

Vision-Inertial Navigation Integration Module

Unjammable Navigation

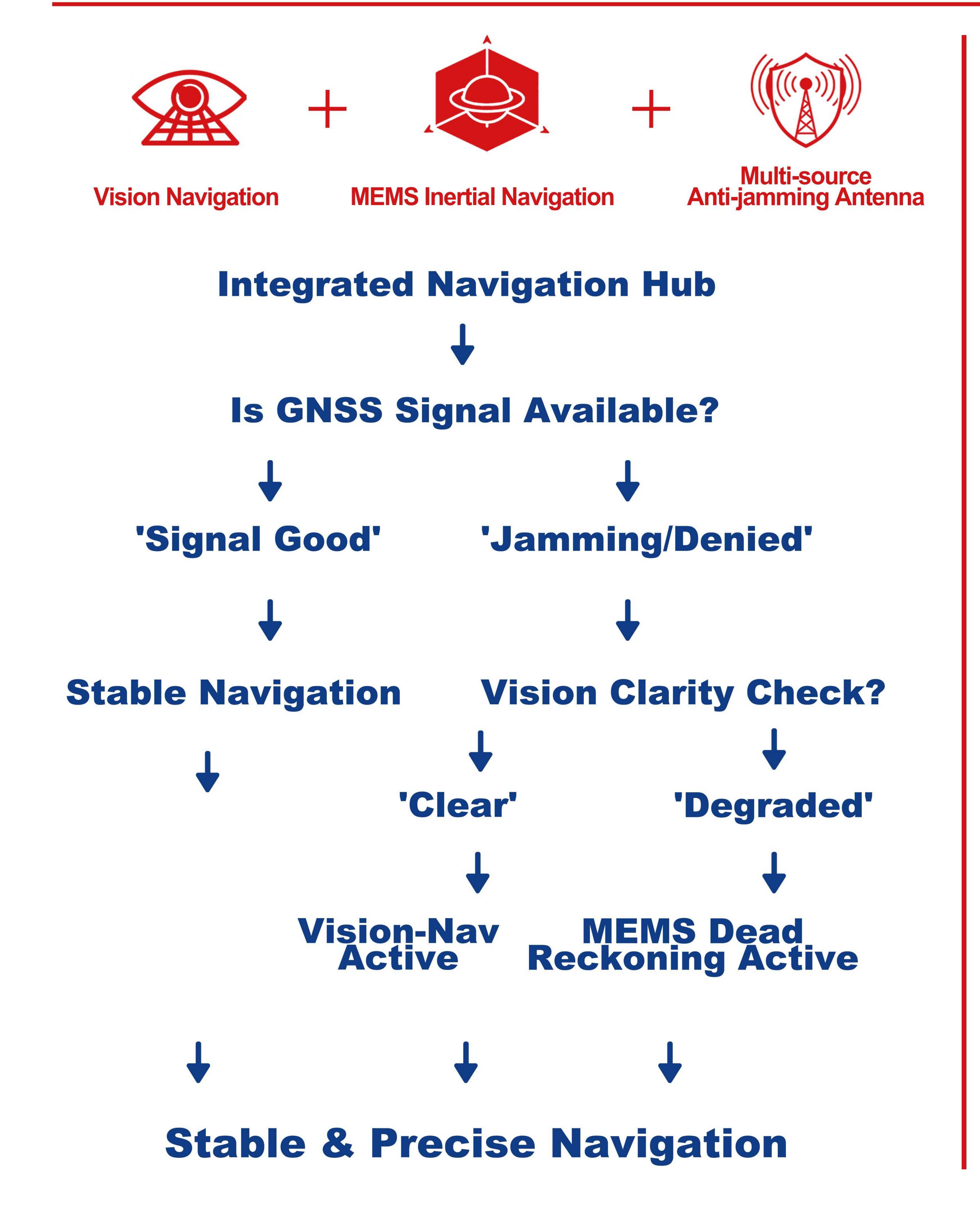
Why You Need Unjammable Navigation

"In urban canyons, electromagnetic interference zones, or GPS-denied environments,

traditional drone navigation systems fail – causing 78% of commercial drone missions to fail (Drone Industry Insights, 2023)."

