



Electro-optical Detection And Tracking System

For UAV, Ship And Car



ESV-1000



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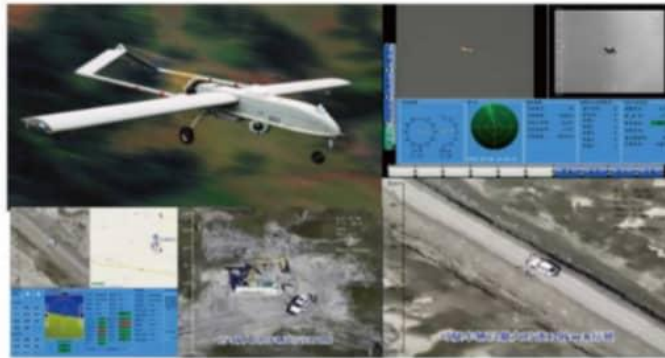
ESV-1000



ESVISION

Marine Electro-optical Detection And Tracking System

ES400S3



UAV monitors the oil field, captures and tracks ground targets, the target moving speed is 120KM



The patrol car with electro-optical camera monitoring system

Monitoring ship in South China sea chasing moving target

1 Product Introduction

1.1 Product overview

The electro-optical forensics system (ES400S3) adopts an advanced dual-frame, two-axis gyro stabilization and computer control system, which ensures the full sealing performance of electro-optical equipment while stabilizing images with high precision, and can meet the requirements of all-weather target monitoring and searching in harsh marine environment.

The electro-optical turret is installed outside the ship, and the display control part is installed in the cabin. During the day, the high-performance color CCD camera is used to observe and search the target; Search and observe targets by infrared thermal imaging at night or in rainy and foggy weather.

1.2 Product composition

The electro-optical turret forensics system consists of electro-optical turret and ground station. The electro-optical turret is based on the gyro stabilized platform and integrates infrared camera and visible light camera. Ground station includes display and control console, integrated control box and other parts. The system composition diagram is as follows:



Fig. 1 Composition diagram of marine **electro-optical** turret system

1.3 Complete set of products

- 1) electro-optical turret: 1 set;
- 2) Display and control console: 1 set
- 3) Integrated control box (including video tracker): 1 set
- 4) Product cable: 1 set;
- 5) Product certificate: 1 sheet

1.4 Appearance, installation size and weight

1.4.1 Overall dimensions and mechanical installation interface

The overall dimensions and mechanical installation interfaces of electro-optical turret and ground station

equipment are shown in the following figure.

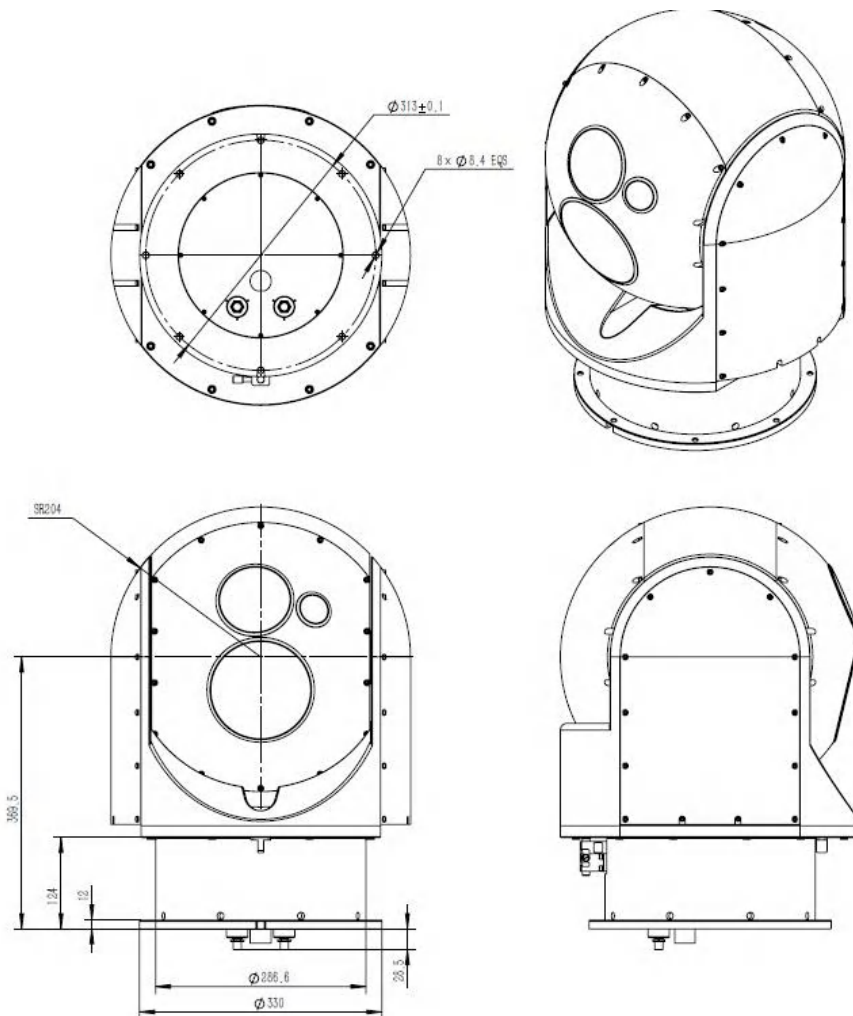


Fig. 2 Outline dimensions and installation interface diagram
of electro-optical turret

