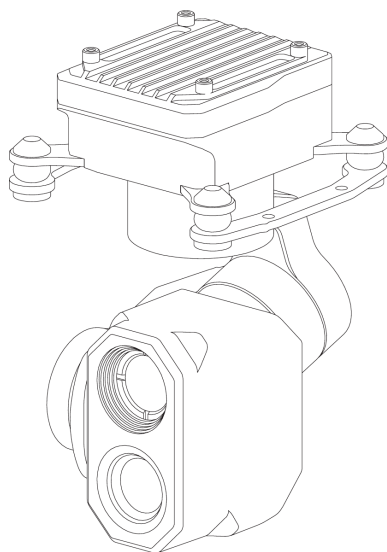




Z-2Pro

4K + thermal stabilised camera pod
User Manual



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

Rotorama, s.r.o. · based on the original manufacturer's documentation (XF, version V1.1)

Contents

1. Before first use

- 1.1 Symbols used
- 1.2 Safety instructions

2. Product description

- 2.1 Synopsis
- 2.2 Characteristics
- 2.3 Overview
- 2.4 Accessories

3. Ports definition

4. Installation

5. Configuration and upgrading

- 5.1 Configuration
- 5.2 GCU upgrading
- 5.3 Gimbal upgrading

6. Operation

- 6.1 Real-time video playing
- 6.2 Overheat protection

7. Appendices

- 7.1 Wiring diagram of connecting to an open source autopilot
- 7.2 MAVLink communication process
- 7.3 MAVLink configuration — ArduPilot
- 7.4 MAVLink configuration — PX4

8. Information for the EU and Czech Market

- 8.1 Importer and responsible person in the EU
- 8.2 Product conformity

8.3 Disposal of electrical equipment

8.4 Electromagnetic compatibility and installation

8.5 Operation on an unmanned aircraft

8.6 Personal data protection

9. Warranty and rights arising from defective performance

1. Before first use

This manual describes the **XF Z-2Pro** stabilised camera pod — a **payload** for an unmanned aircraft or another carrier, not an unmanned aircraft in itself. It is based on the original manufacturer's manual (NANJING XIANFEI ROBOT TECHNOLOGY CO., LTD., version V1.1, 08/2025) and is supplemented with information required by EU and Czech legislation.

1.1 Symbols used

⚠ Important	An instruction which, if not observed, may damage the product, void the warranty or create a safety hazard.
※ Tips	A recommendation that makes working with the product easier.
? Explanation	Additional information on the function described.

1.2 Safety instructions

1. When not in use, store the pod in the package box. The recommended storage environment is a relative humidity below 40 % at 20 ± 5 °C. If the lenses fog up, the water vapour usually dissipates after the device has been on for a while.
2. Do not expose the thermal camera lens to a strong energy source such as sun, lava or laser beam. The temperature of the observation target should not exceed **600 °C**, otherwise it will cause permanent damage.
3. Do not place the product under direct sunlight, in areas with poor ventilation, or near a heat source such as a heater.
4. Do not frequently power on/off the product. After it is turned off, wait at least **30 seconds** before turning back on, otherwise the product life will be affected.
5. Make sure the pod port and pod surface are free from any liquid before installation.
6. Make sure the pod is securely installed onto the aircraft.
7. Do not plug or unplug the microSD card during use.
8. Do not touch the surface of the camera lenses and keep them away from hard objects, as this may lead to blurred images and affect the imaging quality.
9. Clean the surface of the camera lenses with a soft, dry, clean cloth. Do not use alkaline detergents.
10. When not receiving valid carrier INS data, the yaw shaft of the pod will drift about **15 degrees per hour** because of the earth rotation. To keep the pod attitude correct, valid carrier INS data must be transmitted; the GNSS should be positioning.
11. When its damping platform is tilted over **45°**, the pod will trigger protection mode and return to its neutral position (except in FPV mode).