Skypath Vision-Inertial Navigation Module delivers 99.9% navigation reliability and ±15m positioning accuracy,

turning "potential success" into "guaranteed success."



Why Choose SKYPATH?

Reliable in Urban Canyons & Indoors

Resistant to Spoofing & Jamming

Seamless Transition Between Sensors

Long-Endurance Mapping Capability

Application Scenarios

UAV Navigation
Urban Mapping
Industrial Inspection
Autonomous Systems



Module Includes:

- 1. Visual navigation unit
- 2. Inertial navigation unit
- 3. Satellite receiver
- 4. Altimeter
- 5. Magnetometer

Key Capabilities:

Vision + IMU

Position: 10-20m or 5% of relative

altitude (whichever is larger)

Attitude: 0.5°

Velocity: 2m/s

- Anti-satellite spoofing
- Stores map data for flight areas up to 90,000 km²

Feature	Skypath Vision-Inertial	Traditional Systems	Improvement
Navigation Reliability	99.9%(Interference-Resilient)	55% (Signal-Dependent)	+44.9%
Position Accuracy	15m(10-20m or 5% altitude)	50m	3.3x Better
Attitude Accuracy	0.5°	3.0°	6x Higher Precision
Velocity Accuracy	2m/s	8m/s	4x Higher Accuracy
GPS-Denied Operation Time	30 mins (30 minutes) Continuous Guidance	Immediate Failure	Critical Breakthrough





Vision-Inertial Navigation Integrated Module

1. Product Overview

The Visual-Inertial Integrated Navigation Module integrates multiple sensors,

including a visual navigation unit, inertial navigation unit (IMU), satellite receiver,

altimeter, and magnetometer. It supports a combination of multiple navigation

methods to output the aerial vehicles' position, attitude, velocity, and altitude

data, effectively meeting the navigation and positioning needs of aerial

vehicles in satellite-denied environments.

The module captures images via a downward-facing camera and performs real-time comparison and calculation against pre-stored map data in the module to

output the vehicle 's position information. This position data is then fused with

data from other on-board sensors to generate comprehensive information on

the vehicle 's velocity, position, and attitude. Featuring a miniaturized board

design, the product is widely applicable to various aerial vehicle systems such

as UAVs and loitering munitions.



2. Product Function Description

The Visual-Inertial Integrated Navigation Module offers the following functions:

- 1 Positioning capability in satellite-denied conditions;
- 2 Integrated navigation function: fuses visual positioning data with IMU data to output the vehicle 's attitude, position, and velocity information;
- 3 Integrates a high-precision MEMS inertial navigation unit; also supports connection to external high-precision inertial navigation data for integrated navigation;
- 4 Integrates a satellite receiver, Which automatically switches between visual positioning and satellite positioning

based on the strength of received satellite signals;

- 5 Anti-satellite spoofing capability;
- 6 Integrates a barometric altimeter to provide the vehicle 's altitude information;
- 7 Integrates a large-capacity memory to store map data for large flight areas;
- 8 Supports external magnetometer connection to provide the vehicle 's heading information;
- 9 Geofencing capability;
- 10 Customizable automatic ground target recognition and positioning function;
- 11 Customizable auxiliary aircraft landing function.





