NanoCam3D Mk.1 Instruction Manual

IMPORTANT – READ CAREFULLY BEFORE USE
KEEP FOR FUTURE REFERENCE

EN

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List of Abbreviations

AE	Auto Exposure
ESD	Electrostatic Discharge
FS	Field-Sequential
CVBS	Color Video Blanking Signal
FPV	First Person View
SBS	Side-by-Side
SELV	Separated/Safety Extra Low Voltage

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NanoCam3DMk1 Manual EN V1.0

1 Introduction and Designated Use

NanoCam3D Mk.1 is a stereoscopic FPV camera for radio-controlled vehicles, in particular for micro quad-copters. The camera is delivered in a pre-calibrated and ready-to-use state. The factory settings of the camera are:

- Video norm: PAL,

- 3D-Mode: Squeezed Side-by-Side 3D,

- Image swap: No swap,

- Auto exposure algorithm: Average Brightness Tracking.

These settings provide compatibility with most of the currently available 3D-capable FPV goggles like FatShark Dominator HD V1-V3 and Dominator V3; Zeiss Cinemizer, Cinemizer Plus and Cinemizer OLED as well as AOMWAY Commander V1. Users of FatShark Attitude V3 or Headplay PCS video goggles (with Field-Sequential 3D support) should refer to chapter 2.3 for video setup. The following picture shows all camera connectors and data ports.
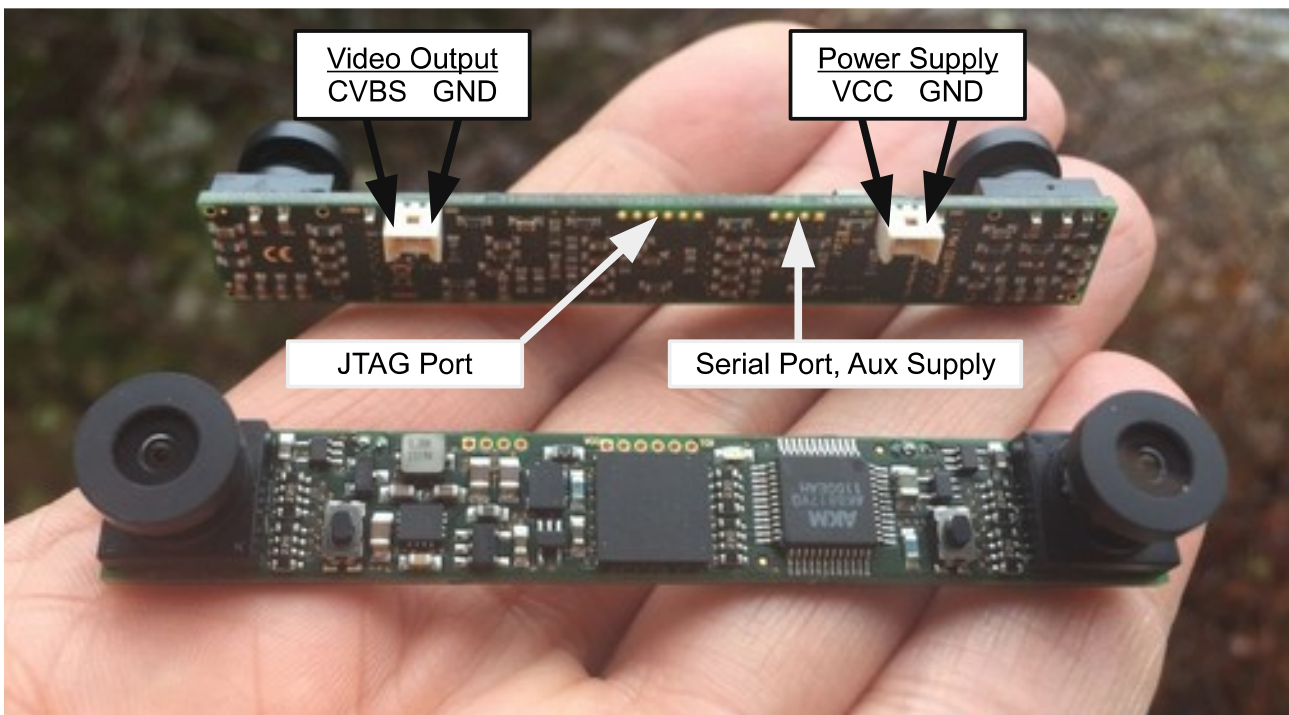

