Mid-Wave 1280×1024 Infrared Thermal Imager — Electro-Optical Technical Specifications

InSb Mid-Wave 1280×1024 Infrared Thermal Imager

Technical Specification

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Product Type	InSb Mid-Wave 1280×1024 Infrared Thermal Imager
Confidentiality Level	Internal



1. System Overview

This product is an InSb mid-wave 1280×1024 infrared thermal imager. It adopts a closed-loop Stirling-cooled InSb detector with a resolution of 1280×1024, is equipped with a 50 mm fixed-focus infrared lens, and integrates advanced image processing algorithms. It is applicable to professional fields such as high-precision infrared detection, target recognition, industrial temperature measurement and security surveillance.

1.1 System Composition

The thermal imager system consists of the following parts:

50 mm fixed-focus infrared lens;

Imaging detector assembly;

Imaging processing circuit;

Image processing circuit;

Fixed mounting structural components;

Host computer control software.

2. Main Technical Specifications

2.1 Detector Parameters

Parameter	Technical Specification
Detector type	Closed-loop Stirling-cooled InSb detector
Response band	3.7 μm – 4.8 μm (mid-wave infrared)
Detector resolution	1280 × 1024 (H × V)
Pixel size	15 μm × 15 μm
Noise equivalent temperature difference (NETD)	≤ 25 mK (@ 25 °C ambient temperature)
Relative aperture (F number)	F#2.0/4.0 (±3%)
Blind pixel rate	≤ 5%
Defect cluster limit	Maximum defect cluster ≤9 pixels; defect clusters exceeding 4 pixels shall not be located in the central 160×160 area

2.2 Optical Parameters

Parameter	Technical Specification
Lens focal length	50 mm
Lens type	Fixed-focus infrared lens
Matching F number	F#4.0

2.3 Mechanical Parameters

Parameter	Technical Specification
Overall dimensions	To be determined
Overall weight	To be determined
Mounting method	Fixed mounting structure

2.4 Electrical Parameters

Parameter	Technical Specification
Supply voltage	DC 24 V (±6 V)
Maximum operating current	4 A @ 24 V (during cooler start-up phase)
Steady-state operating current	≤ 3.5 A @ 24 V (after cooling completion and stable operation)
Interface types	Power interface, SDI video output interface, raw digital video output interface, control interface, synchronization interface

2.5 Video Output

Interface Type	Technical Specification
SDI video	HD-SDI-25p
Digital video	Camera Link (Base configuration) interface (50 Hz customized)

2.6 Communication and Control

Parameter	Technical Specification

Communication interface	RS422 full-duplex serial port
Communication baud rate	115200 bps
Data format	8 data bits, 1 stop bit, no parity bit
Synchronization interface	RS-422 level standard external synchronization signal, synchronizing the start of integration

3. Imaging Performance Parameters

Parameter	Technical Specification
Integration time range	Approx. 1 ms – 19 ms @ 50 Hz frame rate
Operating frame rate	50 Hz @ 640×512 resolution
Non-uniformity correction	Supported (two-point / multi-point correction)
Image polarity	Black-hot / white-hot switching supported (SDI video only)
Electronic zoom	Supported (SDI video only)
Image mirroring	Supported (SDI video only)
Digital image processing	Built-in adaptive contrast enhancement and detail enhancement algorithms

4. Main Functional Features

4.1 Image Processing Functions

Non-uniformity correction: real-time correction of detector response non-uniformity;

Brightness/contrast adjustment: manual/automatic modes supported;

Integration time selection: integration time can be dynamically adjusted according to the scene;

Bad pixel replacement: automatic detection and replacement of blind/defective pixels;

Test image: built-in test pattern generation;

External synchronization: external synchronization signal input supported (customizable).

4.2 System Functions

User setting storage: user-defined parameters can be saved;

Factory reset: one-click restoration of default parameters;

Operating status feedback: real-time reporting of detector temperature, cooling status and other information;

Host computer control: full-function control via the accompanying software.

5. Environmental Adaptability

Parameter	Technical Specification
Operating temperature range	-40 °C – +60 °C
Storage temperature range	-40 °C – +65 °C
Cooling method	Closed-loop Stirling mechanical cooling

Athermalization design	The lens supports athermalized imaging over a wide temperature range

6. Delivery Checklist

No.	Item	Quantity	Remarks
1	Cooled infrared thermal imager main unit	1 set	Including lens, detector, processing circuits and structural components
2	Operation and control software	1 set	Delivered on a burned optical disc
3	Product operation manual	1 copy	Including operation and maintenance instructions
4	Debugging tooling cables	1 set	Including power, communication and video connection cables

7. Remarks

Important Notes

Functional items marked as "customizable" in this specification shall have their specific requirements clarified before contract signing;

The overall mounting dimensions will be adaptively designed according to the customer's installation space requirements, and shall be subject to the supplementary technical minutes confirmed by both parties;

The high frame rate mode (100 Hz) requires customized development based on the detector model and output configuration; the standard version does not support it for the time being, and the signal-to-noise ratio will decrease slightly at 100 Hz;

Functions of the digital video channel (mirroring, polarity, electronic zoom, etc.) can be evaluated and developed separately if support is required.