2. Product description

2.1 Synopsis

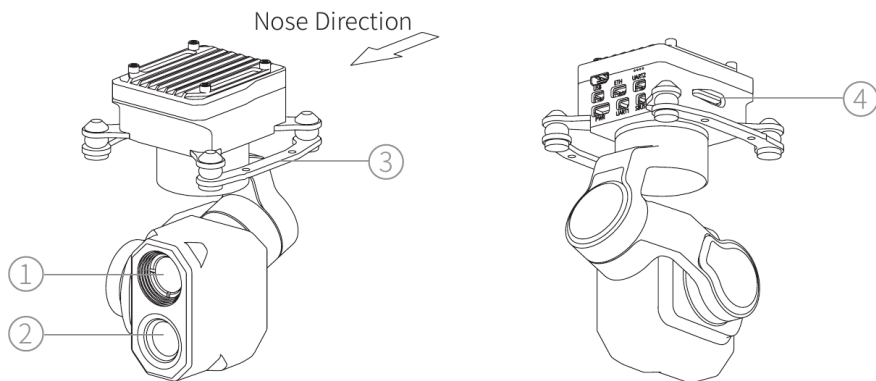
The Z-2Pro integrates a 4K resolution visible light camera and a 640 × 512 thermal camera. Combined with the AI-ISP full-colour night vision imaging engine and the AI-HDR imaging engine, it can present clear full-colour images whether in extremely low-light environments or in complex lighting environments. Featuring AI multi-object detection and tracking, the Z-2Pro can constantly track one of the persons and vehicles intelligently identified in the image.

The Z-2Pro features a micro 3-axis non-orthogonal mechanically stabilised structure, supporting both downward and upward installation. With the *Dragonfly* software, the user can watch the image and control the pod without protocol ducking. Integrated with the *XF-QGC* software, it achieves comprehensive functionality compatibility with open source autopilots.

2.2 Characteristics

- Integrates a 4K-resolution visible light camera and a 640 × 512 thermal camera. Powered by the AI-ISP full-colour night vision imaging engine, it delivers clear full-colour images in low-light environments. Featuring AI-HDR, it ensures both highlights 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 mechanical stabilised structure reducing the weight down to **130 g**.
- Supports network, UART and S.BUS control and is compatible with both private protocol and MAVLink protocol.
- Thanks to the dual-IMU complementary algorithms with IMU temperature control and carrier AHRS fusion, the gimbal provides a stabilisation accuracy of **±0.01°**.
- Can be mounted onto multiple carriers, whether downward or upward.
- With the *Dragonfly* software, the user can watch the image and control the pod without protocol ducking, and download photos and videos online as well.
- With the *XF-QGC* software, all the functions of the pod can be achieved 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



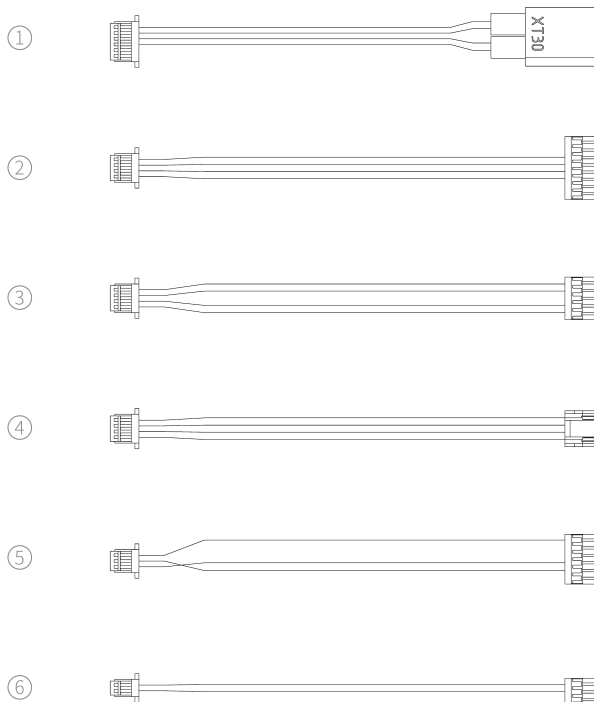
The callouts ① to ④ and the nose direction marking are taken from the original manufacturer's documentation.