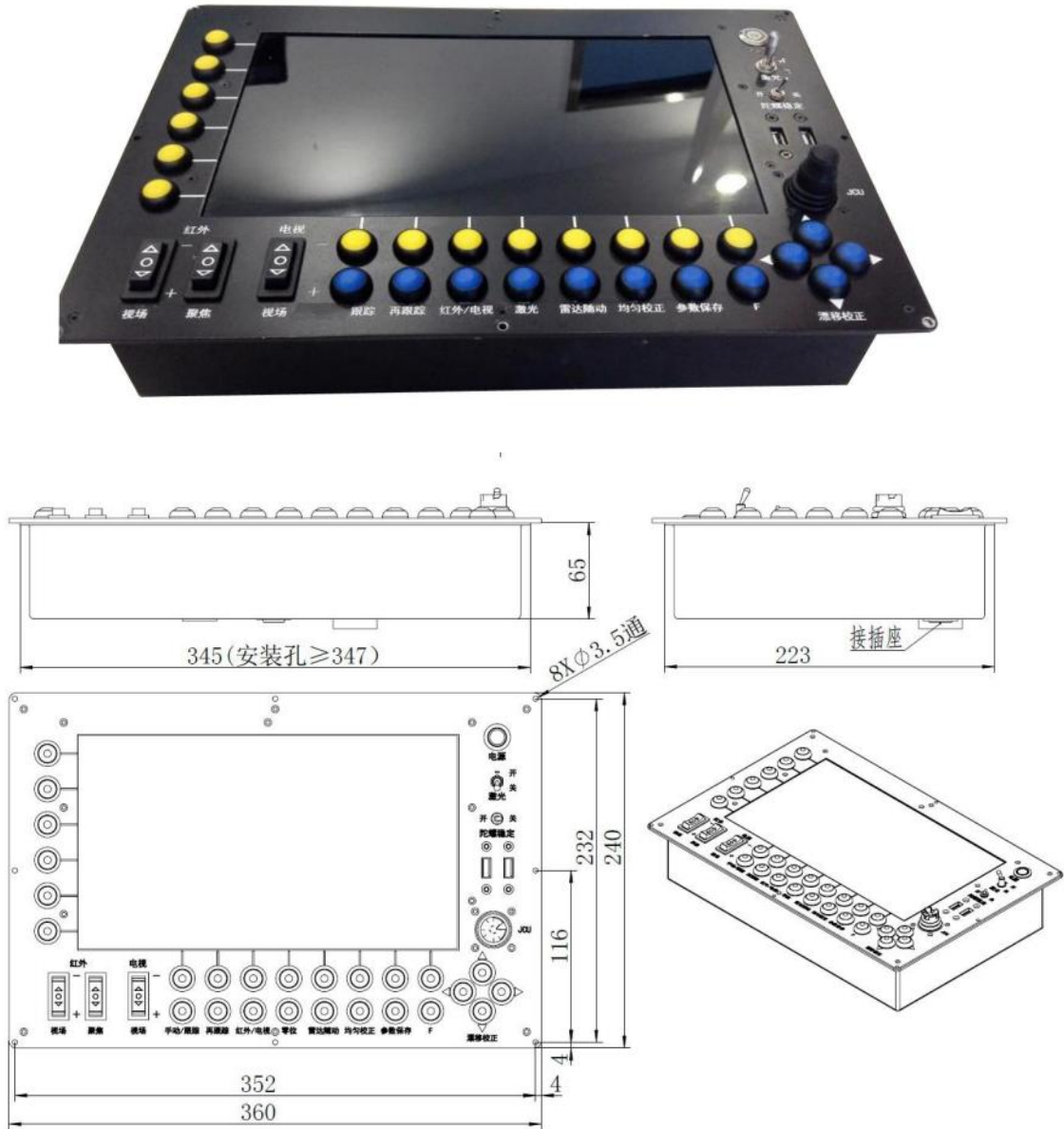


Fig. 3 Overall dimensions and installation interface diagram of display
and control console



Fig. 4 Overall dimensions and installation interface diagram of integrated control box

1.4.2 product weight

Optoelectronic turret: $\leq 55\text{kg}$;

Display and control console: $\leq 3.5\text{kg}$.

Comprehensive control box: $\leq 7\text{kg}$.

2 Product functional requirements

Functional index requirements of electro-optical forensics system:

- 1) It can provide video images of various spectra such as infrared and visible light, and search and monitor air, ground and sea targets day and night; Infrared camera should have the function of assisting navigation;
- 2) It has the function of gyro stabilization of the visual axis on the moving carrier (two-axis gyro stabilization);
- 3) Able to manually operate the line of sight and track the target manually or automatically;
- 4) Able to perform maintenance operations such as online drift correction;
- 5) Receive the target position signal from the external system and make the line of sight follow the position;
- 6) Accurate and real-time reporting of line-of-sight position;
- 7) It can realize the focusing and zooming functions of electro-optical equipment;

-
- 8) With laser lighting function, it can provide light source for visible light at night;
 - 9) It can receive the serial data of radar, GPS (and Beidou) and gyrocompass on the ship, and provide the target geographical position for image forensics after the data is solved;
 - 10) Video tracking function: Using video image information technology, it can automatically track the specified target with high precision and then drive the turntable to lock the target. Template matching tracking algorithm is used to extract, identify and track targets under complex background;
 - 11) It can provide users with a good man-machine interface to complete the operation and control of peripheral devices such as electro-optical turret;
 - a) Control and parameter setting of electro-optical turret, optical sensor and other equipment are completed through display and control panel buttons and operating rocker;
 - b) The azimuth and pitch motion of electro-optical turret turntable are controlled by small Hall directional joystick.
 - c) The electro-optical turret system and electro-optical load are controlled by operating the function keys and switches

on the countertop:

- d) The control and parameter setting of electro-optical turret system and electro-optical load are realized through the buttons around the liquid crystal display screen;
- e) Display the information of electro-optical turret system (including video information and parameter information) through LCD screen;
- f) Real-time display of geographic information (including map and coordinate information, with GPS and compass on board) of electro-optical turret system and observation target through LCD screen;
- g) It can record, store and play back the video information of electro-optical turret, and export the stored data to U disk.

3 Technical index of products

Performance index requirements of electro-optical forensics system:

3.1.1 Mechanical rotation range of turret

Orientation: 360-degree continuous rotation;

Pitch: $-90^{\circ} \sim +87^{\circ}$.

3.1.2 Maximum line-of-sight rotation angular velocity

Azimuth: $\geq 90/s$;

Pitch: $\geq 90/s$.

3.1.3 Maximum line-of-sight angular acceleration

Orientation: $\geq 100/s^2$;

Elevation: $\geq 100/s^2$.

3.1.4 Accuracy of line-of-sight angular position

Orientation: $\leq 0.5\text{mrad}$;

Pitch: $\leq 0.5\text{mrad}$;

3.1.5 Stability accuracy of line-of-sight gyro

Orientation: $\leq 0.1\text{mrad}$ (15/0.1hz swing)

Pitch: $\leq 0.1\text{ mrad}$ (15/0.1 Hz swing)

3.1.6 Visible light camera index

1) Focal length: 15mm~500mm;

2) Optical magnification: 33 times;

3) Horizontal viewing angle range: $32.7 \sim 1$;

4) Effective pixel count: 1920 x 1080 pixels;

5) 1080P HD output is supported.

