, so the device can be readied for operation immediately.

B) When **transporting by car**, when **traveling by air** (regardless of whether you take the LizardQ as carry-on baggage or checked baggage), when **wheeling along on uneven surfaces** or over steps, or when **shipping by parcel or courier service**:

- Always remove the Canon camera body from the lens and stow it separately (see picture below). Either unfasten the black finger screw, unmount the lens and Canon body, remove the body, reattach the lens. Or, point the lens approximately at the horizon; you can then remove the Canon body without unfastening the lens.
- 2. Place caps on both Canon body and lens.



3. In addition to the above: When shipping the suitcase with a parcel or courier service, always use sturdy external cardboard packaging. Stuff empty space with padding material.

LizardQ: Vorgehensweise beim Transport und auf Reisen

Ihr LizardQ verlangt eine korrekte Handhabung beim Versand, beim Transport mit dem Auto oder per Flugzeug, beim Tragen in der Hand oder beim Rollen des Koffers als Trolley. Nichtbeachten der folgenden Vorgehensweisen kann zur Beschädigung des Objektivs oder anderen Teilen des Systems führen.

A) Beim Transport per Hand (oder beim Rollen über ebene Böden):

- 1. Behandeln Sie das Gerät vorsichtig.
- 2. Vermeiden Sie Stöße.
- 3. Stellen Sie den Koffer sanft auf dem Boden ab.
- 4. Die Canon-Kamera kann auf dem Objektiv montiert bleiben, so dass das Gerät sofort nach dem Herausnehmen aus dem Koffer betriebsbereit ist.

B) Beim **Transport mit dem Auto**, mit dem **Flugzeug** (gleichgültig ob als Handgepäck oder als aufgegebenes Gepäck), **beim Rollen über unebene Böden oder über Stufen**, oder beim **Versand mit einem Paketdienst**:

- Trennen Sie immer die Canon-Kamera vom Objektiv und verstauen Sie die Canon separat (siehe Bild unten). Dazu lösen Sie entweder die schwarze Rändelschraube, demontieren das Objektiv mitsamt Canon-Kamera, nehmen die Kamera ab und schrauben das Objektiv wieder an. Oder Sie richten das Objektiv ungefähr zum Horizont; in dieser Position kann die Canon-Kamera vom Objektiv abgenommen werden, ohne die Rändelschraube zu lösen.
- 2. Setzen Sie die Plastikkappen auf die Kamera und das Objektiv.



3. Zusätzlich: Beim Versand des Koffers mit einem Paketdienst ist es wichtig, immer eine stabile Umverpackung aus Karton zu benutzen. Leerräume müssen mit Füllmaterial ausgefüllt werden.

How to remove and attach the Canon camera body (do this before and after transport)

Note: Never touch the screw on the clamping ring. The clamping ring holds the lens in proper position and must never be removed.

Note: For removing and attaching the Canon camera, mount the LizardQ onto the tripod, so it has a firm stand.



1. Unplug the USB and the power cable.

Remove the USB plug from the Canon camera and the power plug from the LizardQ.





2. Unfasten the black finger screw and unmount the lens from the LizardQ.

Remove the Canon camera including the lens from the LizardQ device. You may have to wiggle a bit in case the alignment pins should be stuck.

3. Unmount the lens from the Canon camera body and mount the lens back onto the LizardQ.

Immediately protect the camera by placing the plastic camera cap. Also, place the rear lens cap. Reattach the lens (without the Canon camera) to the LizardQ device. Now you're ready to stow away the individual parts into the case.

Perform the above steps in reverse order to make your LizardQ ready for operation after transport.

Note: Alternative to steps 2 and 3, you may instead remove the Canon camera without removing the lens. To do so, rotate the horizontal axis by hand so that the lens points to the horizon and then remove the Canon camera from the lens. This is faster but needs a bit more practice.

Troubleshooting Checklist: Status Light

If the LizardQ status light does not show steady green color after starting up or when idle, please switch on your iPod and navigate to the LizardQ web interface. It should display a meaningful error message.

Status light is steady red after booting up or when idle:

- Jack plug of Canon power adaptor properly inserted?
- USB cable inserted into Canon camera?
- Canon camera body switched on?
- Canon camera mode dial set to M?
- Card slot closed?
- Canon camera models other than EOS 5D Mark II: operating mode switch set to photo (not video)?

Status light is <u>steady red</u> after starting a capture:

- LizardQ may be tilted too much (more than about 10 degrees). Level the device at least approximately on its tripod.
- Disconnect power or network cable. For safety reasons, your LizardQ will not move with either DC cable or Ethernet cable connected.
- Lens set to manual focus (M)?

Status light is <u>blinking red slowly</u>:

- Memory card inserted into Canon camera?
- Memory card is full?
- Device movement blocked?

Status light is <u>blinking red quickly</u>:

• Switch the LizardQ off and on again, this should remove the problem. Please contact LizardQ support.

Status light is <u>blinking green slowly</u>:

- This indicates normal operation. The LizardQ is busy booting up, shutting down or reflashing the firmware (when LizardQ-USB-Stick is inserted), please wait for any action to complete.
- If this condition persists for more than 60 seconds during normal boot-up: Switch off your LizardQ and turn it on again.

Status light is <u>flashing green and red (alternating)</u>:

• This indicates a low-light condition ("underexposure warning"). Check the capture settings. If necessary, use manual settings to cope with very dark scenery.



LizardQ settings quick guide

If unsure, use these fail-safe settings for all scenery and lighting conditions:



For optimizing capture time and image quality, use these settings:

a) Lighting conditions

	Bright sunlight	Overcast	Artificial lighting	Dark	Darkest night	
HDR Mode	Auto/Max	Auto/Max	Auto/Max	Auto/Max	Auto/Max	
Base Exposure	Auto	Auto	Auto	Auto	Manual, >8 sec	
Max ISO	400	800	Auto	Auto	1600 to 6400	
Aperture	f11	f11	Auto	Auto	f5.6	

b) Object distance (images shown for Sigma 15mm fisheye lens)

Objects are more than 1.5m (5ft) away	Objects are less than 1.5m (5ft) away
Set lens focus as shown:	Set lens focus to 1m as shown:

c) Photographic intent

Overview	Best details	No under- or overexposed areas in image
Intention is to get an overview over an area, a street or inside a large building. Detail in small objects, dark shadows or bright light sources are not required.	Intention is to capture small objects or details of large objects , to save on the number of stills that need to be taken.	Intention is to be able to look through a window from the inside out or vice-versa, and still see the bright exterior or dim interior.
Place LizardQ camera 30ft (10m) to 150ft (45m) away from objects of interest. Optionally, use HDR mode "3 shot" to save on capture time.	Place LizardQ camera no more than 10ft (3m) away from objects of interest.	Use HDR mode "Auto/Max" .

LizardQ Operation

Getting Started

Procedure outline:

- 1. Prepare your Canon camera body (skip if already prepared or delivered by LizardQ)
- 2. Set up your LizardQ onto a tripod
- 3. Attach Canon camera body to LizardQ (skip if already attached)
- 4. Switch on!
- 5. Connect your Wi-Fi device to the LizardQ wireless network (skip if already prepared or delivered by LizardQ)

Follow these detailed step-by-step instructions:

1. Prepare your Canon EOS camera body

(skip if already prepared or delivered by LizardQ)

This is a one time setup of your Canon camera body. If you received a complete system from LizardQ, the Canon camera body will already be set up correctly. For details see the appendix.

2. Set up your LizardQ onto a tripod

- 1. **Set up your tripod**. Make sure the tripod has a firm stand and any leg extenders are securely fastened. It is not necessary to exactly level the tripod. The LizardQ device has a built-in tilt sensor that is used to auto-level the final panoramic image. The LizardQ will be able to capture with a tilt of up to 10 degrees in any direction. The actual tilt is recorded and corrected for in the Stitcher software. If tilted more than 10 degrees, the red light will flash, when a capture is attempted.
- 2. Attach the quick release adapter to the tripod. The corresponding rectangular plate is already mounted to the bottom side of your LizardQ.
- 3. **Make sure the adapter is fastened tightly**. Check this occasionally. If the adapter should come loose on its thread, the powerful movements of the LizardQ's motors could inadvertently turn the adapter a few degrees at every stop, which might render your panoramic images useless.
- 4. **Open the quick release adapter's latching mechanism** using its lever and lock in open position.
- 5. **Slide the rectangular plate into the quick release adapter**. Make sure the lever is now in closed position. Use the golden safety pin to guard against unintended lever operation.