3. Product Performance Specifications

Visible Light Camera	Specifications	
Resolution	1600×1200	
Response Band	$0.4 \mu m \sim 0.9 \mu m$	
Pixel Size	2.9µm	
Focal Length	2.7mm	
Field of View (FOV)	66°×52°	
Infrared Camera	Specifications	
Operating Band	$8\mu m \sim 14 \mu m$	
Detector Resolution	640×512	
Pixel Size	12µm	
Lens Focal Length	4.7mm	
Field of View (FOV)	79°×67°	
Performance	Specifications	
Indicator		
Flight Altitude	80m–3000m (lens replacement required for altitudes	
	exceeding 3000m)	
Position Accuracy	10m–20m (1σ) (for altitudes 100m–300m); 5% of	
	relative altitude (1σ) (for altitudes 300m–3000m)	
Velocity Accuracy	2m/s	
Attitude Accuracy	0.5°	
Altitude Accuracy	1m	
Output Frequency	1–10Hz	
On-Board Storage	64G: 22,500 km²; 128G: 45,000 km²; 256G: 90,000	
Capacity	km ²	
On-Board Sensors	MEMS IMU, barometric altimeter (optional), satellite	
	receiver (optional)	
Shock Resistance	>500g	
Power Supply	+12V ~ +30V, <20W	
Operating	-40°C ~ 60°C	
Temperature		
Communication	RS232/RS422/UART, Ethernet	
Interfaces		
	Split-type integrated navigation module: 130g;	
Weight	Integrated navigation module: 150g; Single visible	
	light camera module: 30g; Dual-camera module	
	(visible + infrared): 110g	



4. Structural Installation Methods

4. Structural Installation Methods

The product consists of two main components: the navigation module and the downward-facing camera. Two installation methods are available based on the aerial vehicles' internal space constraints:

Split-type installation:

Connects the downward-facing camera and navigation module via a flexible cable;

Integrated installation: It Combines the downward-facing camera and navigation

module into a single unit.

Detailed structures are as follows:

4.1 Split-Type Installation

Split-type installation involves mounting the camera and integrated navigation

module separately at different locations on the vehicle, with a flexible cable

connecting the two components. This method is suitable for vehicles with limited internal space.

4.1.1 Split-Type Visual Integrated Navigation Module

The split-type visual integrated navigation module has dimensions of 80×73×19 mm. Its housing adopts an all-metal design, with full consideration for heat

dissipation and electromagnetic compatibility (EMC).

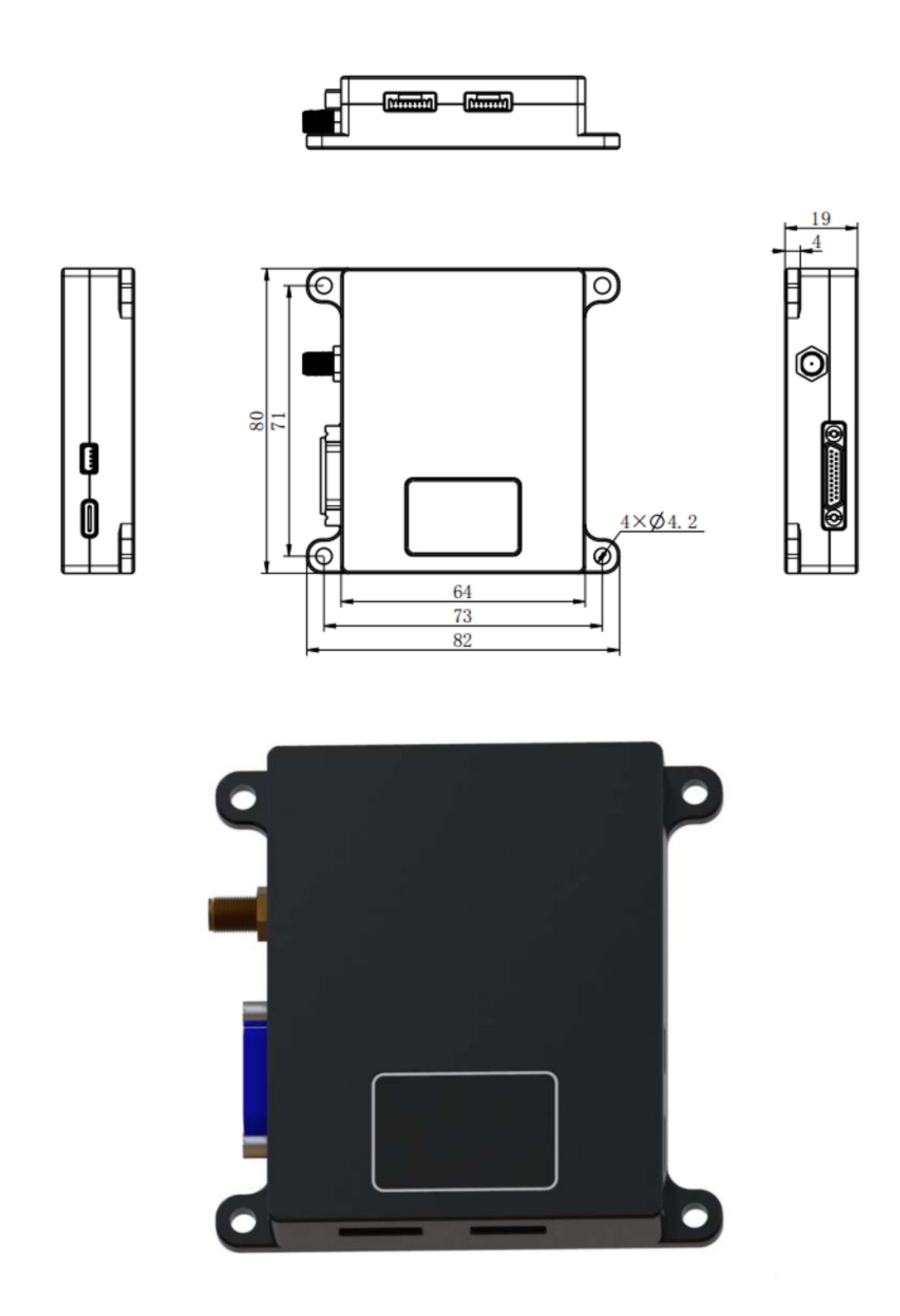
Weight: 130g.