3.1.7 Index of uncooled infrared sensor

- 1) Focal length: 20mm~120mm continuous;
- 2) Number of pixels: 640×512 pixels;
- 3) Field of view: $31.2 \times 25 \sim 5.2 \times 4$;
- 4) Detector material: vanadium oxide;
- 5) Pixel size: 17um.

3.1.8 Index of laser rangefinder: (choose one of laser ranging and laser illumination)

- 1) Working wavelength: 1.55μm (eye-safe);
- 2) Measuring range: $\geq 4.5\text{km}$; (under the weather condition of visibility 15km);
- 3) Ranging accuracy: 5m;
- 4) Repetition frequency: 1Hz;
- 5) Accurate measurement rate: $\geq 95\%$.

3.1.9 Index of laser illuminator:

- 1) Optical power: optical power 10 watts;
- 2) Wavelength: $808 \pm 5\text{nm}$;
- 3) Illumination angle: electric synchronous zoom is

continuously adjustable from 68 to 1.5;

- 4) Illumination distance: far angle: effective distance \geq 1000m;
- 5) Working voltage: dc12v 10%;
- 6) Maximum power consumption: 15W.

3.1.10 Power Supply

Ac 220v 10%, 50hz 5%, 500w;

3.1.11 power

Constant value: \leq 200W, peak value: \leq 500W.

3.1.12 Environmental adaptability requirements

- 1) Working temperature: $-30^{\circ}\text{C} \sim +60^{\circ}\text{C}$ (extravehicular equipment);
 $-10^{\circ}\text{C} \sim +50^{\circ}\text{C}$ (cabin equipment);
- 2) Storage temperature: $-30^{\circ}\text{C} \sim +60^{\circ}\text{C}$.

4 Product software interface

High-definition LCD (11-inch LCD screen with resolution of 1920*1080) is used in the display and control console. In order to meet the requirements of environmental use, the LCD is reinforced to meet the electromagnetic compatibility, dustproof and shockproof functions. The display and control screen is used to display system information

(including images, maps and parameters), and the peripheral keys beside the LCD realize the quick operation of the software.

The software interface is divided into video area, map area, parameter area and operation area. Software operation is carried out through peripheral keys corresponding to peripheral display buttons, which is fast, accurate and reliable.

- 1) Video is divided into high-definition video (picture-in-picture mode), and the video can be enlarged to full screen display;
- 2) The map area is located on the right side of the screen. The geographical position of the ship, the optical axis of the electro-optical turret and the geographical position of the target are superimposed on the map. The map can be enlarged to full screen display;
- 3) The parameter area is located at the lower left of the screen, which is used to display the geographic information of the ship and the target, the information of the electro-optical turret and the external equipment, etc.
- 4) The operation area is located at the left edge and the lower edge of the screen, and consists of 14 buttons, each button corresponds to a physical peripheral button, and the left button is the main menu button, which is the main interface, map, playback and video; The

lower keys are changed and correspond to different left keys.



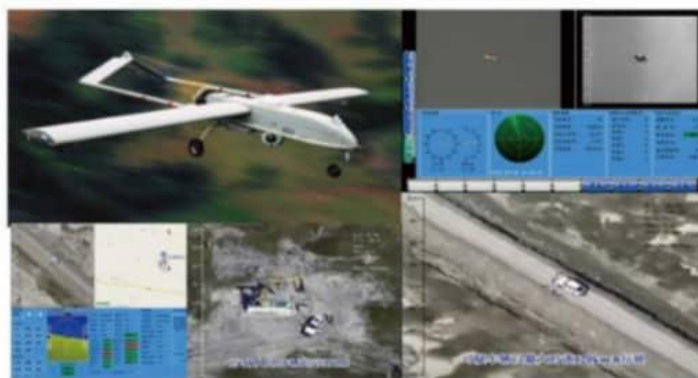
Fig. 5 Software interface diagram of display and control console



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Electro-optical Detection And Tracking System

ES255S3



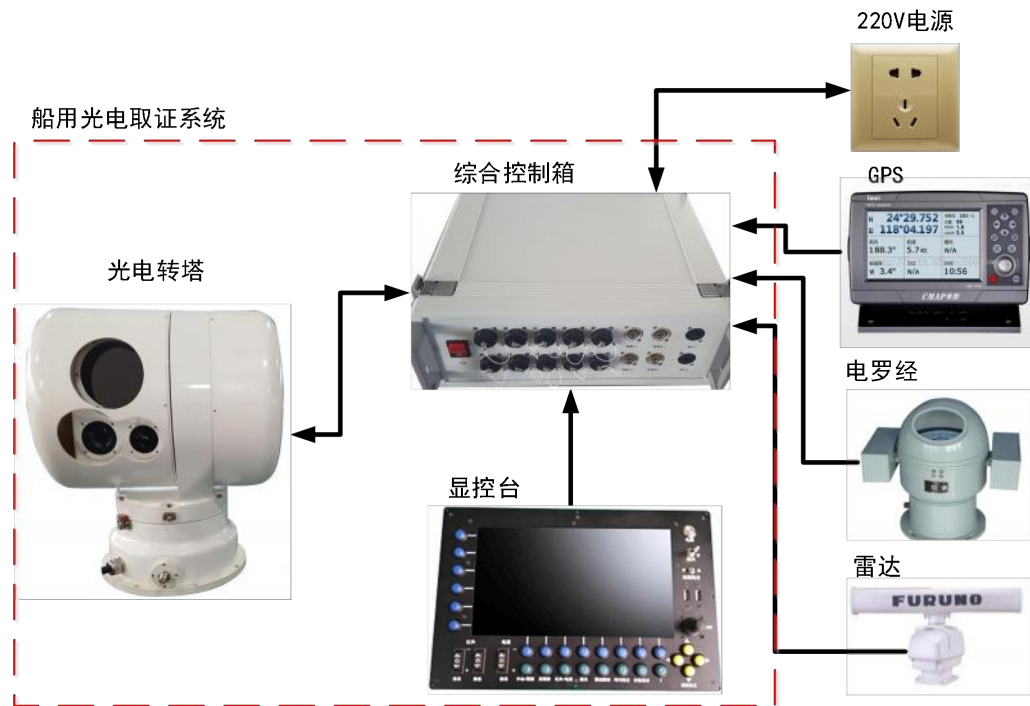


Fig. 1 Composition diagram of electro-optical turret system

1.2 Complete set of products

- 1) electro-optical turret: 1 set;
- 2) Display and control console: 1 set
- 3) Integrated control box: 1 set
- 4) Product cable: 1 set;
- 5) Product certificate: 1 sheet

1.3 Appearance, installation size and weight

1.3.1 Overall dimensions and mechanical installation interface

The overall dimensions and mechanical installation interfaces of electro-optical turret and ground station

equipment are shown in the following figure.