3. Attach your Canon EOS camera body to the LizardQ

(skip if already attached)

- 1. Make sure your **LizardQ is powered off** and the AC adapter is disconnected.
- 2. **Remove the clamping ring including the lens** from the LizardQ using the finger screw.
- 3. Snap the lens to the Canon camera body.
- 4. **Fasten the clamping ring** (with lens and Canon camera) to the LizardQ using the finger screw. Make sure the screw is tightened.
- 5. Attach the short USB cable to the Canon camera. Fit the cable snugly between the lens and camera body so there is no excess length of cable that might get in the way of movement. Point the connector cover upwards as shown in the image.

For the Canon EOS 5DS, 5DS R and 5D Mark IV models, the USB cable has a "USB Micro B" connector. It fits into the Canon's USB receptacle as shown below, aligned to the left of the receptacle. The cable actually occupies only the left half of the camera's USB receptacle, the right half stays unused (see picture below).

Make the cable go around the lens as shown in the picture.

6. **Insert the Canon power adapter into the Canon camera**'s battery bay and **attach the jack plug** into the receptacle at the horizontal axis (opposite to where the USB receptacle is located). Fit the cable snugly near the lens:



5D Mark II / III / 6D



5D Mark IV / 5DS / 5DS R

- 7. Make sure the **15mm fisheye lens is set to "M"** (manual focus) on its AF/M switch as shown on the right. For the **Zeiss 18mm lens**, there is no such switch; the focus ring is always operated manually.
- 8. Set distance ring of 15mm fisheye lens between 1m and the infinity mark as shown on the right. For the Zeiss 18mm lens, we recommend to experiment with different focus settings to find the optimum position for your application and scene.

On your LizardQ, the focus ring may have been immobilized with black tape at the factory. If so, we recommend this fixed distance setting for your application. If you need a different focus setting, just remove the tape and adjust the focus ring as desired.

- 9. For Canon cameras other than the 5D Mark II, make sure the **photo/video** switch is set to photo.
- 10. Make sure there is a **formatted and empty memory card inserted** into the Canon camera body.

DO NOT USE SD/SDHC/SDXC memory cards with the 5D Mark III, 5DS or 5DS R. Always use CF (compact flash) memory cards with these camera models, 160 MB/sec or better. Never use SD and CF cards at the same time.

Please see the Appendix for details.

Note: The 5D Mark IV and 6D will work fine with SD cards. Use the fastest write speeds available, 90 MB/sec or better.





4. Switch on

1. **Press the silver pushbutton** (at the device's side) once. You hear a short beep and the green status light starts pulsing.

Note: If there is no beep or green light, please check that you have inserted an non-empty battery. Open the battery lid by moving it upwards to have a look at the battery level display.



- 2. Wait about 20 seconds while the green status light is pulsing. When the status light changes to a steady green, the device is ready to capture.
- 3. If the status light shows red color, or is blinking red, or is not lit at all, please see the "Troubleshooting Checklist".
- 4. Remove the lens cover from the lens.

To **switch the LizardQ off** and pack it back into the carrying case to the following:

- 1. Press and hold the pushbutton for about three seconds.
- 2. You hear a short beep and the status light will begin pulsing in green color.
- 3. Release the pushbutton.
- 4. Wait until the device powers off (indicated by another beep and the status light is off).
- 5. Leave the Canon camera switched on. It has been unpowered automatically.
- 6. Don't forget to replace the lens cover onto the lens.
- 7. Remove the LizardQ from the tripod and place it back into the carrying case.

Note: If the carrying case is handled with care, you may leave the Canon camera body mounted onto the lens when stowing the LizardQ back into the case. Please take a look at the handling instructions for transport and travel at the beginning of this document for when to remove the Canon camera before putting the device back into the case.

Note: The pushbutton also serves to start image capture or to cancel a capture in progress. Please see below.

5. Connect your Wi-Fi device to the LizardQ wireless network to access the remote control web interface

(skip if already prepared or delivered by LizardQ)

If you bought a complete system then the delivered iPod touch is already completely set up to access your LizardQ Wi-Fi network. Otherwise please see the appendix for how to connect a Wi-Fi-capable device (e.g. an Apple iPod touch or a Smartphone) to the LizardQ.

The Wi-Fi access information can be found on the label on the bottom side of your LizardQ.

Note: If you can't seem to find the LizardQ wireless network, Wi-Fi may be switched off. Please see the bottom of the device near the label and check the setting of the Wi-Fi switch.

You can also use an Ethernet cable connection to access the web interface. Please see the appendix.

Capturing and processing panoramic images

Procedure outline:

- 1. Adjust imaging parameters
- 2. Capture panoramic image
- 3. Copy the image files from the memory card to a computer
- 4. Process images using LizardQ Stitcher software
- 5. View finished panorama using LizardQ Viewer software



Follow these detailed step-by-step instructions:

1. Adjust imaging parameters

Imaging settings can comfortably be adjusted using the web interface, so you need to use an iPod, iPhone, tablet, smartphone or similar device for this task. A notebook computer with a recent web browser (Firefox, Safari, Opera, not Internet Explorer) will also work. There is also a method to change some settings using the Canon camera's control knobs themselves, please see the appendix.

Press the Settings button on the web interface to call up the Settings screen as shown on the right:

In this case, the LizardQ is set to *HDR Mode* "3 Shot", uses automatic exposure, a maximum ISO value of "400" and a lens aperture of "f11". There is no custom *Pano Name* set, so the images will be named according to their number.

The row of icons at the lower edge of the screen indicates (from left to right):

- The battery has 75% capacity left
- GPS has no signal (black flag, i.e. no position fix)



- There is space for 31 panoramas on the memory card at the current settings
- The most recently captured panorama was number 18 (this number will increase with every started capture)

The battery icon will turn red if less than 10% capacity remain. This will also be indicated by the charger light turning red (indicator LED above the DC jack). The GPS icon will show a green flag if the GPS receiver has a valid position fix.

HDR Mode

The LizardQ is a **high dynamic range (HDR)** capable camera system, i.e. the resulting image will have a contrast range that vastly exceeds the contrast range of conventional or digital photography. This is done by so-called "exposure bracketing", i.e. for every camera viewing direction, multiple shots with different exposure times (and ISO settings) are taken. This makes the darkest and the brightest objects discernible in the same panoramic HDR image.

The LizardQ camera can operate in one of several *HDR Modes*, depending on the desired output image contrast range vs. capture time.

"Auto/Max". For maximum contrast range, set *HDR Mode* to "Auto/Max". This will do a bracketing series from the selected base exposure time downwards to the shortest possible exposure time. The number of images taken at different exposure/ISO settings will vary in "Auto/Max" mode. The advantage of this mode is that bright areas of a scene will be visible and well exposed, within the limits of camera technology (and the limits of auto exposure, see below). If you set the base exposure time such that it is suitable for the darkest spot in the scene, then the resulting HDR image will be properly exposed for both dark and bright objects in the scene.

"5 Shot". Similar to "Auto/Max" mode, just that the number of images in the bracketing series is limited to five, cutting off the brightest areas in a scene. This saves on the amount of image data and some capturing time at the expense of highlights. If available is uses the internal bracketing of the camera.

"3 Shot". For faster shooting with limited dynamic range, set *HDR Mode* to "3 Shot". This will do a 3-shot bracketing series around the base exposure, yielding an adequately exposed image, but cutting off bright lights and very dark shadows. It is important to set the base exposure to "Auto" or use the preview function to determine the correct base exposure, when using "3 Shot" *HDR Mode*.

"1 Shot". If an HDR image is undesired, you can outright switch off the bracketing process (*HDR Mode* "1 Shot"). Only a single shot at the selected base exposure time will then be taken in every viewing direction. This is the fastest capture mode, but will produce over- or underexposed images if base exposure, ISO and aperture are not carefully chosen. Using *HDR Mode* "1 shot" is useful only if the shortest possible capture time must be achieved.

