File number	Piece number

File Number TYS-HSTA1-IDS

Stage mark FM

Page 18

HST-A1 Star Tracker IDS

Signature

Edit ： FUSHUXIN

Proofreading ： FANWEI

Check ： WANG HONGQIANG

Standard check： LI YANAN

Approval ： WANGHAIJUN

TY-Space Technology (Beijing) Ltd.

IDS 1：Performance Index

	File number	TYS-HSTA1-IDS				
	Sub-system name					
	Device name	HSTA1 Star Tracker	Stage mark			
	Device code				FM	

Attitude Accuracy	Pointing: 0.3″ (3 σ) Rolling: 5″ (3 σ)
Dynamic Range	@ 0.1°/s: 0.3″ (Pointing, 3 σ); 5″ (Rolling, 3 σ); @0.5°/s: 1″ (Pointing, 3 σ); 15″ (Rolling, 3 σ); @1.0°/s: 1.5″ (Pointing, 3 σ); 20″ (Rolling, 3 σ); @ 1.5° /s: follow up
Field of View	≥5.5° ×5.5°
Update Rate	≥10Hz
Acquisition Rate	Max. ≤2s
Start-up Time	Better than 5s
Exclusive Angle	Sun:better than 30°;
Timing Accuracy	±1μs @ synchronization pulse（PPS Signal）
Quaternion Continuity	the scalar of quaternion: non-negative
Communication	RS422
Image Output	Cameralink
Life Time	7years @LEO Orbit
Reliability	≥0.98 @ the end of 7 years running

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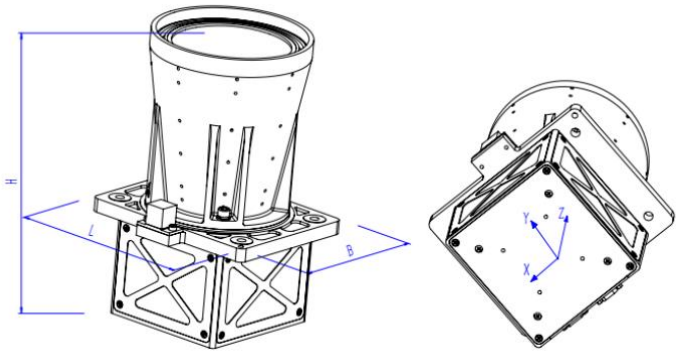
IDS 2：Mechanical Characteristics-Body

			File number	TYS-HSTA1-IDS				
			Sub-system name					
			Device name	HSTA1 Star Tracker	Stage mark			
			Device code				FM	
Device weight[note] 4kg±0.3kg			Device number：1			√		
Weight characteristics	Envelope size mm	Envelope：140±1×125±1		Height：212±2		√		
	Centroid position mm	X：-0.357	Y：-0.24	Z：117.992		√		
	Inertia of centroid kg.mm^2	P_X = 17195.736	P_Y =17212.202	P_Z =6331.998		√		
					Measure-ment	Calc-ulation	Esti-mate	
Installation characteristics	Installed holes number：4	Size of installed holes（tolerance）mm：Φ6.5±0.1		Material:2A12-T4	Determination method（√）			
	Installation contacting area mm^2 ：5680	Note：						
	Installation surface flatness：0.1mm							
	Installation surface roughness Ra μm: 3.2μm							
	Installation surface flatness：0.1mm/100mm×100mm							
	Installation surface state：the installation area is oxidized by conduction, and the remaining area is oxidized black.							

Parameter relationship diagram:
Note: the determination method refers to the way to determine the weight of device.



Note：The origin of the coordinates lies in the geometric center of the outer surface of the lower shell (see "Instrument diagram");

