Z CAM E2

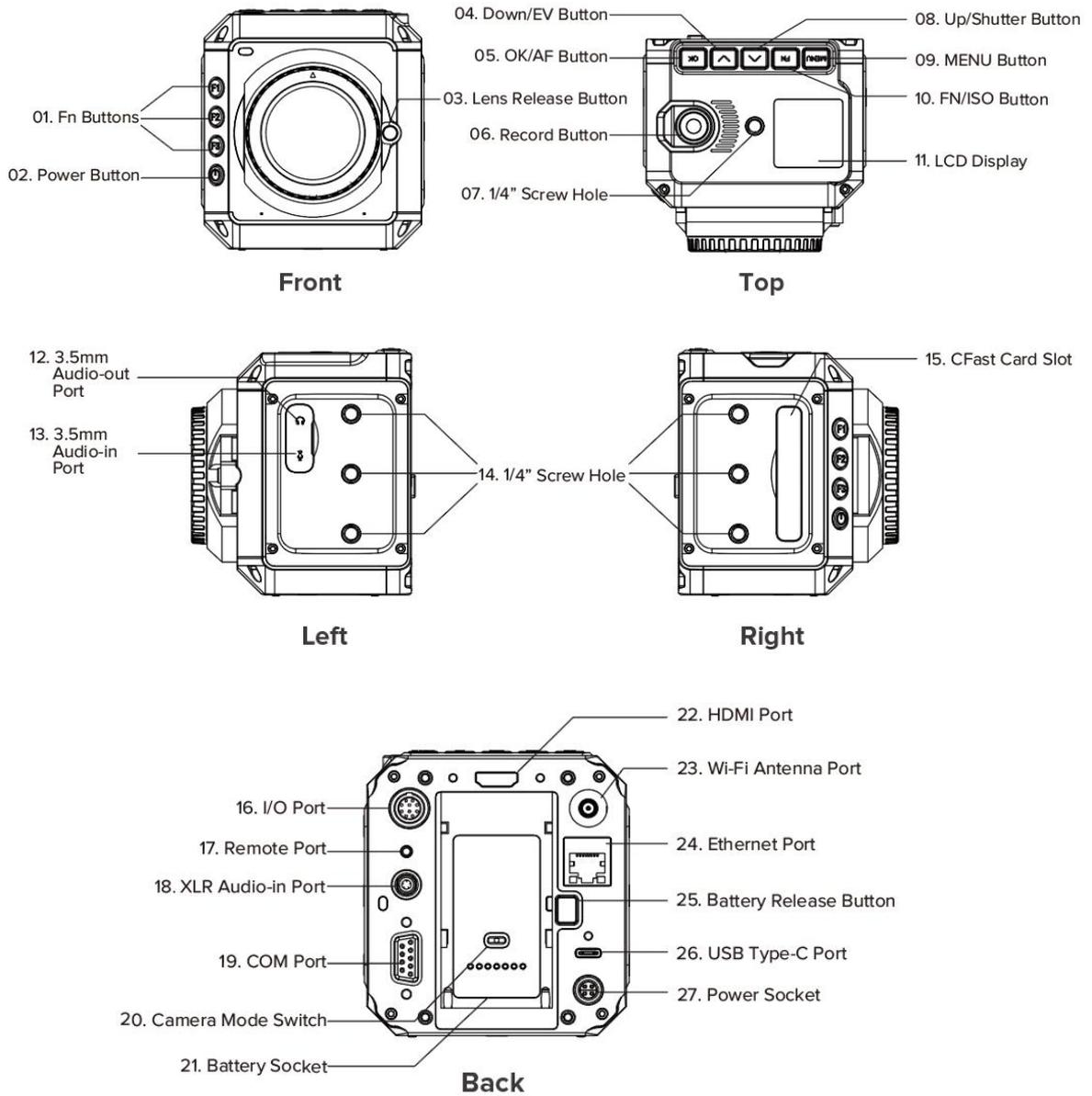## User Manual v0.6
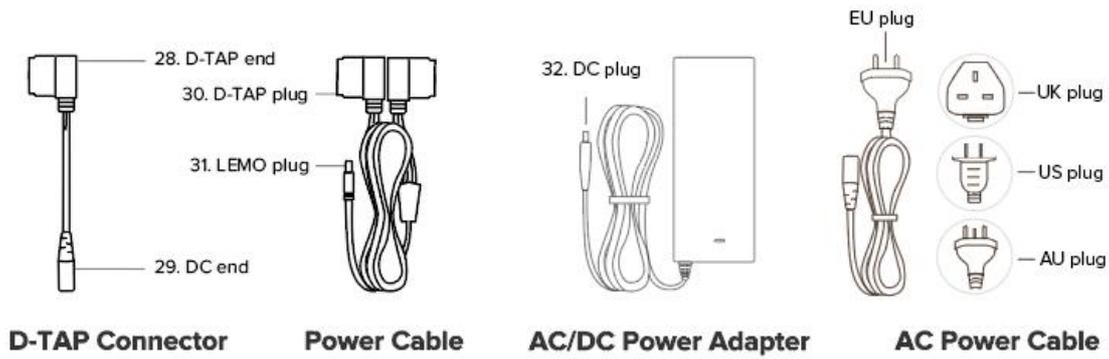## Draft

(Firmware 0.89)

1. Introduction

1.1. Camera Introduction

Front

01. Fn Buttons
02. Power Button
03. Lens Release Button

Top

04. Down/EV Button
05. OK/AF Button
06. Record Button
07. 1/4" Screw Hole
08. Up/Shutter Button
09. MENU Button
10. FN/ISO Button
11. LCD Display

Left

12. 3.5mm Audio-out Port
13. 3.5mm Audio-in Port
14. 1/4" Screw Hole

Right

15. CFast Card Slot

Back

16. I/O Port
17. Remote Port
18. XLR Audio-in Port
19. COM Port
20. Camera Mode Switch
21. Battery Socket
22. HDMI Port
23. Wi-Fi Antenna Port
24. Ethernet Port
25. Battery Release Button
26. USB Type-C Port
27. Power Socket

28. D-TAP end
30. D-TAP plug
31. LEMO plug
29. DC end

D-TAP Connector

Power Cable

32. DC plug

AC/DC Power Adapter

EU plug
UK plug
US plug
AU plug

AC Power Cable

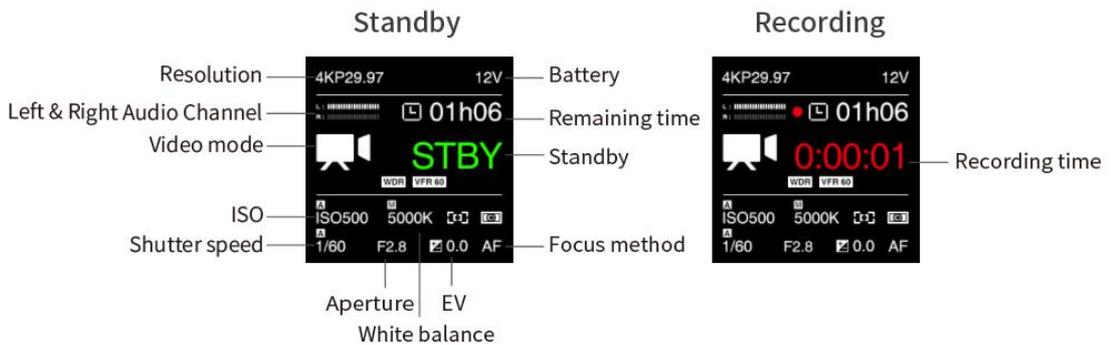## 1.2. LCD Screen

The content displayed on the LCD Screen will be different when the camera is in different mode.

- **Standby & Recording**

Standby

Recording

Resolution — 4KP29.97 — 12V — Battery
Left & Right Audio Channel — 01h06 — Remaining time
Video mode — STBY — Standby
WDR VFR 60
ISO — ISO500 5000K
Shutter speed — 1/60 F2.8 0.0 AF — Focus method
Aperture EV
White balance

4KP29.97 12V
01h06
0:00:01 — Recording time
WDR VFR 60
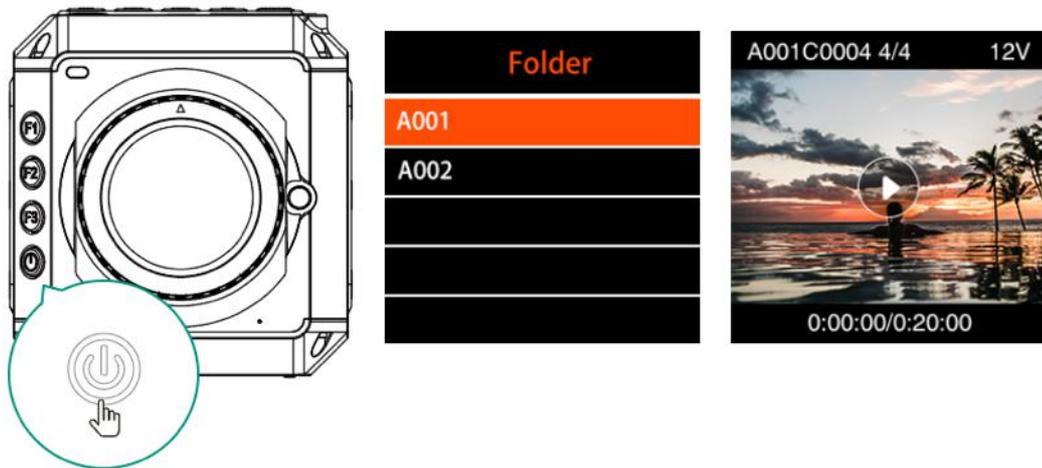ISO500 5000K
1/60 F2.8 0.0 AF

-

- **Preview**

Press **FN + OK** button when the camera is in **Standby** mode, it will switch to **Preview** mode. Press **FN + OK** again to come back to **Standby** mode.
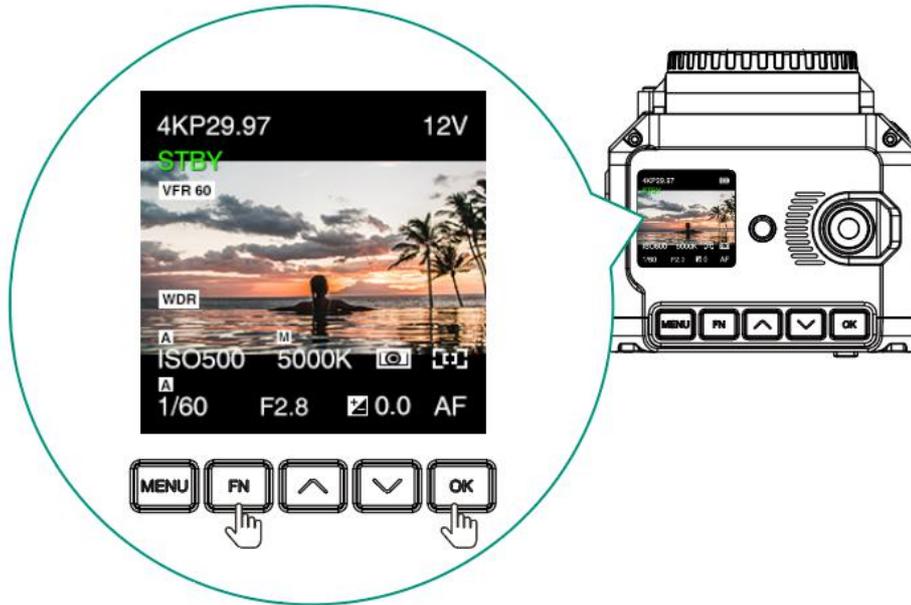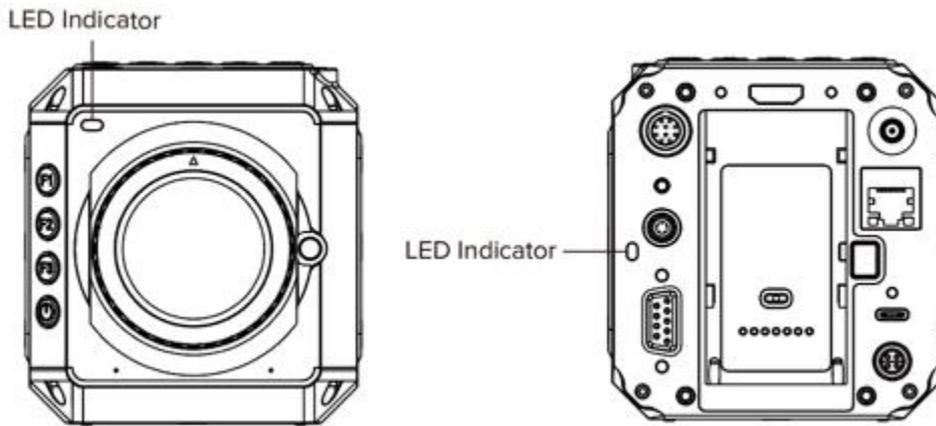
- **Playback**

