



Z-1Pro

Full-color night vision gimbal camera
User Manual



Read this manual carefully before installation and first use, and keep it for future reference.

Based on the manufacturer's original manual, version V1.4 (08/2025)

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1. Safety instructions

- ① When not in use, store the gimbal in the package box. The recommended storage environment is a relative humidity of less than 40 % at a temperature of 20 ± 5 °C. If the lens fogs up, the water vapor will usually dissipate after turning on the device for a while.
- ② Do not place the product under direct sunlight, in areas with poor ventilation, or near a heat source such as a heater.
- ③ Do not frequently power the product on and off. After it is turned off, wait at least 30 seconds before turning it back on, otherwise the product life will be affected.
- ④ Make sure the ports and the surface of the gimbal are completely free from any liquid before installation.
- ⑤ Make sure the gimbal is securely installed onto the aircraft.
- ⑥ Do not insert or remove the microSD card during use.
- ⑦ Do not touch the surface of the camera lens and keep it away from hard objects, as doing so may lead to blurred images and affect the imaging quality.
- ⑧ Clean the surface of the camera lens with a soft, dry, clean cloth. Do not use alkaline detergents.
- ⑨ When the gimbal is not receiving valid carrier INS data, its yaw axis will drift about 15° per hour because of the Earth's rotation. To keep the gimbal attitude correct, valid carrier INS data must be transmitted — usually the GNSS receiver of the drone should have a position fix.
- ⑩ When the damping platform is tilted over 45°, the gimbal will trigger protection mode and return to its neutral position (except in FPV mode).

2. Product description

2.1 Introduction

The Z-1Pro carries an ultra-starlight image sensor visible light camera. Combined with the AI-ISP full-color night vision imaging engine and the AI-HDR imaging engine, it can present clear full-color images both in extremely low-light environments and in complex lighting environments. Featuring AI multi-object detection and tracking, the Z-1Pro can constantly track one of the persons and vehicles intelligently identified in the image.

The Z-1Pro features a micro 3-axis non-orthogonal mechanically stabilized structure, supporting both downward and upward installation. With the Dragonfly software, the user can watch the image and control the gimbal without dealing with the communication protocol. Integrated with the XF-QGC software, it achieves comprehensive functional compatibility with open-source autopilots.

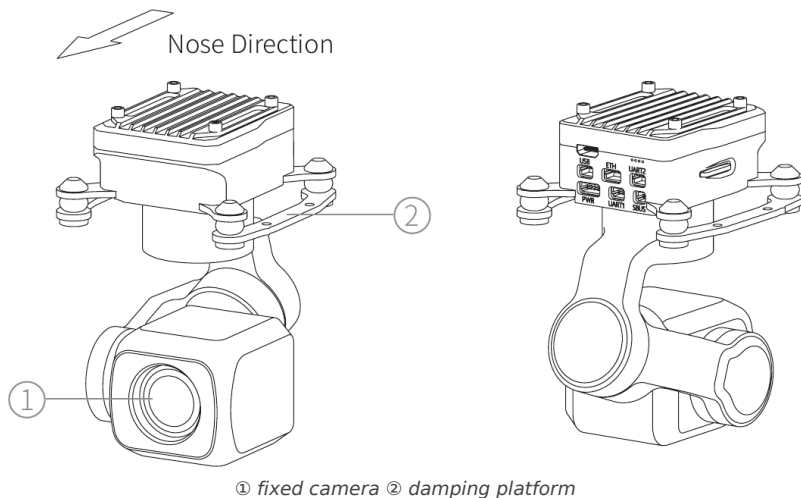
Manufacturer	Nanjing Xianfei Robot Technology Co., Ltd. (XF Robot)
Manufacturer website	www.allxf.com / www.allxianfei.com
Manufacturer support	support@allxianfei.com

2.2 Characteristics

- Carries an ultra-starlight image sensor visible light camera; combined with the AI-ISP full-color night vision imaging engine, it can present clear full-color images in extremely low-light environments, delivering a night-vision-level low-light imaging experience. Featuring AI-HDR, it ensures both highlight and shadow details remain vividly visible even in complex lighting scenarios with extreme brightness contrasts.
- Features AI multi-object detection and tracking, which can constantly track one of the persons and vehicles intelligently identified in the image.
- Micro 3-axis non-orthogonal mechanically stabilized structure reducing the weight down to 100 g.
- Supports network (Ethernet), UART and S.BUS control; compatible with both the manufacturer's private protocol and the MAVLink protocol.
- Thanks to the dual-IMU complementary algorithms with IMU temperature control and carrier AHRS fusion, the gimbal provides a stabilization accuracy of $\pm 0.01^\circ$.
- Can be mounted onto multiple carriers, whether downward or upward.
- With the Dragonfly software, the user can watch the image, control the gimbal, and download photos and videos online as well.
- With the customized QGC software (XF-QGC), all the functions of the gimbal can be used in conjunction with an open-source autopilot.