- ① Thermal camera
- ② Visible light camera
- ③ Damping platform
- ④ MicroSD card slot

2.4 Accessories



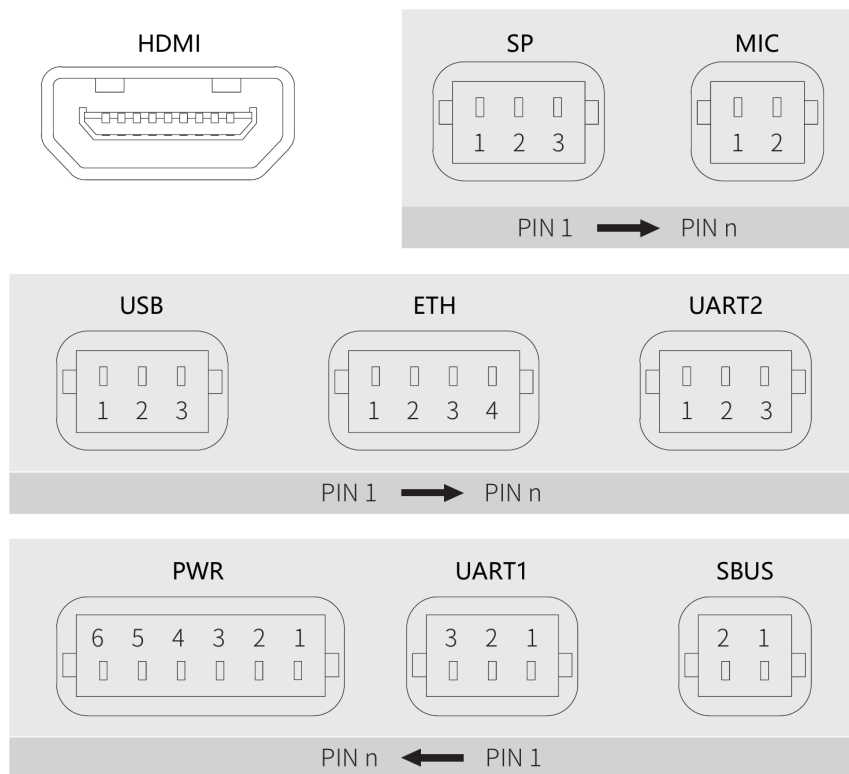
Left: J1.0 Config Module. Right: Network Conversion Module.



- ① Power cable
- ② SIYI AirUnit net cable
- ③ SKYDROID H16 net cable
- ④ Network Converter / SKYDROID H12Pro and H30 net cable
- ⑤ Open source autopilot UART cable
- ⑥ S.BUS cable

※ The scope of delivery may differ between individual packaging variants. The actual package contents are stated on the delivery note.

3. Ports definition



Layout and pin numbering of the individual connectors.

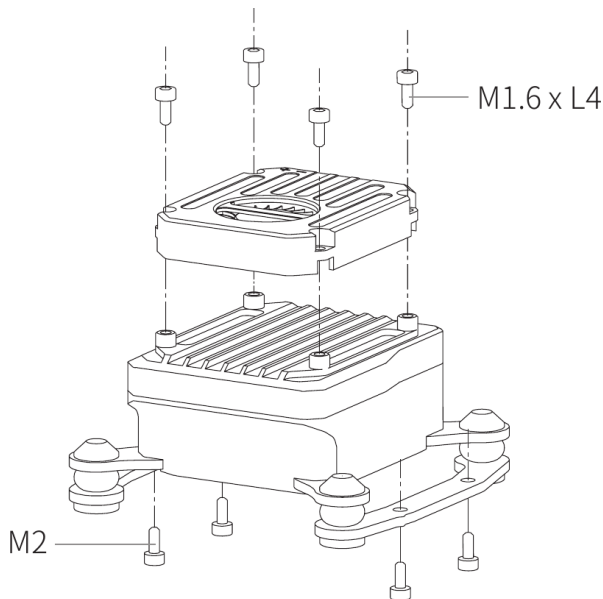
Port	Description	Header	Pin definition
HDMI	For video output	Micro HDMI	—
SP	Audio out (will be supported via subsequent firmware updates)	SM03B-SRSS-TB	1 — GND 2 — AUDIO_OUT+ 3 — AUDIO_OUT-
MIC	Audio in (will be supported via subsequent firmware updates)	SM02B-SRSS-TB	1 — MIC+ 2 — MIC-
USB	Reserved	SM03B-SRSS-TB	1 — GND 2 — USB_D+ 3 — USB_D-
ETH	For GCU configuration and upgrading, private protocol control, video output and connecting AICore	SM04B-SRSS-TB	1 — ETH_Tx+ 2 — ETH_Tx- 3 — ETH_Rx+ 4 — ETH_Rx-
UART2	For 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 and connecting AICore. Operating voltage: 10-26.4 V DC	SM06B-SRSS-TB	1, 2 — Power In 3, 4 — GND 5 — UART_AICore_Rx 6 — UART_AICore_Tx
UART1	For gimbal 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 such as FASST and SFHSS, and S.BUS2 such as FASSTest	SM02B-SRSS-TB	1 — GND 2 — S.BUS In