  Short press **Power** button when the camera is in **Standby / Preview** mode, it will switch to **Playback** mode. Short press **Power** button again to come back to **Standby / Preview** mode.
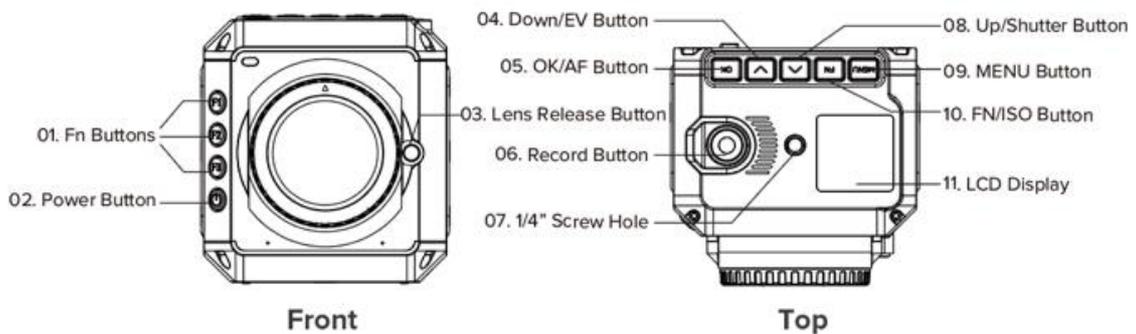
1.3. LED Indicator Status

- **Green**   : Standby

- **Red**   : Recording.

- **Flashing Red** (every 1s)   : No memory card.

- **Flashing Red** (every 0.5s)   : Memory card is full.

- **Flashing Red** (every 0.2s)   : Camera overheat.

- **Flashing Red** (very fast)   : Critical error.

- **Flashing Red** (fast & slow alternant) : Low battery
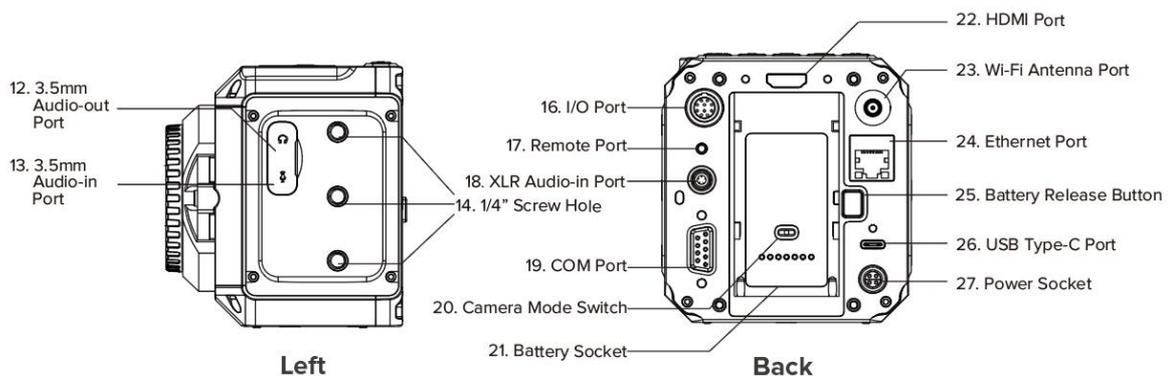
1.4. Buttons

- **MENU**: Camera setting.

- **FN / ISO**: FN or ISO quick setting (**2.1 Quick Settings**).

- **Up / SHT**: Up selection (or add value) or Shutter Speed / Shutter Angle quick setting (**2.1 Quick Settings**).

- **Down / EV**: Down selection (or reduce value) or EV quick setting (**2.1 Quick Settings**).

- **OK**: Confirmation or to trigger the AF function (**2.1 Quick Settings**).

- **F1**: AEL (Auto Exposure Lock) by default, can be changed to other quick settings (**2.10 System - Fn**).

- **F2**: Load profile by default, can be changed to other quick settings (**2.10 System - Fn**).

- **F3**: Aperture quick setting by default, can be changed to other quick settings (**2.10 System - Fn**).

- **Power button**: Long press for 3 seconds to power on / off the camera, short press to switch to / back from **Playback** mode.

1.5. Interfaces

12. 3.5mm Audio-out Port	22. HDMI Port
13. 3.5mm Audio-in Port	23. Wi-Fi Antenna Port
14. 1/4" Screw Hole	16. I/O Port · 24. Ethernet Port

(Left / Back diagram labels: 12. 3.5mm Audio-out Port, 13. 3.5mm Audio-in Port, 14. 1/4" Screw Hole, 16. I/O Port, 17. Remote Port, 18. XLR Audio-in Port, 19. COM Port, 20. Camera Mode Switch, 21. Battery Socket, 22. HDMI Port, 23. Wi-Fi Antenna Port, 24. Ethernet Port, 25. Battery Release Button, 26. USB Type-C Port, 27. Power Socket)

Left   **Back**

- **3.5mm Audio-out**: 3.5mm (TRS) jack socket, stereo audio-out, can connect headphone for audio monitoring

- **3.5mm Audio-in**: 3.5mm (TRS) jack socket, support stereo microphone input (do not support line-in), can connect external microphone

- **HDMI**: HDMI 2.0 Type A port, video output up to C4K @60fps（10-bit 4:2:2）.

- **Wi-Fi**: 2.4GHz Wi-Fi antenna port, 802.11n supported.

- **Ethernet**: Gigabit Ethernet port for camera control, setting & live streaming (with Z CAM software installed on PC).

- **USB**: USB 3.0 Type C port for camera control and data transformation only.

- **Remote**: 2.5mm jack socket, compatible with Sony LANC protocol.

- **XLR audio-in**: 5-pin LEMO port for dual-channel XLR microphone, require additional XLR audio connector (compatible with ARRI Mini XLR connector).

- **COM**: DB-9 connector with RS232 protocol supported.

- **I/O**: 10-pin LEMO port for multi-camera synchronization (with exclusive Z CAM E2 Sync Cable, not included).

- **Camera Mode Switch**: The switch to set working mode of camera, of which **M** (Master) and **S** (Slave) is for multi-camera synchronization (with exclusive Z CAM E2 Sync Cable, not included), and **I** for individual mode (default).

1.6. Power Options

- **External Power Source**: The camera comes with a LEMO power cable (D-TAP plug end), D-TAP/DC connector and AC/DC power adapter, which can use AC 100~240V power source.
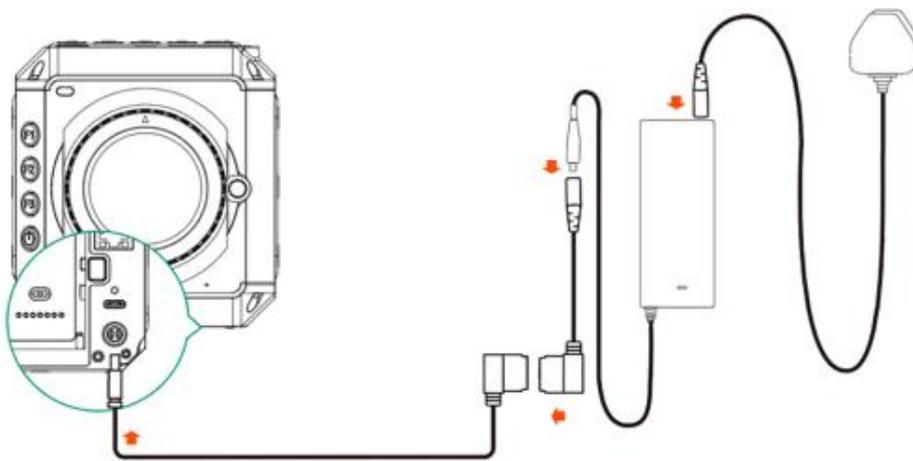
- **Camera Battery**: The battery socket is compatible with SONY NP-F series batteries, including NP-F970/770/550 etc. (Note 2)
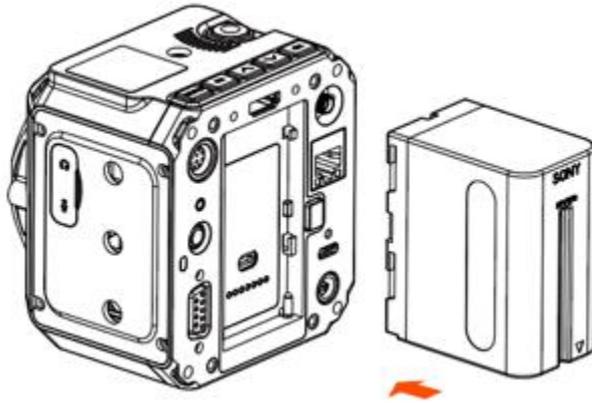
- **External Battery**: Connect the camera to a V mount battery (with D-TAP port) with the LEMO power cable (D-TAP plug).
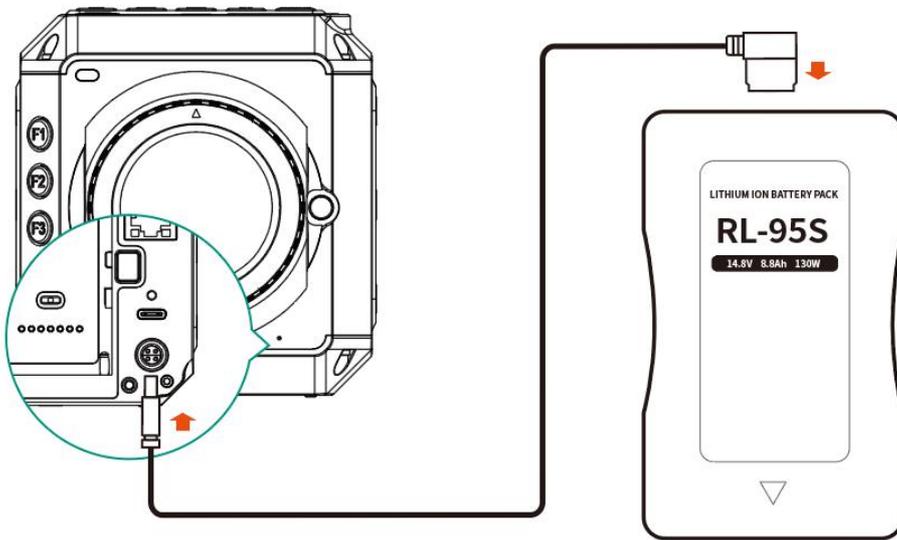

1.7. Storage

The camera uses CFast 2.0 card or SSD as storage.

- **CFast card**: The camera has 1 x internal CFast card slot, which supports CFast 2.0 standard. Insert the CFast card with correct direction, push it to the end until it's locked. To take out the CFast card, push in the card and it will be unlocked, then take it out from the slot.

- **SSD:** Connect the SSD through USB-C port on back of camera as storage. (Note: USB-C port must be in "Host" mode, see **2.9 Connect - USB**)
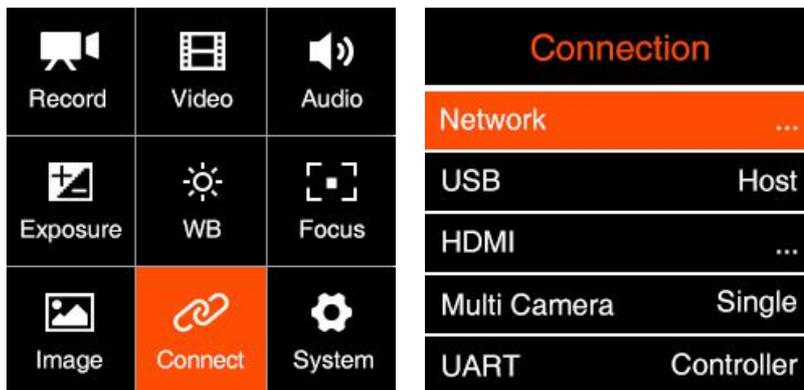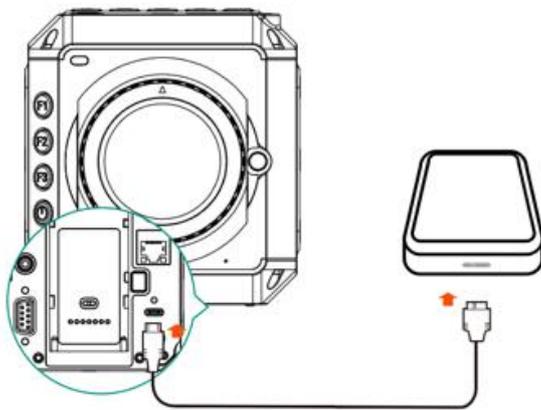
Please not that the SSD will NOT be recognized if there is CFast card in the camera.

