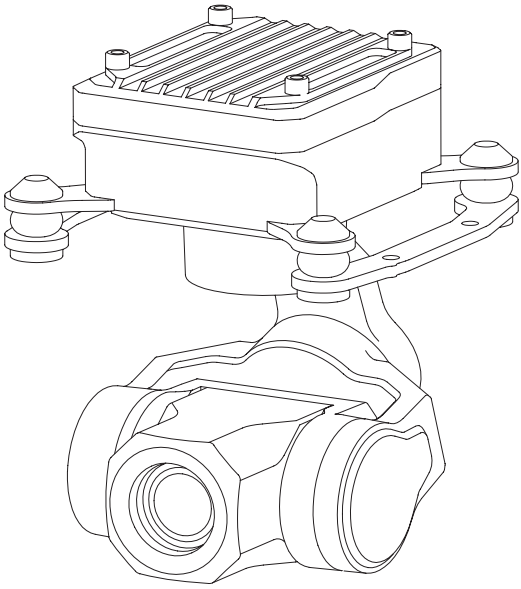
V1.2

2025.01

# Z-1 Mini

## User Manual



# Using this Manual – Legend

 Important

 Tips

 Explanation

# Revision History

| Date | Document Version |
| --- | --- |
| 2024.06.17 | V1.0 |

| Date | Document Version |
| --- | --- |
| 2024.10.15 | V1.1 |

| Date | Document Version |
| --- | --- |
| 2025.01.15 | V1.2 |

## Caution

1. When not in use, store the pod in the package box. The recommended storage environment is a relative humidity less than 40% at a temperature of 20±5° C. If the lenses fog 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 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.
4. Make sure the pod port and pod surface are free from any liquid before installation.
5. Make sure the pod is securely installed onto the aircraft.
6. Do not plug or unplug the microSD card during use.
7. Do not touch the surface of the camera lenses 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 lenses with a soft, dry, clean cloth. Do not use alkaline detergents.
9. 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 make sure the pod attitude corrects, it is necessary to transmit valid carrier INS data, usually the GNSS should be positioning.
10. When its damping platform tilted over 45° , the pod will trigger protection mode and return to its neutral position. (except in FPV mode)

# Catalog

# Introduction

## Synopsis

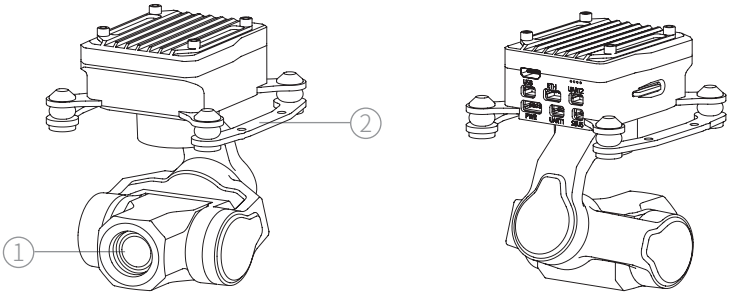
The Z-1Mini Intelligent 4K Full-Color Night Vision Micro Pod carries a 4K resolution camera empowered with the AI-ISP full-color night vision imaging engine, which can provide a good full-color night observation performance even in extremely low-light environments such as night time or confined spaces. The Z-1Mini has AI multi-object detection and tracking function. The pod can intelligently identify the persons and vehicles in the image, and constantly tracking one of them.

With a high accuracy 3-axis nonorthogonal gimbal, the Z-1Mini can be mounted whether downward or upward. With the Dragonfly software, users can watch the image from the camera and control the pod real-timely on a computer. With the customized QGC software, all the functions of the pod can be achieved in conjunction with an open source autopilot.

## Characteristics

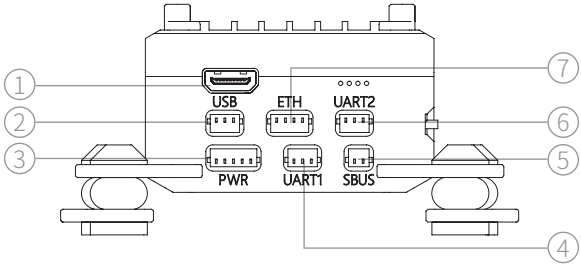
- 4K resolution and AI-ISP full-color night vision imaging engine empowerment.
- Features AI multi-object detection and tracking, which can constantly track one of the persons and vehicles intelligently identified in the image.
- Micro 3-axis nonorthogonal mechanical stabilized structure reducing the weight down to 69g.
- Supports network, UART and S.BUS control and compatible with both private protocol and MAVLink protocol. Supports image transmission though network and HDMI.
- Thanks to the Dual-IMU complementary algorithms with IMU temperature control and carrier AHRS fusion, the gimbal provides a stabilization accuracy at ±0.01° .
- Can be mounted onto multiple carriers, whether downward or upward.
- With the Dragonfly software, user can watch the image and control the pod without protocol ducking.
- Photos and videos can be downloaded online through the "Gallery" function of the Dragonfly software.
- With the customized QGC software, all the functions of the pod can be achieved in conjunction with an open source autopilot.
- Screen supports overlaying OSD information such as latitude, longitude and altitude. Image supports shooting point coordinate EXIF save.
- 10~26.4 VDC wide voltage input.

