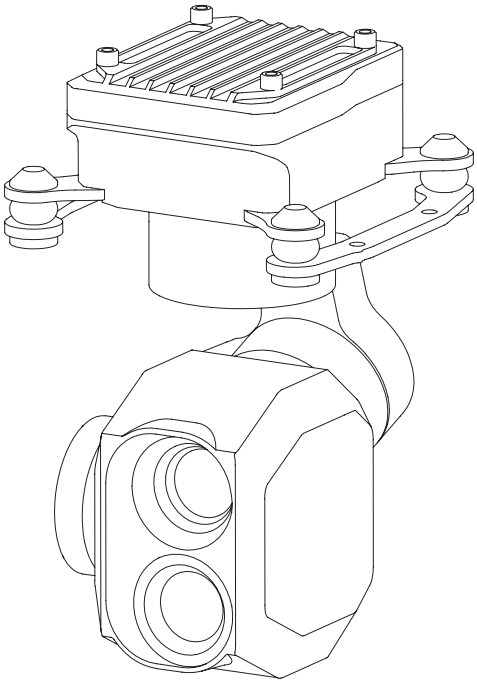
V1.0

2024.07

Z-2Mini

User Manual



Using this Manual – Legend

 Important

 Tips

 Explanation

Revision History

Date	Document Version
2024.06.17	V1.0

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.

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Introduction

Synopsis

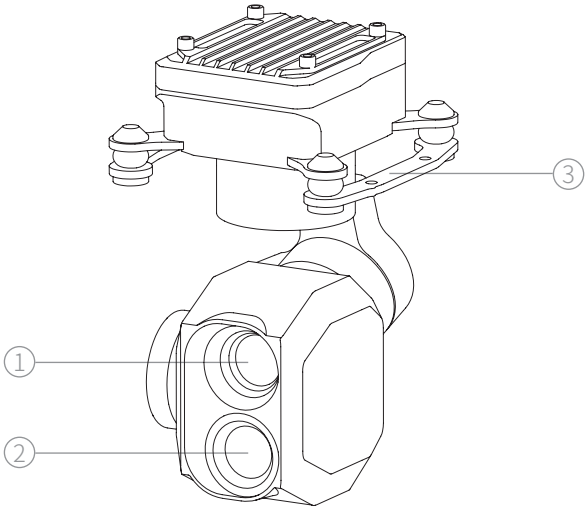
The Z-2Mini Intelligent 4K Full-Color Night Vision Dual-Sensor Micro Pod carries a 4K resolution camera empowered with the AI-ISP full-color night vision imaging engine, which can provide a good full-color night observation performance even in extremely low-light environments such as night time or confined spaces. The Z-2Mini also features a long-wave infrared thermal camera, which can capture thermal images. The Z-2Mini 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.

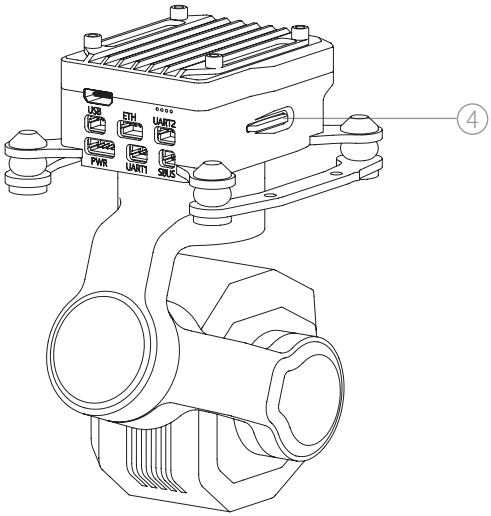
With a high accuracy 3-axis nonorthogonal gimbal, the Z-2Mini can be mounted whether downward or upward. With the Dragonfly software, users can watch the image from the camera and control the pod real-timely on a computer. With the customized QGC software, all the functions of the pod can be achieved in conjunction with an open source autopilot.

Characteristics

- Carries an AI-ISP 4K full-color night vision camera and a thermal camera.
- 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 110g.
- Supports network, UART and S.BUS control and compatible with both private protocol and MAVLink protocol. Support image transmission through 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.
- 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.