Attention: When using a CFast or SSD on Z CAM E2 for the first time, please format it (**2.10 System – Format Card**).

2. Camera Settings

2.1. Quick Setting

When the camera is in **Standby** or **Recording** mode, some key settings can be quickly accessed by pressing the buttons on the camera.
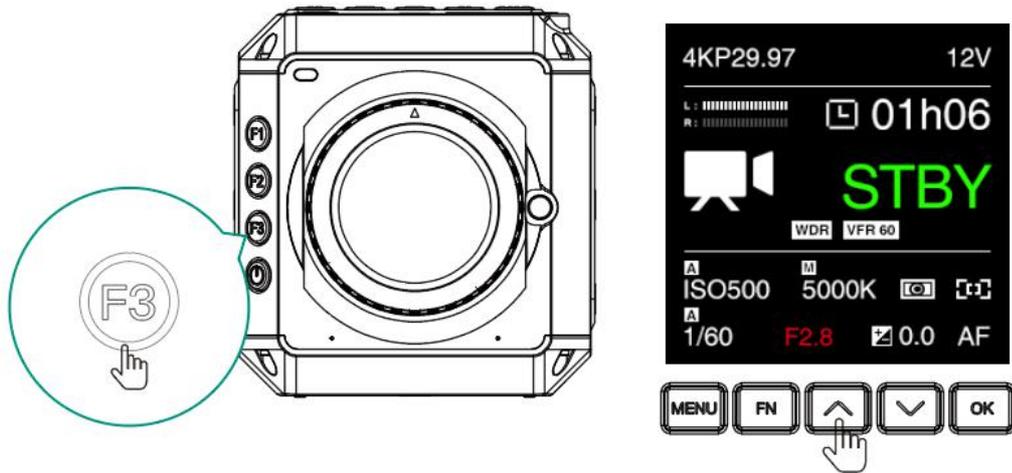
- **ISO**: Press **FN** to set ISO, then press **Up** / **Down** to adjust the value, and **OK** to confirm.
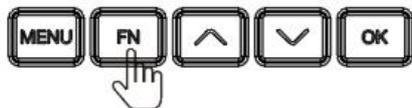
- **Shutter**: Press **UP** to set shutter speed / angle (refer to **2.5 Exposure – Shutter Operation** about shutter speed / shutter angle), then press **Up** / **Down** to adjust the value, and **OK** to confirm.
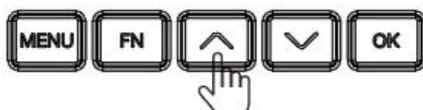
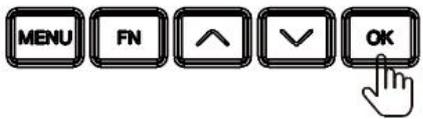- **Aperture**：Press **F3** to set the aperture, then press **Up / Down** to adjust the value, and OK to confirm.

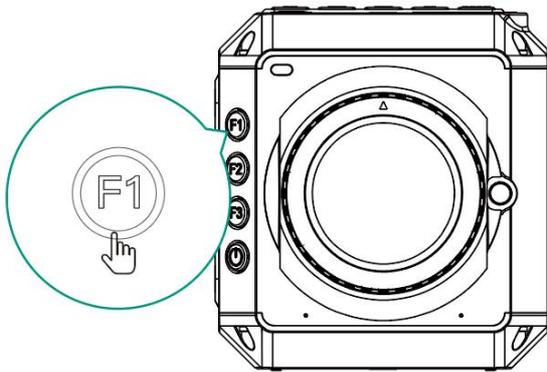- **EV**: Press **DOWN** to set EV, then press **Up** / **Down** to adjust the value, and **OK** to confirm.
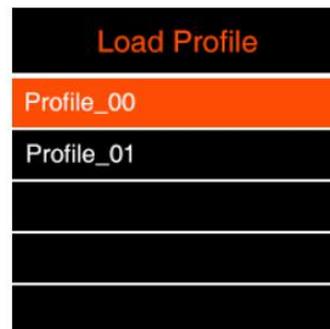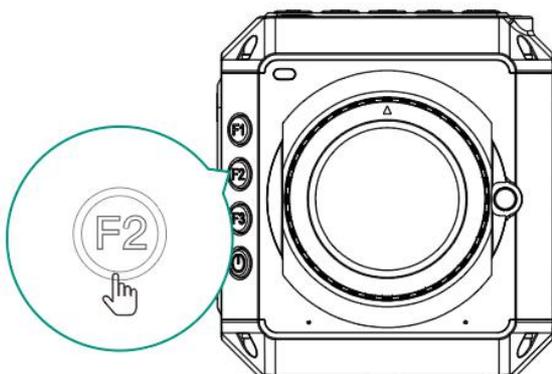

- **AF**: When focus is in **AF** mode (require to connect the autofocus lens), press **OK** to do auto focus.
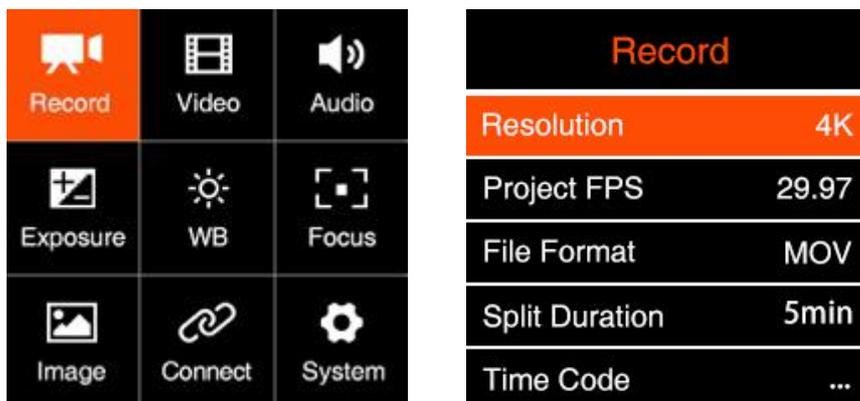
- **AEL (F1)**: Press **F1** to lock the exposure, then press again to unlock

- **Load profile (F2):** Load the configuration saved in the camera. (2.10 System User Profile).

2.2. Record

- **Resolution**

Resolution	Details
4K (Low Noise)	3840 x 2160 (16:9), with lower noise in shadow area in this mode, but the jelly effect will be more obvious. So it is suitable for static scenes shooting or less moving scene. This option is only available when the frame rate <=30fps and the Wide Dynamic Range is disabled.
C4K (Low Noise)	4096 x 2160 (17:9), see above.
4K	3840 x 2160 (16:9), compare with low noise mode, this option has the lower jelly effect. But the shadow area noise will be more obvious in low light scene. This resolution is suitable for all frame rates.
C4K	4096 x 2160 (17:9), see above.
C4K 2.4:1	4096 x 1728 (2.4:1), the VFR can be up to 150fps in this resolution.
4K 2.4:1	3840 x 1620 (2.4:1)，the VFR can be up to 160fps in this resolution.
3696 x 2772(LN)	4:3 aspect ratio，with lower noise in shadow area in this mode, but the jelly effect will be more obvious. So it is suitable for static scenes shooting or less moving

	scene. This option is only available when the frame rate <=30fps and the Wide Dynamic Range is disabled.
3696 x 2772	4:3 aspect ratio，can be used with anamorphic wide screen lens.
3312 x 2760	6:5 aspect ratio,
Super 16	2704 x 1600, S16 mode，suitable for S16 cinema camera lens，the VFR can be up to 160fps in this resolution.
1920 x 1080	16:9，the VFR can be up to 240fps in this resolution.

- **Project FPS**: Frame rate of the video project. It will be different when the resolution is set to different values.

Resolution	Project FPS
C4K / 4K / C4K 2.4:1 / 4K 2.4:1 3696x2772 / 3312 x 2760 / Super 16 / 1920x1080	23.98 / 24 / 25 / 29.97 / 50 / 59.94
C4K（Low Noise）/ 4K （Low Noise）/ 3696 x 2772(LN)	23.98 / 24 / 25 / 29.97

- **File format:** MOV / MP4

- **Split duration:** 1 / 5 / 10 / 15 / 20 / 30 / 60 min. The camera will split the video with the length set here automatically.

  Note：After the first section via camera automatically splitting, the out of sync problem between audio and video will happen. You need to use "Z CAM™ Video Concatenator" to merge the video section before the post editing and processing. The download link as below:

  - http://www.z-cam.com/cn/software-update/

- **Time Code:** Set the time code, there are sub-items as below:

■ **Time Code Source**: Internal / External

■ **Time Code Value**: Reset / Manual / Current

- **Reset**: Reset the time code value to 0.

- **Manual Input**: Set the time code value manually 00:00:00:00 （hour:minute:second:frame）.

- Current Time: Set time according to the camera system setting time.

■ **Count Up**: Rec Run / Free Run.

- **Rec Run**: Counts the time code only when recording video.

- **Free Run**: Counts the time code even when not recording video (including when the camera is power off)

■ **Time Code Mode**: DF / NDF.

- **DF**: The camera modifies the difference between recorded time and time code. Seconds and frames are separated by ".". (Example: 00:00:00.00)

- **NDF**: Records the time code without drop frame. Seconds and frames are separated by ":". (Example: 00:00:00:00)

■ **HDMI Display**: On / Off. To enable / disable the display of time code through HDMI output.

● **Playback FR**: Default / VFR. When it's set to Default, the frame rate of playback will be the same as set in Project FPS, when it's set VFR, the frame rate of playback will be the same as set in Variable Frame Rate (2.3 Video – Variable Frame Rate)

For example: Set "Record"-"Project FPS" to 29.97, and "Video"-"Variable Frame Rate" to 120. If the "playback FR" is set to "Default", the playback frame rate of the video is 29.97fps (4-fold slow motion). If the "playback frame rate" is set to ''Variable Frame Rate'', the playback frame rate of the video is 120fps (normal speed).

● **Meta Setup**: Set the camera metadata, include "Camera ID" and "Reel Name".
■ Camera ID：A ~ Z
■ Reel Name：001 ~ 999

● **Pre Roll:** On / Off. After seting "Pre Roll" to "ON", there will show a red flashing circle on the standby interface (as below), and when the Record button is pressed, the camera will save the footage 5 seconds before the recording automatically.

2.3. Video
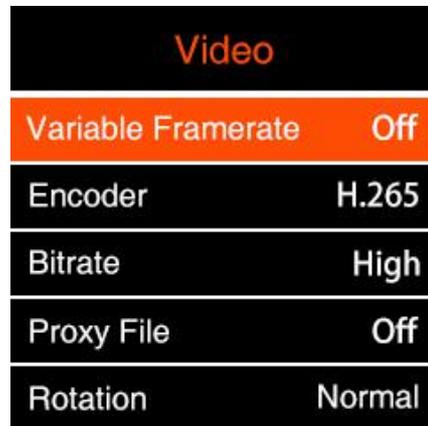
- **Variable Frame Rate (VFR)**: With VFR you can set a different frame rate for capturing based on the Project FPS for recording, in this way you can get a slow-motion or fast-motion footage.