Figure 1: Camera front and rear side

The JTAG port is used for device programming and typically not of interest for operational use. The serial port with auxiliary 3.3V supply connects the camera to future devices, e.g. for generation of a stereoscopic on-screen display (3D-OSD).

1.1 Safety Instructions

	Risk of electrostatic discharge!
NOTICE	Take appropriate measures to protect the camera against electrostatic discharge during assembly, technical modification and operation.
	Risk of electric shock!
⚠ **WARNING**	Operate camera with Separated/Safety Extra Low Voltage (SELV) power sources only!
	Risk of fire! Burn hazard!
⚠ **WARNING**	Operate the camera only with DC voltage between +3V and +16V!

1.2 Quick Start Guide

For a quick setup with factory defaults follow the subsequent instructions.

1	Connect the camera's video output with suitable Molex PicoBlade™ connectors to your video transmitter. Notice the CVBS/GND pin assignment. If possible, use a dedicated ground wire between camera and video transmitter.

2	Connect the camera's power supply port to a **DC power supply (min. +3V, max. +16V)** using a suitable Molex PicoBlade™ connector. Notice the VCC/GND pin assignment. Both GND pins on camera's video output and camera's power supply are directly connected and hence of the same electric potential.

3	Power-up the camera and check whether the green status LED is continuously on. Check the received video signal with your FPV goggle or a test monitor. FPV goggles may need to be put into 3D mode manually. See the manual of your FPV goggle if unsure how to put the goggle into 3D-mode.

Enjoy your first flights with NanoCam3D Mk.1 and become familiar with FPV in 3D.

2 Optional Camera Setup

The camera has only two control elements on the front side: push buttons 1 and 2. These push buttons are used for camera set-up and adjustment purposes. The camera's status LED indicates the current state of operation.

The camera features a number of setup and adjustment modes to improve user experience. All adjustments are executed using the two push buttons on the front side of the camera. The result of these adjustments is applied and saved for future use into a nonvolatile memory section of the camera's video processing unit.

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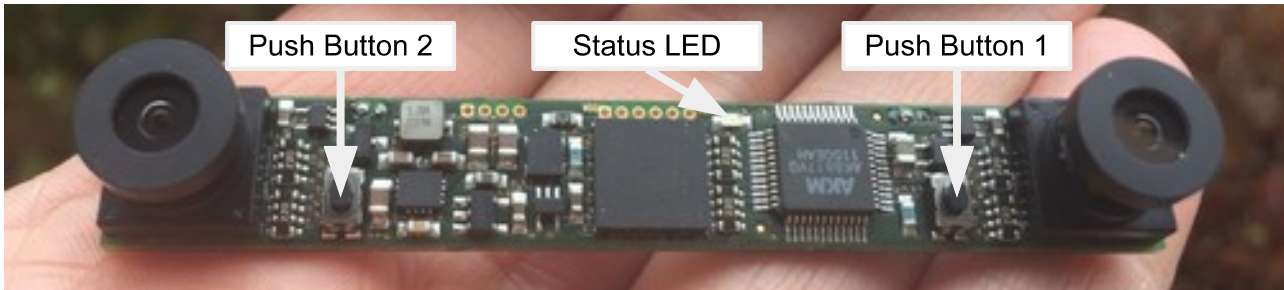KEEP FOR FUTURE REFERENCE

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2.1 Control Elements

Figure 2: Control Elements

Status LED	
State	**Remark**
Off	No power supply. Camera out of operation.
On	Normal operation.
Blinking	Camera in setup or adjustment mode.