- The screen supports overlaying OSD information; images support EXIF saving. Live video stream and recording support SEI saving (the SEI functionality will be supported via subsequent firmware updates).
- 10-26.4 V DC wide voltage input.

2.3 Overview

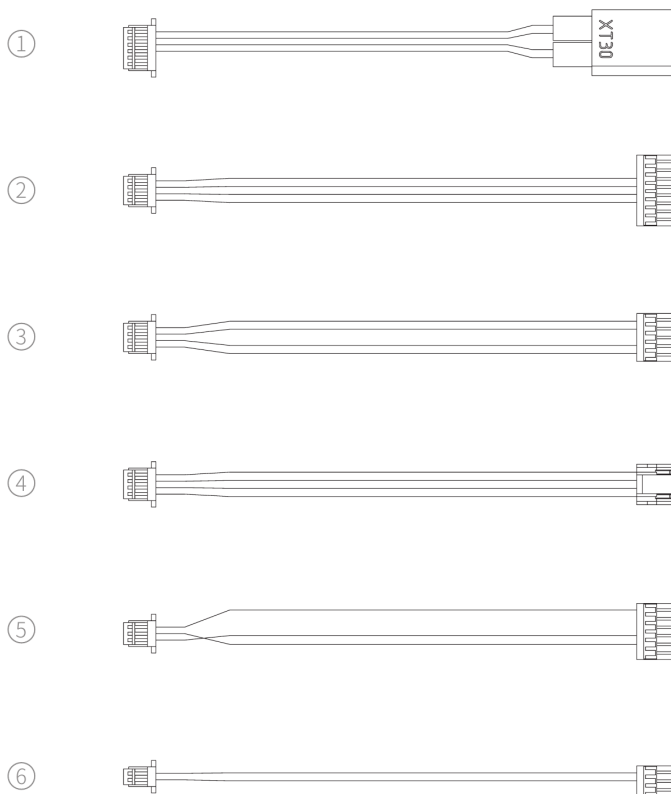


The *Nose Direction* arrow in the figure indicates the direction of the aircraft's nose. The upper part of the gimbal houses the gimbal control electronics — the **GCU** (Gimbal Control Unit) with its ports.

2.4 Accessories



J1.0 Config Module (left) and Network Conversion Module (right)



Supplied cables

- ① power cable (XT30)
- ② SIYI AirUnit net cable
- ③ SKYDROID H16 net cable
- ④ Network Converter / SKYDROID H12Pro/H30 net cable
- ⑤ open-source autopilot UART cable
- ⑥ S.BUS cable

2.5 Specifications

Dimensions	59.2 × 48.4 × 80.2 mm
Weight	100 g
Operating voltage	10–26.4 V DC
Power	6 W (average) / 20 W (stall)
Mounting	downward / upward
Stabilization	3-axis non-orthogonal mechanical
Angular accuracy	±0.01°
Max. stable tilt angle of the carrier	45°
Controllable range	pitch –110° to +120°, yaw ±140°
Max. rotation speed	150°/s
Image sensor	1/1.8" CMOS, 4.09 MP effective
Lens	focal length 8.5 mm (equivalent 41.1 mm), aperture f/1.0 HFOV 57.1°, VFOV 30.4°, DFOV 66.3°
Resolution	2688 × 1520
Digital zoom	6×
Image format	JPEG (with EXIF data)
Video format	MP4; stream 2688 × 1520 @ 30 fps, recording 1920 × 1080 @ 30 fps ※
Stream encoding	H.264, H.265
Stream network protocol	RTSP
Memory card	microSD U3/V30 or faster, up to 256 GB
Operating temperature	–20 °C to 50 °C
Storage temperature	–40 °C to 60 °C
Operating humidity	≤85 % RH (non-condensing)