Base Exposure

The *Base Exposure* setting tells the LizardQ camera which exposure to use as a basis for its HDR bracketing series from long exposure times to shorter ones. The *Base Exposure* is always the longest exposure in this bracketing series.

The LizardQ camera has an auto exposure feature. We recommend to always use it. Auto exposure actually uses the light metering built into the Canon camera, so you can expect similar results as if you would be using the Canon camera on its auto exposure setting. The result is a conservatively balanced image - good exposure for most of a scene, with only very little detail in dark areas traded off against a shorter capture time.

To enable auto exposure, select "Auto" from the *Base Exposure* dial. This is the factory default.

When auto exposure is selected, the LizardQ device will precede the actual panoramic image capture by two auto exposure shots, one image pointing downwards and one image pointing upwards. These images are purely for light metering purposes and are not saved to the memory card.



Note: Auto exposure will never choose exposure times longer than 8 seconds. If it is very dark,

you may get an "underexposure" warning on the iPod when this limit is reached. You may want to set a longer manual exposure time in this case.

If automatic exposure is undesired, the operator can choose a suitable base exposure manually. This requires photographic knowledge. See the appendix for an explanation of manual exposure.

Max ISO

Max ISO sets the maximum ISO value the LizardQ camera will use for the individual images of a bracketing series. The ISO value sets "film sensitivity". The higher the ISO value, the more sensitive the "film" (i.e. the digital image sensor). Sensitivity doubles when the ISO value is doubled, effectively halving the exposure time necessary to achieve an equally bright image.

Higher ISO values adversely affect image quality. Higher ISO also means more "pixel noise".

We recommend setting *Max ISO* to "Auto". This will select a range of ISO values from the lower end, aiming for a balance between capture speed and image quality.

You may set a *Max ISO* value from 100 to 6400 in full f-stop increments. Use a *Max ISO* setting of 100 if you need highest quality (minimum noise) or set it to 6400 for the shortest possible capture time at night (caution: introduces massive noise into the image). A *Max ISO* setting of 800 will only minimally affect images while giving a substantial speed advantage in many cases.

Note: The LizardQ device will never use a ISO value higher than the one selected, whatever the circumstances. This allows you to enforce a certain image quality (in terms of image noise). Remember to check the ISO setting when the scene is dark - forcing a low ISO value may underexpose your images in this case. Use "Auto" if unsure.

Note: When *Max ISO* is in "Auto" setting, the LizardQ will not use an ISO value greater than 1600, even when the scene is very dark. If you want to enable ISO settings greater than 1600, you need to set the *Max ISO* value accordingly.

Note: The ISO value is automatically reduced towards 100 during a bracketing sequence whenever possible (i.e. when using a higher ISO number would not result in a noticeably shorter capture time), also when *Max ISO* is not set to "Auto". This optimizes image quality.

Aperture

The *Aperture* setting controls the amount of light the lens lets pass through to the sensor. Lower aperture values mean more light, but less depth of field (near objects may blur). Higher aperture values mean less light, but more depth of field (generally all objects are in focus).

We recommend setting *Aperture* to "Auto". This will use "f11" normally, with "f8" and "f5.6" chosen in low light. Other settings will be used only in exceptional circumstances (e.g. when on a sunny day you manually set a long base exposure of 4 seconds in HDR mode "1 Shot" - there may be no other way to avoid overexposure than to use an aperture value of "f22").

If setting an aperture value manually: Keep the *Aperture* setting at "f11", except for dark environments, where you can gain image brightness by setting it to "f8" or "f5.6" (i.e. you open the aperture by one or two stops). Keep in mind that a lower aperture number causes less depth of field, which in the case of the LizardQ's lens means a loss of sharpness for near objects (up to a distance of 3m).

Pano Name

If you press the little ">" button at the upper right of the Settings screen, you will arrive at the second screen of Settings. This screen holds less-often used settings. Press the same button again to return to the first Settings screen.

The *Pano Name* setting is a text entry field for entering a custom name for the next panorama to be captured. An example would be "MyPano 123" as shown in the screenshot below:

The *Pano Name* may or may not end with a number (like in the example). If it does, the LizardQ will automatically increment that number after each successful panorama capture, i.e. the one after the "MyPano 123" will be named "MyPano 124". This allows the operator to sync the image numbering with other capturing devices, like a laser scanner for easy assignment of panorama image files to laser scan files. If the *Pano Name* does not end with a number or if it is empty, the current pano number of the device will automatically be appended or used, respectively. This makes sure that each panorama gets a distinct name.

The LizardQ Stitcher will then automatically rename all panorama related files according to the *Pano Name* setting.

Valid characters for *Pano Name* are letters, numbers, space, underscore, minus sign and a few select special characters. Length restrictions apply.

Drive Delay

The *Drive Delay* setting is useful when the tripod or the ground, it is standing on, is not stable, or when the device is used in upside-down configuration. Normally, when *Drive Delay* is None, the camera will snap images instantly after the movement to the next capture direction is done. With an unstable tripod, there may be shaking for several seconds, which will introduce motion blur into the image. To avoid that, set *Drive Delay* to 3 seconds. This will introduce a delay after the motor movement as well as slow down the motors in order to reduce shaking. Watch closely to determine if a 3 second delay is right. Inspect the resulting image for blur. You may also choose longer or shorter delays as needed.

For full control, there is also the "Pause" option in the *Drive Delay* setting. This choice will pause the capture process after each movement until the user explicitly presses the "Continue" button on the remote control. This allows for arbitrary delays and comes also handy in scenes with moving objects or persons, so you can hit just the right time for taking the shot.

Press the Reset button to return both Pano Name and Drive Delay to their default values.

Selftimer

The *Selftimer Delay* setting determines how many seconds the capture is delayed, when the silver start button on the device is pressed twice in quick succession. Pressing once will start a capture immediately, pressing twice will use the selftimer delay.

The status light will blink green while the selftimer is counting down.

Leave Settings dialog

Press Ok to leave the settings dialog and go back to the main screen. Capture parameters are persistent. A panoramic image capture is always done using the capture parameters that have been last set. These settings are retained when the LizardQ is switched off and on again.

Lens distance setting (Focus setting)

The default focus setting (shown on the right for the Sigma Fisheye lens) is applicable for most scenes. Those are outdoor scenes or normal indoor scenes with objects more than 1m away.







When shooting in confined spaces (e.g. inside vehicles or in small rooms), it is better to set the lens focus at 1m. The image will be sharper. **One must remember to reset it afterwards, as the 1m setting is unsuitable for landscape panoramas**. Consult with LizardQ if unsure about the best distance setting for your application.

The focus ring on your lens may be fixed with black tape, which can be removed if necessary.

Note: Users of the Zeiss 18mm lens have their default focus setting fixed at 3m, which is the recommended value for most scenery.

2. Capture a panoramic image

Panoramic image capture is started by briefly pressing the pushbutton at the side of the LizardQ. You can also press the Start button on the web interface. Or, press the center button on the key fob remote control.

The LizardQ will now capture images and move from viewing direction to viewing direction (7 directions for the 15m fisheye lens and 14 directions for the Zeiss 18mm lens). At each position, a number of individual shots are taken. The capture is complete when the green light comes on again. This is also displayed on your remote control.

Note: For the downward (nadir) shot, only one single image is taken. This is perfectly normal.

Q

Pause and resume a capture

Image capture can be paused and resumed. This comes in handy when there is imminent movement in the scene (e.g. a person approaching, or road traffic). Pausing a capture at the right time may be effective in removing any unwanted movement artifacts from the resulting panoramic image. Press the Pause button and the Continue button as shown on the right.

Cancel a capture

You can cancel a capture at any time by pressing the device's pushbutton again, or the Cancel button on the web interface, or the

center button on the key fob. Your LizardQ will finish the current exposure and then return to its starting position, ready for a new capture.

Any images already taken will be kept on the Compact Flash card (but they cannot be processed into a panoramic image). Panoramic image numbering will continue with the next higher number, i.e. the number of the canceled image will not be re-used.