Fig. 2 Outline dimensions and installation interface diagram

of electro-optical turret

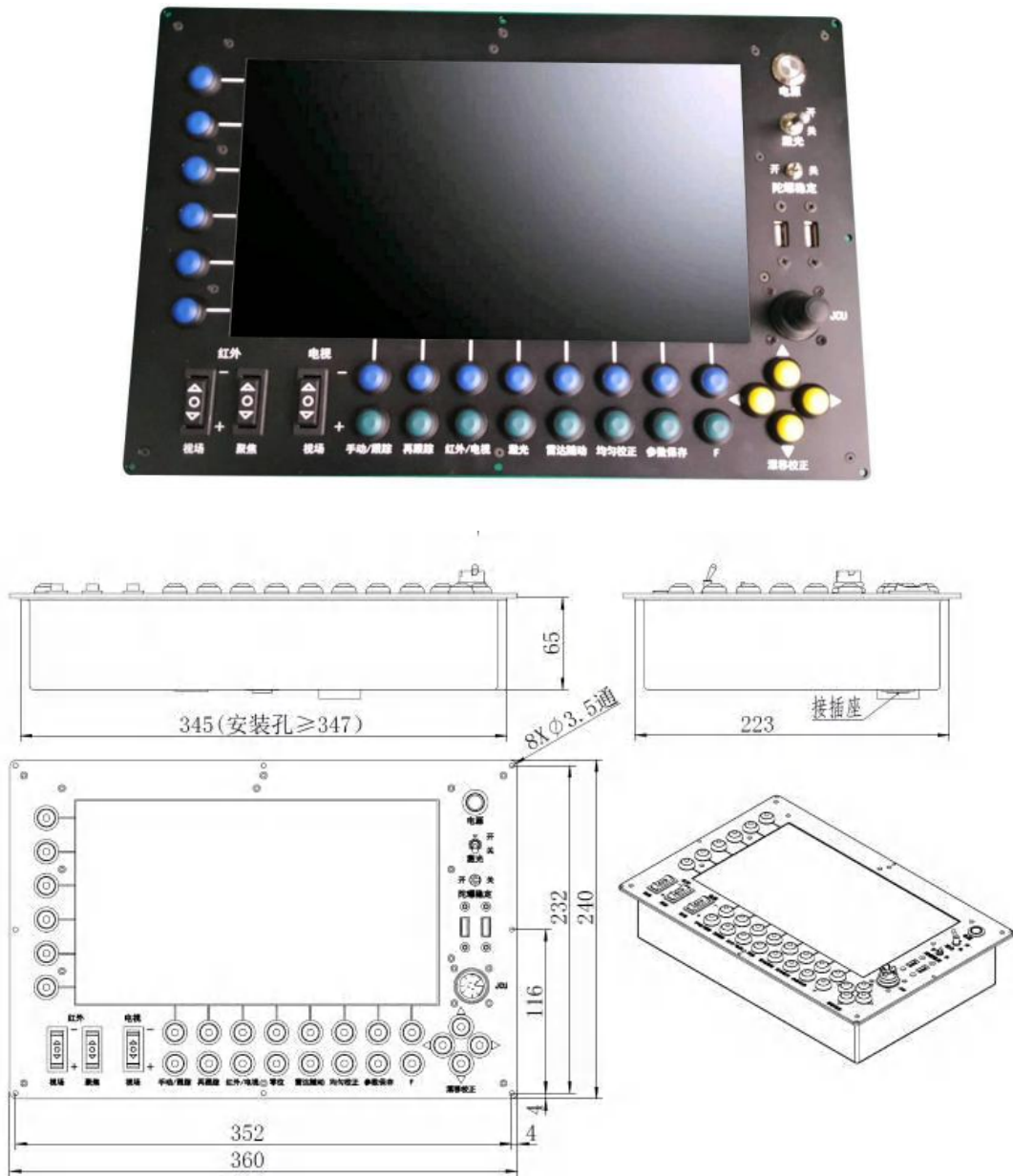


Fig. 3 Overall dimensions and installation interface diagram of display and control console



Fig. 4 Overall dimensions and installation interface diagram of integrated control box

1.3.2 product weight

electro-optical turret: $\leq 20\text{kg}$;

Display and control console: $\leq 3.5\text{kg}$.

Comprehensive control box: $\leq 10\text{kg}$.

2 Product functional requirements

Functional index requirements of electro-optical forensics system:

- 1) It can provide video images of various spectra such as infrared and visible light, and search and monitor air, ground and sea targets day and night; Infrared camera should have the function of assisting navigation;
- 2) It has the function of gyro stabilization of the visual axis on the moving carrier (two-axis gyro stabilization);
- 3) Able to manually operate the line of sight and track the target manually or automatically;
- 4) Able to perform maintenance operations such as online drift correction;
- 5) Receive the target position signal from the external system and make the line of sight follow the position;
- 6) Accurate and real-time reporting of line-of-sight position;
- 7) It can realize the focusing and zooming functions of electro-optical equipment;

-
- 8) With laser lighting function, it can provide light source for visible light at night;
 - 9) Have laser ranging function to provide distance information for target positioning; (choose one of laser illumination and laser ranging)
 - 10) It can receive the serial data of radar, GPS (and Beidou) and gyrocompass on the ship, and provide the target geographical position for image forensics after the data is solved;
 - 11) Video tracking function: Using video image information technology, it can automatically track the specified target with high precision and then drive the turntable to lock the target. Template matching tracking algorithm is used to extract, identify and track targets under complex background;
 - 12) It can provide users with a good man-machine interface to complete the operation and control of peripheral devices such as electro-optical turret;
 - a) Control and parameter setting of electro-optical turret, optical sensor and other equipment are completed through display and control panel buttons and operating rocker;

-
- b) The azimuth and pitch motion of electro-optical turret turntable are controlled by small Hall directional joystick.
 - c) The electro-optical turret system and electro-optical load are controlled by the function keys and switches on the display and control panel:
 - d) The control and parameter setting of electro-optical turret system and electro-optical load are realized by the buttons around the liquid crystal display screen;
 - e) Display the information of electro-optical turret system (including video information and parameter information) through LCD screen;
 - f) Real-time display of geographic information (including map and coordinate information, with GPS and compass on board) of electro-optical turret system and observation target through LCD screen;
 - g) It can record, store and play back the video information of electro-optical turret, and export the stored data to U disk.