  VFR options are related to the **Resolution** and **Project FPS in Record** setting**,** and whether to enable **Wide Dynamic Range (WDR).**

  Here list the maximum VFR under each setting combination as below:

  WDR Off

Project FPS / Resolution	23.98	24	25	29.97	50	59.97
C4K (Low Noise)	30	30	30	30	N/A	N/A
4K (Low Noise)	30	30	30	30	N/A	N/A

C4K	120	120	120	120	120	120
4K	120	120	120	120	120	120
C4K 2.4:1	150	150	150	150	150	150
4K 2.4:1	160	160	160	160	160	160
3696 x 2772 (Low Noise)	N/A	N/A	N/A	N/A	N/A	N/A
3696 x 2772	60	60	50	60	50	60
3312 x 2760	60	60	50	60	50	60
Super 16	160	160	160	160	160	160
1920 x 1080	240	240	240	240	240	240

WDR On

Resolution / Project PFS	23.98	24	25	29.97	50	59.97
C4K (Low Noise)	N/A	N/A	N/A	N/A	N/A	N/A
4K (Low Noise)	N/A	N/A	N/A	N/A	N/A	N/A
C4K	60	60	60	60	60	60
4K	60	60	60	60	60	60
C4K 2.4:1	N/A	N/A	N/A	N/A	N/A	N/A
4K 2.4:1	N/A	N/A	N/A	N/A	N/A	N/A
3696 x 2772 (Low Noise)	N/A	N/A	N/A	N/A	N/A	N/A
3696 x 2772	48	48	48	48	N/A	N/A

3312 x 2760	48	48	48	48	N/A	N/A
Super 16	N/A	N/A	N/A	N/A	N/A	N/A
1920 x 1080	60	60	60	60	60	60

Note: When **WDR** is enabled，the resolutions as below will be disabled

C4K (Low Noise) / 4K (Low Noise) / C4K 2.4:1 / 4K 2.4:1 / 3696 x 2772 (Low Noise) **/** Super 16 resolution

For more detail, please check **9. Appendix 1: Variable Frame Rate Detail**

- **Encoder**: H.264 / H.265 / ProRes 422 Proxy / ProRes 422 LT / ProRes 422 / ProRes 422 HQ / ZRAW

The corresponding color bit depth and color sampling of each encoding format are as follows:

Encoder	H.264	H.265	ProRes	ZRAW
Color Bit Depth	8bit	10bit	10bit	12bit & 14bit
Color Sampling	4:2:0	4:2:0	4:2:2	N/A

Options of video encoder depends on the setting of resolution and frame rates (take VFR if it's different from the Project FPS). The resolutions and max frame rates (including VFR) combinations supported by each encoding format are as follows:

Encoder Resolution & Max Frame Rate	H.264	H.265	ProRes 422 Proxy	ProRes 422 LT	ProRes 422	ProRes 422 HQ	ZRAW
C4K (Low Noise)	30	30	30	30	30	30	30
4K (Low Noise)	30	30	30	30	30	30	30
C4K	60	120	75	60	60	30	30
4K	60	120	75	75	60	50	30
C4K 2.4:1	60	150	75	60	60	50	30

4K 2.4:1	60	160	75	75	60	60	30
3696 x 2772 (Low Noise)	30	30	30	30	30	30	30
3696 x 2772	60	60	60	60	50	30	24
3312 x 2760	60	60	60	60	60	30	25
Super 16	60	160	75	75	75	75	50
1920 x 1080	120	240	120	120	120	120	N/A

- **Bitrate:** High / Middle / Low. Value of the bitrate varies in different resolution and frame rate.

Resolution	Frame Rate (FR) Range (fps)*	Bitrate (Mbps)		
		High	Medium	Low
C4K (Low Noise) / 4K (Low Noise) / C4K / 4K / C4K 2.4:1 / 4K 2.4:1 / **3696 x 2772 (Low Noise) /** 3696 x 2772 / 3312 x 2760 / Super 16	FR <= 30	200	130	60
	30 < FR <= 60	230	150	100
	60 < FR	300	200	160
1920 x 1080	FR <= 30	30	20	10
	30 < FR <= 60	60	30	15
	60 < FR	200	130	60

* If **VFR** is activated, the frame rate here refers to the frame rate in **VFR**, otherwise it refers to the frame rate in **Project FR.**

** This setting is disabled when the encoding format is set to ProRes or ZRAW.

- For ProRes, the recorded video bit rate refers to the standard defined in the Apple ProRes white paper.

- For ZRAW, the bit rate is fixed to 1.2Gbps.

- **Proxy File**: On / Off. To enable or disable proxy file recording during video recording, please note that it will not be available when the **Bit Rate** in **Video** is set to "High" (**2.3 Video**)

  Note: the proxy file can not be recorded when the following encoding format, resolution, and code rate are set:

  - H.265，Bitrate set as "High"
  - ProRes 422 HQ, 4K (3840 x 2160) resolution，FR >= 48fps
  - ProRes 422, C4K (4096 x 2160) resolution，FR >= 60fps
  - No proxy recording is allowed when ZRAW is selected. Use iOS device or HDMI to record proxy file instead.

- **Rotation:** Normal / Upside Down. Rotate the image by 180 degrees.

  Note: This setting is available only when the frame rate of recording is under 30fps (include 30fps). The display on the LCD and the video output from HDMI will not be rotated during preview and recording in current firmware, and only the video recorded in the storage will be rotated when it's set to "Upside Down".

- **WDR** (Wide Dynamic Rage)**:** Off / on (only available when camera is in Z-Log2 mode and not use ZRAW encoder). When WDR is enabled, the dynamic range will be extended from13 stops of Z-Log2 to 16 stops, with 1.5 stops increased for highlight and shadow part each.

  Turn on or off the wide dynamic range mode and the camera will restart automatically. Turning on the "wide dynamic range" mode limits the optional resolution and maximum variable frame rate for video recording, see details in the above "variable frame rate" section.

- **Timelapse:** Off / Manual, when it's Off, the camera is in normal record mode. When it is set to a specific value, the camera is in time lapse video mode.

- **VFR Control**：Coarse / Fine

  - Coarse：See **9. Appendix 1**

 - Fine：VFR fine control, 1 frame per step.

2.4. Audio
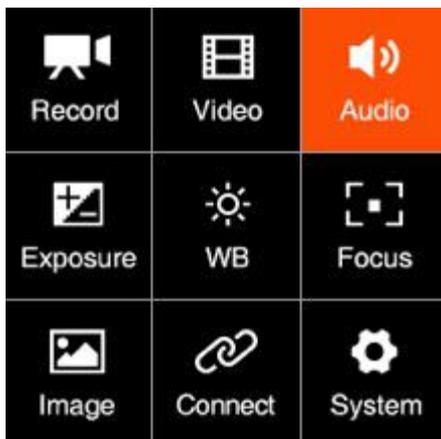
- **Encoder:** None / AAC / PCM

- **Input:** Off / Microphone / XLR / Mic Left + XLR Right / Mic Right + XLR Left

  - **Off**：Turn off all audio input.

  - **Microphone**：The camera will use built-in microphone as audio input if there is no external microphone plugged into the 3.5mm audio-in port, and will use the external microphone if there is one plugged into the 3.5mm audio-in port.

  - **XLR**：Take XLR port as audio-in

  - **Mic Left + XLR Right**: Take 3.5mm audio-in(microphone) left channel, and XLR port right channel to merge for audio-in

  - **Mic Right + XLR Left**: Take 3.5mm audio-in(microphone) right channel, and XLR port left channel to merge for audio-in

- **Input Gain:** Control / Manual Gain

- Control: Auto / Manual

- Manual Gain: -18 ~ 6 dB, can be set manually.

- **Output Gain:** -6 ~ 6 dB, can be set manually.

- **Phantom Power:** Enable / Disable. Available when "Input" is set to "XLR"," Mic Left + XLR Right" and "Mic Right + XLR Left" to enable or disable the phantom power of the XLR port.

- **Audio Level Display:** Disable / Enable

2.5. Exposure
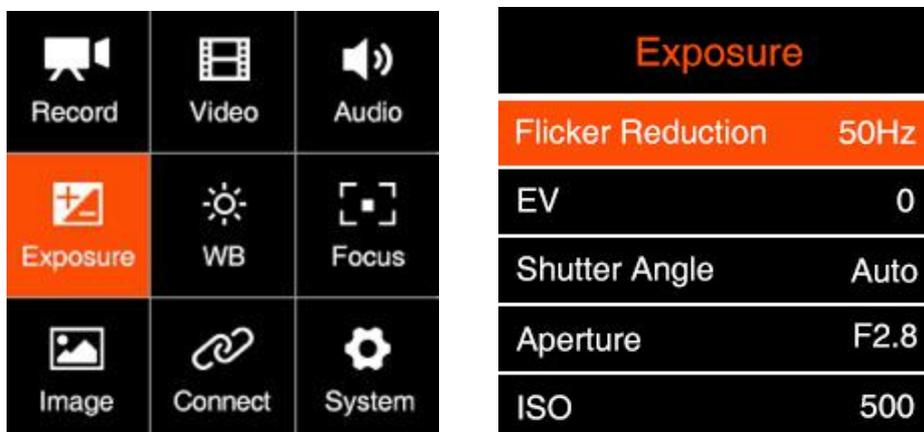
- **Flicker Reduction**：60Hz / 50Hz. It's set to eliminate light flicking caused by the frequency of the electricity, which is 60Hz in North America and some parts of Asia. (South Korea，Philippines，Taiwan of China), And 50Hz for China mainland, other countries and regions.

- **EV**: -3.0 ~ 3.0

- **Shutter Speed / Shutter Angle**: This setting depends on whether "Shutter Speed" or "Shutter Angle" is selected in **2.5 Exposure - Shutter Operation**

  Shutter Speed: Auto / Manual

（1" ~1/8000"）*

Shutter Angle: Auto / Manual（1°～360°）

* The minimum shutter speed "1" is available only when" variable frame rate "is set to "1".

- **Aperture**: It shows the range of aperture of the lens, and can be adjusted manually if it's an electrical lens. Only for lenses with electronic contacts. If the lens used is a purely mechanical without electronic contacts, the aperture value is not shown here.

- **ISO**: Auto or Manual, the range of ISO depends on the setting of **Dual Native ISO**, and whether **Wide Dynamic Range (WDR)** is activated

WDR	ISO Control	ISO Range
Normal	Fine (Auto)	500 ~ 102400
	Dual Native ISO	500 / 2500
WDR	Fine (Auto)	250 ~ 51200
	Dual Native ISO	250 / 1250

- **Minimum ISO**: This setting will only be enabled when **ISO** is set to "Auto". Range of **Min. ISO** also depends on setting of **Dual Native ISO**, and whether **Wide Dynamic Range (WDR)** is activated.

WDR	Dual Native ISO	Min. ISO Range
Normal	Fine (Auto)	500 ~ 3200
	Dual Native ISO	N/A
WDR	Fine (Auto)	250 ~ 3200
	Dual Native ISO	N/A

- **Max ISO**: This setting will only be enabled when **ISO** is set to "Auto". Range of **Max ISO** also depends on setting of **Dual Native ISO**, and whether **Wide Dynamic Range (WDR)** is activated

WDR	Dual Native ISO	Max ISO

Normal	Fine(Auto)	1000 ~ 102400
	Dual Native ISO	N/A
WDR	Fine(Auto)	1000 ~ 51200
	Dual Native ISO	N/A

- **Dual Native ISO**: Auto / Low / High. Setting of the **Native ISO** here will determine the range of **ISO** and **Max ISO**, as listed above.

- **Max Shutter Speed / Max Shutter Angle**: This setting will be activated if Shutter Speed / Shutter Angle is in **Auto** mode.

  Max Shutter Speed: Auto / Manual （1" ~ 1/1600") *

  Max Shutter Angle: Auto / Manual (1° ~ 360°)

- **Metering Mode**: Center / Average / Spot, it sets the metering mode of exposure.

- **Shutter Operation**: Speed / Angle

- **ISO Control:** Fine / Native ISO

  – Fine: User can select from the ISO range in details;

  – Native ISO: User can only use native ISO 500 / 2500 (250 / 1250 in when WDR is enabled)

2.6. White Balance

- **Mode**: Auto / Incandescent / Cloudy / D10000 / Fluorescent / Daylight / Shade / Manual

- **Kelvin**: When **White Balance** is set to "Auto" or "Preset Value", it shows the current color temperature, when **White Balance** is set to "Manual", it can be adjusted manually (2300 K ~ 7500 K)

- **Tint**: -100 ~ 100, default is 0.

- **Priority**: Ambiance / White *

  - **Ambiance**: To increase the intensity of the image's warm color cast when shooting a tungsten-light scene.

  - **White**: To reduce the intensity of the image's warm color cast when shooting a tungsten-light scene.