3. Copy the image files from the memory card to a computer

At this point, the Canon camera will have saved the individual image files onto the memory card. The file names of these image files will follow the numbering scheme that is set on the Canon camera, generally something like "IMG00001.CR2", counting up. The image file names will not reflect the panorama numbers displayed on the remote control or a "pano name" you may have set in the LizardQ settings. This does not matter. Just dump these files into the Stitcher software and they will get renamed



automatically to reflect panorama number or "pano name".

- 1. Remove the memory card from the Canon camera. Take care not to open the card slot while the red light on the rear of the Canon camera is lit if so, the camera is still busy writing data to the memory card.
- 2. Create a new folder on your computer. We will call this folder the "image folder".
- 3. Use a memory card reader to transfer all files from the memory card into the image folder. Your notebook computer may also have a memory card reader built in. The folder should now contain a large number of camera raw (*.CR2) files.
- 4. You may then delete the contents of the memory card (or save it as a backup of your valuable raw images).
- 5. Don't forget to re-insert this memory card (or a fresh one) back into the Canon camera.

Note: Do not sort the raw images, group them into folders or rename them. The Stitcher will take care of that automatically, see below.

Note: Be sure to actually copy the image files from the memory card to the local harddisk of your computer. Stitching directly from the card is very slow and may fail.

4. Processing images

The raw images from the camera need to be processed into a panoramic image that is suitable for further use, e.g. for retouching or viewing. This is done using the LizardQ Stitcher software.

Installing the LizardQ Stitcher and Viewer software (one time setup)

Now that is easy. Just execute the setup program. This will create two shortcuts on your Windows desktop (LizardQ Stitcher and LizardQ Viewer). After you start up the LizardQ Stitcher, it will look like the screenshot on the right:

In the upper part there is the "Input list", where you queue up panoramic images to be processed. The lower part holds the "Output list", which is populated as soon as processing finishes one by one. The "Processing" box in the middle tells you which panoramic image is currently being processed (if any) and gives an indication of progress.

Add image files (import)

- Drag & drop your image folder (the one containing the camera raw files) onto the Stitcher icon on your Desktop. Or, use the "Add..." button to add a folder by browsing through your hard disk.
- 2. Wait a few seconds. For a large number of images, this process may take longer.
- 3. The images have now been renamed on disk for easier file management.
- 4. The Input list now contains a list of all detected panoramic images to be processed. If desired, image processing starts automatically, as shown on the right (this is the default):

Help						
nput						
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rocessing)					
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utput						
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LizardQ Help nput (1)	Stitcher		Viev	<u> </u>		
Help nput (1) Name	Stitcher Thumbnai	I Time	Add.	·		
Help nput (1) Name 1000-13	Stitcher Thumbnai	I Time Tue	Add.	·		
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Note: You are adding folders here, not individual raw image files or anything else. The LizardQ Stitcher will analyze the contents of the added folder, determine if and which LizardQ panoramic images it contains, and add the detected panoramas to your Input list. Files it does not recognize will be ignored. Incomplete panoramas will be ignored.

Note: Each LizardQ camera keeps track of the number of panoramic images it has taken during its lifetime. This number is set to 0 initially. The renamed image file names all begin with this panoramic image number. All files that belong to the same panoramic image start with the same number. This makes the task of archiving files easier.

Start and stop image processing

If not set to start automatically, you can start and stop processing by pressing the button right next to the progress bar. Stopping will move the panorama currently being processed back to the Input list.

Viewing the generated final panoramic image

After processing of an image is done, it will be visible in the output list as shown on the right.

To view a panoramic image in the Output list, select it (click on it with the left mouse button), then press the View button. The Image will open in the LizardQ Viewer: Use your mouse to pan, zoom, adjust brightness etc., see instructions on how to use the LizardQ Viewer below.

Note: The geometry and the file format(s) of the output image(s) is determined by the current settings. The details are described on the next page.

Viewing information about a panoramic image

When you double-click a panoramic image in the Stitcher's input or output list, an information window is displayed as shown on the right.

You can double-click images that reside in the Input or the Output list. Before a panoramic image is processed, the preview image is really just that - a quick rendering of the output that may be off somewhat.

You can also use the Info button to bring up the information window for images that already reside in the output list.





Settings

There are a few settings for LizardQ Stitcher that change the generated output or the behaviour of the application:

- You can choose which output formats you like the software to produce. Both equirectangular and cube face geometry may be generated in HDR or LDR color depth. The standard output for use with the LizardQ Viewer (and LizardQ Binder) is "Cube Faces Output - HDR".
- For the equirectangular and cube face output you can manually specify the desired image width in pixels. Entered values are rounded to the nearest possible value.
- For measurement applications (laser point cloud coloring, image pair based photogrammetry or general photogrammetry) select the "Disable auto-leveling" option.
- The recommended compression method for OpenEXR images is the lossy but highly effective DWA compression. It is comparable to JPEG, but works for HDR images. This is the default. If you really need lossless compression for 100% quality and have lost of harddisk space, you can check the "Use lossless" option. Lossless PIZ compression will be used instead of DWA in this case.

ne stranda se	
Equirectangular Output	
HDR (OpenEXR)	
HDR (Radiance)	
LDR (Tonemapped JPG)	
Auto size Manual width	14140
Cube Faces Output	
HDR (OpenEXR for LizardQ Viewer and	Binder)
LDR (6 Tonemapped JPEG files)	
Auto size Manual width	4096
Auto size	4096
Auto size	
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Auto size Manual width Processing Automatically start processing after add Disable auto-leveling (for measurement Use lossless compression for OpenEXR Specify directory for saving output files Directory: D:/panos/3D/WZ-brackets Specify sqare logo image to cover the b	ding pairs) s olack tripod 'hole'

This setting only applies to equirectangular OpenEXR images. Cube Faces OpenEXR output for LizardQ Viewer and Binder will always use the lossy DWA compression.

- Normally output image files will be saved alongside the corresponding raw images. Specifying an output directory will save all output image files to the given location.
- You may specify a square JPEG image to be used to automatically fill the black spot at the nadir of the panorama, where the tripod is. This may be used to embed e.g. a company logo into each panorama. Note: Single-channel (i.e. black&white) JPEG images are not supported.
- You can also specify an external program to run after the Stitcher has completed its task. This is useful for customized post processing of panoramic images. Please ask LizardQ support for details on how to use this feature.

5. Using the LizardQ Viewer

To view an output image file, drag&drop the *.hdr/*.exr/*.jpg file onto the "LizardQ Viewer" icon on your Desktop. You can also open the viewer application directly and browse for *.hdr, *.exr and *.jpg image files.

The viewer can be controlled using the mouse and the keyboard. Here are the most common actions:

- Help: Press h
- Pan left/right/up/down: Press left mouse button and drag
- Zoom in/out: Use mouse wheel or use + and - keys
- Adjust brightness: Press both mouse buttons and drag or use . and , keys
- Save a screenshot: Press s
- Toggle fullscreen mode: Press f
- Hide/show info text at lower left: Press i
- Auto-rotate on/off: Press a
- Tonemapping on/off: Press t



The viewer also has a context menu for easy access to this functionality (accessible with the right mouse button).

Please note that the Viewer, just like the Stitcher, makes extensive use of your PC's graphics chip. In case of any problems, the first step is to update the graphics drivers to the latest version. This will fix the problem in 99% of all cases.

Advanced Operation

Dealing with low-light scenes and underexposure

Under some circumstances, you will see the yellow warning message on the iPod remote control as shown to the right.

This means that the capture settings are not suitable for the scene you'd like to capture (i.e. the scene is too dark for the exposure time, Max ISO and aperture chosen), or that the auto-exposure was unable to choose adequate capture settings. In this case, you should

- Set all capture settings to "Auto" if you have been using manual settings for one or more settings and repeat the capture.
- 2. Adjust settings manually if you have been using "Auto":
 - a. Longer exposure time
 - b. Higher Max ISO
 - c. Lower aperture f-number



The warning message contains a valuable hint as to the required adjustment: "need 2 more f-stops", in this case. The same information is repeated in the "Capture complete" message after a capture is done:

"2 f-stops" is a photographic term and means to adjust either exposure, aperture or Max ISO by two steps towards a longer exposure, higher ISO, or lower aperture f-number in the settings dialog. In this example, exposure time was manually set to 1/30 of a second, so you should increase that by two steps to 1/8 of a second (1/30 -> 1/15 -> 1/8).

