

# STAR TRACKER



NST and PST star tracker are a new generation of ultra-small and high-precision attitude sensors designed by Tianyin Interstellar. They have been successfully used in NS-2, Jilin No. 1 video 04-12, high-resolution micro-nano, smart imaging, Laser communications, Chuangxin 06, CE-4 moon formation constellation, Zhuhai Orbit constellation, Microscape constellation, Celestial constellation and other on-orbit satellite applications or selection.

It is divided into NST4S-A2, PST3S, NST10 and other product series according to the quality, solar stray light suppression angle, accuracy and dynamic performance.

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# 154 Sets


on-orbit service  
successfully

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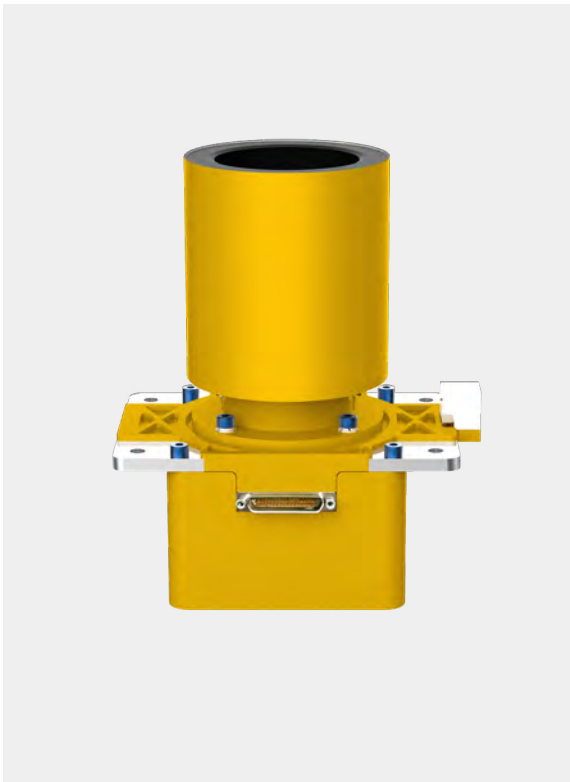
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# MST STAR TRACKER

## NST10-G1 STAR TRACKER

NST10-G1 is a fully autonomous nano high precision attitude sensor, dynamic performance up to 10/s to meet the ultra-high dynamic requirements of satellites.



- Low power consumption(2w)
- Pointing accuracy(5" , 3σ)
- Dynamic performance(10°/s)
- stray light suppression angle

## NST10-G1 Technical parameter

| Dimensions                       |  |
|----------------------------------|--|
| Sensor+Baffle                    | 90 × 90 × 200 ( mm <sup>3</sup> )        |
| Mass                             |  |
| Sensor+Baffle                    | 500g                                     |
| Optical Design                   |  |
| Lens                             | refractive                               |
| Environmental Tolerance          |  |
| Vibration(Flight mode)           | sine 13g, random 12 grms                 |
| Vibration(Qualification testing) | sine 16g, random 18 grms                 |
| Thermal                          | -30~50 ( °C )                            |
| Radiation Hardness               | 30 Krad [Si]                             |
| Performance                      |  |
| Field of View                    | 18° × 18°[effective]                     |
| Attitude Accuracy                | <5" [3σ] pointing      <50" [3σ] rolling |
| Update Rate                      | 20 Hz                                    |
| Slew Rate                        | 10°/s                                    |
| Sensitivity                      | 5.8Mv,Go.Ref star                        |
| Exclusive Angle                  | Sun: < 35°      Earth: < 30°             |
| Data Interface                   |  |
|                                  | RS422/CAN                                |
| Power Consumption                |  |
|                                  | 2W                                       |
| Operating Modes                  |  |
|                                  | Posture output mode, image output mode   |
| Input Voltage Range              |  |
|                                  | 5V                                       |
| Life Time                        |  |
|                                  | 5years                                   |

## NST20-G2 STAR TRACKER

NST20-G2 is a fully autonomous, highly reliable, high-precision, high- dynamic attitude satellite sensor with a dynamic performance of up to 20°/s, which can meet the high dynamic requirements of satellites.