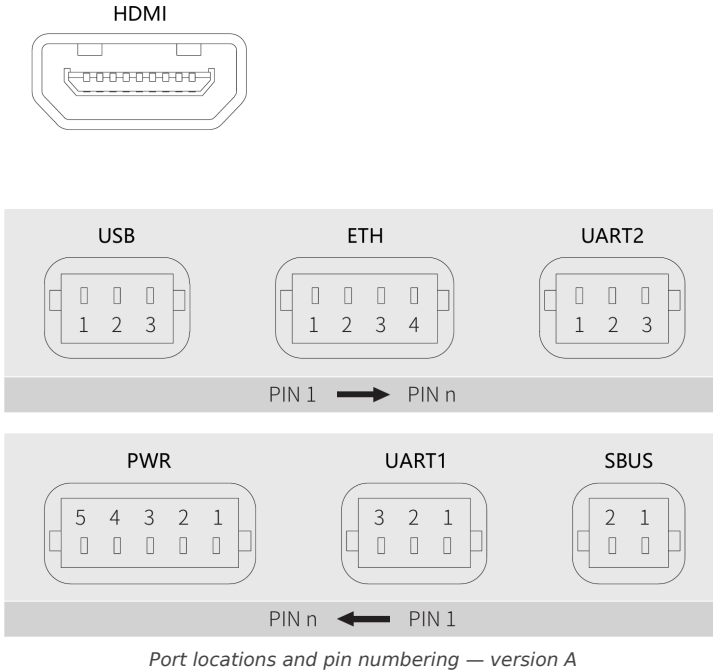
※ Recording at 2688 × 1520 @ 30 fps will be supported via subsequent firmware updates.

3. Ports

The Z-1Pro is manufactured in two hardware revisions that differ in the ports fitted. **Version B** additionally has the SP (audio output) and MIC (audio input) ports and a six-pin PWR power connector. Check which revision you have and follow the corresponding table.

3.1 Version A

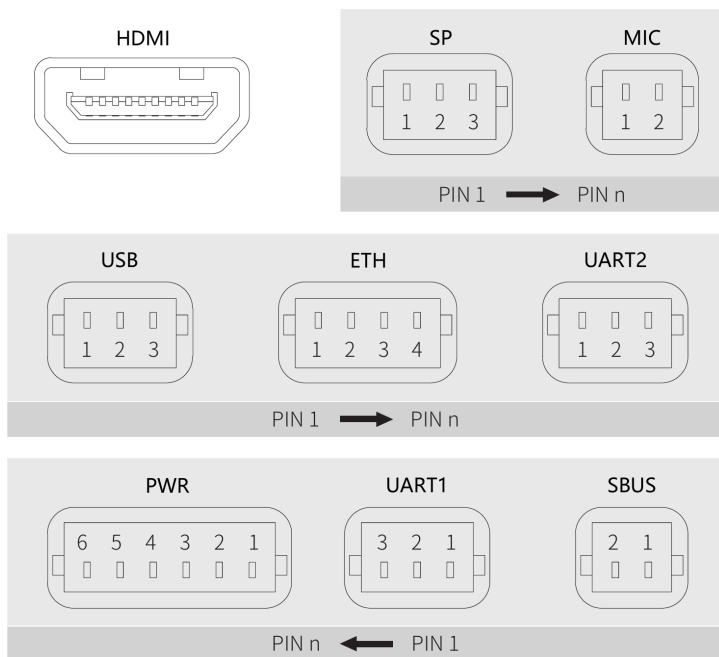
Port	Description	Header	Pin definition
HDMI	video output	micro HDMI	—
USB	reserved	SM03B-SRSS-TB	1 GND 2 USB_D+ 3 USB_D-
ETH	GCU configuration and upgrading, private protocol control, video output, AICore connection	SM04B-SRSS-TB	1 ETH_Tx+ 2 ETH_Tx- 3 ETH_Rx+ 4 ETH_Rx-
UART2	GCU IP configuration, private protocol control and MAVLink protocol control	SM03B-SRSS-TB	1 GND 2 UART_Rx (0-3.3 V) 3 UART_Tx (0-3.3 V)
PWR	power in, 10-26.4 V DC	SM05B-SRSS-TB	1, 2 Power In 3 NC 4, 5 GND
UART1	gimbal firmware upgrading	SM03B-SRSS-TB	1 GND 2 UART_Rx (0-3.3 V) 3 UART_Tx (0-3.3 V)
S.BUS	S.BUS in; compatible with the S.BUS1 standard (FASST, SFHSS) and S.BUS2 (FASSTes)	SM02B-SRSS-TB	1 GND 2 S.BUS In