3 Technical index of products

Performance index requirements of electro-optical

forensics system:

3.1.1 Mechanical rotation range of turret

Orientation: 360 continuous;

Pitch: $-90^{\circ} \sim +85^{\circ}$.

3.1.2 Maximum line-of-sight rotation angular velocity

Azimuth: $\geq 90/s$;

Pitch: $\geq 90/s$.

3.1.3 Maximum line-of-sight angular acceleration

Orientation: $\geq 100/s^2$;

Elevation: $\geq 100/s^2$.

3.1.4 Accuracy of line-of-sight angular position

Orientation: $\leq 0.5\text{mrad}$;

Pitch: $\leq 0.5\text{mrad}$;

3.1.5 Stability accuracy of line-of-sight gyro

Orientation: $\leq 0.1\text{mrad}$ (15/0.1hz swing)

Pitch: $\leq 0.1\text{ mrad}$ (15/0.1 Hz swing)

3.1.6 Visible light camera index

1) Focal length: $4.3\text{mm} \sim 258\text{mm}$;

-
- 2) Optical magnification: 30 times;
 - 3) Digital zoom: 2x
 - 4) Horizontal viewing angle range: $63.7^\circ \sim 1.1^\circ$;
 - 5) Effective pixel count: 1920 x 1080 pixels;
 - 6) 1080P HD output is supported.
 - 7) The operating distance requirements of high-definition visible light camera for typical targets are shown in Table 1.

Table 1.

| target | Goal size (m) | Detection distance (Km) | Identification distance (Km) | Automatic tracking distance (Km) |
|--------|---------------|-------------------------|------------------------------|----------------------------------|
| human | 0.5×1.8 | ≥ 3 | ≥ 2 | ≥ 1 |
| boat | 2×6 | ≥ 10 | ≥ 5 | ≥ 3 |

Note: Under the conditions of visibility greater than 15km and relative humidity less than 70%.

3.1.7 Index of uncooled infrared sensor

- 1) The focal length is 75mm;
- 2) Number of pixels: 640×512 ;
- 3) The viewing angle is $8.3^\circ \times 6.2^\circ$;
- 4) Detector material: vanadium oxide;
- 5) Pixel size: 17um;

6) The operating distance requirements of infrared thermal imager for typical targets are shown in Table 2.

Table 2

| target | Goal size (m) | Detection distance (Km) | Identification distance (Km) | Automatic tracking distance (Km) |
|--------|---------------|-------------------------|------------------------------|----------------------------------|
| human | 0.5×1.8 | ≥2 | ≥1 | ≥0.5 |
| boat | 2×6 | ≥5 | ≥3 | ≥2 |

Note: under the conditions of visibility ≤15km, relative humidity ≥70% and target background temperature difference of 3~5K

3.1.8 Index of laser rangefinder (laser ranging and laser illumination):

- 1) Working wavelength: 1.55 μ m (eye-safe);
- 2) Measuring range: ≥5km;
- 3) Ranging accuracy: 3m;
- 4) Repetition frequency: 1Hz;
- 5) Accurate measurement rate: ≥95%.

3.1.9 Index of laser illuminator (laser ranging and laser illumination):

- 6) Optical power: optical power 5 watts;
- 7) Wavelength: 808±5nm;
- 8) Illumination angle: electric synchronous zoom is

continuously adjustable from 68 to 1.5;

9) Lighting distance: far angle: effective distance ≥ 800 meters;

10) Working voltage: dc12v 10%;

11) Maximum power consumption: 15W.

3.1.10 Power Supply

Ac 220v 10%, 50hz 5%, 500w;

3.1.11 power

Constant value: $\leq 200W$, peak value: $\leq 500W$.

3.1.12 Environmental adaptability requirements

1) Working temperature: $-30^{\circ}C \sim +60^{\circ}C$ (extravehicular equipment);
 $-10^{\circ}C \sim +50^{\circ}C$ (cabin equipment);

2) Storage temperature: $-40^{\circ}C \sim +65^{\circ}C$.

4 Product software interface

High-definition LCD (11-inch LCD screen with resolution of 1920*1080) is used in the display and control console. In order to meet the requirements of environmental use, the LCD is reinforced to meet the electromagnetic compatibility, dustproof and shockproof functions. The display and control screen is used to display system information

(including images, maps and parameters), and the peripheral keys beside the LCD realize the quick operation of the software.

The software interface is divided into video area, map area, parameter area and operation area. Software operation is carried out through peripheral keys corresponding to peripheral display buttons, which is fast, accurate and reliable.

- 1) Video is divided into high-definition video (picture-in-picture mode), and the video can be enlarged to full screen display;
- 2) The map area is located on the right side of the screen. The geographical position of the ship, the optical axis of the electro-optical turret and the geographical position of the target are superimposed on the map. The map can be enlarged to full screen display;
- 3) The parameter area is located at the lower left of the screen, which is used to display the geographic information of the ship and the target, the information of the electro-optical turret and the external equipment, etc.
- 4) The operation area is located at the left edge and the lower edge of the screen, and consists of 14 buttons, each button corresponds to a physical peripheral button, and the left button is the main menu button, which is the main interface, map, playback and video; The

lower keys are changed and correspond to different left keys.