The precision of attitude determination reaches  $3''$   $3\sigma$ , which meets the requirements of satellite attitude control.

A secondary hood is added to ensure that the star sensor can work at an inhibition Angle of 25° and is free from stray light outside 20°.



## PST3S-H1 Technical parameter

### Dimensions

Sensor+Baffle 90 × 100 × 268 (mm<sup>3</sup>)

### Mass

Sensor+Baffle 1200g

### Optical Design

Lens refractive

### Environmental Tolerance

Vibration(Flight mode) sine 13g, random 12 grms

Vibration(Qualification testing) sine 16g, random 18 grms

Thermal -30~50 (°C)

Radiation Hardness 30 Krad [Si]

### Performance

Field of View 15° × 15°[effective]

Attitude Accuracy <3" [3σ] pointing <30" [3σ] rolling

Update Rate 20 Hz

Slew Rate 10°/s

Sensitivity 5.8Mv,Go.Ref star

Exclusive Angle Sun: < 25° Earth: < 20°

### Data Interface

RS422/CAN

### Power Consumption

3.5W

### Operating Modes

Posture output mode, image output mode

### Input Voltage Range

28V

### Life Time

7years

# NST20-G3 STAR TRACKER

The NST20-G3 is a fully autonomous, highly reliable, high-precision and high-dynamic attitude satellite sensor. It has an attitude determination accuracy of 1" (3σ) and a dynamic performance of 5°/s, which meets the requirements of high-precision attitude determination for satellites at high dynamics.

The 25° sun light suppression Angle plus secondary hood ensures that the star sensor can work at 25° sun suppression Angle and is free from stray light interference beyond 20°



## NST20-G3 Technical parameter

### Dimensions

Sensor+Baffle 90 × 100 × 248 ( mm<sup>3</sup> )

### Mass

Sensor+Baffle 1200g

### Optical Design

Lens refractive

### Environmental Tolerance

Vibration(Flight mode) sine 13g, random 12 grms

Vibration(Qualification testing) sine 16g, random 18 grms

Thermal -30~50 ( °C )

Radiation Hardness 30 Krad [Si]

### Performance

Field of View 15° × 15°[effective]

Attitude Accuracy <1" [3σ] pointing <6" [3σ] rolling

Update Rate 20 Hz

Slew Rate 5°/s

Sensitivity 5.8Mv,Go.Ref star

Exclusive Angle Sun: < 25° Earth: < 20°

### Data Interface

RS422/CAN

### Power Consumption

3.5W

### Operating Modes

Posture output mode, image output mode

### Input Voltage Range

28V

### Life Time

7years

# NST STAR TRACKER

## NST4S-A2 STAR TRACKER

NST4S-A2 Is a fully autonomous ultra small high precision attitude sensor, The 25' sun exclusion angle plus the secondary baffle

guarantees that the star tracker will work at 25' and outside the 20 is not disturbed by stray light.



## NST4S-A2 Technical parameter

### Dimensions

Sensor+Baffle 57 × 57 × 182 ( mm<sup>3</sup> )

### Mass

Sensor+Baffle 350g

### Optical Design

Lens refractive

### Environmental Tolerance

Vibration(Flight mode) sine 13g, random 12 grms

Vibration(Qualification testing) sine 16g, random 18 grms

Thermal -30~40 ( °C )

Radiation Hardness 30 Krad [Si]

### Performance

Field of View 15° × 18°[effective]

Attitude Accuracy <3" [3σ] pointing <30" [3σ] rolling

Update Rate 10 Hz

Slew Rate 3°/s

Sensitivity 5.8Mv,Go.Ref star

Exclusive Angle Sun: < 25° Earth: < 20°

### Data Interface

RS422/CAN

### Power Consumption

0.8W

### Operating Modes

Posture output mode, image output mode

### Input Voltage Range

5V

### Life Time

7years

# PST STAR TRACKER

The leather star sensor is currently the world's smallest and lightest low-power, fully autonomous system high-precision star sensor. Customizable design can meet a variety of application requirements. At present, OCE's latest PST3 series products, PST3S-H1 and PST3S-H2, have undergone a new upgrade in product performance.