3.2 Version B

The HDMI, USB, ETH, UART1, UART2 and S.BUS ports are wired identically to version A. Ports that differ or are added:

Port	Description	Header	Pin definition
SP	audio output (will be supported via subsequent firmware updates)	SM03B-SRSS-TB	1 GND 2 AUDIO_OUT+ 3 AUDIO_OUT-
MIC	audio input (will be supported via subsequent firmware updates)	SM02B-SRSS-TB	1 MIC+ 2 MIC-
PWR	power in, 10-26.4 V DC; AICore connection	SM06B-SRSS-TB	1, 2 Power In 3, 4 GND 5 UART_AICore_Rx 6 UART_AICore_Tx



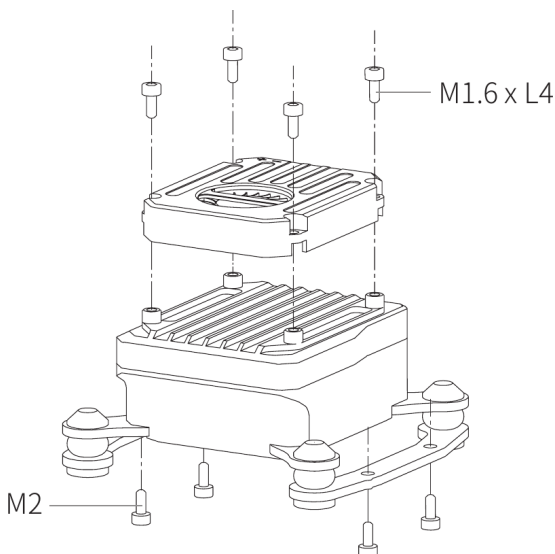
Port locations and pin numbering — version B

4. Installation

Use 4 × **M2** screws to fix the damping platform to the carrier (drone) and reserve enough space for the damping to move freely.

Do not hard-connect the gimbal to the carrier, and make sure that the gimbal does not come into contact with the carrier during use.

The gimbal heats up while operating. Please ensure that the device is well cooled. The **Micro-pod Cooling Kit** can be used to assist with heat dissipation — install it on the top of the gimbal with 4 M1.6 × 4 mm screws.



Installing the cooling kit (M1.6 × L4) and fixing the platform (M2)

- ※ The Micro-pod Cooling Kit is sold separately. The M2 screws for fixing the gimbal are not included in the package.
- ※ The Micro-pod Cooling Kit needs to be powered separately; the power supply range is 10–26.4 V DC at 0.5 W.
- ※ The gimbal supports a U3/V30 or faster microSD card with a capacity of up to 256 GB.

5. Configuration and firmware upgrading

- Ensure the gimbal and the GCU have both been upgraded to the latest firmware before use. Otherwise, some functions may not be available.
- Ensure the driver of the Config Module is installed on the computer before configuration or upgrading.
- Before configuration, the computer should be set to a static IP address in the same network segment as the GCU (without IP address conflicts). The default IP address of the GCU is 192.168.144.108.
- Do not power off the device while upgrading. Restart the device once the upgrading is complete.

