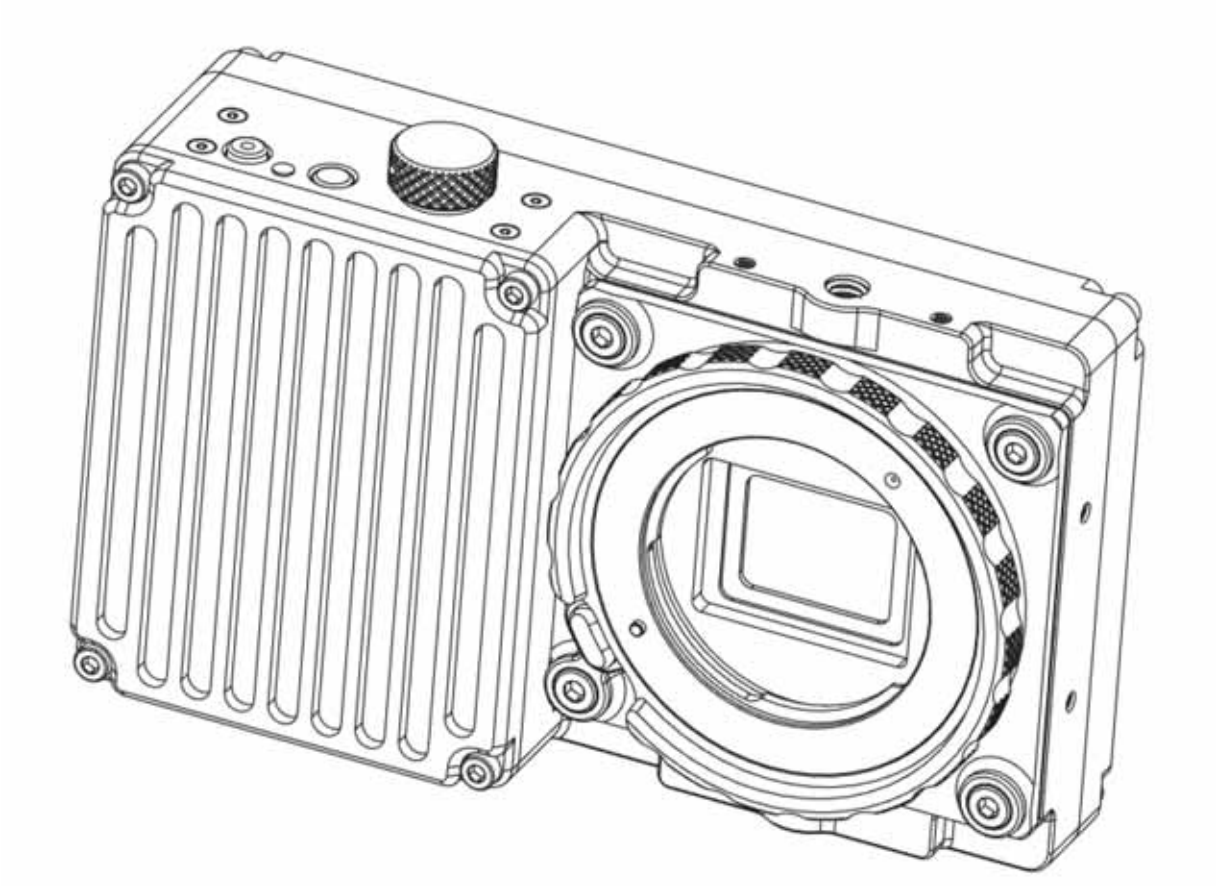

Wave

MANUAL RESUMIDO (SOLO INFORMATIVO)
CONTACTE CON FABRICANTE o con GimateG

Continuous High-Speed Video Camera

User Guide

Rev6 | 2021-10-18 | Camera Firmware v1.4.x | Wave Player v1.4.x

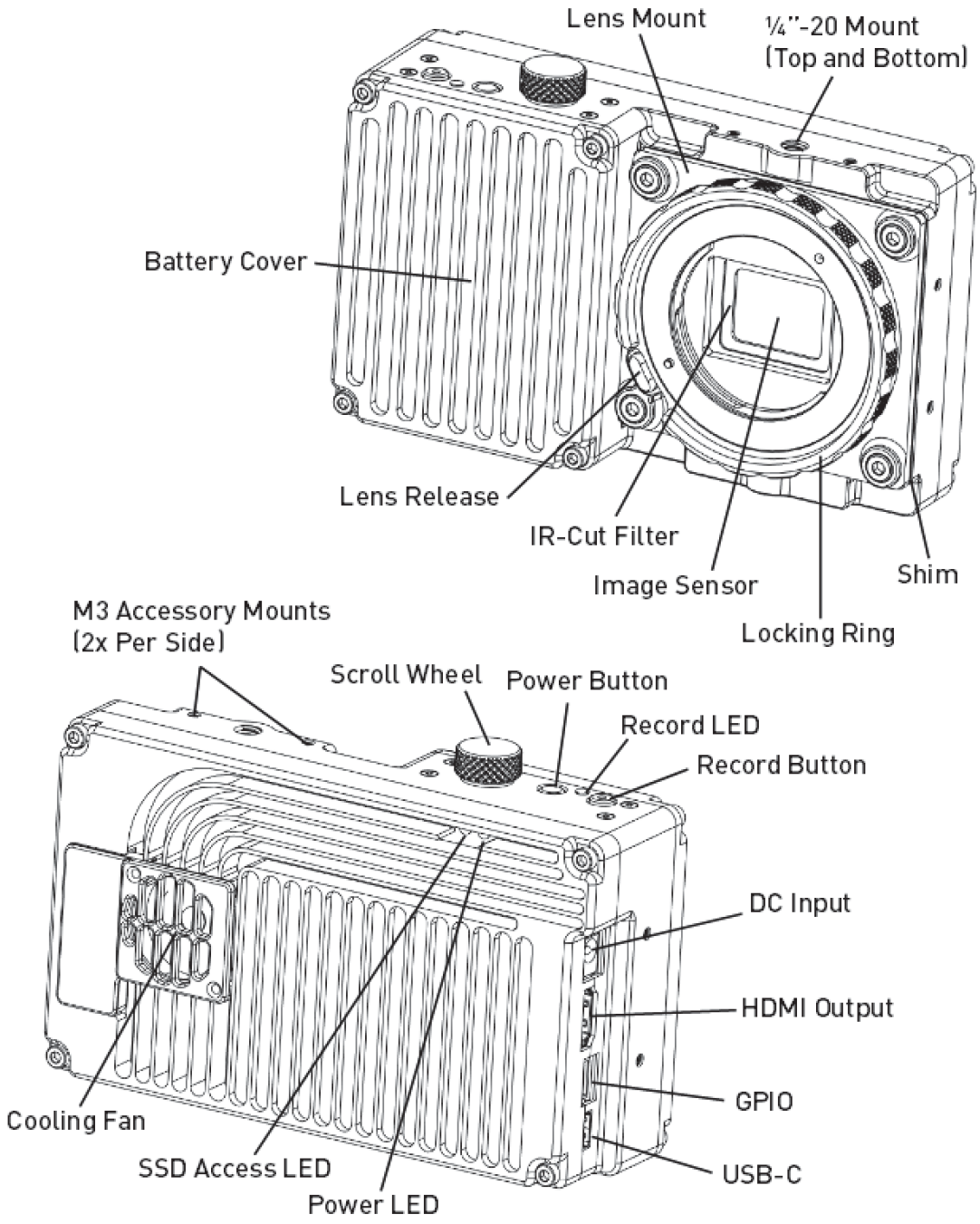

Figure 1: Wave Camera Components

2 Specifications

2.1 Key Specifications

Specification	Condition	Value
Image Sensor		
Format	-	S35
Aspect Ratio	-	4:3
Pixel Size	-	5.5µm x 5.5µm
Native Resolution	-	4096 x 3072
Active Area	-	22.53mm x 16.90mm
Shutter Type	-	Global Electronic
Native ISO	-	250
Lens Mount		
Standard Lens Mount	-	E-mount Compatible
Removable	-	Yes
Positive Locking	-	Yes
Electronic	-	No
Recording		
Media	-	Internal NVMe SSD
Media Size	-	1TB or 2TB
Native Format	-	Compressed RGB
Native Bit Depth	-	10-bit
Compression Ratio	Typical	5:1 to 6:1
Resolutions / Frame Rates	-	See Table 1.
Bit Rate	Maximum	1.00GB/s (8.00Gb/s)
	4096 x 2176, 422fps, 5.5:1	0.89GB/s (6.84Gb/s)
	2048 x 1088, 1461fps, 5.5:1	0.74GB/s (5.92Gb/s)
Continuous Capture Time	4096 x 2176, 422fps, 1TB	19min
	4096 x 2176, 422fps, 2TB	39min
	2048 x 1088, 1461fps, 1TB	23min
	2048 x 1088, 1461fps, 2TB	45min
	Others	Limited only by Media Size
Power		
Battery	-	Internal 11.1V, 2200mAh
Run Time	Standby	90min
	Recording (Max Rate)	60min
Charge Time	Powered Off	90min
DC Input Voltage	Operation	12V – 26V
	Charging to 100%	14V – 26V
Power Consumption	Standby	15W
	Recording (Max Rate)	19W
	Charging (Max)	24W