## PST3S-H1 STAR TRACKER

### Features

- Small volume;
- Low power consumption: 0.7w;
- The 35-degree sun suppression angle and secondary shading ensure the normal operation of the star sensor under stray light. The installation method and sun suppression angle can be customized to be designed for a variety of application requirements;
- Single chip system based on electronic design pattern;
- Radiation resistant design;
- 5-year service life.



## PST3S-H1 Technical parameter

| Dimensions                       |  |
|----------------------------------|--|
| Sensor+Baffle                    | 35.5 × 35.5 × 134 ( mm <sup>3</sup> )    |
| Mass                             |  |
| Sensor+Baffle                    | 130g                                     |
| Optical Design                   |  |
| Lens                             | refractive                               |
| Environmental Tolerance          |  |
| Vibration(Flight mode)           | sine 13g, random 12 grms                 |
| Vibration(Qualification testing) | sine 16g, random 18 grms                 |
| Thermal                          | -30~40 ( °C )                            |
| Radiation Hardness               | 20 Krad [Si]                             |
| Performance                      |  |
| Field of View                    | 15° × 18°[effective]                     |
| Attitude Accuracy                | <3" [3σ] pointing      <30" [3σ] rolling |
| Update Rate                      | 10 Hz                                    |
| Slew Rate                        | 3°/s                                     |
| Sensitivity                      | 5.8Mv,Go.Ref star                        |
| Exclusive Angle                  | Sun: < 35°      Earth: < 30°             |
| Data Interface                   |  |
|                                  | RS422/CAN                                |
| Power Consumption                |  |
|                                  | 0.7W                                     |
| Operating Modes                  |  |
|                                  | Posture output mode, image output mode   |
| Input Voltage Range              |  |
|                                  | 5V                                       |
| Life Time                        |  |
|                                  | 5years                                   |



# PST3S-H2 STAR TRACKER

## Features

- Small volume;
- Low power consumption: 0.7w;
- The 35 degree solar suppression angle, installation method and solar suppression angle can be customized design suitable for a variety of application requirements;
- Single chip system based on electronic design pattern;
- Radiation resistant design;
- 3 years service life.



# PST3S-H2 Technical parameter

## Dimensions

Sensor+Baffle 33 × 33 × 96 ( mm<sup>3</sup> )

## Mass

Sensor+Baffle 85g

## Optical Design

Lens refractive

## Environmental Tolerance

Vibration(Flight mode) sine 13g, random 12 grms

Vibration(Qualification testing) sine 16g, random 18 grms

Thermal -30~40 ( °C )

Radiation Hardness 20 Krad [Si]

## Performance

Field of View 15° × 18°[effective]

Attitude Accuracy <5" [3σ] pointing <50" [3σ] rolling

Update Rate 10 Hz

Slew Rate 3°/s

Sensitivity 5.8Mv,Go.Ref star

Exclusive Angle Sun: < 35° Earth: < 30°

## Data Interface

RS422/CAN

## Power Consumption

0.7W

## Operating Modes

Posture output mode, image output mode

## Input Voltage Range

5V

## Life Time

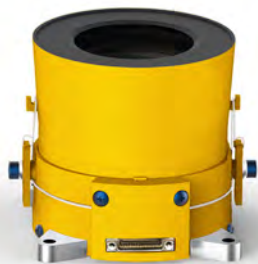
3years

OCE's latest PST3 series new products, PST3S-K3 and PST3S-K4, are designed in an on-orbit deployment and are professionally configured for cubic star and other micro-nano satellites.

# PST3S-K3 STAR TRACKER

## Features

- The hood can be expanded;
- Low power consumption: 1W;
- The star sensor hood can be deployed in orbit. The star sensor hood is compressed when the hood is not deployed. The total length of the star sensor is less than 50mm, which is suitable for cubic star layout;
- Single chip system based on electronic design pattern;
- Radiation resistant design;
- 5-year service life.