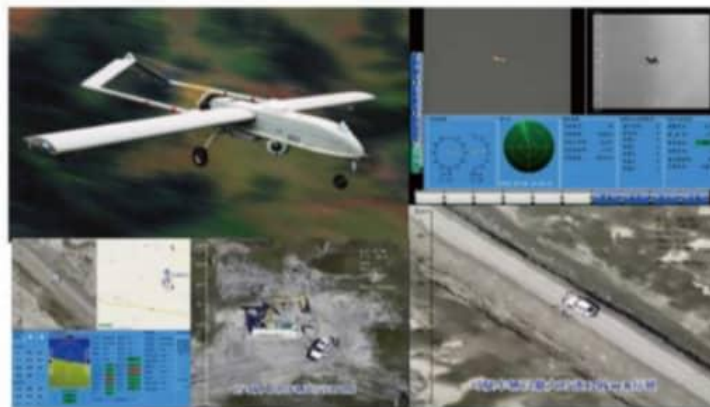
Fig. 5 Software interface diagram of display and control console



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Electro-optical Detection And Tracking System

ES200S2



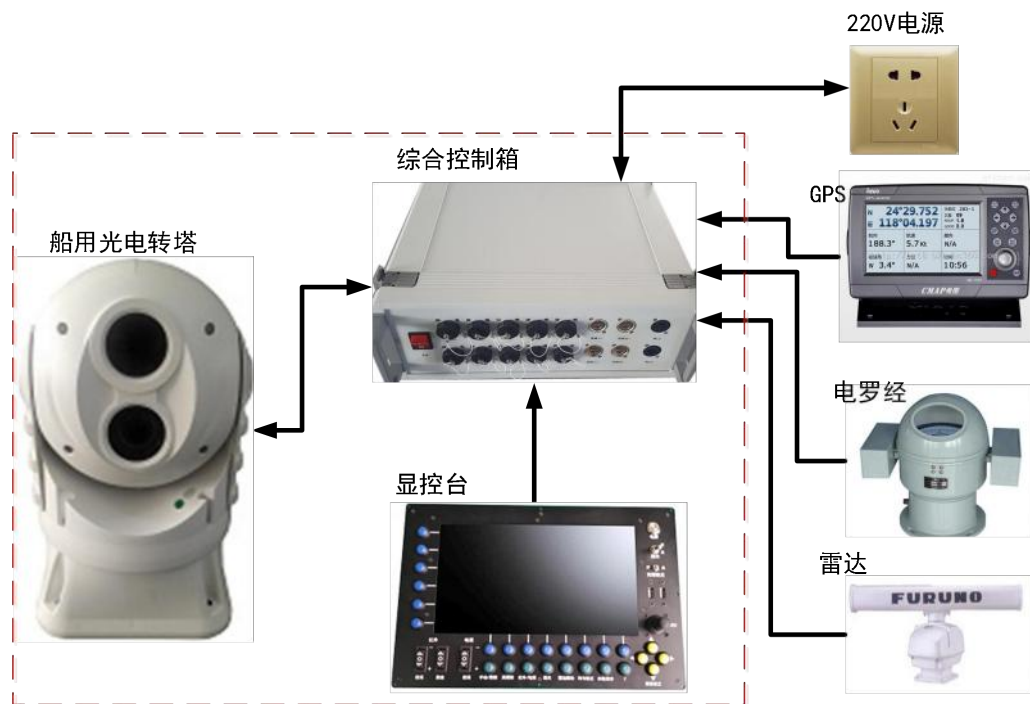


Fig. 1 Composition diagram of electro-optical turret system 1.

2 Complete set of products

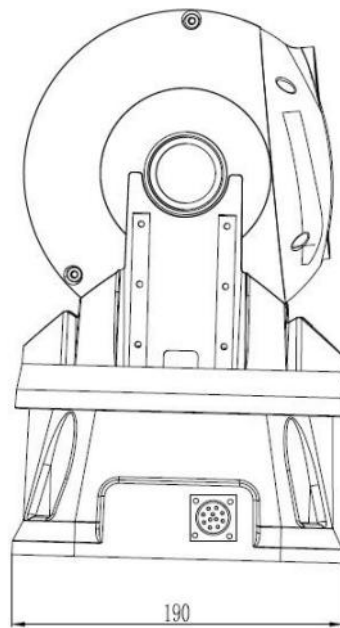
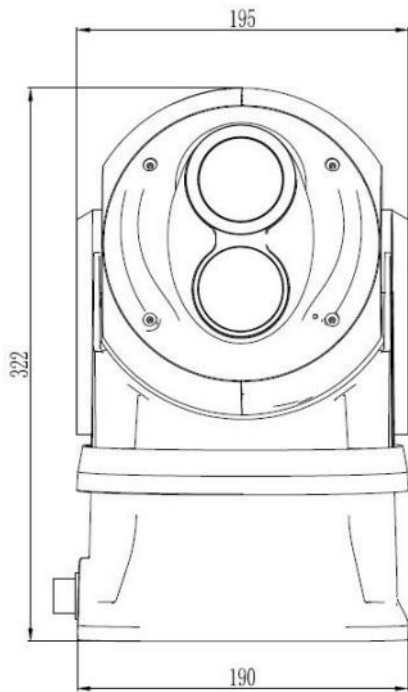
- 1) electro-optical turret: 1 set;
- 2) Display and control console: 1 set
- 3) Integrated control box: 1 set
- 4) Product cable: 1 set;
- 5) Product certificate: 1 sheet

1.3 Appearance, installation size and weight

1.3.1 Overall dimensions and mechanical installation interface

The overall dimensions and mechanical installation interface of electro-optical turret are shown in the following

figure.



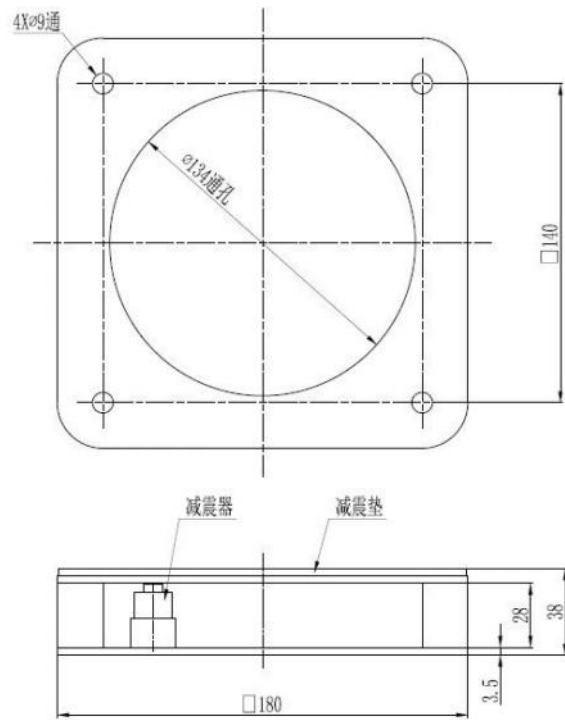


Fig. 2 Outline dimensions and installation interface diagram of electro-optical turret