4. Installation

Use **4 × M2 screws** to fix the damping platform to the carrier and reserve enough space for damping.

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

The pod heats while operating. Please ensure that the device is well cooled. The *Micro-pod Cooling Kit* can be used to assist with heat dissipation. Install the cooling kit on the top of the pod with **4 × M1.6 × L4 mm screws**.



Mounting the cooling kit (M1.6 × L4) and the damping platform to the carrier (M2).

❖ **The Micro-pod Cooling Kit is sold separately. The M2 screws for fixing the pod are not included in the package.**

❖ **The cooling kit needs to be powered separately; the power supply range is 10-26.4 V DC @ 0.5 W.**

❖ **The pod supports a U3/V30 or above microSD card with a capacity of up to 256 GB.**

5. Configuration and upgrading

5.1 Configuration

⚠ **Ensure the gimbal and the GCU have both been upgraded to the latest firmware before use. Otherwise, usage may be affected.**

⚠ **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 which is 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.**

1. Connect the computer and the ETH port with the Network Conversion Module. Power on the devices.
2. Run the *Dragonfly* display and control software to confirm that it is connected to the pod. Open the settings page.
3. Open the settings and configure the current pod.
4. When the settings are complete, click *Save*.
5. Restart the pod to enable the configurations 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 the Video Center at www.allxianfei.com.**

✳ **After enabling OSD or target recognition, the video stream delay will increase and the frame rate will decrease.**

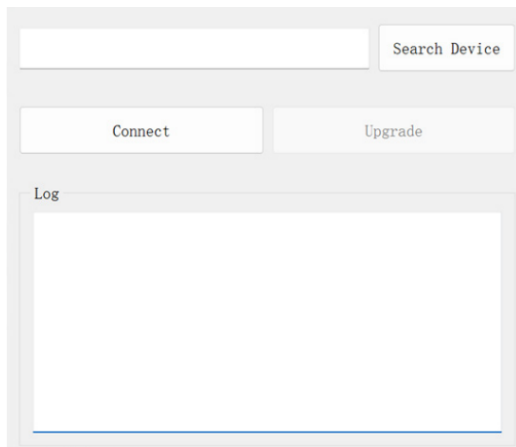
✳ **When changing the video stream resolution, the *Dragonfly* software or the player needs to be restarted.**

✳ **After modifying network settings, the gimbal pod will automatically reboot.**