# Overview

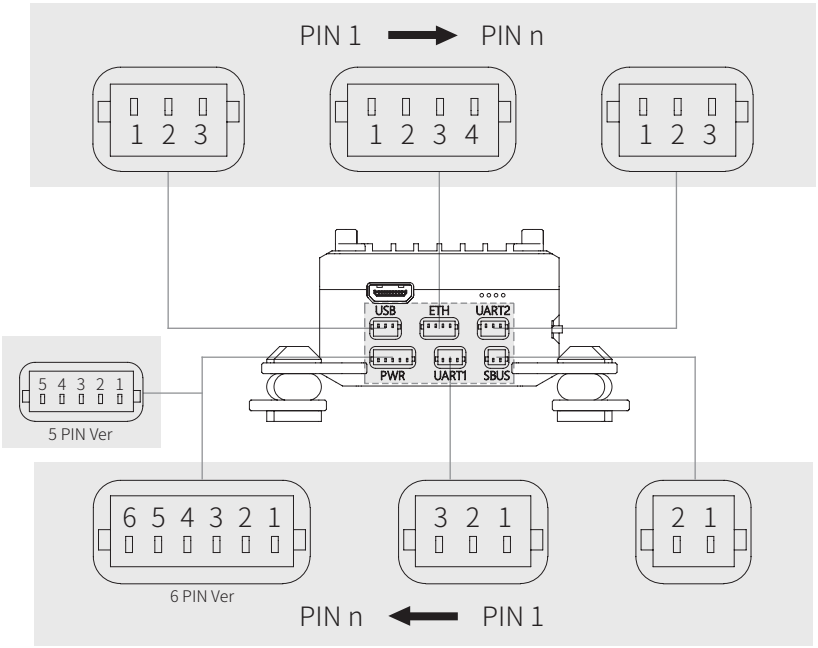



1. Fixed Camera　　2. Damping Platform

# Ports Definition




1.Micro HDMI Port　　2. USB Port　　3. Power Port
4. UART1 Port　　5. S.BUS Port　　6. UART2 Port
7. Network Port




| Port | Description | Header | Pin | Definition |
|---|---|---|---|---|
| Micro HDMI Port | For video output | Micro HDMI | - | - |
| USB Port | Reserved | SM03B-SRSS-TB | 1 | GND |
| | | | 2 | USB_D+ |
| | | | | USB_D- |
| Network Port | For camera configuration, camera upgrading, private protocol control and video output | SM04B-SRSS-TB | 1 | ETH_Tx+ |
| | | | 2 | ETH_Tx- |
| | | | 3 | ETH_Rx+ |
| | | | | ETH_Rx- |
| UART2 Port | For camera IP configuration, private protocol control and MAVLink protocol control | SM03B-SRSS-TB | 1 | GND |
| | | | 2 | UART_Rx (0~3.3V) |
| | | | 3 | UART_Tx (0~3.3V) |
| S.BUS Port | For S.BUS Input. Compatible with S.BUS1 standard such as FASST and SFHSS, and S.BUS2 such as FASSTest | SM02B-SRSS-TB | 1 | GND |
| | | | 2 | S.BUS Out |

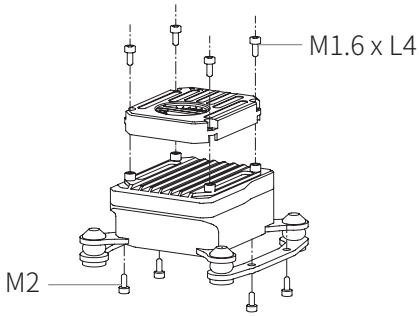
| Port | Description | Header | Pin | Definition |
|---|---|---|---|---|
| UART1 Port | For gimbal upgrading | SM03B-SRSS-TB | 1 | GND |
| | | | 2 | UART_Rx (0~3.3V) |
| | | | 3 | UART_Tx (0~3.3V) |
| Power Port (5 PIN Ver) | Power in. Operating Voltage: 10~26.4VDC | SM05B-SRSS-TB | 1 | Power In |
| | | | 2 | |
| | | | 3 | NC |
| | | | 4 | GND |
| | | | 5 | |
| Power Port (6 PIN Ver) | | SM06B-SRSS-TB | 1 | Power In |
| | | | 2 | |
| | | | 3 | GND |
| | | | 4 | |
| | | | 5 | Reserved |
| | | | 6 | |

## Installation

Use 4 x 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 x L4mm screws.