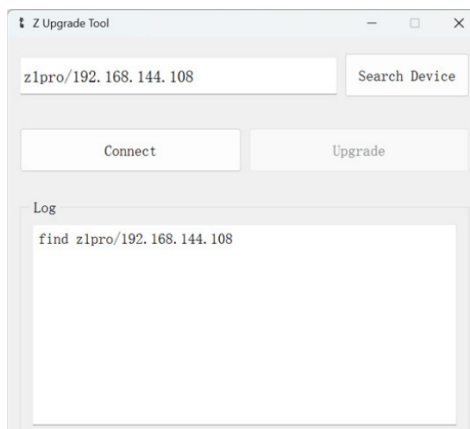
5.1 Configuration

- ① Connect the computer to the ETH port with the Network Conversion Module. Power on the devices.
 - ② Run the *Dragonfly* display and control software and confirm that it is connected to the gimbal. Open the settings page.
 - ③ In the settings, configure the connected gimbal.
 - ④ When the settings are complete, click *Save*.
 - ⑤ Restart the gimbal to enable the configuration to take effect.
- ※ For instructions on *Net Settings*, *CAMERA*, *S.BUS Setting*, *Calibration*, *Carrier* and *Advance*, please refer to the *Dragonfly Quick Start Guide* (Ribbon — *Settings*) or visit www.allxianfei.com and see the Video Center.
 - ※ After enabling OSD or target recognition, the video stream delay will increase and the frame rate will decrease.
 - ※ When changing the video stream resolution, the Dragonfly software or the player needs to be restarted.
 - ※ After modifying the network settings, the gimbal will automatically reboot.

5.2 GCU firmware upgrading

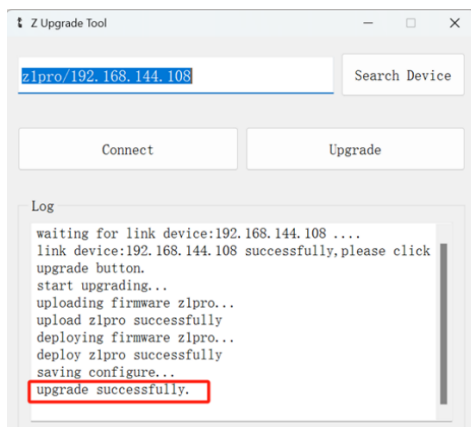
Before performing the firmware upgrade, please make sure that the Dragonfly software is turned off.

- ① Connect the computer to the ETH port with the Network Conversion Module. Power on the devices.
- ② Run the *GCU Upgrade Tool*.
- ③ Click the *Search Device* button and wait for the host computer search to complete.



Device found after clicking Search Device

- ④ After the search is complete, click *Connect* and wait for the confirmation that the connection is successful.
- ⑤ After the connection is successful, click *Upgrade* — the device will start upgrading. Wait for the software to prompt *upgrade successfully*, which indicates that the upgrade is complete.



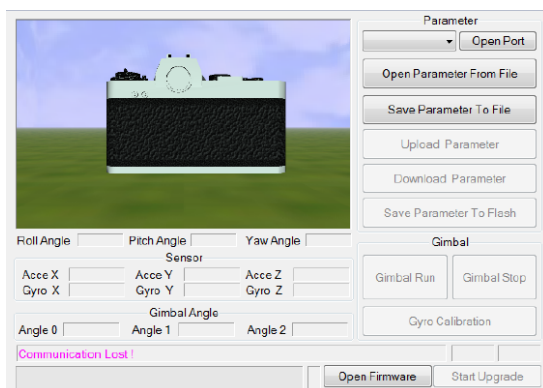
Upgrade completed successfully

Following a GCU firmware upgrade, all configurations will be restored to default values.

5.3 Gimbal firmware upgrading

Ensure the driver of the Config Module is installed on the computer before upgrading.

- ① Connect the UART1 port to the computer with the J1.0 Config Module. Power up the gimbal.
- ② Run the *GimbalConfig* software. Select the COM port corresponding to the Config Module. Click *Open Port* and confirm that the software and the gimbal are connected.
- ③ Click *Open Firmware*. Select the firmware file. Click *Start Upgrade* and wait for the upgrade to complete.



GimbalConfig software

※ With some brands of dual USB-C cables, the computer may not recognize the Config Module. In that case, use a USB-A → USB-C cable.

6. Video output and overheat protection

6.1 Real-time video playing

The live image is available via the RTSP protocol. Example for a camera with the IP address 192.168.144.108:

