SEEKER-20 ITR 20X Optical Zoom Object Identification and Tracking

Camera with 3-axis Gimbal

User Manual



1. Equipment overview	4
1.1 Application and scope of use	4
1.2 The main components and functions of the product	6
1.3 Use environment and working conditions	7
2.Technical characteristics	7
3.Installation and commission	9
3.1 Gimbal installation Hole and Structure	9
3.2 Electrical interface	10
3.3 Communication and control	13
3.3.1 Serial communication frame structure (optional function)	13
3.3.2 Digital picture integrated control and display	15
3.3.3 Touch screen and joystick control the gimbal	17
3.4 Gimbal debugging	19
3.4.1 Starup screen	19
3.4.2 Visible light image zoom	19
3.4.3 Visible light focusing	20
3.4.4 Take pictures and capture pictures	20
3.4.5 Video recording	21
3.4.6 AI tracking function	22
3.5 Gimbal debugging and control	25
3.5.1 Gimbal return to center	25
3.5.2 Gimbal YAW lock	25
3.5.3 Gimbal YAW follow	25
3.5.4 Attitude control	25
3.5.5 Speed control	
3.5.6 Automatic drift calibration	26
4. Use and operation	
4.1 Preparation and inspection before use	26
4.2 Safety protection, safety signs and instructions during use	27
4.3 Operating procedures during use	27
4.4 Inspection and recording during operation	27
5. Fault analysis and troubleshooting	
6. Product maintenance	
6.1 Daily maintenance	29
6.2 Maintenance procedures and methods	30
7. Transportation and storage	
7.1 Transportation	
7.2 Storage	31
8. Other introduction	33
8.1 Packing list and matters needing attention	33
8.2 After-sales service department	34

目录

Warning



Warning

- > Ensure that the interface definition of the airborne terminal is correct;
- > Ensure that the power supply voltage is within the given range.
- Under any circumstances, including when it is turned on or off, do not look directly at the sun, carbon dioxide laser, electric welding machine and other high-intensity radiation sources with the thermal imaging camera in the pod to avoid damage to the focal plane of the detector;

Transmitter System User Manual

1. Equipment overview

1.1 Application and scope of use

AIS20S90/AIS20S91 is an integrated 20x optical zoom, high-precision stabilization gimbal and image transmission integrated system. The pan/tilt adopts high-precision encoder FOC control scheme, integrated AI recognition module, and has human and vehicle Pattern recognition, characteristic target tracking, integrated long-distance 10KM image transmission and ground display and control integrated PAD, built-in TOPOTEK ground station software. SENSOR has 2 million effective pixels, AIS20S90 has wide dynamic function, AIS20S91 has low illumination function, and the rest of the functions, parameters, control, and structure are exactly the same. This system supports: network dual stream output, local TF video and camera, ground station software control and real-time video display, optical zoom. The onboard side can supply power. The system structure is shown in pic.



Picture1-1-1 Gimbal System with Transmitter

The AIS20S90/AIS20S91 integrated pan/tilt system can be widely used in public security emergency, fire rescue, power line inspection, military reconnaissance, field search and other industries. The system integrates optical zoom, AI artificial intelligence recognition, target tracking, video and photography, stabilization of the PTZ, image transmission, control, and display. This equipment can be used for target ranging and position calculation. Customer docking is simple, the airborne side is installed and fixed to the drone and other equipment. After the antenna is connected, only power supply is required and the system can work. The software on the ground side can directly display the video, and functions such as zooming, focusing, camera and video recording, and pan/tilt control can be realized by a button or mouse.

1.2 The main components and functions of the product

The device consists of five parts: zoom visible light movement, AI tracking module, stabilization gimbal, and image transmission control. The visible light zoom camera processes the video stream, internally performs TF card recording, and encodes and outputs to the image transmission module . The image transmission module transmits the real-time video and parameters to the ground receiving end and receives ground Control signals to control the PTZ and camera respectively. The structure of the system function frame is shown in Figure 1-2-1:



Picture 1-2-1 System function framework

1.3 Use environment and working conditions

- \blacktriangleright Working environment: -10°C to +55°C / 20% to 80% RH
- > Storage environment: -20° C to $+60^{\circ}$ C / 20% to 95% RH
- Transportability: After the packaging is completed, the PTZ can meet the requirements of air, road, rail, and water transportation.