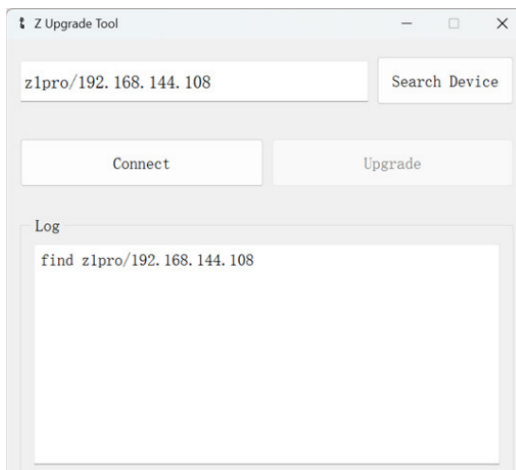
5.2 GCU upgrading

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

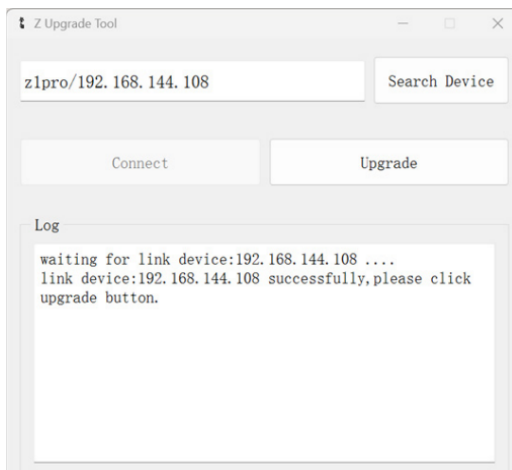
1. Connect the computer and the ETH port with the Network Conversion Module. Power on the devices.
2. Run the *GCU Upgrade Tool*.



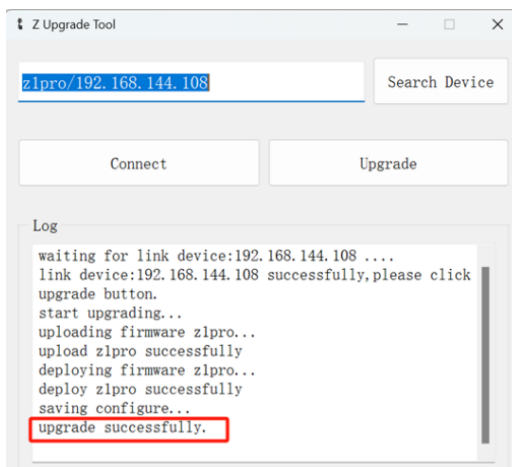
3. Click the *Search Device* button and wait for the host computer search to complete.



4. After the search is complete, click *Connect* and wait for the connection to confirm that the connection is successful.



5. After the connection is successful, click *Upgrade* and the device will start upgrading. Wait for the software to prompt *upgrade successfully* to indicate that the upgrade is successful.

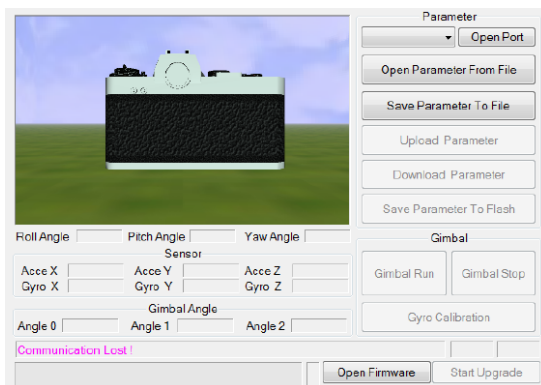


❖ **Following a GCU firmware upgrade, all configurations will be restored to default values.**

5.3 Gimbal upgrading

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

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



✳ For some brands of cables with a Type-C connector at both ends, there may be cases where the computer cannot recognise the Config Module. Please try replacing it with a Type-A to Type-C cable.

6. Operation

6.1 Real-time video playing

Example for a camera IP address of 192.168.144.108:

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

✳ **After the pod starts up, a brief period of colour distortion may occur, which is normal.**