  * It's fixed to White priority when the Image Profile is Z-Log2 and White Balance is set to Auto.

2.7. Focus
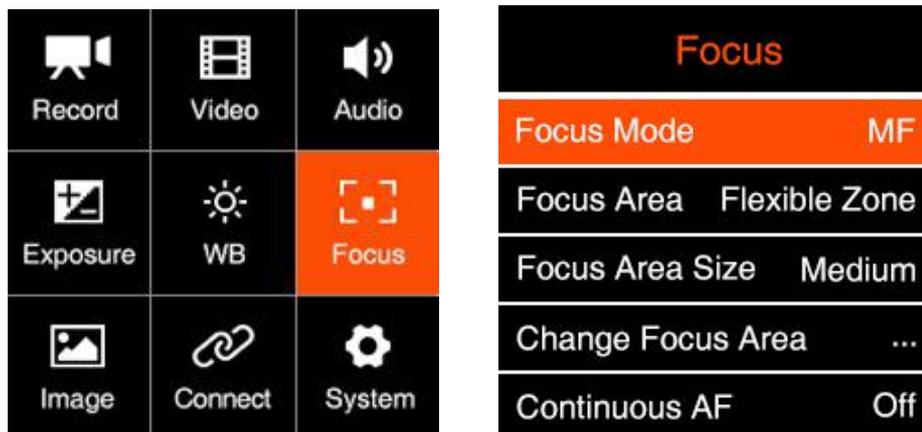
- **Focus Mode**: MF (Manual Focus) / AF (Auto Focus)

- **Focus Area**: Flexible Zone / Human Track. This will only be enabled when **Focus Mode** is set to "Auto Focus".

  - **Flexible Zon**e: Can move focus area via Up / Down button

  - **Human Track**: The camera can detect whether there is a human body in the picture. If yes, the focus area will keep tracking the human body automatically.

- **Focus Area size:** Small / Medium / Large. This will only be enabled when **Focus Mode** is set to "AF" and **Focus Area** is set to "Flexible Zone".

- **Change Focus Area: Move the focus area via** Up / Down button. This will only be enabled when **Focus Mode** is set to "AF" and **Focus Area** is set to "Flexible Zone".

- **Continuous AF (CAF)**: On / Off. This will only be enabled when **Focus Mode** is set to "Auto Focus". When CAF is activated, the camera will continuously adjust the focus as to follow the target object when it is moving.

- **Live CAF**: On / Off. This will only be enabled when **CAF** is set to "On". Active continuous focus in real time according to the scene.

- **Continuous AF Sensitivity**: High / Medium / Low. This will only be enabled when **CAF** is activated.

- **MF Assist**
  - **Preview**: On / Off
  - **Recording**: On / Off

  This will only be enabled when Focus Mode is set to **MF**. When it is set to On, the image in the focus mode will enlarged to 2 x size on the screen(both LCD display and HDMI output) when the focus is being adjusted manually. And it be set for Preview and Recording separately.

2.8. Image

- **Image Profile**: Rec.709 / Z-Log2 / Flat / HLG

  - **Rec.709**：It is Rec.709 like color space, which is usually used for directly output
  - **Z-Log2**：It is the log developed by Z CAM, with 13 stops of dynamic range and reserve more detain in highlight area, good enough for post processing.
  - **FLAT**：It is 709 like curve with color information, and lower the contrast for easy post processing.
  - **HLG (**Hybrid Log-Gamma): Encode the high-light and low-light parts of the HDR signal in two different ways in which the low-light part use the standard gamma curve and the high-light part use the logarithmic curve.

- **Sharpness**: Strong / Medium / Week, default Medium.

- **Brightness**: 0~100, default is 50.*

- **Saturation**: 0~100, default is 50.*

- **Contrast**: 0~100, default 50.*

  * Available only when Image Profile is set to Rec.709 or HLG.

- **Luminance Level**: Full / Limited. The range of luminance level is 0~255 when it's set to Full, and 16~235 when it's set to Limited.

2.9. Connect
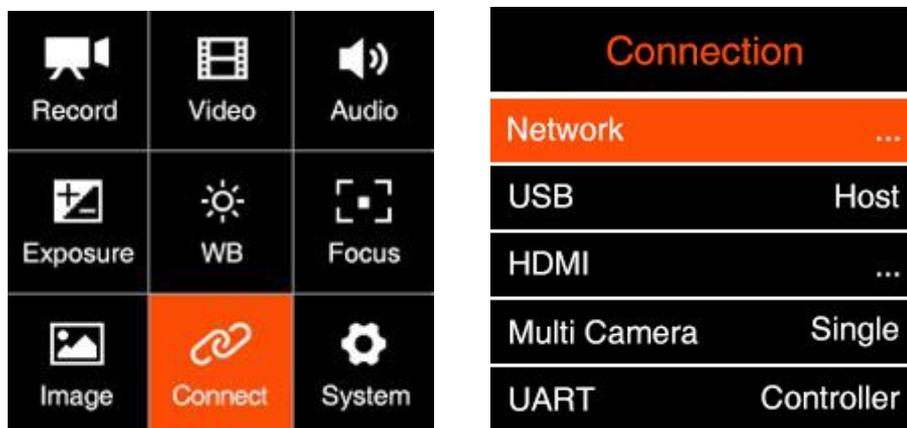
- **Network:** there are sub-items as below:

  - **Wi-Fi**: Off / On. When the Wi-Fi is activated, here will show the Wi-Fi ID, which is ZCAM-E2-XXXX (last four digits which match to the camera ID), and the default password is: **12345678**, which can only be changed with iOS app (**6. Using Z Camera App**)

  - **Wi-Fi IP**: Here will show IP address of the Wi-Fi when it's is activated.

  - **ETH. Mode (Ethernet Mode)**: Direct / Router / Static

    - **Router**: Camera is connected to the computer through a router, IP address will be assigned by the router.

    - **Direct**: Camera is connected to the computer directly through Ethernet cable, camera will generate the IP address. The default is: 10.98.32.1

    - **Static**: to set the IP address with configuration file. (Please contact Z CAM's technical support if you want to set this)

  - **ETH. IP**: IP address of the Ethernet when it's connected.

- **USB**: Host / Mass Storage / Network

    ■ **Host**: The camera will act as a host device which can transfer data to external storage (SSD e.g.) or communicate with external device like smart phone or tablet etc. with **Z Camera** app (**6. Using Z Camera App**).

    ■ **Mass Storage**: The camera will be recognized as a storage when it is connected to a computer (PC / Mac), and the file on the CFast card inside the camera can be accessed.

    ■ **Network**: The camera will act as a RNDIS device.

    The camera will be recognized as a RNDIS device when it is connected to a computer (PC / Mac) or external device. Computer or external device can access or control the camera using the HTTP API. (for HTTP API information, contact Z CAM technical support)

- **HDMI: Display Info. / Format / Use EDID**

    ■ **Display Info**: On / Off. Turn on / off camera status on HDMI monitor.

    ■ **Format**: Auto / Manual (options supported by the HDMI display).

    Auto: The camera will select the most suitable format (resolution & frame rate) from the HDMI monitor.

    Manual: Here will list the formats supported by the HDMI monitor for the user to select manually.

    Typically, the maximum output resolution/frame rate by HDMI is 4096 x 2160@60fps (10-bit 4:2:2 color depth and sampling). However, under certain video resolution, frame rate and encoding format settings, the camera will limit the output resolution/frame rate of the HDMI interface to ensure the normal recording function. See the table below for details:

Resolution	Frame Rate	Enconder	HDMI Max Resolution/Frame Rate
Any value	>=100	Any value	1080P60
4K 2.4:1 / Super 16	60	ProRes 422 HQ	
C4K 2.4:1 / 4K	48	ProRes 422 HQ	
4K	45	ProRes 422 HQ	

4K / 3312 x 2760	60	ProRes 422	
4K	75	ProRes 422 LT	
3696 x 2772	60	ProRes 422 LT	
3696 x 2772 (Low Noise)	30	ProRes 422 HQ	
C4K 2.4:1 / 3840 x 2160	50	ProRes 422 HQ	1080P50
C4K / 4K / 3696 x 2772 / 3312 x 2760	50	ProRes 422	
C4K	60	ProRes 422	720P60
C4K (Low Noise) / 4K (Low Noise) / C4K / 4K / C4K 2.4:1 / 4K 2.4:1	30	ZRAW	1080P30
Super 16	50	ZRAW	720P50

- **Use EDID**: Disable / Enable. This setting determines whether the camera automatically reads the EDID information of the HDMI connected monitor.

- **Multi Camera: Single / Master / Slave** The status matches to the status of the **Camera Mode Switch** on the back of the camera.
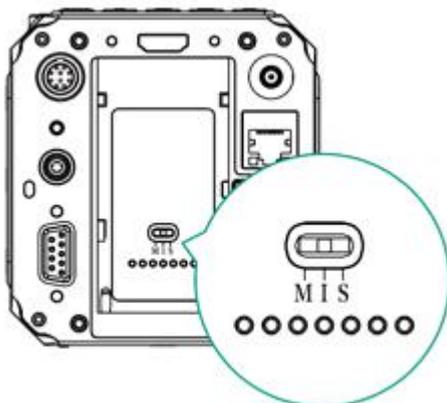
- **Individual (I)**: The camera is working as an Individual device.

- **Master (M)**: The camera is working as **Master** device in multi-camera synchronization setup. It will trigger all the **Slave** ones to start / stop recording. The "M" will show on the standby interface after restarting the camera.


- **Slave (S)**: The camera is working as the Slave device in multi-camera synchronization setup. It will be triggered by the Master one to start / stop recording.

   The "S" will show on the standby interface after restarting the camera.

- **UART Role**：Controller / Pelco D / Multiplexer / Linear TC. It's to set the camera's role in UART application.

  - **Controller**: The camera will be controlled by UART command from a computer through COM port.
  - **Pelco D**：The camera will control the external device like a gimbal through COM port with Pelco D protocol.
  - **Multiplexer**：Need 3rd-party device to support.
  - **Linear TC**: Connect the "time code adapter" through the COM interface (additional purchase required) and input the time code from the external device.

    Note: when changing the serial port function, you need to restart the camera to

take effect.

2.10. System
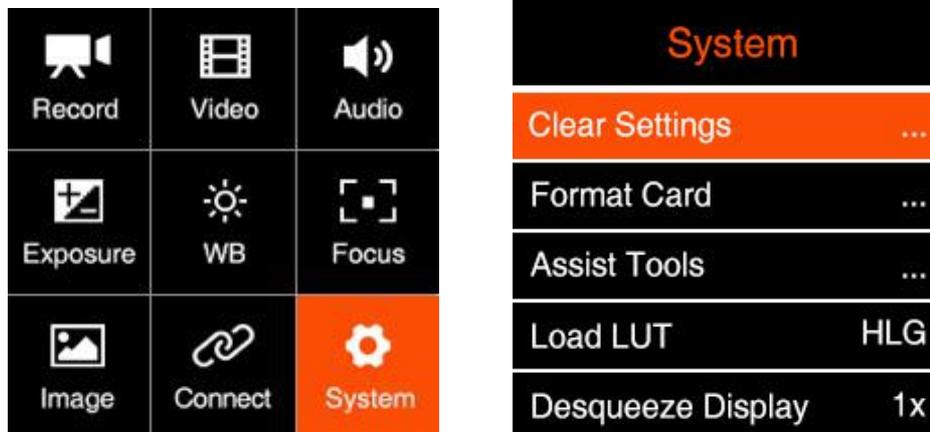
- **Clear Settings**：Clear all the Settings in the camera and set them to default values.

- **Format Card**：Format the CFast card or the external SSD connected through USB Type C port (if there is no CFast card in the camera). **Please note that formatting will erase ALL DATA in the storage!**

  Attention: When using a CFast or SSD on Z CAM E2 for the first time, please format it on the computer in exFAT format, and then format it in the camera.

- **Assist Tools**: There is three sub-items in this setting: Display / Peak / Exposure / Frame Line / Center Mark /

  ■ **Display**: On / Off. To enable or disable the assist tool on the display. Please note that when the assist tool is enabled, the effect will be output through HDMI together with the video stream. So you would need to turn it off if you are using external recorder though HDMI connection.

  ■ **Scope:** Tool / Opacity

    - Tool: Disable / Waveform / Parade / Vectorscope, for HDMI output o'n'ly

    - Opacity: 10~100, adjust the tool's brightness on the monitor when it's enabled.