2.Technical characteristics

- 1. Zoom camera parameters:
- SENSOR Pixel: 2 million pixels wide dynamic (AIS20S90) /Low

illumination (AIS20S91)

- ✤ Focal length: 4.7±10%~94±10%mm
- ✤ FOV:
 - **D** : WIDE 72° \pm 5% TELE 3.8° \pm 5%
 - H : WIDE 55.5° ± 5% TELE 3° ± 5%
 - V: WIDE 43° \pm 5% Tele 2.2° \pm 5%
- Zoom:20x electric optical zoom

Zoom mode: electric zoom and continuously adjustable

- Image and video storage format:
 - Image: jpeg; Various pixels to choose from
 - Video: H.264;1080P;480P Dual stream

Storage capacity: 128G TF Card; calss 6 and above

Image output interface: wireless network H.264s tream output

Wireless Transmitter:

Working frequency: 2.4GHz;

Wireless power: 25dBm

Wireless distance: 5-10Km

Pitch angle action range: -90° ~+90°

Rolling angle action range: -85° ~+85°

Heading angle action range: 360° Infinite continuous rotation

control precision: Pitch and Roll: $\pm 0.02^{\circ}$ horizontal direction: $\pm 0.03^{\circ}$

Gimbal Control Mode:

IP Control:can be controlled by mouse and touch screen.



H185



3.Installation and commission

Picture 3-1-1 System overall connection diagram

3.1 Gimbal installation Hole and Structure



Picture 3-1-2 Stucture Size

Space between mounting holes of shock

absorber:100mm*100mm;

Mounting Hole: 4*M2.5

3.2 Electrical interface

• Gimbal

There are four external electrical interfaces for the gimbal camera, which are power interface, communication interface (including reserved serial communication and network interface), and TF card interface. Among them, video and control can communicate with the ground station through wireless two-way communication. The USB interface is used to debug the stabilization parameters of the gimbal. The external wiring port is shown in Figure 3-2-1, and the line sequence is shown in Table 3-2-1.



Picture 3-2-1 External connection port diagram

No.	Model	Interface Mode	Interface definition	Function
1		Power interface	GND	GND
2		Power interface	5V	+5V output
3		Communication Interface	RxD4	Serial port
4	8PIN socket	Communication Interface	TXD4	Serial port
5		Communication Interface	DB-	Network port
6		Communication Interface	DB+	Network port
7		Communication Interface	DA-	Network port

8		Communication Interface	DA+	Network port
---	--	-------------------------	-----	--------------

*Due to product upgrades, the appearance/size/weight/power consumption may slightly change, please contact sales for the latest data, please understand.

*The USB port on the pod is only used for gimbal stabilization adjustment. Please do not connect to other devices. If you need to use this interface to adjust gimbal stabilization parameters, please contact technical support.

Picture 3-2-1 External interface 8PIN socket line sequence

• AI Identification and tracking module

When using the AI module, the XT30 interface is used for power supply. The current is large when it is turned on, and the peak current must be above 2A. The video stream processing starts about 1 minute after power-on. 10P wiring terminal adopts GH1.25-10P, 1 to 4 pins are network interface signals, used to connect to the network port of the pod.





The weight is 156 grams. Size: 94*63*28mm, installation hole spacing

79.2*42mm, M2

Power supply voltage: 3S-6S, current 0.8A

Picture 3-2-2 AI Recognition and tracking module size chart

 Image transmission & data transmission two-way transceiver equip For the air-side module, the network port is GH1.25-5, and the power and SBUS ports are GH1.25-4. The power supply range can be 3S-6S.



Picture 3-2-3 AI Image transmission sky side module diagram

The ground receiving end of the image transmission receives the wireless network RTSP stream, and displays the video on the PAD. Send commands to the pod through the touch screen, or send commands through the joystick, and the joystick commands are output from the SBUS bus on the sky side. a small board can be provided for SBUS to serial port commands for protocol conversion and SBUS channel mapping software tools.