You might also decide to increase Max ISO from 400 to 1600 (400 -> 800 -> 1600), which will cause more pixel noise in the image. Likewise, you could open the aperture from f5.6 to f2.8 (f5.6 -> f4 -> f2.8). The latter will introduce unsharpness

Capture complete, but image is underexposed by 2 f-stops. Please check settings and consider repeating this capture. (Panorama #3721)



into the image, as a wide-open aperture significantly decreases depth of field.

If the warning message says "3 f-stops", you should adjust settings by 3 steps, and so on.

It is always preferable to choose a longer exposure time before considering to increase Max ISO or open up the aperture, as a longer exposure always improves image quality (and makes the capture take longer). Increasing Max ISO or opening up the lens aperture will usually adversely affect image quality.

Note: The "underexposure warning" will not appear when all three capture settings are set to manual. In this case, the LizardQ does no auto-exposure and hence is unable to determine if the image is over- or underexposed. Essentially, if all settings are on manual, the machine assumes you know what you're doing.

Please also refer to the "Limits when settings are on 'Auto'" paragraph below.

Using manual exposure mode

Using preview for manually setting a base exposure time

For estimating the proper base exposure time, use the preview function. Just press the Preview button. The camera will take a single image while pointing sideways. This image will be displayed along with its histogram.



Press OK to go back to the Settings screen. Adjust base exposure and use Preview repeatedly until satisfied with the result.

Do some experimenting to get a feel for the correct exposure time. Start with 4 seconds for the base exposure when indoors, and try 1/2 second when outdoors.

Tip: It is a good idea to use auto exposure mode. Then you can just unpack, set up and press the start button to capture in the shortest possible time, even without using the iPod remote control.

Note: The Preview function is not available when either base exposure or aperture (or both) is set to "auto". This is because in these modes the LizardQ will have to do auto-exposure shots before capturing the spherical in any case.

How to choose capture parameters in manual exposure mode

Failsafe settings

Even without using the preview function, a good capture is virtually assured by using these settings depending on the scene you're in:

Scene description	HDR Mode	Base Exposure	Max ISO	Aperture
Good for almost all scenes (except after sunset, at night or in dark rooms)	Auto/Max	4 seconds	800	f11
Outdoors in full daylight	Auto/Max	1/4 second	400	f11
Outdoors at night	Auto/Max	15 seconds	1600	f5.6

It is generally safe to choose a longer base exposure but this might unnecessarily increase the total capture time for a complete panorama.

Using "3 Shot" HDR Mode

The "3 Shot" *HDR Mode* is good for saving on capture time and the generated amount of raw image data. In "3 Shot" *HDR Mode*, the exposure bracketing only comprises three different exposure times, which is normally not enough to capture the complete dynamic range of the scene. When not using auto exposure, setting the correct base exposure time is critical for obtaining a well-exposed and balanced panoramic image. See above for how to use the preview function.

Panoramic images taken in "3 Shot" mode will generally be unsuitable for "image based lighting" applications popular in the movie industry or for computer generated imagery (CGI). The contrast range is limited and light sources may be clipped. Use "Auto/Max" mode if this usage is intended.

Limits when settings are on "Auto"

When a LizardQ setting is set to "Auto", the corresponding value will be determined automatically. However, "Auto" will not select from all available values, but limit its choice to safe values. For instance, choosing a *Max ISO* of 6400 will usually introduce unwanted noise into the image, so selecting 6400 should be a deliberate choice by the operator. The same goes for an aperture value of e.g. f2.8, which can introduce unsharpness into the image.

Whenever the LizardQ is unable to achieve a bright-enough image with the parameters chosen, it will display an "underexposure warning" on the iPod remote control. It is then the operator's choice to accept the underexposed image or to manually set values that are outside the automatic range.

Setting	"Dark scene" limit	"Bright scene" limit
Base exposure	8 seconds	shortest exposure supported by Canon camera
Max ISO	ISO 1600	ISO 100
Aperture	f/5.6	f/16

Here is a table of limiting values when a setting is on "Auto":

Using the key fob remote control

In case your LizardQ is equipped with the key fob remote control feature and came with the depicted "garage-door-opener"-type of device, you may use that remote to control some functions of the LizardQ camera system.



The center button S5 does the same as the Start and Cancel buttons on the web interface. **Pressing S5** once while the device is idle **will start a capture**. Pressing S5 again while it is capturing will cancel the capture.

Button **S4 controls the Pause function**. Press it once during a capture and the device will pause its motion. Press S4 again and it will resume.

The remaining buttons don't do anything.

Note: The key fob remote control will function even if the WiFi switch at the bottom of the LizardQ is in the OFF position. It works in a completely different wireless band and has nothing to do with WiFi or Bluetooth.

Note: As the key fob works one-way only (key fob to LizardQ device), there is no feedback on the key fob itself. Best practise is to visually check that the system is doing the right thing after pressing a key fob button.

Note: There are no key fob related radio emissions from the LizardQ device. Also the key fob only emits radiation in the 433 MHz band while a button is pressed, so operation in controlled environments should not pose any problems.



Resetting settings without remote control

Sometimes a WiFi-connected remote control is not available, so you'll be unable to adjust the LizardQ settings via the familiar web interface. In that case, you can at least reset the settings to factory defaults by pressing the power button three times right after powering on. The sequence is as follows:

- 1. Press the silver power button once
- 2. The LizardQ will start blinking green
- 3. Press the power button again three times in quick succession
- 4. You'll hear a confirmation beep (meep-meep ... meep-meep) and the green light will blink faster
- 5. After booting up, you will see the usual green steady light (ready for operation)

Now, the LizardQ settings have been reset to the factory default, which is:

- HDR mode = Auto
- Base exposure = Auto
- Max ISO = Auto
- Aperture = Auto
- Drive delay = None
- Pano name = None

Other settings, e.g. panorama counter will be unaffected. Please also see the next section.

Using the Canon camera body to change settings

If using the iPod (or another device connected by Ethernet cable) for adjusting the LizardQ's settings is undesired or impossible for any reason, you can use the Canon camera's own controls for this task.

A common use case for this is when the LizardQ must be used in environments where wireless remote control is not allowed or otherwise regulated (e.g. on offshore platforms or inside nuclear plants).

How to use?

To use the Canon controls to adjust the LizardQ settings, WiFi must be switched off (see switch at the bottom of the LizardQ device) and any WiFi stick must be removed from the system. This prevents a simultaneous use of the iPod web interface and the Canon controls, which can be confusing.

General caveats

After powering up, the LizardQ camera will always use the same settings that were active the last time it was used. The Canon's own settings (i.e. the control wheels) are meaningless, until they are changed at least once while the LizardQ is powered on.

To make sure the LizardQ settings are in a certain desired state, always check the Canon's controls after power up.

Note: The Canon's mode dial must be set to "M" at all times:



Changing HDR Mode

This is not possible using the Canon's controls. You must use the web interface to set HDR mode.

Changing Base Exposure

The Canon's "exposure time" setting directly sets the LizardQ's "base exposure" time. Use the <

Note: Exposure times shorter than 1/1000 seconds are mapped internally to 1/1000.

Note: While the exposure value can be set in ½ or ½ f-stop increments, the LizardQ device software rounds that to the nearest full f-stop value (e.g. 1/20 second is rounded up to 1/15 second).

Note: Setting the base exposure to "automatic" is done by selecting one of these special values: **25 seconds, 20 seconds, 1/3000 second or shorter**. (Rule to remember: go to either of the extremal values, i.e. shortest or longest exposure, and then go back one step.)

Changing Max ISO

The Canon's "ISO" setting directly sets the LizardQ's *Max ISO* value. Maximum ISO values from 100 to 6400, and A, can be set as follows:

- 1. Press the <ISO•22> button.
- 2. Turn the < wheel to adjust the ISO value, visible in the Canon's display.
- 3. Press the <ISO•522> button again.