The Micro-pod Cooling Kit is sold separately.

The Micro-pod Cooling Kit needs to be powered separately, and the power supply range is 10~26.4VDC @0.5W.

# Configuration & Upgrading

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

⚠ Ensure the diver 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 with 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.

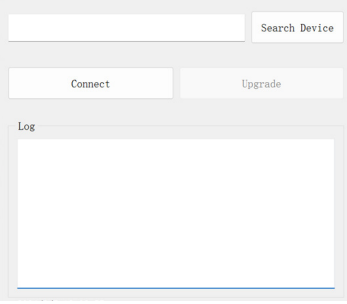
1. Connect the computer and ETH port with the Network Conversion Module. Power on the devices.
2. Run the Dragonfly display and control software to confirm that it is connected to the pod. Open the settings page.
3. When the settings are complete, click "Save".
4. Restart the pod to enable the configurations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

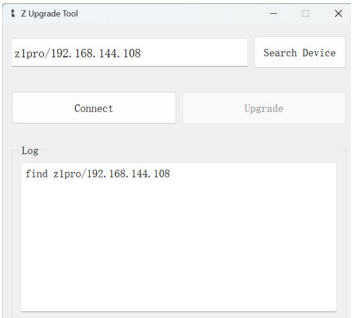
## GCU Upgrading

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

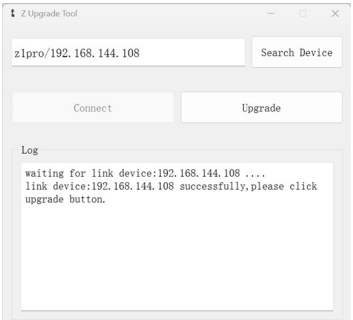
1. Connect the computer and ETH port with the Network Conversion Module. Power on the devices.
2. Run the GCU Upgrade Tool.



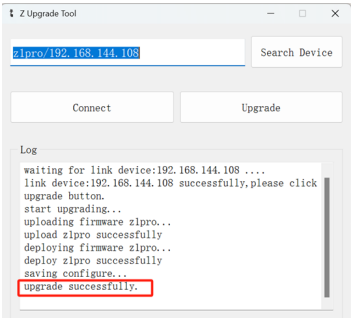

3. Click the "Search Device" button and wait for the host computer search to complete.




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.

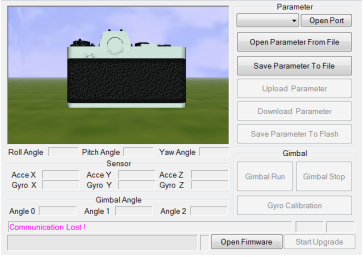



## Gimbal Upgrading

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

1. Connect the upgrading port and the computer with the J1.0 Config Module. Power up the pod.
2. Run *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". Select the firmware file. Click "Start Upgrade" and wait for the upgrade to complete.

**For some brands of dual Type-C cables, there may be cases where the computer cannot recognize the Config Module. Please try replacing it with a Type-A to Type-C cable.**




**Visit the www.allxianfei.com for more information in the Video Center.**

## Real-time Video Playing

Example as camera IP address 192.168.144.108：
Stream address: rtsp://192.168.144.108

# Appendix 1 Specifications

| | | |
|---|---|---|
| **General** | | |
| Product Name | Z-1Mini | |
| Dimensions | 50.2 x 48.4 x 67.4mm | |
| Weight | 69g | |
| Operating Voltage | 10 ~ 26.4VDC | |
| Power | 4.5W (AVG) / 18W (Stall) | |
| Mounting | Downward / Upward | |
| **Gimbal** | | |
| Gimbal Type | 3-axis Nonorthogonal Mechanical Stabilization | |
| Angular Accuracy | ±0.01° | |
| Controllable Range | Pitch: ±120° , Roll: ±60° , Yaw: ±160° | |
| Max Controllable Speed | ±200° /s | |
| **Fixed Camera** | | |
| Image Sensor | 1/2.8-inch CMOS, Effective Pixels: 8.29M | |
| Lens | Actual Focal Length: 6.0mm (Equivalent focal length: 40.6mm)<br>Aperture: f/1.0<br>HFOV：54.7°<br>VFOV：30.2°<br>DFOV：63.2° | |
| Resolution | 3840(H) x 2160(V) | |
| Pixel Size | 1.45μm(H) x 1.45μm(V) | |
| Equivalent Digital Zoom Rate | 8x | |
| Object Detection Distance | EN62676-4:2015 | Person[1]：175m<br>Light vehicle[2]：230m<br>Large vehicle[3]：491m |
| | Johnson Criteria | Person：2069m<br>Light vehicle：6345m<br>Large vehicle：13517m |
| Object Identification Distance | EN62676-4:2015 | Person：35m<br>Light vehicle：46m<br>Large vehicle：98m |
| | Johnson Criteria | Person：517m<br>Light vehicle：1586m<br>Large vehicle：3379m |
| Object Verification Distance | EN62676-4:2015 | Person：18m<br>Light vehicle：23m<br>Large vehicle：49m |
| | Johnson Criteria | Person：259m<br>Light vehicle：793m<br>Large vehicle：1690m |