2.2 Video Norm Setup

The camera's video norm can be selected between PAL (factory default) or NTSC. It can be changed by executing the following procedure. The video norm setup procedure can be canceled at any time by power-cycling the camera.

- Power off camera.

- Press push button 1 and keep it pressed.

- Power on camera and release push button 1. The camera's status LED starts to flash. Flashing cycle indicates current video norm setting (PAL = repeated single flash, NTSC = repeated double flash).

- Press and release push button 2 to toggle between PAL and NTSC. LED flash cycle changes accordingly.

- Press and release push button 1 to save setting and restart camera with new setting.

2.3 3D Video Mode Setup

The camera's 3D-mode can be selected between squeezed side-by-side 3D (factory default) and field-sequential 3D, both with normal (factory default) and swapped images. The 3D-mode can be changed by executing the following procedure, which can be canceled at any time by power-cycling the camera.

- Power off camera.

- Press push button 2 and keep it pressed.

- Power on camera and release push button 2. The camera's status LED starts to flash. Flashing cycle indicates current 3D-mode and image swap setting (SBS no swap = repeated single flash, SBS swapped = repeated double flash, FS no swap = repeated triple flash, FS swapped = repeated quadruple flash).

- Press and release push button 1 to toggle between these 4 possible modes. LED flash cycle changes accordingly.

- Press and release push button 2 to save setting and restart camera with new setting.

2.4 Reset to Factory Default Settings

It is possible to reset the camera to default settings by executing the following procedure. Notice that also the camera's adjustment settings (see following chapters) will be erased.

- Power off camera.

- Press both push buttons 1 and 2 and keep them pressed.

- Power on camera, LED flashes fast.

- Release both push buttons to execute camera reset and to restart camera with factory defaults.

2.5 Sensor Vertical Adjustment

Manufacturing tolerances sometimes lead to vertically misaligned left and right images. This effect is most prominent in side-by-side 3D mode (Figure 3).
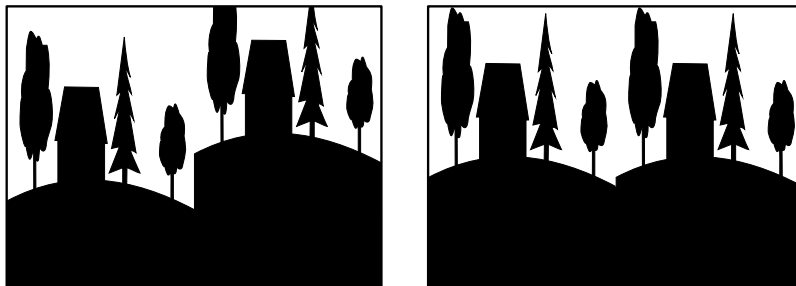

Figure 3: Vertically misaligned images (left) and correctly aligned images (right)

The camera is able to compensate such misalignment without loss of resolution or black bar padding as the utilized image sensors provide extra video pixels for that purpose. Follow the procedure outlined below for vertical sensor adjustment. The procedure can be canceled at any time by power-cycling the camera.

- Power on camera and display video signal on a suitable test monitor or video goggle. The adjustment should be made in side-by-side 3D mode.

- Press push button 1 and keep it pressed for ca. 1 sec until the status LED flashes fast, then release push button 1.

■ The camera is now in online calibration mode, which is indicated by a slow LED flashing cycle. There are two different adjustment modes (Sensor Vertical Adjustment Mode = repeated single flash, Side-by-Side Offset Adjustment Mode = repeated double flash), here the required Sensor Vertical Adjustment Mode is automatically preselected.

■ Activate Sensor Vertical Adjustment Mode by pressing push button 1 again and keep it pressed for ca. 1 sec until the status LED flashes fast. Then release push button 1. Horizontal lines are displayed over the SBS-video signal to assist the following video image alignment.

■ Now press and release one of the two push buttons at a time to vertically align left and right video image. Each push button is responsible for one of the two possible shift directions (left down/right up; left up/right down). Input is accepted upon <u>release</u> of the respective push button. The possible range for vertical image alignment is +/- 36 video lines.