Identically to the meaning of *Max ISO* on the iPod web interface, this ISO value is the maximum ISO value the device will use for any image under any circumstances.

Note: Selecting the value 'A' sets Max ISO to "Auto".

Note: While the ISO value can be set in ¹/₃ or ¹/₂ f-stop increments, the LizardQ device software rounds that to the nearest full f-stop value (e.g. ISO 320 is rounded up to ISO 400).

Note: If ISO extension is selected in the Canon's custom functions menu, there are three additional ISO values: H1, H2 and L. These are mapped internally to the highest (6400) and lowest (100) supported ISO values, respectively.

Changing Aperture

Note: While the aperture value can be set in $\frac{1}{3}$ or $\frac{1}{2}$ f-stop increments, the LizardQ device software rounds that to the nearest full f-stop value (e.g. f7.1 is rounded up to f8).

Note: Setting aperture to "automatic" is done by selecting one of these special values: "**3.2" or** "**20**". (Rule to remember: go to either of the extremal values, i.e. smallest or largest f-stop, and then go back one step.)

Taking measurements with the LizardQ

Method and prerequisites

It is possible to take measurements with the LizardQ. Measurements require additional equipment, namely a measurement tripod (e.g. the one supplied by LizardQ as seen on the right) and the LizardQ Binder software that allows to take measurements inside stereoscopic full spherical images.

The measurement tripod from LizardQ is shown to the right. It is a heavy and stable tripod with a precise moveable column, operated by a crank.

Measurement works by taking two images (called a "measurement image pair") in the same location, but vertically separated by e.g. 60 centimeters. This distance is taken as the baseline for a triangulation, which is performed in LizardQ Binder.

Measurement is reasonably accurate in a 10 meter radius around the LizardQ's location. Longer distances or objects that are farther away cannot be accurately measured, as the baseline (e.g. 60 cm) sets the limit for mathematical accuracy.

Capturing pairs of measurement images

- 1. Move the column to the lowest position using the crank.
- 2. Lock the column in the lower position by tightening the silver nut.
- 3. Capture the first spherical image.
- 4. Unlock the column and move it upwards exactly 60 cm. Use the engraved scale on the column.
- 5. Lock the column in the upper position.
- 6. Capture the second spherical image.

Take care not to move the tripod itself while capturing the two spherical images. Put the tripod on stable ground. If you are unsure if the tripod has moved, repeat the measurement process from the beginning.

The order of capturing the sphericals is not important (i.e. taking the lower one first, then the upper or vice versa).

Note: It is possible to take measurement pairs when the camera is operating inverted, i.e. upside down. This requires the use of a suitable inverted tripod and may be useful for sewer inspection or similar.

Processing measurement images

For processing measurement images, it is important to check "Disable auto-leveling (for measurement pairs)" option in the LizardQ Stitcher settings. Leaving this option unchecked may degrade measurement accuracy. For use with the LizardQ Binder you also need to set the output to "HDR (OpenEXR for LizardQ Viewer and Binder)" under "Cube Faces Output".







Appendix

Prepare your Canon EOS camera body for use

Follow these steps to prepare your Canon EOS camera body for use with the LizardQ. These instructions apply to all supported Canon EOS camera models.

- 1. Attach your Canon camera to the LizardQ and power up the LizardQ unit.
- 2. Switch the Canon camera on and set the mode dial to 'M' (=manual). Always leave the Canon camera in the ON position like this:



EOS 5D Mark II



All other EOS models

 All models except 5D Mark II: Set the operating mode switch to photo (white symbol).



- 4. Make sure sleep timeout is set to "1 minute" (this is the Canon factory default).
- 5. Set "Image review" to "off".
- 6. Set "Beep" to "off".
- EOS 5D Mark IV and 6D only: Decide if you will use the GPS receiver built into the EOS camera. If so, switch on "Internal GPS" in the camera's settings and set update interval to 15 seconds.
- EOS 5D Mark IV and 6D only: Switch off the built-in Wi-Fi. This is done by setting "Wi-Fi/NFC" to "disable".

9. Attach viewfinder cover: cover the viewfinder with the flexible plastic cover (which can be found attached to the Canon shoulder strap) and affix with tape. This prevents light from entering the viewfinder from the rear, which can be reflected onto the image sensor and cause unwanted image artifacts.



Note: Make sure to only use CompactFlash (CF) cards with the EOS 5D Mark III, 5DS and 5DS R cameras. Using SD cards with these camera models will lead to errors with certain capture settings. SD cards are fine with the EOS 6D and 5D Mark IV.

Setting date and time

It is important to set the date/time/zone info on the Canon camera correctly. This is the timestamp that your Canon camera will attach to the raw images of your sphericals, and the same timestamp will be attached to the output image files by the LizardQ Stitcher. It is also used for internal timekeeping by the LizardQ device.

To do this, press the Menu button on the Canon camera and navigate to the yellow Set-Up section. Select "Date/Time/Zone" and enter the numbers that apply to your current location. This includes time zone and whether daylight savings time (DST) is in effect. Remember to check the setting regularly or when DST changes.

Your Canon camera has a coin battery to keep its clock running. If this battery is empty, date/time will reset to January 1st, 2000. The battery will then need replacing. You can do this yourself using a small screwdriver or have the Canon camera serviced. Set the correct date/time afterwards.

With GPS-enabled Canon camera models (EOS 5D mark IV and EOS 6D), you can also choose to set date and time automatically from the data sent by the GPS satellites. This will then always be in the UTC/GMT time zone, without application of DST.

After using your Canon camera with the LizardQ

The LizardQ device software must permanently change some of the Canon camera's settings during operation. This includes

- Shutter time
- Aperture
- ISO
- Image format
- Drive mode
- Auto exposure bracketing
- Auto exposure mode
- Exposure, Aperture, ISO step size (1/2 steps or 1/3 steps)
- Information that is stored in the image's Artist, Copyright or Owner EXIF tags

The LizardQ device software does not reset these settings to its original values after a panorama capture.

If you are using the Canon camera without a LizardQ, please refer to the Canon user manual on how to reset the camera to factory settings. Please note that e.g. the ½ or ⅓ step size is a "custom function" and has its own menu item in the Canon menu and needs to be reset separately. Artist, Copyright and Owner information can be set inside the "Copyright Information" menu.

Which memory cards to use

DO NOT USE SD/SDHC/SDXC memory cards with the 5D Mark III, 5DS or 5DS R. Always use CF (compact flash) memory cards with these camera models. Never use SD and CF cards at the same time.

The choice of memory cards used with your Canon camera body influences the performance of the LizardQ camera system. The primary concern is card write speed. Slow cards can cause unnecessary delays during capture or can even cause image capture to be aborted, when the Canon camera's internal image buffer overruns.

Please use memory cards with a specified write speed as detailed in the table below. Some memory card manufacturers do not specify write speed, but read speed or a general speed instead, which is not a relevant memory card feature - write speed is the important one.

Recommended memory cards by Canon camera model:

EOS 5DS and 5DS R	EOS 5D Mark II, EOS 5D Mark III	EOS 5D Mark IV, EOS 6D
DO NOT USE SD CARDS DO USE:	SanDisk Extreme [®] CompactFlash [®] Memory Card	SanDisk Extreme Pro® SDXC™ UHS-I Memory Card
SanDisk Extreme Pro®	or equivalent	ог
CompactFlash [®] Memory Card or equivalent	CompactFlash card with 90 MB/sec write speed or higher	SanDisk Extreme PRO® SDHC™/SDXC™ UHS-I Memory Card
CompactFlash card with	write speed of higher	or equivalent
160 MB/sec write speed or higher		SD card with 90 MB/sec write speed or higher

Note: Do not use SD memory cards (SD, SDHC, SDXC) with any Canon camera except the EOS 6D and the 5D Mark IV. The SD slot write speed is slow, even with fast SD cards. This is a technical limitation on the Canon cameras. Always use CF (CompactFlash) cards with these camera models. Never use both card types simultaneously.

Note: The storage capacity of the memory card does not make any difference with regard to write speed. We recommend a card size of at least 64 GB. The bigger the card, the more you will benefit from a fast card reader (USB 3.0/3.1 SuperSpeed is nice).