Dimensions and appearance are shown below:





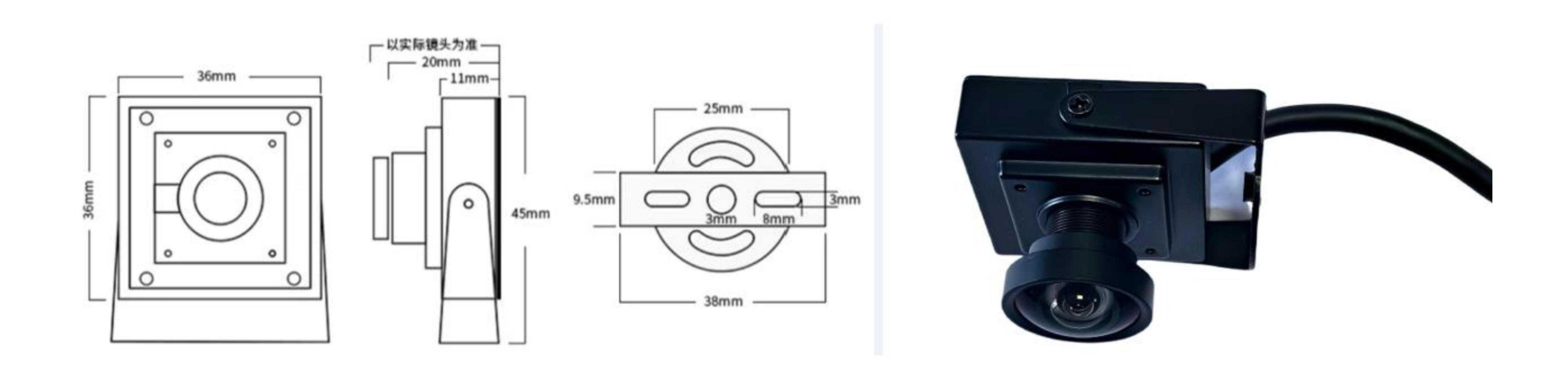




4.1.2 Split-Type Cameras The split-type camera is available in two configurations: a single visible light camera and dual-camera module (visible + infrared). The Single visible light camera: As shown in the figure below, weight: 30g.