■ When done press push button 1 again and keep it pressed for ca. 1 sec until the status LED indicates a solid signal, then release push button 1. This will terminate the Sensor Vertical Adjustment Mode. The vertical adjustment settings will be saved and the camera restarts with the new settings.

2.6 Side-by-Side Offset Adjustment

This adjustment mode is meant as a means to compensate optical imperfections of FPV video goggles that do not separate the left and right picture of squeezed side-by-side input video correctly in the middle of the video frame. A typical symptom is the visibility of portions of the right hand side image in the left display of the goggle or vice versa (Figure 4).
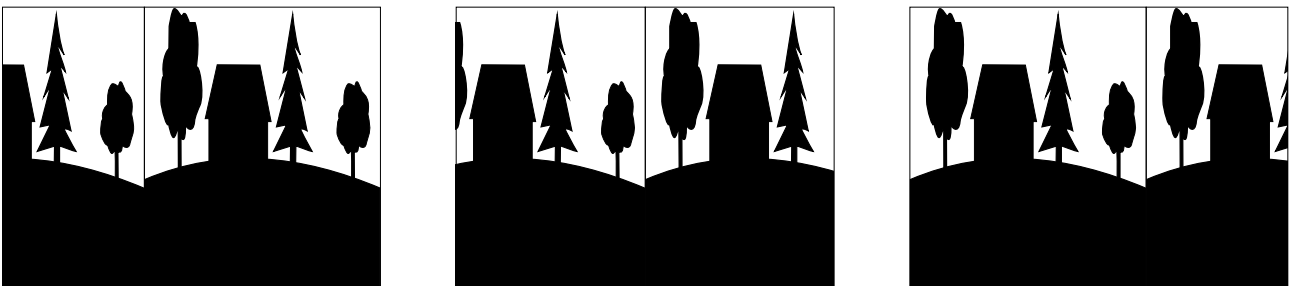

Figure 4: Side-by-Side offset positions: to the left, center, to the right

This effect can be mitigated with the camera by slightly shifting the whole side-by-side raw video arrangement to the left or to the right, without compromising the raw side-by-side video. Follow the procedure outlined below for side-by-side offset adjustment. The procedure can be canceled at any time by power-cycling the camera.

■ Power on camera and display video signal on a suitable test monitor or video goggle. This adjustment is only applicable for side-by-side 3D mode.

■ Press push button 1 and keep it pressed for ca. 1 sec until the status LED flashes fast, then release push button 1.

■ The camera now is in online calibration mode, which is indicated by a slow LED flashing cycle. Currently there are two different adjustment modes (Sensor Vertical Adjustment Mode (default) = repeated single flash, Side-by-Side Offset Adjustment Mode = repeated double flash). The required Side-by-Side Offset Adjustment Mode needs to be selected manually in the next step.

■ Select Side-by-Side Offset Adjustment Mode by pressing and releasing either push button 1 or push button 2. The selected adjustment mode is indicated by the corresponding flashing sequence of the LED. For Side-by-Side Offset Adjustment Mode the LED must show a repeated double-flash cycle.

■ Activate Side-by-Side Offset Adjustment Mode by pressing push button 1 again and keep it pressed for ca. 1 sec until the status LED flashes fast. Then release push button 1.

■ Now press and release one of the two push buttons at a time to horizontally shift the whole side-by-side video image. Each push button is responsible for one of the two possible shift directions (to the left, to the right). Input is accepted upon <u>release</u> of the respective push button. The possible shift range for image alignment is +/- 4 shift steps.

■ When done press push button 1 again and keep it pressed for ca. 1 sec until the status LED indicates a solid signal, then release push button 1. This will terminate the Side-by-Side Offset Adjustment Mode. The side-by-side offset adjustment settings will be saved and the camera restarts with the new settings.