Picture 3-2-4 AI Image transmission sky side module diagram

• SBUS to UART Panel (Optional)

Used for SBUS signal conversion. When the joystick is needed to

control the pod, this small board is needed. The interface signal

definition is as follows:



Pic 3-2-5 SBUS to serial port board diagram

3.3 Communication and control

3.3.1 Serial communication frame structure (optional function)

Frame header(3char)	Address bit(2char)	Data length (1char)	Control bit (1char)	Flag (3char)	Data1 (char)	°°°°	Data L (char)	Check Digit (2char)
#TP	U/M/D/I/E/P	L	w/r	X ₁ X ₂ X ₃	D_1	0 0 0 0	DL	CRC

Frame header :

#TP:Fixed length command, the data length is 2;

#tp:Variable length command, the data length is determined according to the length bit;

Address Bit:

Source address

U-Uart Command;M-Lens related commands; D-System and image related commands; I-Algorithm related commands; E-Thermal Infrared command; P-Gimbal Command

Target: U-Uart command M-Lens related commands; D-System and image related commands I-Algorithm related commands; E-Thermal Infrared command; P-Gimbal Command

Data Length:Number of data longest F

Control bit:r —> Inquire w —> control data:According to length Identification bit: identification function

Data:Data bits, according to data length;

CRC:Except for the beginning, convert the rest to HEX, do the cumulative sum, and then convert the result to ASC-II. Two bytes, high order first. Serial port configuration: baud rate: 115200, data bit: 8, stop bit: 1,

parity bit: none

Note: Please ask marketing staff for the specific network and serial communication protocols.

3.3.2 Digital picture integrated control and display

Default network address:

Video Stream 192.168.144.108 (default control port is the same as the video stream port)

By default, the control IP is the same as the video stream IP.

Note: The customer can also replace the supporting image transmission, its standard RTSP video stream can also be played by VLC, POTPLAY and other software. If customers develop their own ground station software, they can contact us and we will provide technical support.



PAD boot interface:

Picture 3-3-2-1 PAD Boot interface diagram

Click TOPOTEK icon to open Topotek ground station.



Picture3-3-2-2 PAD menu

Various functions of the pod can be controlled through the touch screen of the tablet, such as:

Swipe the screen to control the up, down, left and right rotation of the gimbal;

Click ZOOM and FOCUS to realize the zoom and focus operation of the camera;

Click the camera and video buttons to take pictures and videos locally on the camera;

Click the tracking button to enter the tracking state. At this time, you can press and hold the icon in the middle of the screen to switch modes, mainly people, cars, and feature tracking. Click on the screen to select the tracking target.

In the tracking state, a dial for pan/tilt direction control will pop up;

There is a center button and a menu setting button on the screen;

3.3.3 Touch screen and joystick control the gimbal

The pod adopts the touch screen control mode by default. When the customer needs to control the pod function through the joystick, it needs to use the SBUS to serial port board, and the command of the joystick is output from the SBUS. The small board of SBUS to serial port can be mapped through software tools.



Pic. 3-3-3-1 Connection picture for video transmission via SBUS command's converter plate

Instructions for use of channel configuration software::

Baud rate: 115200 Data Bit: 8 Stop Bit: 0 Parity: No SBUS × Serial Port Yaw 0 -Flash Port Select port Pitch 0 -Port: COM5 Zoom 0 -Default baud rate 115200 Boud: 115200 Focus 0 • Open the UART port Open REC/PIC 0 • After setting select "Read" PIP 0 -Send Read Gimbal 0 www.topotek.com Track 0 ٠ 拓扑联创科技有限公司 IRC 0 • ₹4.0

Click the receive button to get the current channel configuration status;After manually setting the channel configuration, click the send button to write in the configuration;

Setting of Com :

3.4 Gimbal debugging

3.4.1 Starup screen

After the gimbal is powered on, the ground station startup screen, as

shown in pic. 3-4-1:



Pic. 3-4-1-1Startup screen

After the ground station is opened, it will directly search and open the network RTSP stream, and display the image after the initialization is completed.

3.4.2 Visible light image zoom

Visible light has a 20x continuous optical zoom function. When zooming, the magnification is displayed in the lower right corner. It can be controlled by zooming commands or by touch screen. As shown in pic. 3-4-1:



Pic. 3-4-4-1 Visible light zoom effect picture

3.4.3 Visible light focusing

In some special application scenarios (such as power line inspection), if the target object is too small, the target in the visible light image will not be in focus. At this time, the visible light manual focus command can be used to make the target object in focus.