  ■ **Peak**: Enable / Color / Monochrome / Threshold

    - **Enable**: Off / On, to enable / disable the Peak tool and set the color of peaking focus.

    - **Color**: Red, Green, Blue, Orange and White, choose the color of peaking focus display.

- **Monochrome:** Off / On, when it's enabled，the image on the display changes to black and white, while the peak color shows as set in Color.

- **Threshold:** 10~100, to set the threshold of peaking value manually. The lower value will extend more the boarder of focus area, which can help on focusing.

■ **Exposure**: Tool / Zebra1 Setting / Zebra2 Setting

- **Tool**: Disable / False Color / Zebra / Monochrome

Select the appropriate exposure assist tool or turn it off. The false color/ waveform / vectorscope are only displayed on the HDMI output screen.

- **Zebra1 setting**: 55~100, it can only be set when the tool is selected as "zebra".

- **Zebra2 setting**: 0~50, it can only be set when the tool is selected as "zebra".

■ **Frame lin**e: Ratio / Color

- **Ratio**: None / 2.4:1 / 2.35:1 / 1.9:1 / 1.85:1 / 4:3 Frame line can be displayed on the HDMI output screen according to the selected ratio.

- **Color**: Red, Green, Blue, Orange and White, can choose the color of frame line.

■ **Center Mark**: Enable / Color

- **Enable**: On / Off, when setting "Enable", there display cross mark on the center of HDMI output screen.

- **Color**: Red, Green, Blue, Orange and White, can choose the color of center mark.

- **Load LUT:** None / Rec709 / V709 / LC709A / zRGB_AR / zRGB_AX2 / F709 / sRGB / sCINE_709 / Rec2020 / HLG / P3D60 / P3D65 / P3DCI / Import

Note:

1. Import: To import LUT from CFast card, the LUT file should be saved in "MISC/Looks/preview" folder of the storage.

2. Only support x33 cube format for HDMI output.

- **Desqueeze Display**: 1x / 1.33x / 1.5x / 2x. When the camera is using an anamorphic lens, it's to set the de-squeeze ratio as to resize the image correctly.

- **User Profile**： Save Profile / Load Profile / Save To Card / Load From Card

■ **Save Profile**: Export current camera settings to a file and save it in the memory

of the camera.

- ■ **Load Profile:** Select the saved configuration in the camera, import and apply it to the camera settings.

- ■ **Save To Card**: Export the current camera settings as a configuration file and save in the camera card (save in /MISC/profile/ directory, file name suffix.prf)

- ■ **Load From Card**: Import the configuration file from the CFast card of camera, and apply it to the camera settings.

Note: Configuration files saved on a memory card can be renamed, but only in English letters.

- • **User Button:** Users can set the function for all the other keys (including **FN** /**F1** / **F2** / **F3** / **POWER** / **UP** / **DOWN** / **OK**) on the camera except **MENU**. It can be defined as shortcut setting functions., which includes as below:

Playback (for **POWER** button only) / AE Lock / AF Lock / White Balance Lock / Aperture / ISO / Peak / Exposure Tool / Scope Tool / White Balance / HDMI OSD / Shutter / Exposure Value / AF / Magnifier / Focus Area / None

Note: the custom function of the power button is short press trigger, long press the power button is still on/off function.

- • **Record Indicator:** On / Off. Set both front LED light and back LED light on / off

- • **Restore Lens Pos.:** Disable / Enable.

When it's set to "Enable", the camera will remember the latest focusing position of the lens when the camera is shut down, and restore it when it's powered on again (with the same lens only).

- • **LCD Brightness**: 10 ~ 100, default 50.

- • **Power:** Auto Power Off / Low Alarm

- ■ **Auto Power OFF**：Off / 30s / 1min / 2mins / 4mins / 8mins / 15mins

- ■ **Low Alarm:** NP-F series battery / V Mount battery, Low alarm voltage value for camera can be set for the different batteries.

- - **NP-F series battery**：6.6V ~ 7.0V，Default as 6.8V
- - **V Mount Battery**：13.1V ~ 13.5V，Default as 13.5V

- • **Language**：简体中文 / English

- • **Date / Time**: Set the date and time of the camera.

- • **Time Zone**: Set the time zone of the camera.

- **Camera Status**: Displays the current status of the camera, including storage capacity (used and remaining space)，temperature (inside the camera)，firmware version and camera ID etc.


- **Version**: Firmware version of the camera. If there is other version of firmware (newer or older) on root of storage (CFast card or external SSD), press OK when Version is selected and there will pop up a message to update the firmware.

3. Video Recording

3.1. Start / Stop Recording

While camera is in **Standby** mode with CFast card inserted or SSD connected (and the storage is not full), press **Record** button to start recording, and press **Record** button again to stop recording.

The recording time and remaining time for recording (depends on the capacity of the storage) would appear on the LCD display.

Remaining time
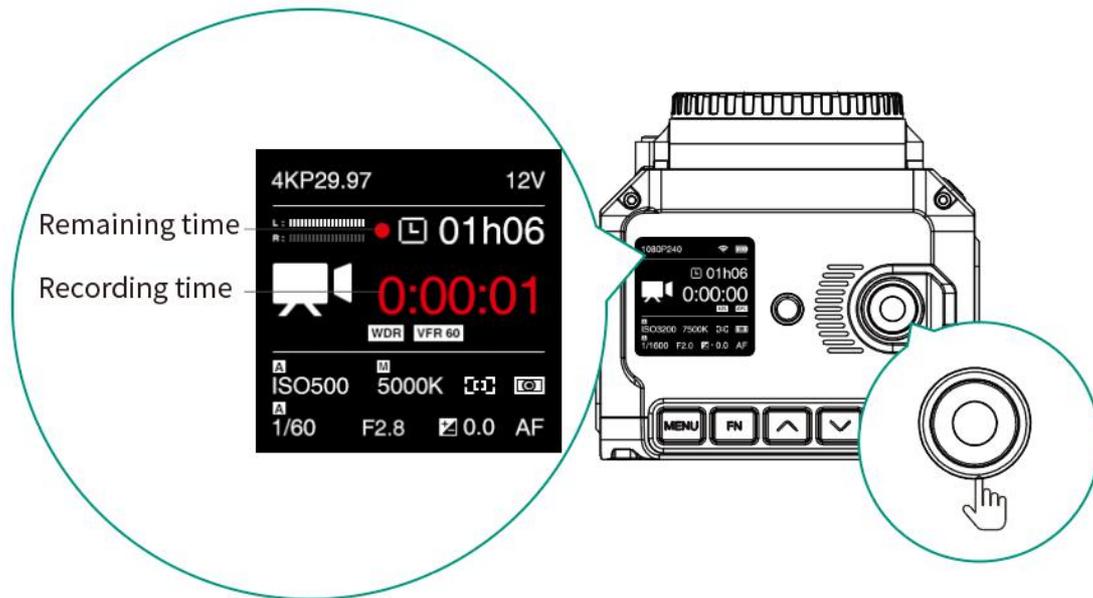
Recording time

3.2. Variable Frame Rate (VFR) Video Recording

VFR will enable you to record a footage with higher / lower frame rate in capturing than in playback, which is usually called slow motion / fast motion effect.

Fox example, to record a 4K @120fps footage with playback frame rate in 4K @29.97fps, you would need to follow the steps as below:

1) In **Record** setting, set **Resolution** to "4K", **Project FPS** to "29.97" and make sure **Playback FR** is set to "Default".

2) In **Video** setting, set **Variable Frame Rate (VFR)** to "120".

3) Go back to the standby status, an "VFR 120" icon would show up on LCD display, which means the camera is working with VFR in 120fps.

    Note: Different resolution and frame rate settings correspond to different variable frame rate range. Refer to **2.2 Record** and **2.3 Video**.

3.3. Wide Dynamic Range (WDR) Video Recording

With WDR enabled, you can get a wider dynamic range (16 stops) than normal Z-Log2 mode which would acquire more details on the highlights and shades, setting steps as following:

1) In **Image** setting, Set **Image Profile** to "Z-Log2";

2) In **Video** setting, Set **WDR** to "On", then the camera will reboot after confirmation.

3) After reboot, an "WDR" icon would show up on LCD screen, which means WDR is activated.

Note: Max VFR in WDR mode will be different comparing to normal mode. Refer to **2.3 Video - Variable Frame Rate (VFR).**

3.4. Timelapse Video Recording

With **Timelapse** function, the camera can record time-lapse video with steps are as follows:

1) Set **Video - Variable Framerate** to "off", otherwise it is not able to enable Timelapse setting.

2) In **Video - Timelapse** setting, set the Timelapse interval value (the interval is the time between each frame shot) through the **FN** key (skip to the next setting item), and **UP/DOWN** button, then select "OK" to confirm it.

   The minimum unit of interval time is milliseconds (0.1s), and the range can be set as 0.2s ~ 60s.

3) After the timelapse interval is confirmed, the value will show in the item **Timelapse**, and the camera icon will change to timelpase recording mode on the standby screen.
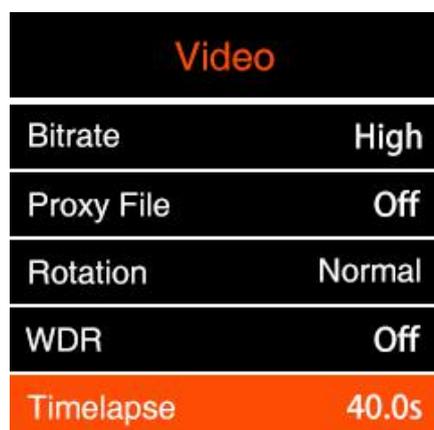
4) Set other required video parameters, except the **Variable Framerate** can not be opened, the rest is the same as normal recording video.

5) Press **Record** button and the camera will start recording. Note that he recording time shown on the screen is the time-length of the video file that is being recorded, but not the time used for recording.

The formula to calculable the time required for recording and the time-length of the video file is:

Recording time = Timelapse interval time x frame rate x time-length of video file

For example, if the timelapse interval is set to 0.5s and the recording frame rate is 25fps, then as to record 1 minute of timelapse video, the time required for recording will be 0.5 x 25 x 1 = 12.5 minutes.

3.5. Pre Roll

Enable "Pre Roll", the camera will record the video before pressing record button in 5 seconds, please follow the steps as follows:

1) Set **Recode - Pre Rol**l to "On". While camera is in **Standby** mode, a red flashing circle will show on the display, which means the "Pre Roll" is enabled.

2) Press **Record** button and the camera will start recording.

3) Short press **Power** button to enter into **Playback** mode, press OK button to playback the footage, and you will see the video 5 seconds before pressing the Record button.

4. Video Playback & File Management

4.1. Video Playback

While camera is in **Standby** mode, short press **Power** button to enter into **Playback** mode, on the LCD display there would list the file folders on the storage(CFast card or external SSD).