Interface		
DC Input	-	Barrel Jack 5.5mm OD x 2.1mm ID
HDMI Output	-	HDMI A (Full Size) 1080p30
GPIO	-	6-Pin JST GH Optically Isolated Start/Stop/Sync UART (3.3V or 5.0V) API[1]
USB	-	Type C (Reversible) USB 3.2 Gen1x1 SuperSpeed 5Gb/s
Wireless	-	WiFi 802.11b/g/n[2] Bluetooth v4.2[2]
Wave Player Software		
Operating System	-	Windows 10
Export Formats	-	Camera-Native ProRes[3] CineForm[4] H.264 PNG Sequence JPEG Sequence
Other Features		
Firmware Update	-	via USB-C
Upgradeable Storage	-	Yes
LCD	-	No
Audio Recording	-	No
Autofocus	-	No
Physical		
Dimensions	w/ E-mount	150mm x 97mm x 47mm
Weight	w/ E-mount	716g
Mounting Points	¼-20	2: 1x Top, 1x Bottom
	M3	8: 2x per Side
Environmental		
Operating Temperature	-	0°C to 40°C
Ingress Protection	-	IP52

[1]Hardware capability, API details TBD.

[2]Hardware capability, no software support or mobile app available as of this release.

[3]Only available on Wave Player Mac and iPad.

[4]Only available on Wave Player Windows.

2.2 Maximum Frame Rates

The maximum frame rate depends on image resolution as set by the Width and Height settings. Table 1 lists the maximum frame rate by aspect ratio for both Width options. Continuous recording is possible at all frame rates from 1fps up to the maximum in increments of 1fps. A set of standard frame rates is available in the menu under the rame Rate setting. For more details, see Section **Error! Reference source not found.**: **Error! Reference source not found.**.

*Table 1: Maximum frame rates by aspect ratio for **4096** (4K and **2048** (2K) width options.*

	Width: 4096 (4K)		Width: 2048 (2K)	
Aspect Ratio	**Height**	**Max FPS**	**Height**	**Max FPS**
4:3	3072	300	1536	1049
16:9	2304	398	1152	1384
17:9	**2176**	**422**	**1088**	**1461**
2:1	2048	448	1024	1548
2.13:1	1920	477	960	1646
2.29:1	1792	511	896	1758
2.46:1	1664	549	832	1885
2.67:1	1536	594	768	2032
2.91:1	1408	647	704	2204
3.2:1	1280	711	640	2408
3.56:1	1152	788	576	2653
3.76:1	1088	833	544	2796
4:1	1024	884	512	2955
4.27:1	960	941	480	3132
4.57:1	896	1006	448	3333
4.92:1	832	1081	416	3561
5.33:1	768	1168	384	3822
5.82:1	704	1270	352	4125
6.4:1	640	1392	320	4480
7.11:1	576	1540	288	4901
8:1	512	1722	256	5411
9.14:1	448	1954	224	6038
10.67:1	384	2257	192	6830
12.8:1	320	2673	160	7861
16:1	256	3275	128	9259

The **2048** (2K) width option uses subsampling, which preserves the crop factor of the Image Sensor but does not increase its light sensitivity. For more information, see Section 4.1.2: Width.

4.1.4 Frame Rate

This setting is the number of frames per second (FPS) captured. The options listed include a set of standard frame rates (select multiples of **24fps**, 25fps, and 30fps) from **24fps** up to 9120fps. The available options are dependent on the Width and Height settings, limited by the maximum frame rate defined in Table 1.

A special option, USER, allows for entering any frame rate from 1fps up to the maximum in increments of 1fps. One application for this is for closely synchronizing to a vibrating or rotating object to measure its frequency or visualize its periodic movement (like a stroboscope). To enter a user frame rate:

1. Click the Frame Rate setting.
2. Scroll to and click USER.
3. Scroll left or right to adjust the user frame rate.
4. Click to apply the user frame rate.

A special option, MAX, applies the maximum frame rate for the current Width and Height settings, as defined in Table 1. This is usually slightly higher than the maximum standard frame rate option listed.

4.1.5 Shutter Angle

This setting is the exposure time expressed as an angular fraction of the time between frames, as shown in Figure 5. At the default value of **180º**, the sensor accumulates light for half of the frame interval. At 360º, the Image Sensor accumulates light for (nearly) the entire frame interval, resulting in twice as much light gathered but also twice as much motion blur. Conversely, at lower shutter angles, less light is gathered and there is less motion blur. The Wave Image Sensor uses a global electronic shutter, so all pixels are exposed at the same time.