3.4.4 Take pictures and capture pictures

When the TF card exists, you can take a photo by sending a photo command, or you can send a photo command to capture a picture during video recording, and the photo time is saved to the photo properties. When taking a photo, "Capture OK" will be displayed below the video.



图 3-4-4-1 Visible light picture

3.4.5 Video recording

r.

When the TF card exists, you can record by sending the recording command. The default resolution of the recorded video is 1080P. Send again to stop the recording, and the recording time is displayed in the middle on the right. The remaining capacity of the TF card is displayed in the lower left corne.



Pic.3-4-5-1 Video effect picture

3.4.6 AI tracking function

Tap the upper left corner of the touch screen to enter the tracking mode. The current tracking mode will be displayed in the center at the bottom of the screen, and a tracking mode selection menu will pop up when you long press it.



Pic 3-4-6-1 Tacking mode display

Can select tracking mode in the menu:

- General: General feature tracking, click on the screen, with the click point as the center, a tracking frame with a size of 60*60 pixels, to perform feature tracking on the tracking target;
- Human: Pattern recognition, personnel detection, to detect and frame the personnel on the screen, after click on the screen, the release point is the center to track the nearest personnel

target and realize the personnel tracking function.

- Car: Pattern recognition, car detection, to detect and frame the car on the screen, after click on the screen, centering on the release point, tracking the nearest car target to achieve the car tracking function.
- Pattern recognition example--- person recognition, target selection and tracking.





Pic. 3-4-6-2 Tracking effect display

 Pattern recognition example---car recognition, target selection and tracking. Supports optical zoom operation during tracking, and the target is not lost.





3.5 Gimbal debugging and control

3.5.1 Gimbal return to center

You can set the gimbal to work in the centered state through the control command. In this state, the gimbal will return and keep the camera looking directly in front of the nose.

3.5.2 Gimbal YAW lock

The gimbal can be set in YAW lock mode by setting. In this mode, the gimbal will not rotate with the rotation of the aircraft heading.

3.5.3 Gimbal YAW follow

The gimbal can be set to work in YAW follow mode. In this mode, the gimbal can maintain a fixed angle between the heading and the fuselage, and rotate with the rotation of the aircraft heading.

3.5.4 Attitude control

The gimbal can be controlled to move at a certain angular rate in the heading and pitch directions through UART commands and network signals. Swipe left, right, up and down on the touch screen to drag the gimbal to rotate.

3.5.5 Speed control

The gimbal has two modes: high speed and low speed. When the gimbal rotates, the speed is self adaptive based on the current speed mode and the zoom of the visible light camera. As shown in Table 3--5-5-1:

Zoom Speed mode	Low speed	Medium speed	High speed
1x	10r/s	15r/s	20r/s
2x	6r/s	9r/s	12r/s
4x	4r/s	6r/s	8r/s

表 3-5-5-1 云台转动速度

(Note: The data is only used to explain the speed control logic and not the actual speed)

3.5.6 Automatic drift calibration

When used for a period of time or when the ambient temperature changes drastically, the gimbal may drift by a large margin, causing the screen to tilt or manual control inconvenience, and it is necessary to use the automatic calibration command for calibrating it.

4. Use and operation

4.1 Preparation and inspection before use

- Check whether the hanging structure of the dual-light gimbal is normal, whether there is obvious deformation or looseness;
- Check if there is any dirt on the lens, if there is, wipe the lens with a lens cloth;

After installing the gimbal, check whether the mechanical installation

- of the system is normal;
- Check whether the electrical connection of the system is normal;
- Check whether the imaging and functions of the gimbal are normal on the ground side.

4.2 Safety protection, safety signs and instructions during use

During the use of the product, avoid the power supply voltage exceeding the allowable range, and avoid using the product under environmental conditions that exceed the normal working load.

4.3 Operating procedures during use

After the system is normally powered on, use the UAV ground station software to control and operate with the mouse or touch screen.

4.4 Inspection and recording during operation

Record the problems encountered during use and save the corresponding image data.

4.5 Operating procedures, methods and precautions after use

After the product is used, disconnect the system power first, separate the gimbal from the fuselage in a static-free environment, and store it in a dry and ventilated environment. It should be placed in the box if it is not used for a long time.