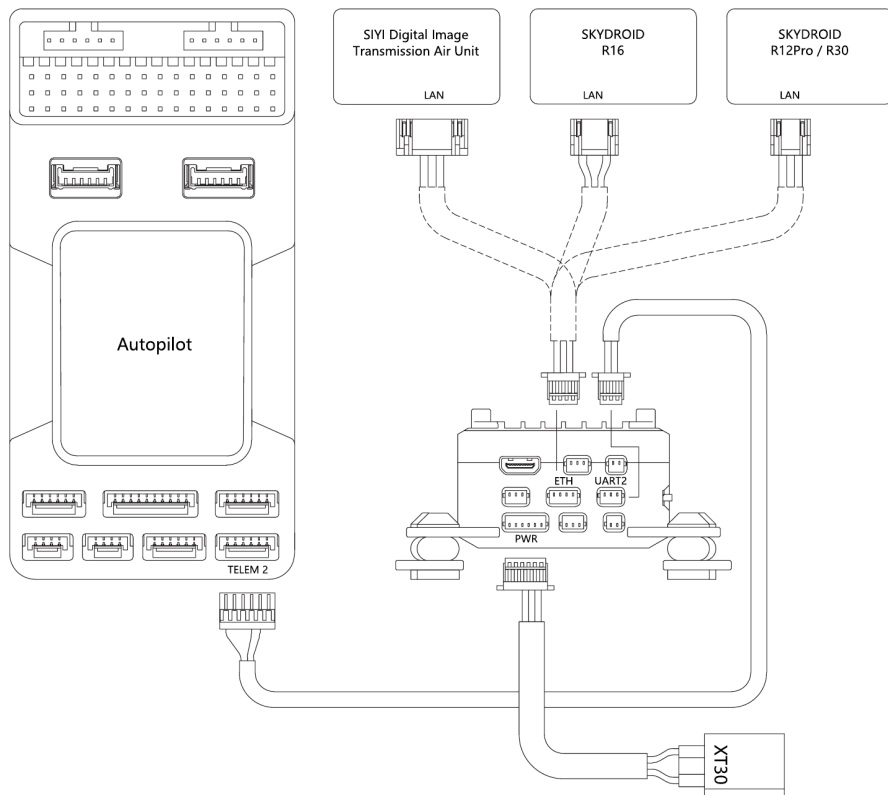
6.2 Overheat protection

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

7. Appendices

7.1 Wiring diagram of connecting to an open source autopilot

Taking the use of the autopilot's TELEM2 port as an example.



Connecting the pod to the autopilot and to a SIYI or SKYDROID video transmission link.

7.2 MAVLink communication process

After receiving HeartBeat from the flight controller (FC) and identifying its SYSID and COMPID, the GCU will operate as below:

1. The GCU actively sends package MAVLINK_MSG_ID_HEARTBEAT 0 at a frequency of 2 Hz.
2. The GCU requests the following packages in turn at a frequency of 1 Hz. The flight controller fills these parameters into package MAVLINK_MSG_ID_COMMAND_LONG 76 until the request is complete:
 - MAVLINK_MSG_ID_EKF_STATUS_REPORT 193 (no this package for PX4)
 - MAVLINK_MSG_ID_GLOBAL_POSITION_INT 33
 - MAVLINK_MSG_ID_SCALED_IMU 26
 - MAVLINK_MSG_ID_SYSTEM_TIME 2
 - MAVLINK_MSG_ID_RC_CHANNELS 65
 - MAVLINK_MSG_ID_CAMERA_TRIGGER 112 (no this package for APM)
 - MAVLINK_MSG_ID_AUTOPILOT_STATE_FOR_GIMBAL_DEVICE 286
 - MAVLINK_MSG_ID_GIMBAL_DEVICE_SET_ATTITUDE 284 (no this package for APM)
3. While the packages above are being received and the pod is operational, the GCU actively sends at a frequency of 100 Hz the package MAVLINK_MSG_ID_GIMBAL_DEVICE_ATTITUDE_STATUS 285.
4. Generally, the flight controller will request package MAVLINK_MSG_ID_GIMBAL_DEVICE_INFORMATION 283, which the GCU does not send actively.

7.3 MAVLink configuration — ArduPilot

Taking the use of the autopilot's TELEM2 port as an example. Parameter names are given in English exactly as displayed by the configuration software.

► Autopilot firmware V4.5.7 to V4.6.2

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

► Autopilot firmware V4.7 or later

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

✳ **Support:** ardupilot.org/copter/docs/common-xfrobot-gimbal.html.

7.4 MAVLink configuration — PX4

Taking the use of the autopilot's TELEM2 port as an example.