Stream address: **rtsp://192.168.144.108**

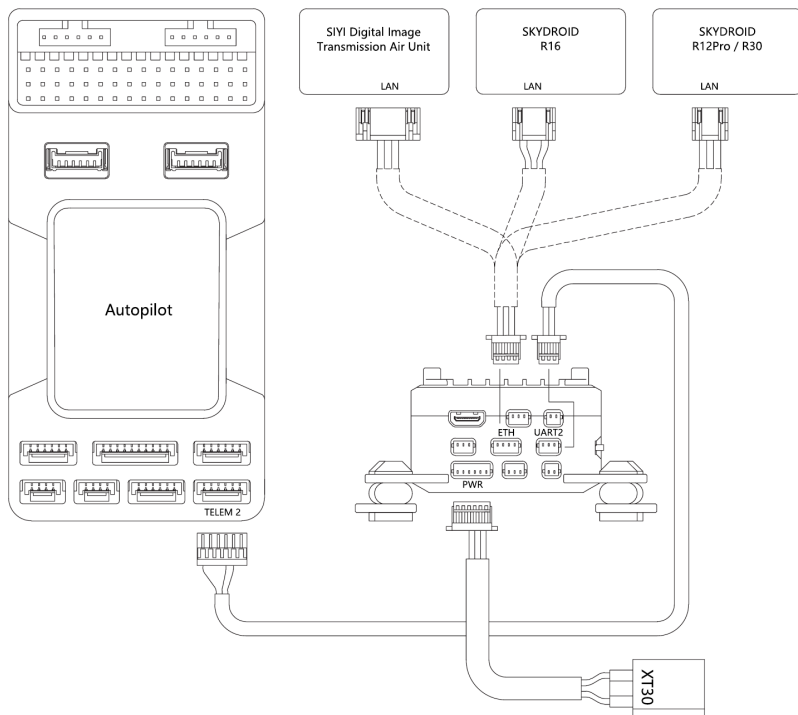
6.2 Overheat protection

When the gimbal's CPU temperature exceeds 80 °C, the camera feed will flicker once and the device will enter overheat protection mode, during which the frame rate drops to 5 fps. The gimbal automatically exits overheat protection mode when the CPU temperature falls below 75 °C, at which point the frame rate returns to normal.

7. Connecting to an open-source autopilot

7.1 Wiring diagram

Example wiring using the autopilot's (flight controller's) TELEM2 port:



Connection to an open-source autopilot and digital video systems

7.2 MAVLink communication process

After receiving a HEARTBEAT from the flight controller (FC) and identifying its SYSID and COMPID, the GCU operates as follows (MAVLink message IDs are given in parentheses):

- ① The GCU actively sends the HEARTBEAT (0) message at a frequency of 2 Hz.
- ② The GCU requests the messages listed below in turn at a frequency of 1 Hz. The flight controller fulfils these requests via the COMMAND_LONG (76) message until the requests are completed:

EKF_STATUS_REPORT (193) — *not available on PX4,*

GLOBAL_POSITION_INT (33),

SCALED_IMU (26),

SYSTEM_TIME (2),

RC_CHANNELS (65),

CAMERA_TRIGGER (112) — *not available on ArduPilot,*

AUTOPILOT_STATE_FOR_GIMBAL_DEVICE (286),

GIMBAL_DEVICE_SET_ATTITUDE (284) — *not available on ArduPilot.*

- ③ The GCU actively sends the GIMBAL_DEVICE_ATTITUDE_STATUS (285) message at a frequency of 100 Hz while the messages above are being received and the gimbal is operational.
- ④ Generally, the flight controller will request the GIMBAL_DEVICE_INFORMATION (283) message, which the GCU does not send actively.

7.3 Configuration — ArduPilot

Example using the autopilot's TELEM2 port. Autopilot firmware **ArduPilot V4.5.7 to V4.6.2**:

Parameter	Value
SERIAL2_BAUD	115
SERIAL2_OPTIONS	1024
SERIAL2_PROTOCOL	2
SR2_ADSB, SR2_EXIT_STAT, SR2_EXTRA1, SR2_EXTRA2, SR2_EXTRA3, SR2_PARAMS, SR2_POSITION, SR2_RAW_CTRL, SR2_RAW_SENS, SR2_RC_CHAN	0 Hz
MNT1_TYPE	4 (SToRM32 Mavlink)
MNT1_DEFLT_MODE	0 (Retracted)
CAM1_TYPE	6 (MAVLinkCamV2)

Autopilot firmware **ArduPilot V4.7 or later**:

Parameter	Value
SERIAL2_PROTOCOL	8 (Gimbal)
SERIAL2_BAUD	115 / 250 / 500 / 1000 (gimbal baud rate auto-adaptation)
CAM1_TYPE	4 (Mount)
MNT1_TYPE	14 (XFRobot)
MNT1_ROLL_MIN / MNT1_ROLL_MAX	−50 / 50
MNT1_PITCH_MIN / MNT1_PITCH_MAX	−145 / 60
MNT1_YAW_MIN / MNT1_YAW_MAX	−180 / 180
MNT1_RC_RATE	60 (°/s)
RC6_OPTION	213 (Mount Pitch)
RC7_OPTION	214 (Mount Yaw)
RC9_OPTION	163 (Mount Lock)