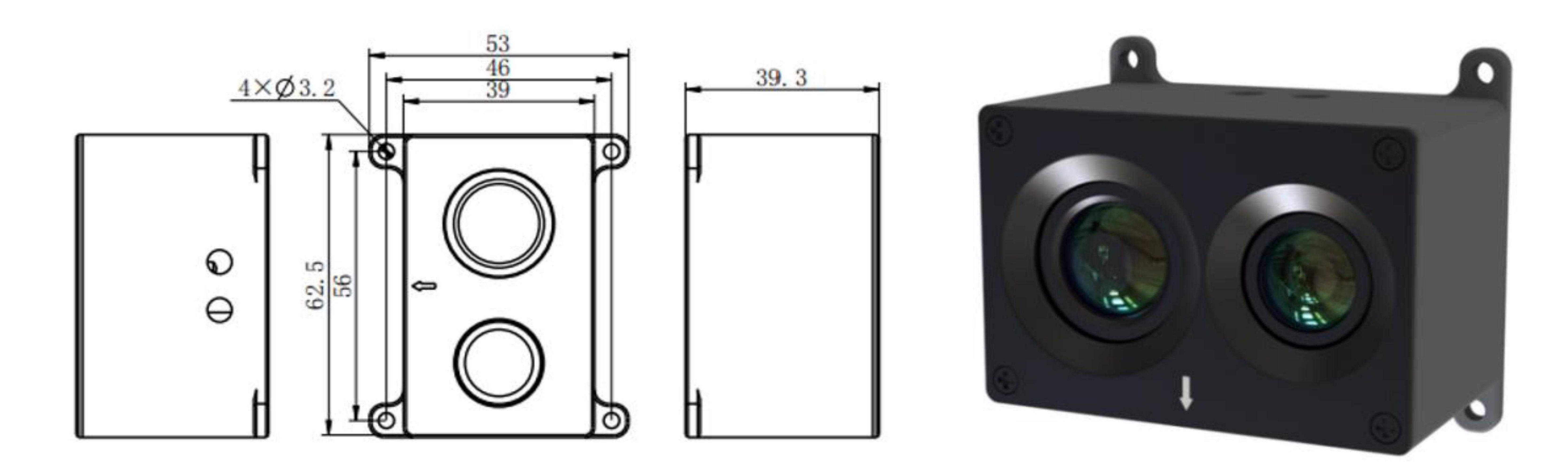






Dual-camera module (visible + infrared): It Integrates a

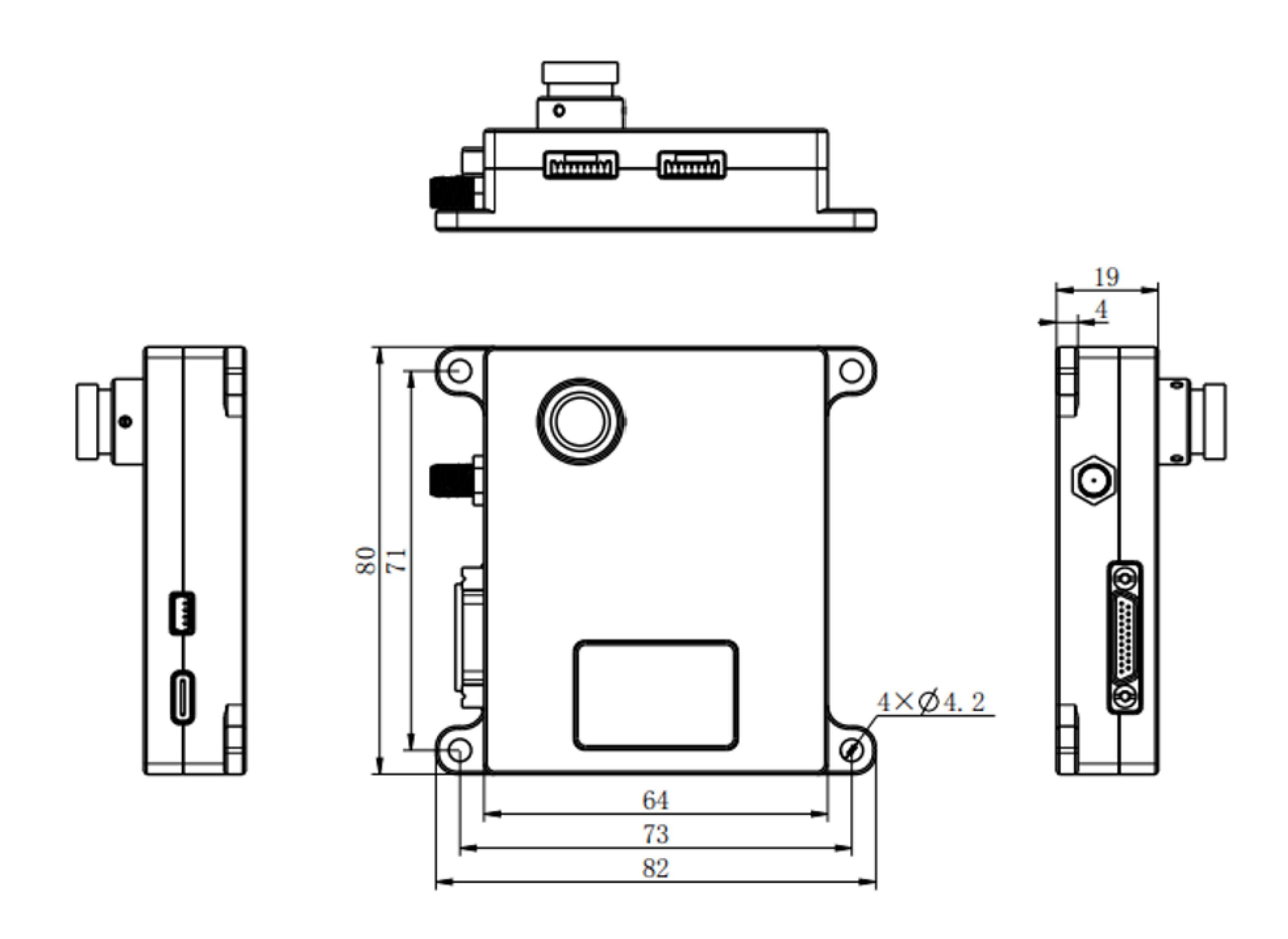
visible light core and an infrared core to provide allweather imaging. Weight of the core module: 110g. Dimensions and physical rendering of the dual-camera core module are shown