## PST3S-K3 Technical parameter

| Dimensions                       |  |                   |
|----------------------------------|--|-------------------|
| Sensor+Baffle                    | The baffle is not expanded:<br>69 × 69 × 50 ( mm <sup>3</sup> )<br>The baffle is expanded:<br>69 × 69 × 95 ( mm <sup>3</sup> ) |                   |
| Mass                             |  |                   |
| Sensor+Baffle                    | 110g   |                   |
| Optical Design                   |  |                   |
| Lens                             | refractive   |                   |
| Environmental Tolerance          |  |                   |
| Vibration(Flight mode)           | sine 13g, random 12 grms   |                   |
| Vibration(Qualification testing) | sine 16g, random 18 grms   |                   |
| Thermal                          | -30~40 ( °C )  |                   |
| Radiation Hardness               | 20 Krad [Si]   |                   |
| Performance                      |  |                   |
| Field of View                    | 15° × 18°[effective]   |                   |
| Attitude Accuracy                | <3" [3σ] pointing  | <30" [3σ] rolling |
| Update Rate                      | 10 Hz  |                   |
| Slew Rate                        | 3°/s   |                   |
| Sensitivity                      | 5.8Mv,Go.Ref star  |                   |
| Exclusive Angle                  | Sun: < 35°   | Earth: < 30°      |
| Data Interface                   |  |                   |
|                                  | RS422/CAN  |                   |
| Power Consumption                |  |                   |
|                                  | 1W   |                   |
| Operating Modes                  |  |                   |
|                                  | Game output mode, image output mode  |                   |
| Input Voltage Range              |  |                   |
|                                  | 5V   |                   |
| Life Time                        |  |                   |
|                                  | 5years   |                   |

# PST3S-K4 STAR TRACKER

## Features

- Ultra small;
- Low power consumption: 0.9w;
- The star sensor hood can be deployed in orbit, and the star sensor hood is compressed in the ground state. In the compressed state, the overall envelope of the star sensor is less than  $40 \times 40 \times 34.6 \text{ mm}^3$ . The ultra-small star sensor is convenient for layout and saves space;
- Radiation resistant design;
- 3 years service life.



# PST3S-K4 Technical parameter

## Dimensions

|               |  |
|---------------|--|
| Sensor+Baffle | The baffle is not expanded:<br>$40 \times 40 \times 34.6 \text{ (mm}^3\text{)}$<br>The baffle is expanded:<br>$40 \times 40 \times 75.7 \text{ (mm}^3\text{)}$ |
|---------------|--|

## Mass

|               |     |
|---------------|-----|
| Sensor+Baffle | 60g |
|---------------|-----|

## Optical Design

|      |            |
|------|------------|
| Lens | refractive |
|------|------------|

## Environmental Tolerance

|                                  |                          |
|----------------------------------|--------------------------|
| Vibration(Flight mode)           | sine 13g, random 12 grms |
| Vibration(Qualification testing) | sine 16g, random 18 grms |
| Thermal                          | -30~40 ( °C )            |
| Radiation Hardness               | 20 Krad [Si]             |

## Performance

|                   |  |                               |
|-------------------|--|-------------------------------|
| Field of View     | $15^\circ \times 15^\circ$ [effective] |                               |
| Attitude Accuracy | $<5''$ [3 $\sigma$ ] pointing          | $<50''$ [3 $\sigma$ ] rolling |
| Update Rate       | 10 Hz                                  |                               |
| Slew Rate         | 3°/s                                   |                               |
| Sensitivity       | 5.8Mv,Go.Ref star                      |                               |
| Exclusive Angle   | Sun: $< 35^\circ$                      | Earth: $< 30^\circ$           |

## Data Interface

RS422/CAN

## Power Consumption

0.9W

## Operating Modes

Game output mode, image output mode

## Input Voltage Range

5V

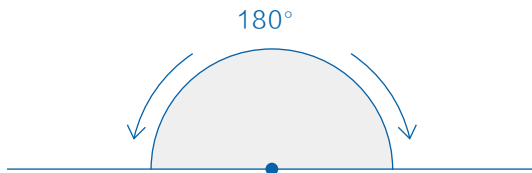
## Life Time

3years

# SUN SENSOR

## SUN SENSOR

High-precision sun sensors are the most widely used sensors in the aerospace industry.