► MAVLink

MAV_1_CONFIG	TELEM2
MAV_1_MODE	Custom / Gimbal
MAV_1_RATE	115200 B/s

► Serial

SER_TEL2_BAUD	115200 8N1
---------------	------------

► Mount

MNT_MAIN_PITCH	AUX1
MNT_MAIN_YAW	AUX2
MNT_MODE_IN	Auto (RC and Mavlink Gimbal)
MNT_MODE_OUT	MAVLink gimbal protocol v2

► Camera Setup

Trigger mode	Distance based, on command (Survey mode)
Trigger interface	MAVLink (forward via MAV_CMD_IMAGE_START_CAPTURE)

❖ **The MAV_1_MODE is recommended as *Custom*.**

❖ **The AUX1 and AUX2 are just examples, which can be defined according to the actual situation. They should be configured in *RC Map* for further application.**

❖ **The trigger mode is just an example, which 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 is **Z-2Pro**; the manufacturer is NANJING XIANFEI ROBOT TECHNOLOGY CO., LTD., People's Republic of China. The serial number is stated on the product or on 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 product does **not** contain a built-in battery or accumulator.
- 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>.

8.4 Electromagnetic compatibility and installation

To maintain the conformity of the product with the electromagnetic compatibility requirements, observe the following measures during installation and operation:

- Use **only the cables supplied by the manufacturer** or cables of an equivalent design; do not splice or extend them and do not replace them with unshielded cables.
- Route the data cables (ETH, UART, S.BUS) separately from the power leads of the propulsion system, from the electronic speed controllers (ESC) and from transmitter antennas.
- Insert connectors fully and secure them against loosening by vibration.
- Attach the pod to the carrier exclusively via the supplied damping platform; do not use metal parts of the carrier as a substitute for a ground connection.
- Do not modify the product. Any modification of the electronics, wiring or housing invalidates the declaration of conformity.

8.5 Operation on an unmanned aircraft

The Z-2Pro is a payload. It is not an unmanned aircraft system in itself and does not bear a class identification label (C0 to C6) under Regulation (EU) 2019/945. Compliance with the operating rules is the responsibility of the UAS operator.

⚠ Regulations (EU) 2019/947 and 2019/945 apply in all Member States of the European Union, but the national implementing rules differ from state to state — registration portals, minimum age of the pilot, geographical zones and compulsory insurance. The information in this chapter describes the situation in the Czech Republic. If you operate the unmanned aircraft in another country, you must comply with the rules of the state in which you fly.

- **Mass.** Fitting the pod increases the take-off mass of the aircraft. Under UAS.OPEN.060 point 1(e) of Regulation (EU) 2019/947, the remote pilot must verify before flight that the resulting mass does not exceed the maximum take-off mass laid down by the aircraft manufacturer, nor the limit for the relevant class. Exceeding the limit removes the aircraft from that class and subcategory.
- **Operator registration.** An unmanned aircraft equipped with a sensor able to capture personal data — that is, with a camera — triggers the obligation to register the operator under Article 14(5) of Regulation (EU) 2019/947, **regardless of the mass of the aircraft.** After fitting this pod, the registration obligation therefore also applies to an aircraft that did not require registration before.
- In the Czech Republic, registration is carried out by the Civil Aviation Authority at dron.caa.gov.cz. The operator registration number must be displayed on every unmanned aircraft so that it is legible without optical aids.
- **Pilot competency.** Check whether the intended operation requires a proof of competency of the remote pilot; the requirements depend on the mass of the aircraft and on the subcategory of operation.
- Observe the operating limits of the open category — in particular the maximum height of 120 m above ground, a continuous visual line of sight with the aircraft and the prohibition of flying over assemblies of people.

8.6 Personal data protection

The product captures image recordings. When using it, you are responsible for complying with data protection and privacy legislation.

- Capturing and distributing recordings on which specific individuals can be identified is governed by Regulation (EU) 2016/679 (GDPR) and by Sections 84 to 90 of Act No. 89/2012 Coll., the Civil Code. As a rule, a person's likeness may be captured and distributed only with their consent.
- The exemption for a purely personal or household activity applies to recordings from an unmanned aircraft only very exceptionally. If the recording covers even part of a public space, the exemption does not apply.
- Do not record the interiors of other people's properties, fenced gardens or the private activities of individuals. Delete recordings you do not need without delay.
- Detailed rules were issued by the Czech Office for Personal Data Protection in Recommendation No. 1/2024 on the processing of personal data through recordings from cameras of unmanned aircraft (uouu.gov.cz).
- **Thermal imaging** may capture information about people even inside buildings. Use it only for a purpose for which you have a legal basis.

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 manufacturer's original documentation does not contain any warranty terms of its own.

- 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.