2.7 Auto Exposure Adjustments

The auto exposure (AE) algorithms running on both image sensors perform automatic adjustments of the image brightness by controlling the exposure time and analog gains of the sensor core, as well as the digital gains applied to the image. Depending on the environment in which the camera is operated one of the four following AE algorithms might improve image quality:

■ **Average brightness tracking:** Factory default, calculates brightness over the full image with automatically set target brightness values.

■ **Weighted Average Brightness:** Calculates brightness corresponding to weight values of 25 sub-windows defined over the full image. Programmed weight values force the algorithm to focus on the lower half of the full image and to ignore the upper half of the full image.

■ **Adaptive Weighted AE for highlights:** The scene will be exposed based on the brightness of each sub-window, and will adapt to correctly expose the highlights (brighter windows). This will correctly expose the foreground of an image when the background is dark.

■ **Adaptive Weighted AE for lowlights:** The scene will be exposed based on the brightness of each window, and will adapt to correctly expose the lowlights. This will correctly expose the foreground of an image when the background is brighter.

The desired AE algorithm can be chosen during camera operation with the following procedure. The procedure can be canceled at any time by power-cycling the camera.

■ Power on camera.

- Press push button 2 and keep it pressed for ca. 1 sec until the status LED flashes fast, then release push button 1.

- The camera now is in online AE algorithm selection mode and displays the currently active algorithm with a slow LED flashing cycle (Average brightness tracking = repeated single flash, Weighted Average Brightness = repeated double flash, Adaptive Weighted AE for highlights = repeated triple flash, Adaptive Weighted AE for lowlights = repeated quadruple flash).

- Select one of the four AE algorithms by pressing and releasing either push button 1 (counts up) or push button 2 (counts down). The selected algorithm is indicated by the corresponding flashing sequence of the LED.

- Activate desired AE algorithm by pressing push button 2 again and keep it pressed for ca. 1 sec until the status LED indicates a solid signal, then release push button 1. This will terminate the AE algorithm selection mode. The algorithm settings will be saved and the camera restarts with the new settings.

3 Warranty

This product is covered by the German statutory warranty. The warranty is fulfilled at the seller's option by repair, replacement or withdrawal of the purchase contract.

The warranty becomes void when the malfunction was or is caused by third party, or by improper installation, or commissioning or modification, by incorrect or negligent handling, or improper transport, or excessive stress, by unsuitable operating resources, by inadequate video transmission systems, by improper use or operation of the product.

Please note that the technical realization of the wireless video transmission from the camera to the end user's video receiver, or video goggle, or head-mounted display has a significant impact on the video quality. Inappropriate video quality caused by the use of unsuitable video transmission systems is therefore not an error or malfunction of the product.

4 Disposal and Environmental Protection

Electrical and Electronic Equipment (EEE) can be recycled when no longer needed and must not be disposed together with usual household waste. Therefore we kindly ask you to support us with your active contribution to the conservation of resources and the protection of the environment by disposing this device at the official EEE collection points.

5 Manufacturer Information and Technical Support

This camera was developed for you by:

TMG - Ingenieurbüro UG (haftungsbeschränkt)	Sales tax ID: DE294861035
Römerstr. 14	WEEE ID: DE55557702
89077 Ulm	Website: www.themissinggear.eu
GERMANY	Contact: info@themissinggear.eu

6 Regulatory Notes

6.1 United States of America

Note: This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

6.2 Canada

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

6.3 European Union

Declaration of Conformity

We,

TMG - Ingenieurbüro UG (haftungsbeschränkt)

Römerstr. 14

89077 Ulm

GERMANY

declare under our sole responsibility, that the product

Product name	NanoCam3D
Trade name	The Missing Gear
Model	Mk. 1

to which this declaration relates, is in conformity with the following directives and harmonized standards:

EMC Directive 2014/30/EU	EN 55022:2010
	EN 55024:2010
RoHS Directive 2011/65/EU	EN 50581:2012

The technical documentation is kept at the above mentioned address open for inspection.

Dr.-Ing. Michael Sabielny
Managing Director

Ulm, 03. July 2017

Notes