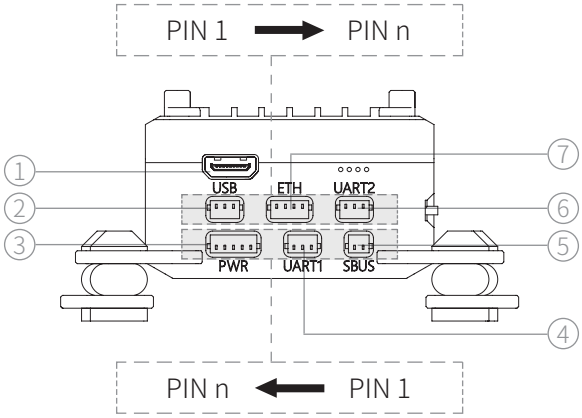
Overview





1. Thermal Camera
2. Fixed Camera
3. Damping Platform
4. MicroSD Card Slot

Ports Definition



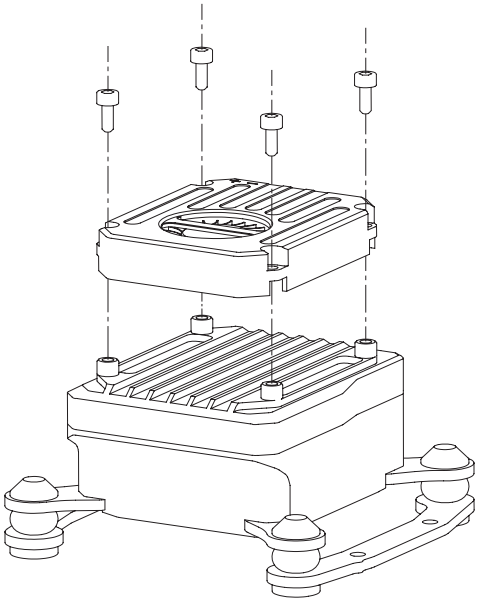
1.Micro HDMI Port
2. USB Port
3. Power Port
4. UART1 Port
5. S.BUS Port
6. UART2 Port
7. Network Port

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 updating, 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 updating	SM03B-SRSS-TB	1	GND
			2	UART_Rx (0~3.3V)
			3	UART_Tx (0~3.3V)
Power Port	Power in. Operating Voltage: 10~26.4VDC	SM05B-SRSS-TB	1	Power In
			2	
			3	NC
			4	GND
			5	

Micro-pod Cooling Kit Installation

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.

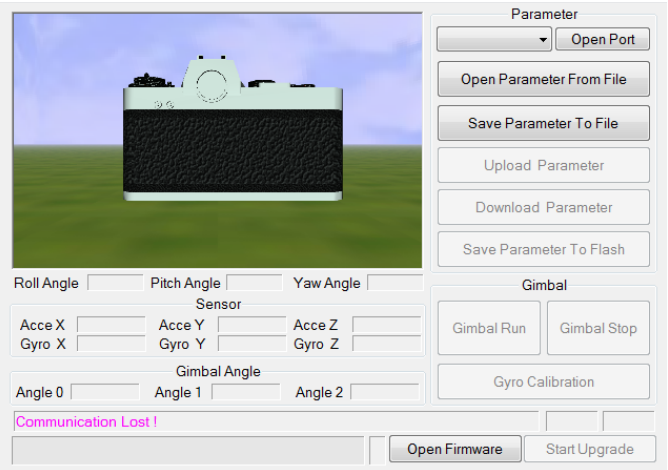
Updating Firmware

Gimbal Updating

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

1. Connect the updating 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 update to complete.

The Config Module is sold separately. 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.



Real-time Video Playing

1920 x 1080 @30fps, @2M bitrate. Stream address: rtsp://192.168.144.108/2

Appendix 1 Specifications

General		
Product Name	Z-2Mini	
Dimensions	59 x 48.4 x 85.7mm	
Weight	110g	
Operating Voltage	10 ~ 26.4VDC	
Power	6.5W (AVG) / 20W (Stall)	
Mounting	Downward / Upward	
Gimbal		
Gimbal Type	3-axis Nonorthogonal Mechanical Stabilization	
Angular Accuracy	±0.01°	
Controllable Range	Pitch: -135°～ +100° , Roll: ±50° , Yaw: ±150°	
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: 34.4mm) Aperture: f/1.0 HFOV: 54.7° VFOV: 30.2° 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 Light vehicle[2]：230m Large vehicle[3]：491m
	Johnson Criteria	Person：2069m Light vehicle：6345m Large vehicle：13517m
Object Identification Distance	EN62676-4:2015	Person：35m Light vehicle：46m Large vehicle：98m
	Johnson Criteria	Person：517m Light vehicle：1586m Large vehicle：3379m
Object Verification Distance	EN62676-4:2015	Person：18m Light vehicle：23m Large vehicle：49m
	Johnson Criteria	Person：259m Light vehicle：793m Large vehicle：1690m

Thermal Camera		
Thermal Sensor	Uncooled VOx Microbolometer	
Lens	Actual Focal Length: 10.0mm (Equivalent focal length: 95.5mm) Aperture: f/1.0 HFOV: 17.5° VFOV: 13.2° DFOV: 21.8°	
Resolution	256(H) x 192(V)	
Pixel Size	12μm(H) x 12μm(V)	
Spectral Band	8~14μm	
Sensitivity (NETD)	<50mk@25°C	
Object Detection Distance	Johnson Criteria	Person：417m Light vehicle：1278m Large vehicle：2722m
Object Identification Distance		Person：188m Light vehicle：575m Large vehicle：1225m
Object Verification Distance		Person：94m Light vehicle：288m Large vehicle：613m
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 Recording: 3840 x 2160 @30ps	
Stream Encode Format	H.264，H.265	
Stream Network Protocol	RTSP	
Storage		
Supported SD Cards	Supports a Speed Class 10 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