Specification note: This technical specification describes the standard configuration of the product; any special customization requirements shall be determined through separate negotiation between both parties.



Tri-Sensor Electro-Optical Pod — Public Material

Functional and Performance Requirements

Functional Requirements

Capability of battlefield surveillance, target search, tracking and localization;

Visible-light imaging capability, with both color and black-and-white video modes;

Infrared imaging capability; the IR sensor features self-calibration and image enhancement;

Digital output of infrared and visible-light images;

Laser ranging and laser designation functions;

Target localization function;

Stabilization of reconnaissance imagery and line of sight;

Image tracking and geo-tracking functions;

Laser spot observation capability;

Built-in self-test (BIT) function;

Automatic indication of moving targets;

Picture-in-picture function, capable of outputting visible-light and infrared high-definition digital images simultaneously;

Rapid switching between visible-light and infrared images; the visible and IR fields of view shall remain synchronized when the field of view is adjusted;

Stable tracking of static or dynamic targets, with anti-jamming and anti-occlusion capability;

Payload slaving: the EO payload can perform reconnaissance based on positions acquired by mission payloads such as the communication system, radar reconnaissance system and AIS;

In-flight target calibration: laser spot detection function enabling visible-light and infrared in-flight target calibration.

Technical Requirements

General Requirements

Power supply interface: 28 VDC (22–32 VDC);

Peak power consumption: ≤500 W;

Stabilized Turret

Azimuth axis rotation range: 360°×n;

Elevation axis rotation range: −20° to +140° (zero = vertically downward);

Search angular rate: ≥50°/s;

Search angular acceleration: ≥60°/s²;

Stabilization accuracy: ≤15 μrad (1σ);

Tracking accuracy: ≤60 μrad (1σ);

Angle measurement accuracy: ≤1 mrad;

Positioning accuracy: 20 m (CEP, relative altitude 5,000 m, squint angle ≤45°).

Visible-Light Camera

Recognition range ≥30 km for a typical 6 m × 4 m target under conditions of visibility ≥30 km and humidity ≤80%;

Resolution: color, ≥1920×1080, 30 fps;

Focal length: 25 mm–685 mm;

Field of view: 27°×15.3°–0.9°×0.51°;

Controllable functions: manual/auto focus, manual/auto iris, image enhancement, electronic zoom, etc.

Infrared Thermal Imager

Recognition range ≥30 km for a typical 6 m × 4 m target under conditions of visibility ≥30 km, target-to-background temperature difference of 5–10 K and humidity ≤80%;

Field of view: 17.5°×14°–1°×0.8°;

Focal length: 50 mm–865 mm;

Detector: ≥1280×1024 cooled type;

Cooldown time: ≤8 min;

Wavelength: 3 μm–5 μm;

Laser Rangefinder/Designator

Ranging capability ≥30 km for a typical 6 m × 4 m target (reflectivity > 0.2) under visibility ≥30 km;

Laser output wavelength: 1.064 μm;

Operating modes: dual mode of ranging and designation;

Laser ranging frequency: 5 Hz;

Laser designation frequency: 20 Hz by default, supporting periodic pulses of 45 ms–53 ms;

Laser average energy: ≥80 mJ / ≥100 mJ / ≥120 mJ, three levels selectable;

Energy variation between adjacent pulses: ≤10%;

Illumination duty cycle: 90 s of operation followed by 60 s of rest (5 consecutive illuminations constitute one cycle, with a 30 min interval between cycles);

Interval between two illuminations: ≤1 min;

Service life: $>2\times10^6$ pulses;

Laser beam divergence: ≤0.18 mrad;

Ranging accuracy: ±5 m;

Material Requirements

Selected materials shall meet the requirements of the operating environment;

External metal materials shall be corrosion-resistant;

External metal surfaces shall be corrosion-resistant (with three-proofing treatment applied).

Structural Design and Weight Requirements

Overall pod envelope dimensions: ≤Φ450 mm × H600 mm, connectors included;