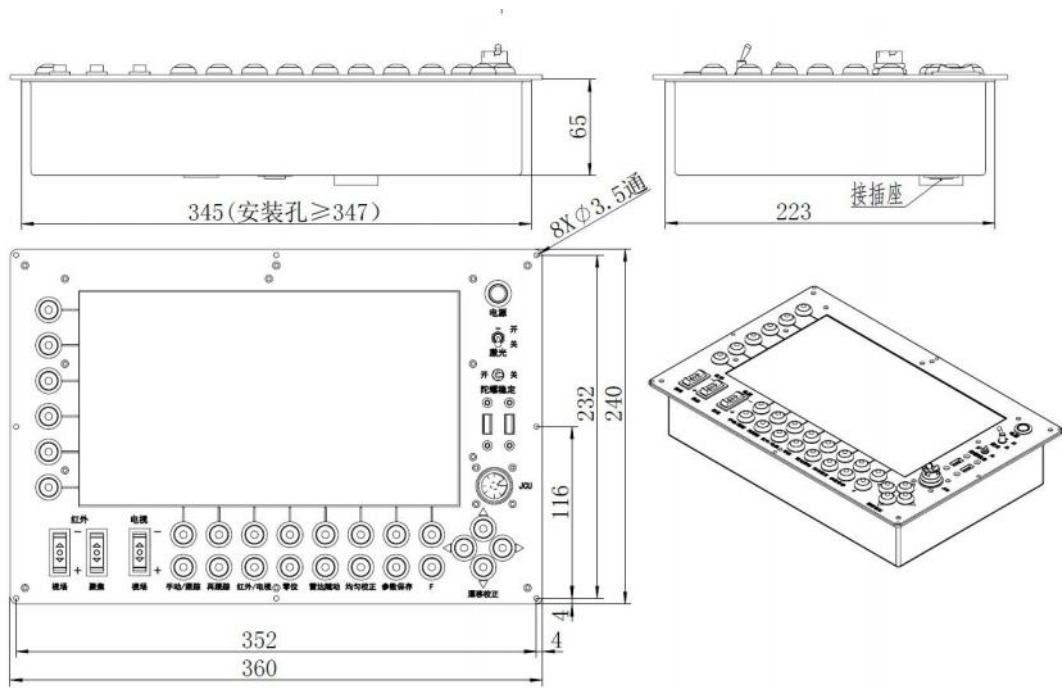


Fig. 3 Overall dimensions and installation interface diagram of display and control console



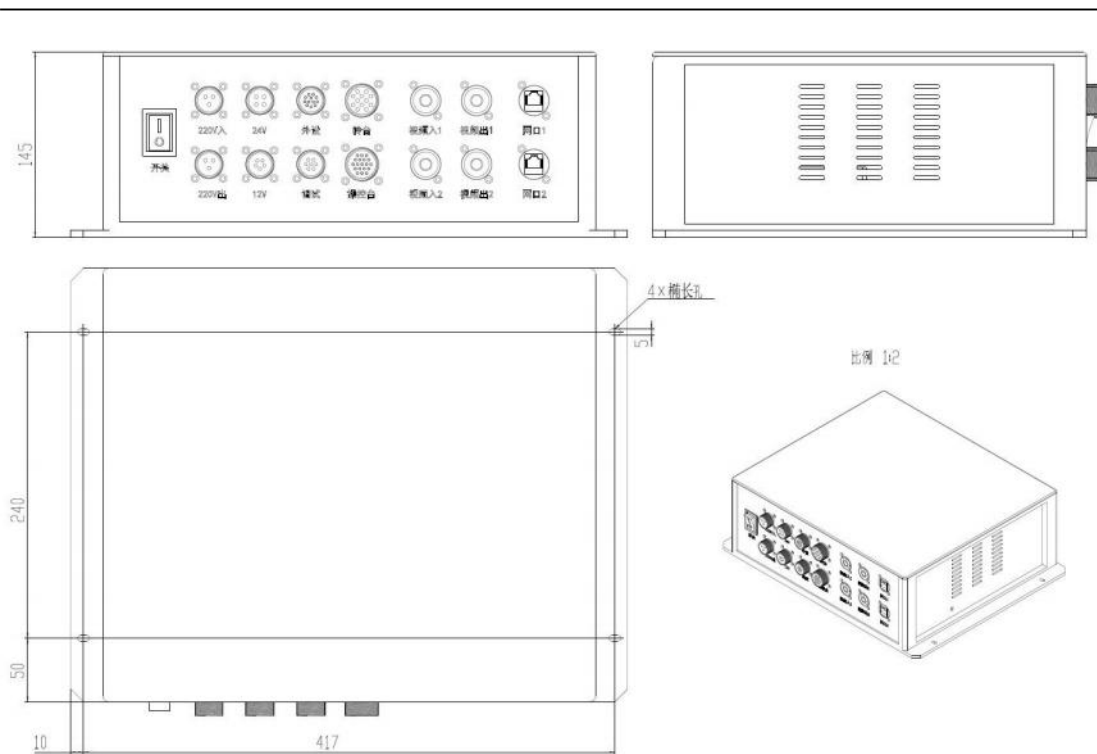


Fig. 4 Overall dimensions and installation interface diagram of integrated control box

1.3.2 product weight

Optoelectronic turret: $\leq 7\text{kg}$;

Ground station: $\leq 15\text{kg}$.

2 Product functional requirements

2.1 electro-optical turret function

- 1) It can provide video images of various spectra such as infrared and visible light, and search and monitor air, ground and sea targets day and night; Infrared camera should have the function of assisting navigation;

-
- 2) It has the function of gyro stabilization of the visual axis on the moving carrier (two-axis gyro stabilization);
 - 3) Able to manually operate the line of sight and track the target manually or automatically;
 - 4) It can output the status information of subsystem through communication interface; Can receive instruction information sent by equipment outside the system through communication interface;
 - 5) Maintenance operations such as online drift correction can be performed.
 - 6) Receive the target position signal from the external system and make the line of sight follow the position;
 - 7) Accurate and real-time reporting of line-of-sight position;
 - 8) It can realize focusing and zooming functions of electro-optical equipment.
 - 9) It can receive the serial data of radar, GPS (Beidou) and gyrocompass on the ship, and provide the target geographical position for image forensics after the data is solved.