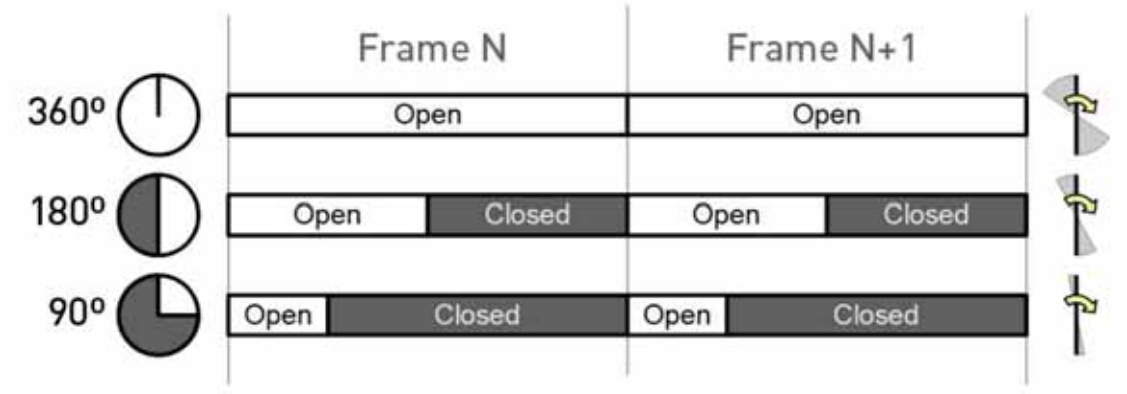

Figure 5: Shutter angle definition.

Table 5 lists the available shutter angle options and their equivalent value in stops above or below the default of **180º**. To convert between Shutter Angle and an exposure time in seconds, use the following equation:

$$(Exposure\ Time) = \left(\frac{Shutter\ Angle}{360º}\right)\left(\frac{1}{Frame\ Rate}\right)$$

*Table 5: Shutter angle options and their equivalent in stops relative to **180º**.*

Shutter Angle	Stops Relative to 180º
360º	+1
270º	+0.59
180º	**0**
135º	-0.42
90º	-1
63.6º	-1.5
45º	-2
31.8º	-2.5
22.5º	-3
15.9º	-3.5
11.3º	-4
7.96º	-4.5
5.63º	-5
3.98º	-5.5
2.81º	-6
1.99º	-6.5
1.41º	-7
0.99º	-7.5
0.70º	-8

4.1.6 Color Temperature

This setting adjusts the color temperature associated with the captured image. It is used by the HDMI preview to compensate for ambient lighting (white balance), and also embedded in the clip metadata so the Wave Player software can apply the same white balance by default. The setting does not affect the recorded image data, so the color temperature option can be changed later in the Wave Player software.

Color temperature options range from 2000K to 9600K, with higher values corresponding to cooler (bluer) ambient lighting conditions. The camera is calibrated at the 3200K (tungsten) and **5600K** (daylight) color temperatures.

4.1.7 Color Profile

This setting selects the color profile used to display the preview/playback image via HMDI, and as a starting point for image adjustments in the Wave Player Software. The

Color Profile controls image characteristics like the color space, black level, tone curve (gamma), and saturation. The setting does not affect the recorded image data, so the image characteristics can be changed later in the Wave Player Software. Table 6 lists the available color profiles as of this firmware version.

Table 6: Color Profile options.

Color Profile	Description
COLOR0	Colors are corrected for white balance only. This is a legacy option included to match v1.0.x firmware, where this was the only available color profile and was called Linear.
COLOR1	Adds correction for saturation and color cross-coupling to more closely match Rec.709 color space. Color corrections are scaled so that no sensor clipping occurs before the white point.
COLOR2	**Scales color corrections to allows some sensor clipping before the white point. This increases the output dynamic range slightly, as some data from the unclipped sensor channels can be included in highlights. More aggressive highlight desaturation is used to compensate for color shifts due to sensor clipping.**

4.1.8 GPI Setting

This setting configures the General-Purpose Input (GPI), which can be used to remotely start and stop recording. Table 7 lists the input trigger options. For more details about the electrical specification of the General-Purpose Input, see Section 8.2.

Table 7: General Purpose Input (GPI) trigger options.

GPI Setting	Description
EDGE	**Recording is toggled on and off at each rising edge of the input.**
LVL	Recording is started at the input falling edge and stopped at the input rising edge. (Recording is active while the input is low.)

4.1.9 Fan Setting

This setting controls the standby/playback mode fan setting, either low speed (**LO**) or high speed (HI). The fan is always set to high speed during recording or if any camera component exceeds its warning temperature. It's recommended to use the high speed (HI) setting when operating the camera outdoors in ambient temperatures above 30°C or in direct sunlight, to help reduce the internal temperatures between shots.

4.1.10 Default

This resets the camera settings to their default values. The reset will be temporary unless a clip is recorded with the defaults. (On boot, the camera loads settings from the most recently recorded clip.) Settings are also reset to defaults when firmware is updated or when the SSD is formatted.