Come into the folder then will show the thumbnail, video serial No. and the total number of the latest video in the folder. Press **Up** / **Down** button to browse the footages inside the folder.
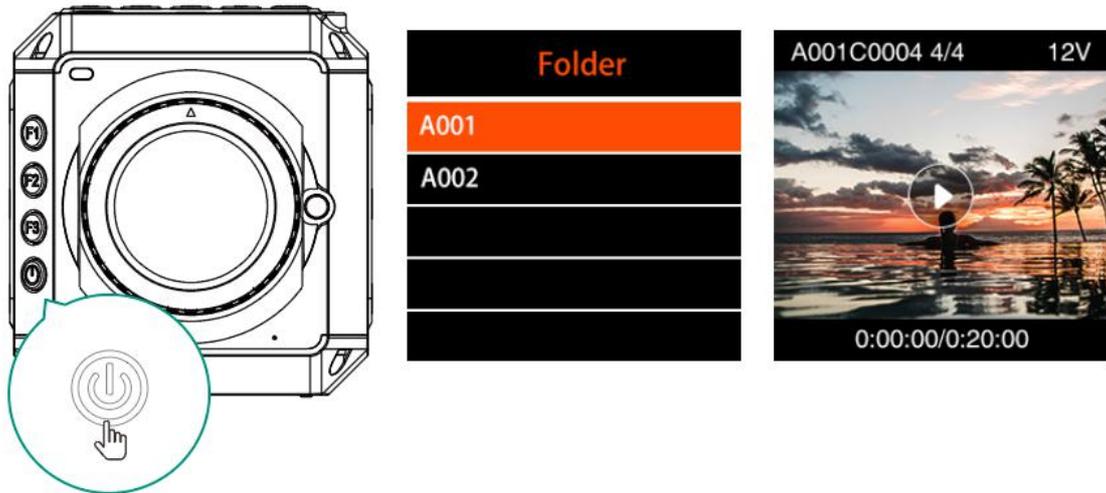
Press **OK** button to play the selected footage. When the footage is being played, press the **Up** / **Down** button to speed up / slow down (2x faster / slower).
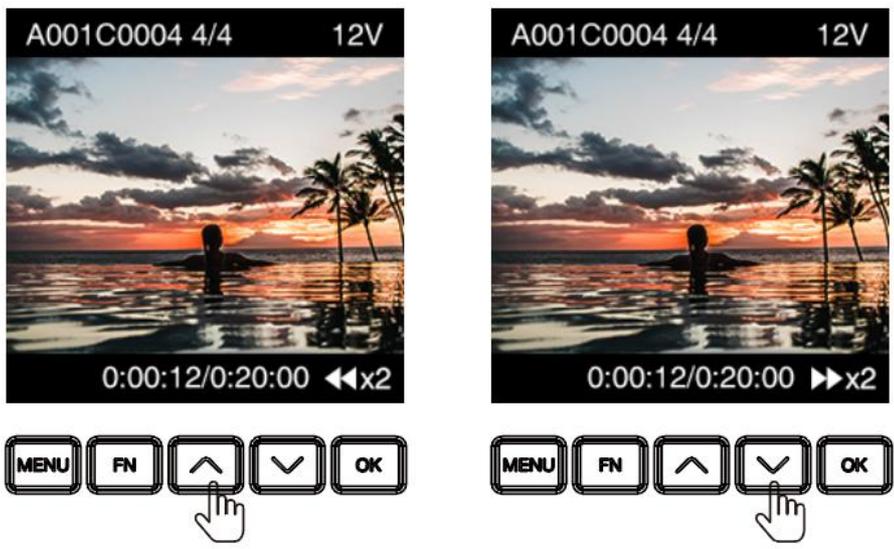
Press **OK** button to pause, and press **MENU** button to stop it.
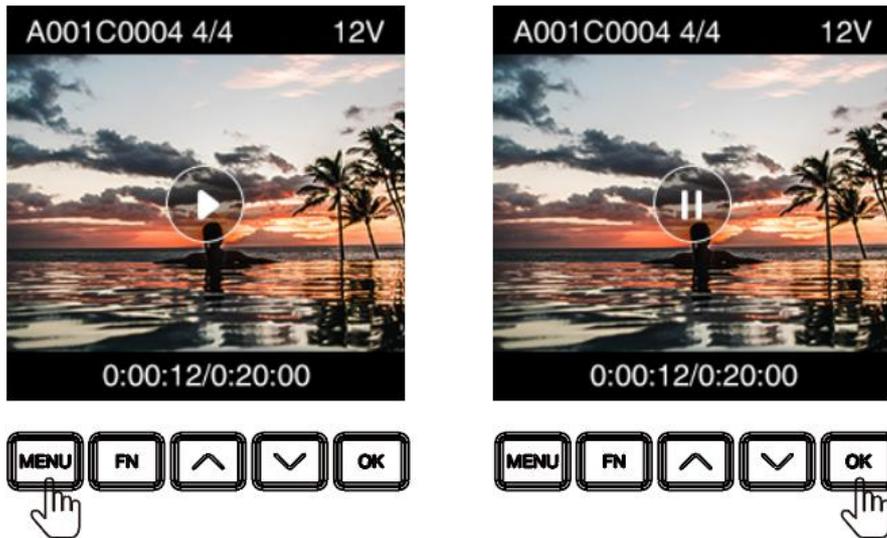
Please note if there is no storage in the camera, or there is storage in the camera but no video footage in the storage (or other files not supported), there will be alert message on the screen.


Note：LUT support in playback

4.2. Delete Video

Under Playback mode, long press **FN** button when the video is not playing, there will be a pop-up confirmation message "Delete the file?" , select "Confirm" and then press **OK** to delete the file.

Note: The deleted file is not restorable, please double check before this action.

4.3. Download Video

Besides taking out the CFast card to get the footages recorded, you can also get the footages from the camera (with CFast card inside) from a computer through an USB Type C cable:

1. Power on the camera.

2. In **Connect** setting, set **USB** to "Mass storage".
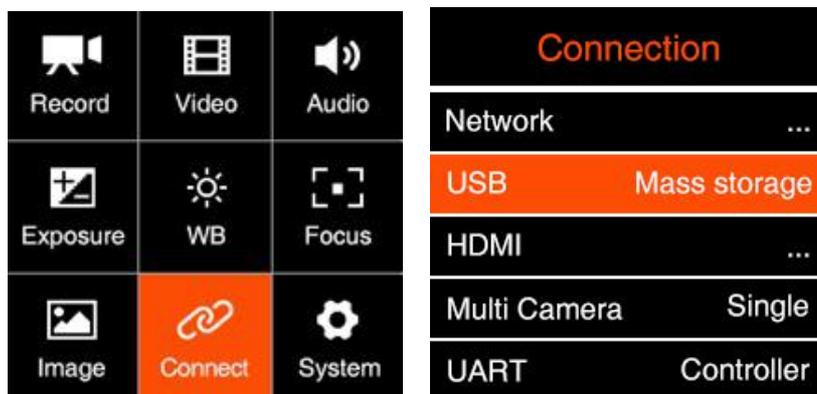
3. Connect the camera to a computer with an USB Type C cable, an "USB" icon would show up on LCD screen, then it's connected successfully.
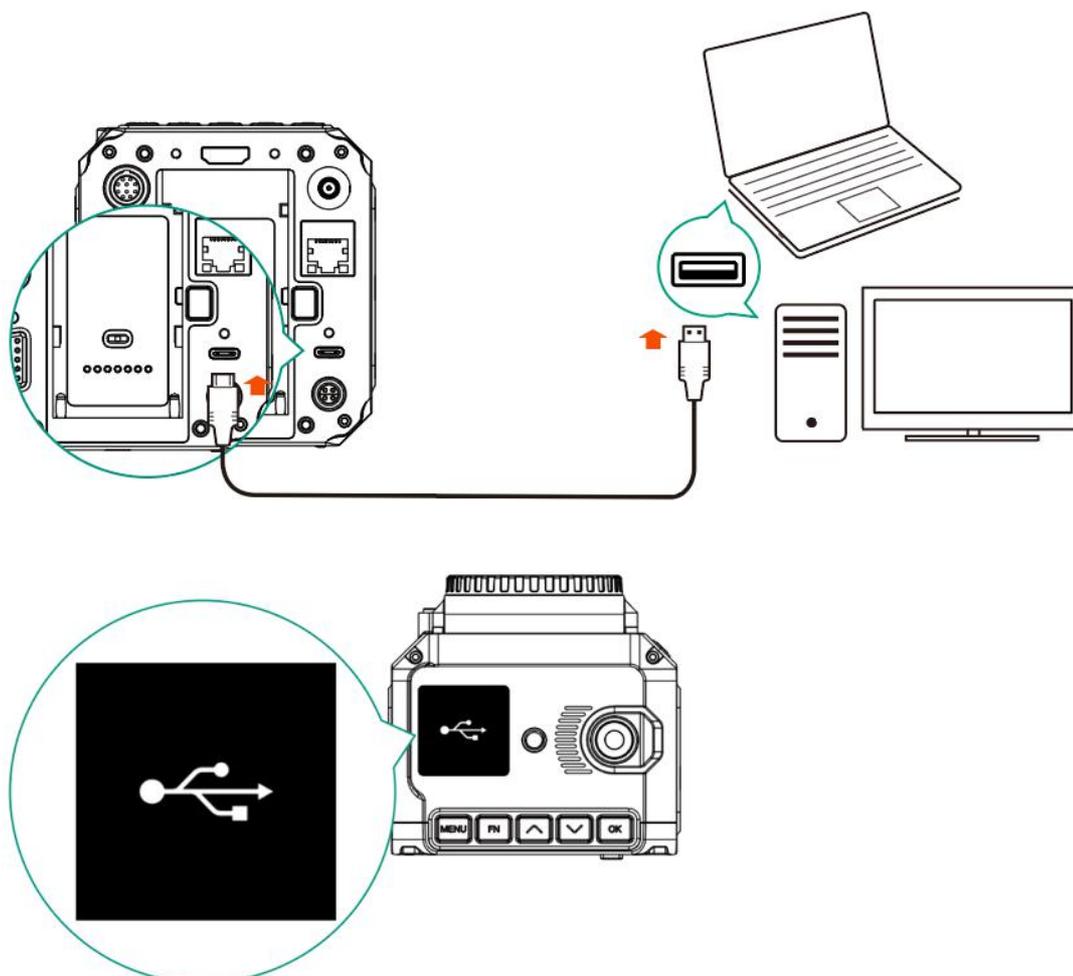

4. PC will detect the camera and shows it as external storage device. You can access & manage the files in the CFast card inside the camera.

5. Connect to the Camera

5.1. Wi-Fi Connection

You can connect the camera to an external device (smart phone / tablet) or a computer (PC / Mac) through Wi-Fi with following steps:

1. Install a Wi-Fi antenna to the **Wi-Fi Antenna Port** of the camera.

2. In **Connect – Network** setting menu, set the **Wi-Fi** to "On"， go back to **Network** setting, there will show the Wi-Fi ID: ZCAM-E2-XXXX (last 4 digits match to camera ID) on the **Wi-Fi** item.
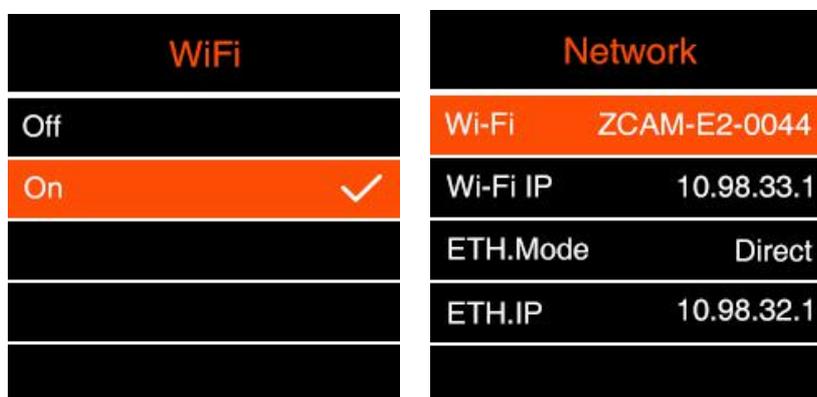
3. Press **MENU** to go back to **Standby** screen, there will be a **Wi-Fi** icon on top of the screen.