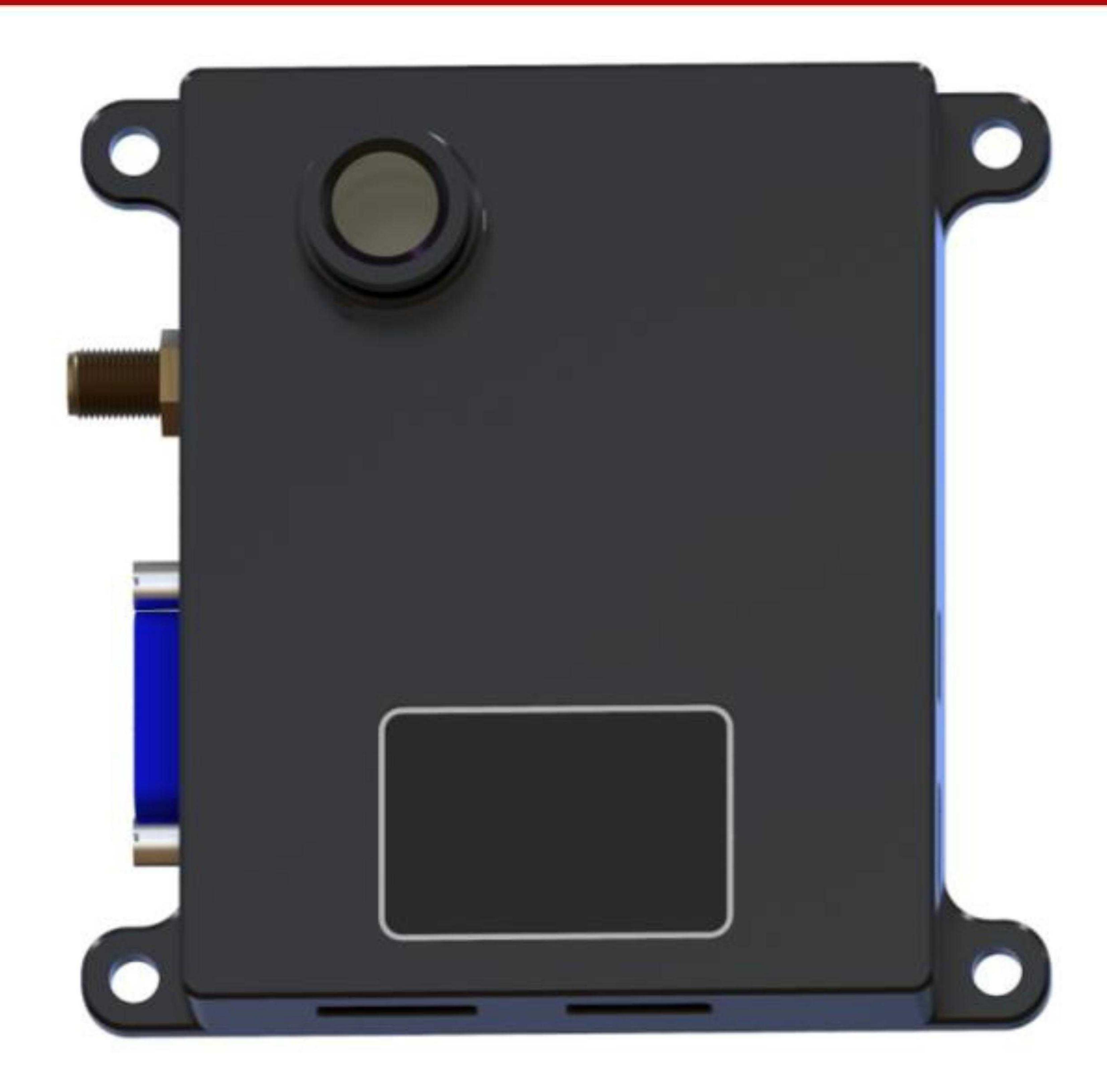


4.2 Integrated Installation

Integrated installation combines the visible light camera and visual integrated navigation module into one unit. During installation, ensure that the camera lens faces vertically downward from the vehicle 's belly. This highly integrated module features an all-metal housing (optimized for heat dissipation and EMC) and weighs 150g. Dimensions are shown below:







5. Electrical Interface Definition

The product provides various external interfaces via a J30-21ZKP aviation connector. Detailed definitions are as follows:



SKYPATR Unjammable Navigation

No.	Interface Name	Interface Description	
1	IMU_RS422_RX+		
	IMU_RS422_RX-/		
2	IMU_RS232_TX/		
	IMU_UART_TX	External IMU interface (select one	
	IMU_RS422_TX+/	of RS422, RS232, UART)	
3	IMU_RS232_RX/		
	IMU_UART_RX		
4	IMU_RS422_TX-		
5	GND1	Signal ground	
6	FK_RS422_RX+	External flight controller interface (select one of RS422, RS232,	
7	FK_RS422_RX-/		
	FK RS232 TX/		
	FK _UART_TX	UART)	
8	FK RS422TX+/		
	FK RS232 RX/		
	FK _UART_RX		
9	FK RS422 TX-		
10	GND2	Signal ground	
11	GPS_UART_TX		
12	GPS_UART_RX	External GPS interface	
13	IIC_SCL		
14	IIC_SDA	External magnetometer interface	
15	VCC_5V_OUT	5V power output, maximum	
16	VCC_5V_OUT	output current: 1.5A	
17	GND3		
18	GND4	Power ground	
19	GND5		
20	VCC_IN	Power input: 12V–36V	
21	VCC_IN		

No.	Interface Name	Interface Description	
1	ETH_D0+		
2	ETH_ D0-	Gigabit Ethernet	
3	ETH_ D1+		
4	ETH_ D1-		
5	ETH_ D2+		
6	ETH_ D2-		
7	ETH_ D3+		
8	ETH_ D3-		