| AI Multi-object Detection & Tracking | |
|---|---|
| Object Size | 16x16 ~ 128x128 px |
| Object Identification Delay | ＜ 40ms |
| Tracking Speed | ±32 px / field |
| Tracking Deviation Refresh Rate | 30Hz |
| Tracking Deviation Output Delay | ⩽ 5ms |
| **Image & Video** | |
| Image Format | JPEG |
| Maximum Image Resolution | 3840 x 2160 |
| EXIF | Shooting point coordinate |
| Video Format | MP4 |
| Maximum Video Resolution | Stream: 1920 x 1080 @30fps<br>Recording: 3840 x 2160 @30ps |
| Stream Encode Format | H.264，H.265 |
| Stream Network Protocol | RTSP |
| **Storage** | |
| Supported SD Cards | Supports a U3/V30 or above MicroSD card with a capacity of up to 256GB |
| **Environment** | |
| Operating Temperature | -20°C～ 50°C |
| Storage Temperature | -40°C～ 60°C |
| Operating Humidity | ⩽ 85%RH (Non-condensing) |

[1] Reference dimension of person: 1.8x0.5m. Critical dimension under Johnson criteria is 0.75m

[2] Reference dimension of light vehicle: 4.2x1.8m. Critical dimension under Johnson criteria is 2.3m

[3] Reference dimension of large vehicle: 6.0x4.0m. Critical dimension under Johnson criteria is 4.9m

# Appendix 2 MAVLink Configuration

## ArduPilot

| SERIAL1 | |
|---|---|
| SERIAL1_BAUD | 115 |
| SERIAL1_OPTIONS | 1024 |
| SERIAL1_PROTOCOL | 2 |
| SR1 | |
| SR1_ADSB | 0 Hz |
| SR1_EXIT_STAT | 0 Hz |
| SR1_EXTRA1 | 0 Hz |
| SR1_EXTRA2 | 0 Hz |
| SR1_EXTRA3 | 0 Hz |
| SR1_PARAMS | 0 Hz |
| SR1_POSITION | 0 Hz |
| SR1_RAW_CTRL | 0 Hz |
| SR1_RAW_SENS | 0 Hz |
| SR1_RC_CHAN | 0 Hz |
| MNT1 | |
| MNT1_TYPE | 4 (Gremsy) / 6 (SToRM32 Mavlink) |
| RC1 | |
| RC1_OPTOPN | 213 (MOUNT1_PITCH) |
| RC2 | |
| RC2_OPTOPN | 214 (MOUNT1_YAW) |
| RC3 | |
| RC3_OPTOPN | 163 (MOUNT1_LOCK) |
| CAM | |
| CAM_TRIGG_TYPE | 3 (Mount) |

The MNT1_TYPE is recommended as 6. The MNT1_ROLL_MAX, MNT1_ROLL_MIN, MNT1_PITCH_MAX, MNT1_PITCH_MIN, MNT1_YAW_MAX and MNT1_YAW_MIN will be configured automatically depend on data from the GCU. The angle limit should be set manual while the MNT1_TYPE is 4.

The RC1~RC3 are just examples, which can be defined according to actual situation.

## PX4

| 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 actual situation. It should be configured in RC Map for further application.

The trigger mode is just an example, which can be modified according to actual situation.

# Appendix 3 MAVlink Communication Process

After receiving HeartBeat from the flight controller, and identifying SYSID and COMPID of the flight controller, GCU will operate as below:

1. GCU actively sends package *MAVLINK_MSG_ID_HEARTBEAT 0* at a frequency of 2Hz.
2. GCU requests following packages in turn at a frequency of 1Hz. The flight controller fills these parameters into package *MAVLINK_MSG_ID_COMMAND_LONG 76* until the request completing.:
   *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. GCU actively sends package *MAVLINK_MSG_ID_GIMBAL_DEVICE_ATTITUDE_STATUS 285* at a frequency of 100 Hz while the packages above being received and the pod being operational.
4. Generally, the flight controller will request package *MAVLINK_MSG_ID_GIMBAL_DEVICE_INFORMATION 283*, which GCU does not send actively.

# Appendix 4 Wiring Diagram of Connecting to Open Source Autopilot