2.2 Display console function

It can provide users with a good man-machine interface to complete

the operation and control of peripheral devices such as electro-optical turret.

- 1) The peripheral devices such as electro-optical turret and optical sensor can be controlled and their parameters set through the buttons on the panel of the display and control console and the operating rocker.
- 2) The azimuth and pitch motion of electro-optical turret turntable are controlled by small Hall directional joystick.
- 3) Complete the following functions by operating the function keys and switches on the countertop:
 - a) Manual/automatic search;
 - b) Lock the trace again;
 - c) Field of view adjustment;
 - d) Fine adjustment of focal length;
 - e) Gyro stabilization mode;
 - f) Tracking video channel switching;
 - g) Speed switching;
 - h) Infrared polarity conversion;
 - i) Infrared uniform correction;

-
- j) Infrared brightness setting;
 - k) Infrared gain setting;
 - l) Zero drift calibration;
 - m) Save the zero drift calibration parameters.
- 4) The control and parameter setting of electro-optical turret system are realized through the peripheral keys and function keys of liquid crystal display screen;
 - 5) Display the information of electro-optical turret system (including video information and parameter information) through LCD screen;
 - 6) Display the geographic information (including map and coordinate information) of electro-optical turret system and observation target in real time through LCD screen;
 - 7) It can record, store and play back the video information of electro-optical turret, and export the stored data to U disk;
 - 8) Video tracking function: Using video image information technology, it can automatically track the specified target with high precision and then drive the turntable to lock the target. Using template matching tracking algorithm, the target can be extracted, identified and tracked under complex background.

3 Technical index of products

3.1 Performance index requirements

3.1.1 Mechanical rotation range of turret

Orientation: 360 continuous;

Pitch: $-40 \sim +40$.

3.1.2 Maximum line-of-sight rotation angular velocity

Azimuth: $\geq 45/s$;

Pitch: $\geq 45/s$.

3.1.3 Maximum line-of-sight angular acceleration

Orientation: $\geq 50/s^2$;

Pitch: $\geq 50/s^2$.

3.1.4 Accuracy of line-of-sight angular position

Orientation: ≤ 0.1 ;

Pitch: ≤ 0.1 ;

3.1.5 Stability accuracy of line-of-sight gyro

Orientation: ≤ 0.2 (15/0.1 Hz swing)

Pitch: ≤ 0.2 (15/0.1 Hz swing)

3.1.6 Visible light camera index

- 1) Focal length: 4.5mm~135.0mm;
- 2) Optical magnification: 30 times;
- 3) Horizontal viewing angle range: 60.5 ~ 2.3;
- 4) Working band: 0.4~0.8 μ m;
- 5) Type: 1/2.8 "color CMOS;
- 6) Effective pixels: 1920 * 10802 million effective pixels.
- 7) The operating distance requirements of high-definition visible light camera for typical targets are shown in Table 1.

Table 1.

| target | Goal size (m) | Detection distance (Km) | Identification distance (Km) | Automatic tracking distance (Km) |
|--------|---------------|-------------------------|------------------------------|----------------------------------|
| human | 0.5×1.8 | ≥3 | ≥2 | ≥1 |
| boat | 2×6 | ≥10 | ≥5 | ≥3 |

Note: Under the conditions of visibility greater than 15km and relative humidity less than 70%.

3.1.7 Index of uncooled infrared sensor

- 1) Detector type: vanadium oxide;
- 2) Number of pixels: 640×512;
- 3) Focal length: 40mm/F1.0 (electric focusing);
- 4) Digital zoom: 4X;
- 5) The viewing angle is 15.5 (h) × 12.4 (v).
- 6) The operating distance requirements of infrared thermal imager

for typical targets are shown in Table 2.

Table 2

| target | Goal size (m) | Detection distance (Km) | Identification distance (Km) | Automatic tracking distance (Km) |
|--------|---------------|-------------------------|------------------------------|----------------------------------|
| human | 0.5×1.8 | ≥1.5 | ≥0.8 | ≥0.4 |
| boat | 2×6 | ≥4 | ≥2 | ≥1 |

Note: under the conditions of visibility $\leq 15\text{km}$, relative humidity $\geq 70\%$ and target background temperature difference of 3 ~ 5 k.

3.1.8 Power Supply

Ac 220v 10%, 50hz 5%, 200w;

3.1.9 power

Constant value: $\leq 50\text{W}$, peak value: $\leq 100\text{W}$.

3.1.10 Environmental adaptability requirements

- 1) Working temperature: $-30^{\circ}\text{C} \sim +60^{\circ}\text{C}$;
- 2) Storage temperature: $-40^{\circ}\text{C} \sim +65^{\circ}\text{C}$.

4 Product software interface

High-definition LCD (11-inch LCD screen with resolution of 1920*1080) is used in the display and control console. In order to meet the requirements of environmental use, the LCD is reinforced to meet the electromagnetic compatibility, dustproof and shockproof functions. The display and control screen is used to display system information (including images, maps and parameters), and the peripheral keys beside

the LCD realize the quick operation of the software.

The software interface is divided into video area, map area, parameter area and operation area. Software operation is carried out through peripheral keys corresponding to peripheral display buttons, which is fast, accurate and reliable.

- 1) The video is divided into high-definition video, and the video can be enlarged to full screen display;
- 2) The map area is located on the right side of the screen. The geographical position of the ship, the optical axis of the electro-optical turret and the geographical position of the target are superimposed on the map. The map can be enlarged to full screen display;
- 3) The parameter area is located at the lower left of the screen, which is used to display the geographic information of the ship and the target, the information of the electro-optical turret and the external equipment, etc.
- 4) The operation area is located at the left edge and the lower edge of the screen, and consists of 14 buttons, each button corresponds to a physical peripheral button, and the left button is the main menu button, which is the main interface, map, playback and video; The lower keys are changed and correspond to different left keys.



Figure 5 Software interface diagram