Note: In case you have a slow memory card that is causing trouble, you might be able to avoid aborted captures by setting a drive delay of 5 to 10 seconds. Navigate to the 2nd settings page on the iPod remote and set accordingly.

Compatible Canon camera models and USB cables

This table lists the Canon EOS camera models that are compatible with the LizardQ system and the type of USB cable needed to connect the Canon camera to the LizardQ.

Canon camera model	LizardQ compatibility	USB cable type
EOS 6D	Yes	usbfirewire.com RR-AR1MBR1-08GL
EOS 6D Mark II	No	N/A (model not supported)
EOS 5D Mark II	Yes	usbfirewire.com RR-AR1MBR1-08GL
EOS 5D Mark III	Yes	usbfirewire.com RR-AR1MBR1-08GL
EOS 5D Mark IV	Yes	Startech UUSBHAUB1LA
EOS 5DS	Yes	Startech UUSBHAUB1LA
EOS 5DS R	Yes	Startech UUSBHAUB1LA
EOS R models	No	N/A (model not supported)
EOS M models	No	N/A (model not supported)

Note: Support for Canon camera models was introduced into the LizardQ firmware as new Canon camera models became available. If your LizardQ has too old a firmware version, newer Canon models will not work until the LizardQ firmware is updated. Please see the section "Upgrading the LizardQ device software" in this manual.

Note: The firmware version installed on the Canon camera itself does not matter for LizardQ compatibility.

Setting up the iPod touch as a remote control

The LizardQ has a web server built-in and offers a web interface for controlling all aspects of taking panoramic images, such as setting parameters, starting, pausing and stopping a capture.

Note: The user interface on the iPod that is normally a part of your LizardQ delivery, is not an "app", i.e. it is not a native application that only runs on Apple devices. It cannot be downloaded from the App Store. Instead, it is a normal web application (i.e. a collection of dynamic web pages), that can be used from every Wi-Fi-capable device with a web browser. This includes any smartphone as well as any notebook computer.

Note: The web interface URL on the Wi-Fi interface is http://192.168.201.1

Note: It's **http**, not https. Just using 192.168.201.1 without the http:// should work as well.

The web interface should be used by connecting to the built-in Wi-Fi access point with a Wi-Fi-enabled device (such as the Apple iPod or iPhone, or pretty much any mobile computer). Here's how to do it, shown for an iPod:

- 1. Make sure the LizardQ is switched on.
- 2. Make sure the Wi-Fi USB-stick is plugged into the side of the LizardQ.
- 3. Make sure the Wi-Fi switch is set to ON (the switch is located at the bottom side of the device).
- 4. The LizardQ's Wi-Fi access point is now operating. Restart for good measure.
- 5. Look up your LizardQ's network settings, i.e. SSID (network name) and password. This information is different for every LizardQ and is located on the label on the bottom.
- 6. Switch on the iPod. Navigate to Settings.
- 7. Select the Wi-Fi menu item. The iPod will search for available networks and should show a network with a name starting with "LizardQ", e.g. "LizardQ-1102".
- 8. Select this network and enter the password, then press "Join". Note the Wi-Fi symbol at the upper left corner of the screen, next to the "iPod" text.
- Use the home button to navigate back to the home screen and call up the Safari web browser and navigate to this numerical URL: 192.168.201.1. When connected to the LizardQ device, this will call up the LizardQ remote control web interface.
- 10. Now press the '+' symbol at the bottom of the screen and select "Add to Home Screen". Accept the default bookmark name and press "Add".
- 11. The home screen will now have an additional LizardQ icon that you can tab to start the LizardQ web-interface in "full screen" mode. It looks and behaves much like any other App.
- 12. It is recommended to switch Bluetooth off in the settings screen, as it is not needed.
- 13. Done! Your iPod should connect to the LizardQ automatically in the future.

Setting up an Ethernet connection for remote control

The LizardQ has a web server built-in and offers a web interface for controlling all parameter settings.

Note: This user interface that can be used from the iPod as well as on other devices with a web browser, is not an "app", i.e. it is not a native application that only runs on Apple devices. Instead, it is a normal web application (i.e. a collection of dynamic web pages), that can be used with almost any web browser. This includes smartphones, tablets as well as any notebook computer.

Note: The web interface URL on the Ethernet interface is <u>http://192.168.200.1/</u>.

Note: It's http, not https.

If using the web interface via the wireless link is not possible, you can connect an Ethernet cable to the LizardQ and directly connect it to e.g. your notebook computer. Follow these steps:

- 1. Make sure the LizardQ is switched on.
- 2. Connect an Ethernet cable to the Ethernet jack at the side of the device.
- 3. Connect the other end to a PC or notebook.
- 4. Technical info: The LizardQ acts as a DHCP server on the Ethernet interface, i.e. it serves IP addresses to connected DHCP clients. This means, your PC or notebook must be set up as a DHCP client. On most operating systems, this is the default. If not, you need to change the network properties to read "Automatic IP address", "DHCP client" or similar.
- 5. Start up an internet browser on your PC or notebook (Internet Explorer, Firefox, Safari, Chrome, ...).
- 6. Navigate to this numeric web address: http://192.168.200.1/.
- 7. You should now see the same web interface that is familiar from the iPod.

Note: After changing any settings, you need to remove the Ethernet cable to do a capture, otherwise the unit will not move for safety considerations.

Organization of files

Files on the memory card

During the capture of a panoramic image, the Canon camera stores images to the Compact Flash (CF) or Secure Digital (SD) memory card that you have inserted. You will use this memory card along with a card reader to transfer images from the camera to your computer, where the files will be processed into the final panoramic image.

Any image captured by the Canon camera, whether controlled by the LizardQ or shot by hand, will be named "IMG_####.CR2" or "LIZQ####.CR2" on the CF card, where #### stands for a number. LizardQ does not use the image file name for any purpose. Therefore, you can safely change or reset the numbering scheme on the Canon camera.

Files after adding them to LizardQ Stitcher

The first thing LizardQ Stitcher will do with your images is to rename them. This is to allow easy attribution as to which individual images belong to which panoramic image. Panoramic images are numbered 1,2,3,... and so on. This number is stored inside the LizardQ itself and cannot be reset. It identifies a panoramic image uniquely, along with the serial number of the LizardQ device it was captured with.

After renaming, the raw image files should look similar to this:



For example, all raw images that have been captured by a LizardQ device with serial number 1103 as panoramic image number 312 will be named "1103-312-##-###" (with a .CR2 file extension that may be invisible on your computer).

- The third number identifies the bracketing sequence this image belongs to, i.e. which direction the camera was pointed to during its capture.
- The fourth number identifies the exposure level and aperture of the image in terms of an "exposure value" (EV).

An additional file with a file extension .lqp is generated after adding image files to the LizardQ Stitcher. This is a "housekeeping" file for internal purposes and used during image processing.

Tip: Download and install the "Canon Raw Codec" from the Canon website for your operating system. This will display preview icons for CR2 raw image files in the Windows file explorer.

Generated files

After processing a panoramic image, there will be one or more of the following 3 main output files in the same location as the original camera RAW files (or in the output directory - see settings dialog above):

- 1. *.hdr file: HDR image in RADIANCE format
- 2. *.exr file: HDR image in OpenEXR format
- 3. *.jpg file: LDR image in JPEG format (derived from the above by tone-mapping)

The file names will be just the panoramic image number with ".hdr", ".exr" and ".jpg" extensions. Along with that, a low resolution thumbnail JPEG file will have been created:



When the option to output tonemapped cube faces is selected, the output files will be named with _r, _l, _f, _b, _u, _d suffixes to denote the view to the right, left, front, back, up and down, respectively:



Additionally, a ".lqp" and a ".log" file is output, which are normally not of interest. We may ask for the ".log" file in case there are issues with the stitching process.

Temporary files

While processing a panoramic image, the LizardQ Stitcher may create a folder for temporary files in the same place the raw images are stored in. Normally this folder will be deleted after processing.

Which files to keep, which files to delete

Always keep your Canon raw images (the ones with the CR2 file extension). You can safely delete all other files. The LizardQ Stitcher will always be able to recreate any output files from the raw image files alone.