| Parameter Type                   | Technical index          |
|----------------------------------|--------------------------|
| Attitude Accuracy                | 0.1° ( 3 σ )             |
| Update Rate                      | 10Hz                     |
| Field of View                    | 180° × 180°              |
| Dimensions (mm3)(L × W × H)      | 34.5 × 34.5 × 39.2       |
| Mass                             | 57g                      |
| Power Consumption                | 0.6W                     |
| Vibration(Flight mode)           | sine 13g, random 12 grms |
| Vibration(Qualification testing) | sine 16g, random 18 grms |
| Thermal                          | -30°C ~ +40°C            |
| Radiation Hardness               | 20Krad ( Si )            |
| Data Interface                   | RS422/CAN                |
| Life Time                        | 5years                   |

# STAR SIMULATOR

## OPTICAL STAR SIMULATOR

Optical star pattern simulator is a simple instrument testing functioning and performance of star tracker. Can be used under environmental

experiments such as thermal vacuum and thermal cycling. Perform star tracker polarity and data stability testing. It is an important instrument in star tracker development and satellite application testing.



| Parameter Type            | Technical index   |
|---------------------------|---|
| Simulator'Sfield of View  | 15° × 15°   |
| Number of simulated stars | >15 pieces  |
| Simulated sky area        | North celestial pole(customizable)                          |
| Starlight type            | LEDUniform lighting   |
| Dimensions                | Φ65mm × 73mm  |
| Mass                      | 108g  |
| Connection method         | Standard configuration according to the type of star sensor |

# DYNAMIC STAR SIMULATOR

Dynamic star simulator is an instrument for function and performance test with star sensor. It can be used in the environment experiments such as thermal vacuum and atmospheric thermal cycle, and it is an important instrument in the development and satellite application testing of the star tracker.

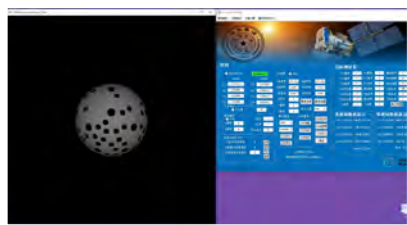


| Parameter Type            | Technical index              |
|---------------------------|------------------------------|
| Simulator's field of View | 20° × 20°                    |
| Simulated magnitude       | 2 ~ 6.5 Mv                   |
| Ejection accuracy         | 30" ( 3σ )                   |
| Display update rate       | > 40Hz                       |
| Ejection accuracy         | 1400 × 140                   |
| Dimensions                | 200mm × 100mm × 100mm        |
| Thermal                   | -40°C ~ 45°C                 |
| Life Time                 | 3years ( Time accumulation ) |

## New test system simplifies interface and operation.



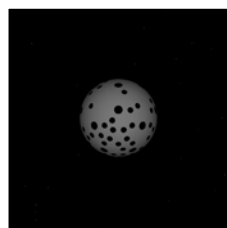
Star TRACKER+Dynamic star simulator  
+Image acquisition system



Dynamic star chart simulation software



Star tracker's Host computer  
+Image acquisition software



The star tracker test system is mainly composed of a star tracker, a star simulator, an image acquisition card, and supporting circuits. The main function is to simulate the working principle and state of star tracker in orbit. With the star tracker upper computer and image acquisition software, the indicators of star tracker can be visually displayed in real-time, and the working principle of the star tracker is better displayed by combining images and data. Communication interface: USB3.0 image transfer rate: 8 fps Weight: less than 3 kg

### Dynamic star simulator's the main function:

- 1) Simulate the starry sky in any sky area;
- 2) Simulation of objects with different shapes;
- 3) Moon simulation;
- 4) Jammer simulation;

### Star tracker's the main function:

- 1) Attitude calculation output;
- 2) Image output;

### Image acquisition system's the main function:

- 1) Image Acquisition;



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