※ For more support, visit ardupilot.org/copter/docs/common-xfrobot-gimbal.html

7.4 Configuration — PX4

Example using the autopilot's TELEM2 port:

Parameter	Value
MAV_1_CONFIG	TELEM2
MAV_1_MODE	Custom / Gimbal
MAV_1_RATE	115200 B/s
SER_TEL2_BAUD	115200 8N1
MNT_MAIN_PITCH	AUX1
MNT_MAIN_YAW	AUX2
MNT_MODE_IN	Auto (RC and Mavlink Gimbal)
MNT_MODE_OUT	MAVLink gimbal protocol v2
Trigger mode	Distance based, on command (Survey mode)
Trigger interface	MAVLink (forward via MAV_CMD_IMAGE_START_CAPTURE)

- ※ Setting MAV_1_MODE to *Custom* is recommended.
- ※ AUX1 and AUX2 are just examples — define the channels according to the actual situation and configure them in RC Map for further application.
- ※ The trigger mode is just an example and can be modified according to the actual situation.

8. Information for the EU and Czech Market

8.1 Importer and responsible person in the EU

The product is placed on the European Union market by the importer stated below, who is at the same time the responsible person within the meaning of Article 16 of Regulation (EU) 2023/988 of the European Parliament and of the Council on general product safety (GPSR).

Importer / responsible person in the EU	Rotorama, s.r.o.
Company ID (IČO)	051 57 692
VAT ID (DIČ)	CZ05157692
Registered office	Okrajová 1351, 674 01 Třebíč, Czech Republic
E-mail	info@rotorاما.cz
Phone	+420 252 252 098
Website	www.rotorاما.cz

8.2 Product conformity



- The product bears the **CE** marking and complies with the requirements of the applicable European Union harmonisation legislation.
- A copy of the **EU Declaration of Conformity** is available from the importer at the address stated above or at the e-mail address info@rotorاما.cz.
- **Product identification:** the type designation (Z-1Pro) and the serial number are given on the rating label on the product or its packaging.

8.3 Disposal of electrical equipment



- The crossed-out wheeled bin symbol on the product, its packaging or in the documentation means that at the end of its service life the product **must not be disposed of together with mixed municipal waste.**
- Hand it over at a take-back point for electrical equipment – at a collection yard, at a take-back point of a collective system, or at the retailer when purchasing a new equivalent product. Take-back is free of charge for the end user.
- The obligations under Act No. 542/2020 Coll., on end-of-life products, are fulfilled by the importer through a collective take-back system.
- Proper disposal helps prevent negative impacts on the environment and human health and contributes to the reuse of secondary raw materials.

Through its contractual partner **ASEKOL a.s.**, the company ensures the take-back of waste electrical equipment from households and the separate collection of waste electrical equipment, batteries and accumulators in accordance with the applicable legislation. The customer is entitled to hand over old electrical equipment or a battery or accumulator at any collection point of the above contractual partner. The addresses of these take-back points are listed at www.asekol.cz, www.ecobat.cz and also <https://visoh2.mzp.cz/RegistrMistZO/RegistrMistZOPublic/MapaMistZpetOdberu>.

9. Warranty and rights arising from defective performance

The rights and obligations of the contracting parties are governed by Czech law, in particular by Act No. 89/2012 Coll., the Civil Code, and Act No. 634/1992 Coll., on consumer protection.

- The seller is liable to the buyer for the product being free of defects on receipt. If the buyer is a consumer, a defect may be notified **within two years of receipt** of the product (Section 2165 of the Civil Code).
- If a defect appears within **one year** of receipt, the product is deemed to have been defective already at the time of receipt (Section 2161(5) of the Civil Code).
- When purchasing online, a consumer has the right to **withdraw from the contract within 14 days** of receiving the goods without giving a reason (Section 1829 of the Civil Code).
- Claims should be made with the retailer from whom you purchased the product. The importer's contact details are given in Chapter 8.1.
- The competent body for out-of-court settlement of consumer disputes is the **Czech Trade Inspection Authority**, Štěpánská 796/44, 110 00 Prague 1, www.coi.cz.