After processing, the generated .hdr, .exr or tonemapped .jpg files are the ones that need to be kept for viewing.

Keeping your LizardQ up to date

Your LizardQ comes with the latest software installed and on the accompanying USB stick at the time of delivery. Over time, we will add features and fix issues and release updated software.

You can always check for the **current release** of software and user manual here: <u>https://www.lizardq.com/downloads/</u>

We recommend subscribing to our **newsletter**, which will inform you (very infrequently) about software updates and other important topics. Please subscribe here:

English language: https://my.sendinblue.com/users/subscribe/js_id/2g427/id/2

German language: <u>https://my.sendinblue.com/users/subscribe/js_id/2g427/id/1</u>

Here's a breakdown of the **software components** of your LizardQ system:

1. LizardQ device software (also called "firmware")

This is the software that runs on the device itself. The procedure to update the firmware involves using the supplied "LizardQ USB stick", please see further down in this text.

2. LizardQ Stitcher and Viewer

This is the software that you install on your Windows PC or Mac computer for stitching and viewing spherical images. You can check for Stitcher updates inside the program itself, please see the "Help / Check for Updates" menu item.

3. LizardQ User Manual

This PDF document describes the operation of your LizardQ system and is also updated from time to time, also independently of any software releases.

4. Canon camera firmware

The Canon camera that is attached to your LizardQ system is running a "firmware" supplied by Canon. Updates will be published by Canon here: https://www.canon-europe.com/support/consumer_products/product_ranges/cameras/eos/ We recommend to install Canon firmware updates only in case of security issues.

Software security

Users are advised to follow industry-standard best practises to safeguard their PCs and Macs from malware. Additional recommendations are:

- 1. Regularly check for (and install) software and firmware updates, see above.
- 2. Do not share the WiFi password of your LizardQ system.
- 3. Make sure all memory cards are stored in a safe place and are accounted for.
- 4. Users of the EOS 5D Mark IV and EOS 6D should disable the internal WiFi of their Canon cameras (this internal WiFi is not needed for operation with a LizardQ system).
- 5. Do not connect your Canon camera to any other device than the LizardQ unit itself.
- 6. Do not use the Ethernet connection of your LizardQ except if directed by LizardQ personnel or if needed for tethered access to the LizardQ's web interface (see separate section below).

Note: On August 6, 2019, Canon has disclosed a security advisory and lists a number of affected camera models. Please see here: <u>https://www.canon-europe.com/support/product-security/</u>. Users should check if their Canon camera is in the list of affected products and follow the steps recommended by Canon.

Upgrading the LizardQ device software

When to upgrade

Upgrade the LizardQ device software (also called "LizardQ firmware") when being informed about the availability of a new software version or when advised to do so by LizardQ personnel.

Note: We recommend to postpone an upgrade if the device is critically needed in the near future. Do the upgrade at a time when there is no immediate time pressure. After upgrading, please take your time to familiarize yourself with any new features and do a short test (i.e. capture a spherical, copy files to the computer, stitch them and inspect the result).

What you need

- 1. Your LizardQ device
- 2. A LizardQ battery, charged to at least 50%
- 3. The USB stick that came with your LizardQ.
- 4. A LizardQ firmware file (named "LizardQ-firmware-####.tgz", where #### is a version number)

Note: It is important that you use your original LizardQ USB stick for the firmware update, any other USB stick will not work. Please refer to the "Recreating your LizardQ USB stick" procedure below in case your LizardQ USB stick is not available or has been lost.

Steps to upgrade

A. Copy the new firmware to USB stick:

- 1. Download the LizardQ firmware file and save it to a PC. Downloads are here: <u>https://www.lizardq.com/downloads</u>
- 2. Do not extract this archive file (must have .tgz file extension, not .tar). If you're using Safari on a Mac, your browser probably has unzipped the tgz archive. This is not what we want. In that case, please follow the steps detailed below ("Preventing Safari from unzipping..."), then redo Step 1.
- 3. Copy the LizardQ firmware file to the LizardQ USB stick.
- 4. Remove the LizardQ USB stick from the computer (observing the usual procedures about safely removing detachable media).

B. Do the actual upgrade:

- 1. Switch off your LizardQ.
- 2. Insert the USB stick into one of the USB connectors of the LizardQ.
- 3. Switch on your LizardQ.
- 4. The LizardQ's green light will be blinking. *This process will last about three to ten minutes while the software is being upgraded*. In case your USB stick has an activity LED on it, it will also blink in different patterns during the process.
- 5. After finishing the upgrade, your LizardQ will switch itself off (green light is off).
- 6. Remove the USB stick from the LizardQ.
- 7. Switch your LizardQ on again. It will now run the new software.
- 8. You can check that the upgrade has completed successfully by navigating to the About page on the LizardQ web interface (iPod). The version number displayed there should match the number in the downloaded firmware file.

Note: After the upgrade, the LizardQ's capture settings have been reset to factory-default values. Please check and adjust as desired. The panorama counter will be unaffected.

Note: Updated firmware will sometimes also require updated Stitcher and Viewer software.

Please download and copy the corresponding installer files onto the USB stick, so you have them handy whenever needed: <u>https://www.lizardq.com/downloads/</u>

Note: The upgrade process may take much longer in rare cases, i.e. when many thousands of sphericals have been captured since the last update. Please wait for up to 30 minutes for the process to complete.

Recommended step: Email LizardQ-Service ZIP file to info@lizardq.com

After doing the upgrade, your LizardQ USB stick will contain a file named "LizardQ-Service-####.zip" (or .7z), where #### is the serial number of your LizardQ device. This ZIP file contains the device log files. If you would like to email this file to info@lizardq.com, that'd be most appreciated. We can then check if all is well with your LizardQ and ascertain that the upgrade process has completed successfully.

Preventing the Safari browser from unzipping the LizardQ firmware file

The Safari browser (mostly used on Apple computers) has a habit of interfering with the firmware upgrade process by unzipping the LizardQ firmware archive file (file extension .tgz) into a .tar file after the download. If this happens, either use a different browser to download the file or follow these steps:

- 1. Open Safari
- 2. Click Preferences
- 3. Under the General tab, uncheck the option Open "safe" files after downloading

Alternative Instructions with screenshots are here: <u>https://macreports.com/how-to-download-zip-files-without-unzipping/</u>

Downgrading

It is possible to revert to an earlier version of the LizardQ firmware or to the original one that was factory-delivered. This should never be necessary. Please call for assistance if you would like to do so.

Recreating your LizardQ USB stick from scratch

Your LizardQ USB stick is special in the sense that it is bootable like your computer's harddisk. If your stick is lost, or for a major software upgrade, it can be necessary to recreate the stick, or to use any available USB stick and turn it into a bootable LizardQ USB stick.

Note: Currently, this process requires a Windows PC.

The steps are detailed below. Please read completely before beginning.

A. Download and prepare:

- Download the Rufus utility here: <u>https://rufus.ie/</u> This is a standalone executable program, no need to install it.
- 2. Download the LizardQ USB stick ISO file: <u>https://www.lizardq.com/cdn/software/LizardResQ.iso</u>
- 3. Insert your LizardQ USB stick (or any other USB stick of at least 4 GB in size) into your computer. **The contents of this USB stick will be overwritten.**

B. Do the actual procedure:

- 4. Run the Rufus program.
- 5. Your USB stick should already be selected in the topmost dropdown entry field.
- 6 Important! Please check "Device" selected actually corresponds to the USB stick you have inserted. Choosing the wrong device here may result in another storage device to be overwritten. Best practise: Unplug all other USB storage devices except the USB stick intended to become a LizardQ USB stick.
- Under "Boot selection", use the SELECT button to the right and choose the LizardResQ.iso file you have downloaded.
- Under "Volume label", please enter "LizardQ".
- Then, press the START button. You will be asked for confirmation. Please check again that the correct device is displayed for overwriting.
- 10. Rufus will now copy files. This will take a moment.
- 11. Press CLOSE to exit Rufus.
- 12. The USB stick is now a bootable LizardQ USB Using images stick and can be used to collect the device log file or do a firmware upgrade (see previous section).

Ø	[®] Rufus 3.5.1497 (Portable)		-		×	
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