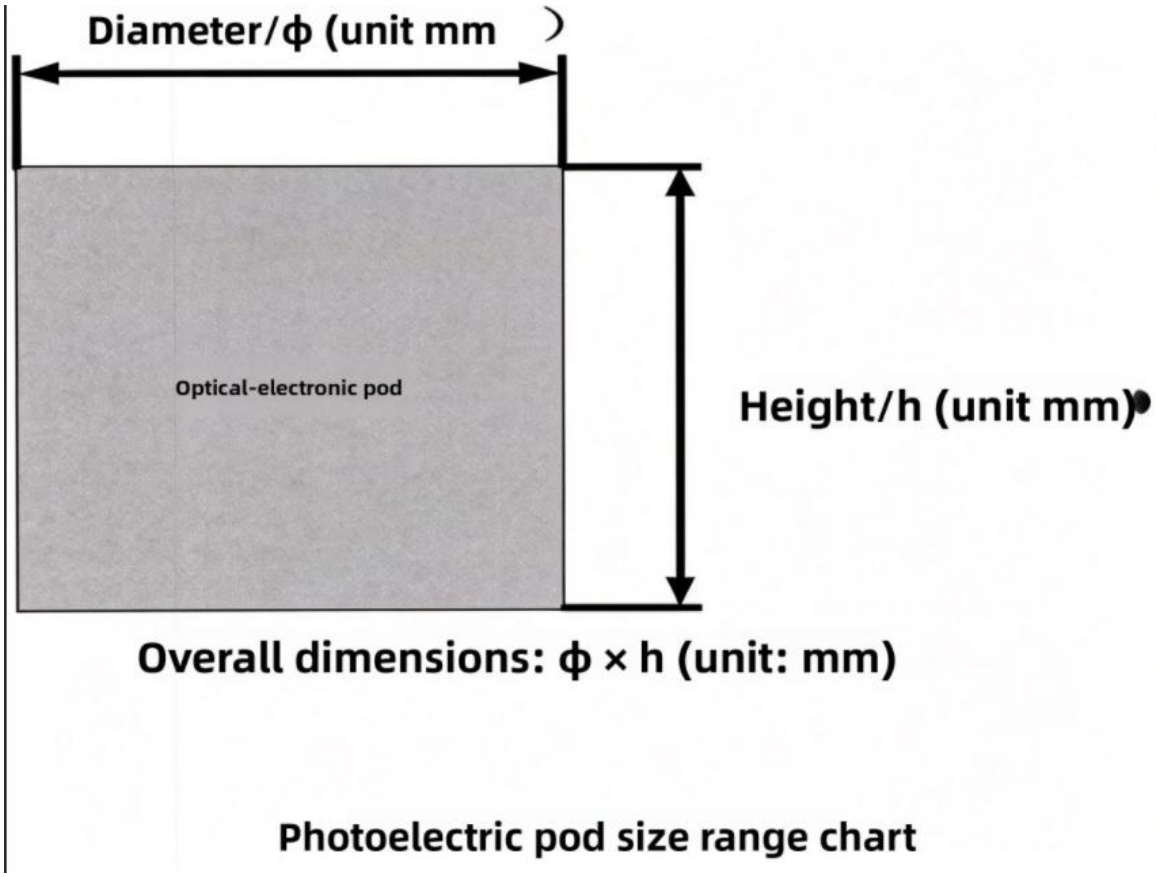

Figure 1 Stabilized turret envelope dimensions

EO pod weight ≤50 kg (including the corresponding connector plugs and sockets);

Lifting mechanism weight ≤15 kg (lifting time ≤60 s);

The product is supplied with a debugging stand to facilitate ground debugging, transportation, etc.

The complete unit undergoes three-proofing treatment.

The product's external surfaces are painted with aircraft gray paint (GSB05-1426-2001 76 G10).

Electrical and Structural Interface Design Requirements

Electrical Interfaces

One power interface with the host aircraft (XS1);

One asynchronous communication interface with the host aircraft's flight management system (XS2);

One asynchronous communication interface with the host aircraft's fire control system (XS3);

One debugging interface (XS4);

Four SDI video interfaces (XS6, XS7, XS8, XS9);

One PAL video interface (XS10);

One interface with the inertial navigation antenna assembly (XS11);

One synchronous RS-422 interface (XS12).

Mechanical Interfaces

The mounting interface is shown in the figure below.

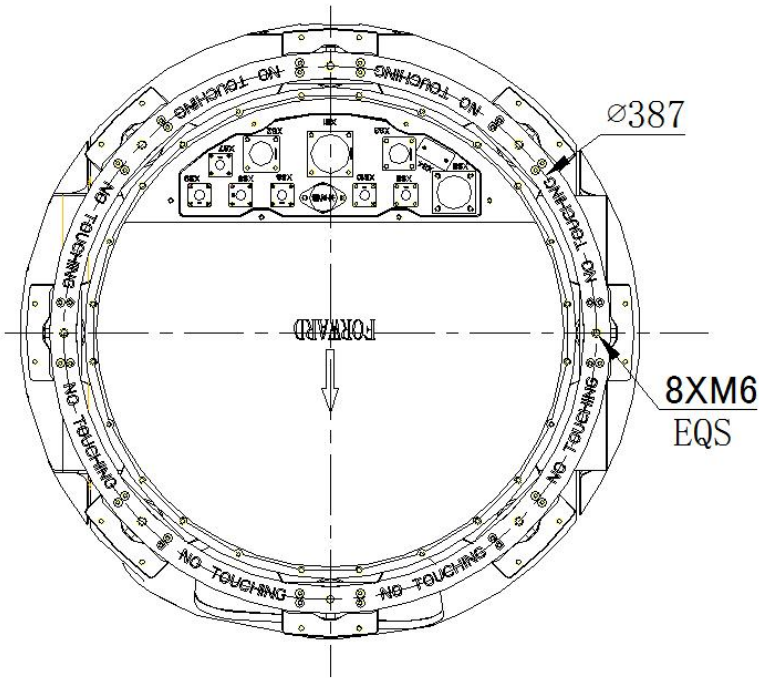

Figure 2 Mechanical interface