5. Fault analysis and troubleshooting

If the user encounters a failure when using this product, please follow the solutions shown in the following table to eliminate it. If the failure is not listed in this manual or the failure cannot be solved through the solutions in this manual, please contact the company's Customer Service Department.

No.	Fault	Reason	Solution
1	Completely unable to control the gimbal	 ♦ The control command is invalid; ♦ Wrong docking signal. 	 ✓ Check the communication protocol carefully ✓ Carefully confirm the definition of the docking signal
2	Sometimes there is no video, sometimes the control command does not respond	 ♦ Poor connection of the docking cable; ♦ Broken external cable. 	 ✓ Re-plug the connector ✓ Re-wrap the cables
3	Image is blurred or image quality is degraded	 ♦ The observation target object is too close to the gimbal; ♦ Whether the optical 	 Adjust the observation distance and observe whether the image is clear

focal length is at a	✓ Re-focus the
clear point;	camera
\diamond The optical lens has	✓ Observe the
dirt;	imaging effect after
♦ Serious quality	cleaning the lens with
problems in optical	cotton and alcohol
lenses;	✓ If there is no
♦ other reasons.	improvement, please
	contact the
	manufacturer

6. Product maintenance

6.1 Daily maintenance

- During transportation, please place it in the factory packing box. If there is no packing box, please place the gimbal in a soft environment such as foam
- After the gimbal is used, turn off the system power and unload the gimbal from the drone fuselage, which can extend the effective use time of the drone system
- When the gimbal is stored for a long time or is not working, it should be kept in a cool and dry environment

- Do not use chemical solvents, thinners, etc. to scrub the gimbal cabinet, you can use a clean, soft, dry flannel.
- The lens of the gimbal is an important optical component. During installation and use, avoid oil stains and various chemical substances from contaminating and damaging the surface of the lens. After use, please clean the surface of the lens with a special lens cloth in time, and also pay attention when storing it take protective measures.
- When not in use for a long time, the power should be turned on to check the functions every week. The function, mechanical interface, and electrical interface of the product should be checked every half month, the lens should be cleaned, and the product should be thoroughly checked every month.

6.2 Maintenance procedures and methods

- Use a clean, soft and dry flannel to wipe off dust and other debris on the surface;
- The task load is correctly connected to the drone body, and after confirming that the connection is correct, power on and check;
- After normal work, adjust and test each function through the drone handheld terminal, and make a detailed record of any problems;
- If the fault cannot be eliminated through the method in this manual, please contact our company.

7. Transportation and storage

7.1 Transportation

- After the orderer accepts the qualified product, the manufacturer shall assist the orderer to transport it to the user unit and warehouse for storage in accordance with the provisions of the order contract;
- The quality of shipment and the safety requirements of the transportation process comply with the relevant regulations of the international transportation management department.
- The following items should be paid attention to when loading and unloading products:
 - 1. No matter what kind of loading and unloading method, it can ensure safety and reliability;
 - 2. Strictly comply with the requirements of fireproof, waterproof, and moisture-proof regulations during shipment;
 - 3. Do not transport in the same vehicle with flammable, explosive or corrosive items.
- > Avoid collisions during transportation

7.2 Storage

Products that have passed the experience acceptance, if not shipped immediately, are stored in the finished product turnover warehouse of the contractor. The storage period does not exceed three months. The storage and maintenance of the product during the storage period shall be the responsibility of the contractor. When the ordering party stores it for a long time, the product shall be energized and tested once every six months.

The product is stored in a dry, ventilated, and non-corrosive environment with a temperature of -20 $^\circ\!\!C$ \sim +65 $^\circ\!\!C$ and a relative humidity of not more than 95%.

8. Other introduction

8.1 Packing list and matters needing attention

When unpacking, pay attention to placing the instrument box steadily. Check the packing list one by one. The product packing list is shown in Table 8-1-1:

Name	Quantity	Unit
Gimbal	1	set
AI tracking module	1	set
Video transmitter at the sky side	1	set
Receiver on the ground	1	set
Certificate of quality	1	page
User manual	1	book (electronic edition)
Desiccant	1	bag
Packing box	1	pcs

Table 8-1-1 Packing list



20x zoom gimbal camera



Video transmitter at the sky side



Video transmitter on the ground