4. Connect to the camera from the iOS device or a computer with that Wi-Fi ID, and the default password of the Wi-Fi is **12345678**. (not changeable for now)

5.2. Ethernet Connection

There are 2 options to connect the camera to a computer through Ethernet: **Direct Connection** or **Connection through a Router**:
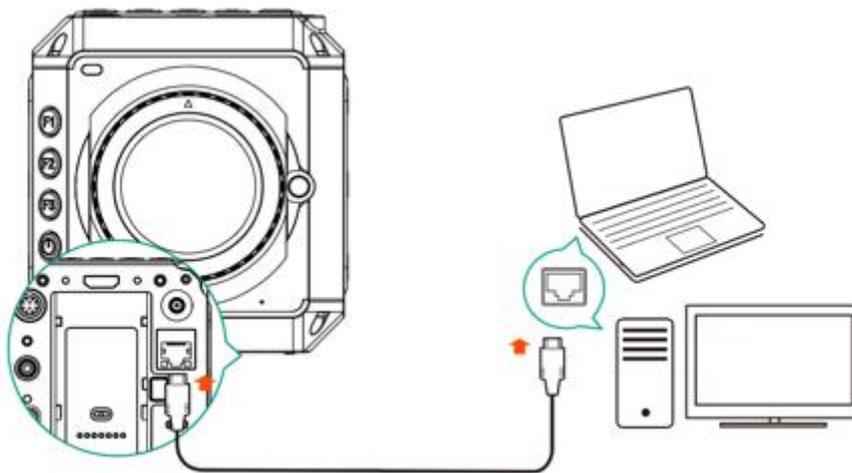
Direct connection

Follow the steps below to set up direct Ethernet connection between the camera and the computer:
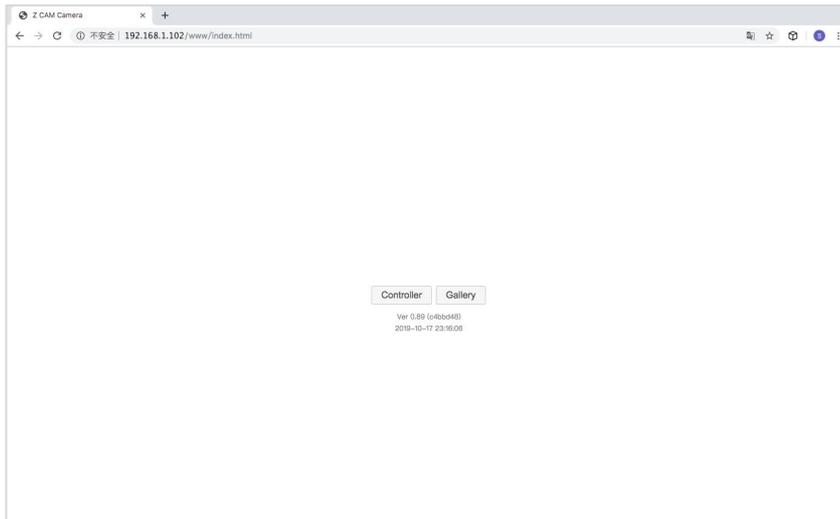
1. Set the **Network-ETH. Mode** to "Direct" in **Connect**-Network setting (default).
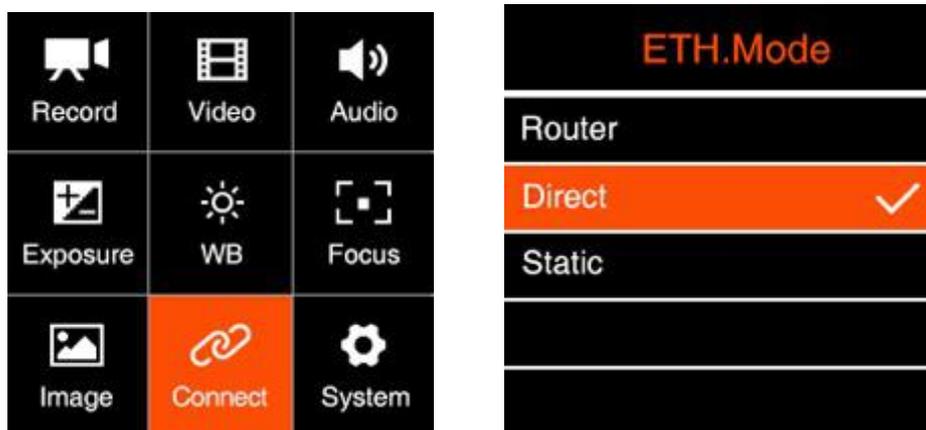
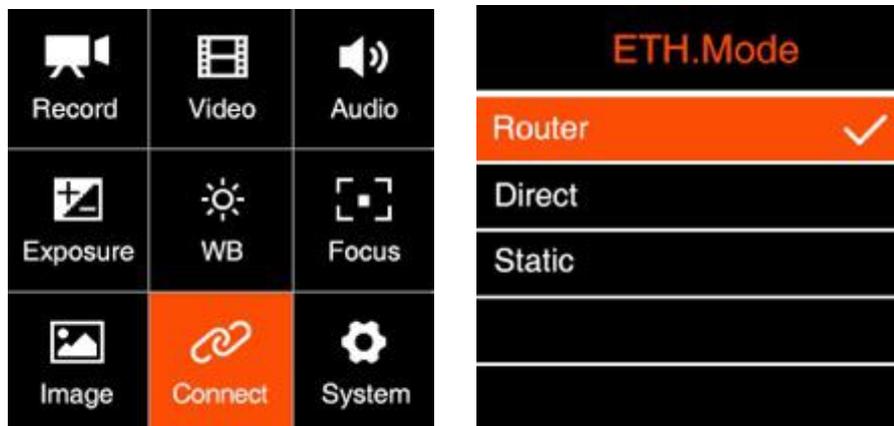2. Connect the camera to a computer with an Ethernet cable.

3. Open a browser on the PC / Mac, type in the address: http://10.98.32.1/www/index.html. You will see the page below if it's connected successfully.

Connection through a Router

You can set up an Ethernet connection between the camera and a computer through a router with following steps:

1. Set the **Network-ETH. Mode** to "Router" in **Connect-Network** setting (**2.10 Connect – Network-ETH. mode**)


2. Connect the camera to a router with an Ethernet cable, then connect the router to the computer with Ethernet cable or Wi-Fi. (Note: Camera and PC should connect to the LAN port of router, not WAN port)
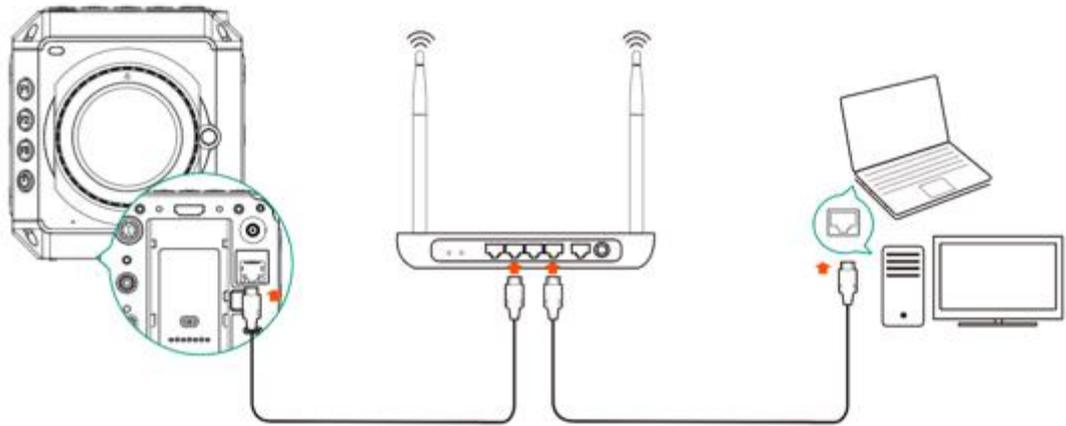
3. Check the **Connect** – **Network** setting, and there will show the IP address of the camera on **ETH.IP** item (e.g. 192.168.1.101) if the connection is OK.

4. Open a browser on the PC / Mac, type in the address: http://192.168.1.101/www/index.html (192.168.1.101 is the IP address example on step 3 above, please use the actual IP address of the camera. You will see the page below if it's connected successfully.
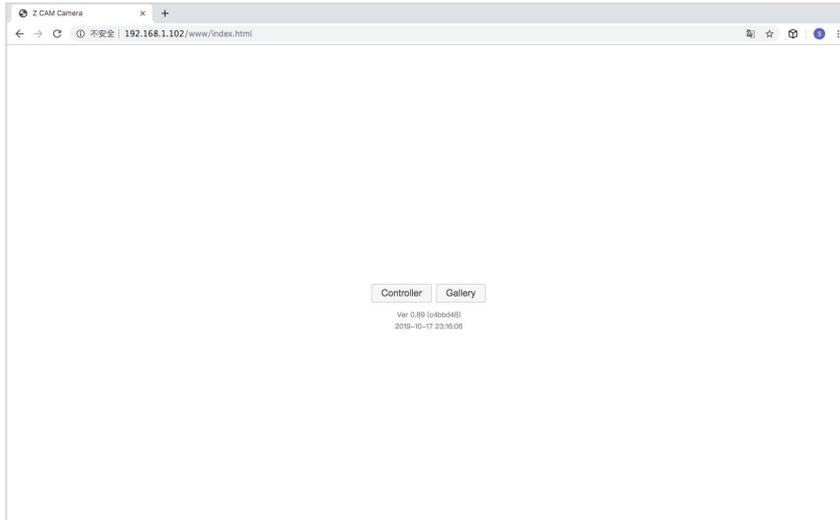
6. Using Z Camera App

Download and install the **Z Camera** App from App Store to your device (smart phone or tablet), then you can use this device to live view and control the camera including start / stop recording and most of the settings, with following steps

- Install App: Search "Z Camera" in App Store to download and install it.

- Connect to camera: Connect the device to the camera with an USB Type C to Lighting cable as below, or through Wi-Fi.

- Wi-Fi connection refer to the section 5.1. The steps of USB connection are as follows:

1. Connect the device to the camera via USB cable
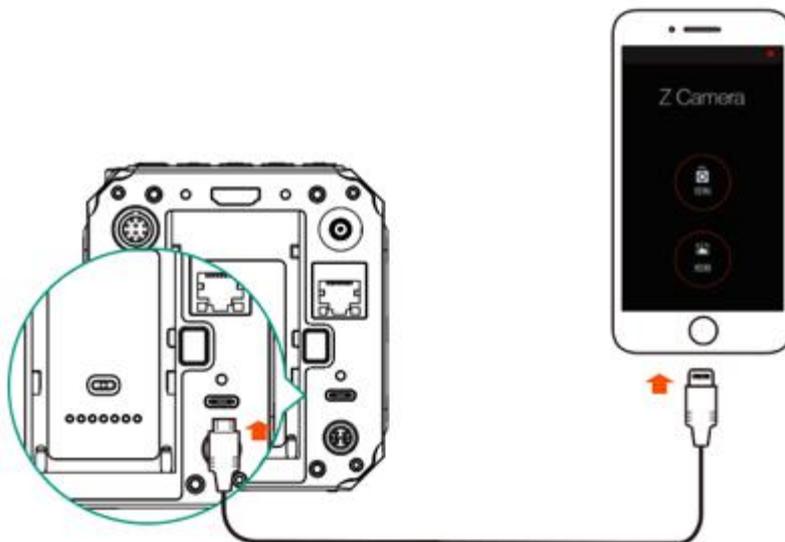
2. If it's the 1st time to connect the device to the camera, there will be a pop-up message on your device "Trust this device?", click "Yes" and it will ask you to input password, which is the password to unlock your iOS device.

3. Open **Z Camera** App, if the camera is connected successfully, the "Control" icon will be activated (it's gray color if there is no connection) and there will be a small USB or Wi-Fi icon on (depends the connection method you use). Click the "Control" icon and you will come into the live-view and control panel.

Details about the Z Camera app will be added in the future update of the document.

In the App, you can monitor and play back the video of the camera in real time, and set camera parameters through the menu.

7. Firmware Upgrade

Follow the steps below to upgrade the firmware of the camera:

1. Download the latest version of firmware (**update.zip**) for Z CAM E2 from Z CAM's website: http://www.z-cam.com/e2/updates/

2. Put the **update.zip** file to the root directory of the CFast card (**DO NOT unzip it!**).

3. Insert the CFast card to the camera and power it on.

   If the firmware version of file in the card is higher than the camera's one, there will be a pop-up message for firmware upgrade. Select "OK" and press **OK** button, the camera will upgrade the firmware* and restart the camera after it's finished.

4. If the version of the **update.zip** file in CFast card is the same as or lower than the camera's one (to refresh or downgrade the firmware), there will be no pop-up message when the camera is powered on. Go to **Version** in **System** setting, press **OK** button and you will see the pop-up message for firmware update. Select "OK" and press **OK** button to update the firmware*.

* Please make sure the camera will not power off during the firmware upgrade / update process.

8. Camera Maintenance

- As the camera is a precise instrument, please do not flop it or let it suffer physical strike.

- As the camera is a non-waterproof of camera, please do not use it in water or a humid environment.

- If water accidently invades the camera, please shut it down, take off the battery (if any) and the memory card, and make the camera dry within 24 hours.

- As the camera's heating range is 0-40°C, please do not place or use the camera in an environment where the temperature is lower than 0°C or higher than 40°C.

- Please do not let the camera and the already installed lens face the sun.

- Please do not touch the image sensor while removing the lens.

- Please do not blow off any dust on the sensor with a dust blower.

- Please do not use any detergent containing organic solvent to clean the camera body and the lens.

- Please use soft lens cloth to clean the camera body regularly.

- Please do not disassemble the camera by yourself.

- Please do not place the camera in a darkroom, a lab or other places where corrosive chemicals are stored.