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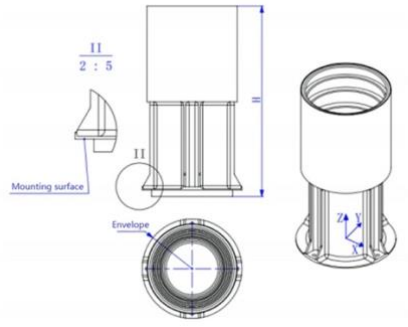
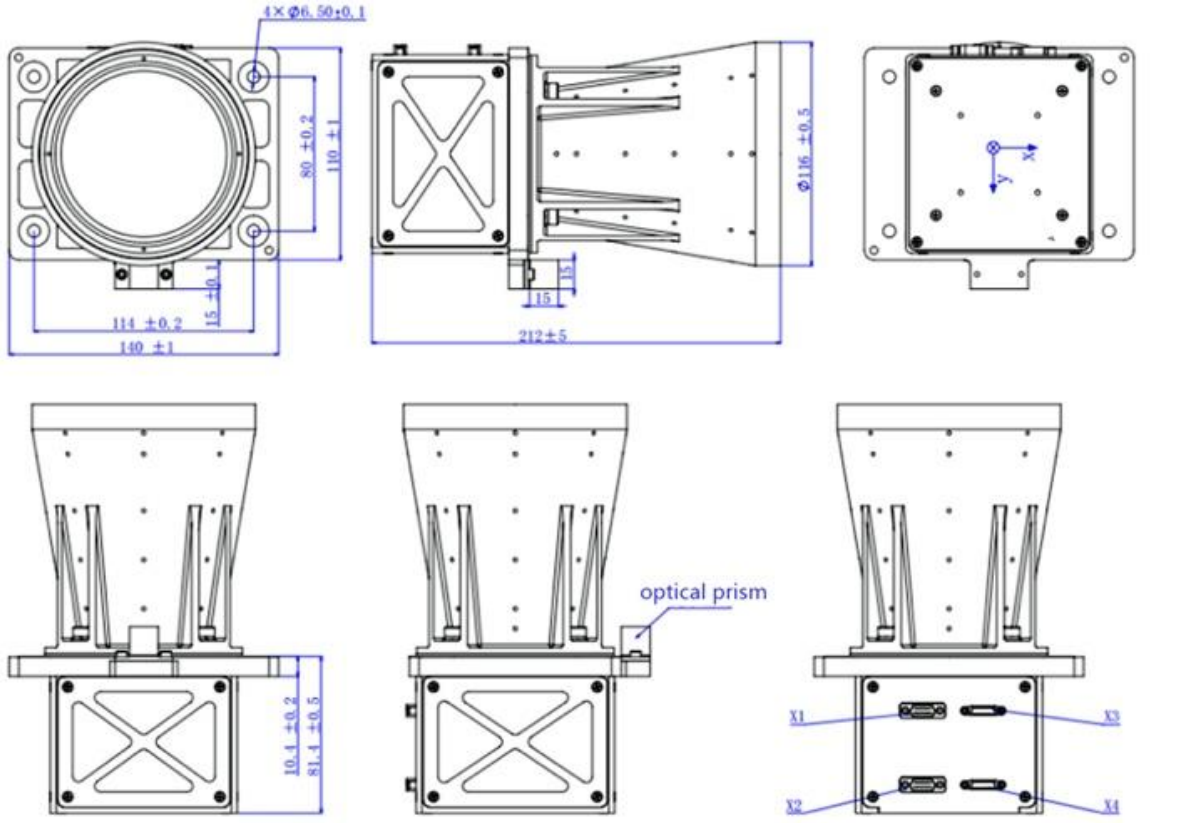
IDS 3：Mechanical Characteristics-Baffle

<table>
<tr><td colspan="3" rowspan="4"></td><td>File number</td><td colspan="2">TYS-HSTA1-IDS</td><td colspan="3"></td></tr>
<tr><td>Sub-system name</td><td colspan="2"></td><td colspan="3"></td></tr>
<tr><td>Device name</td><td colspan="2">HSTA1 Star Tracker</td><td colspan="3">Stage mark</td></tr>
<tr><td>Device code</td><td colspan="2"></td><td></td><td>FM</td><td></td></tr>
<tr><td colspan="3">Device weight[note] 0.72kg±0.02kg</td><td colspan="2">Device number：1</td><td></td><td>√</td><td></td></tr>
<tr><td rowspan="4">Weight characteristics</td><td>Envelope size mm</td><td colspan="2">Envelope：155±2</td><td>Height：297±5</td><td></td><td>√</td><td></td></tr>
<tr><td>Centroid position mm</td><td>X：0</td><td>Y：0</td><td>Z：112.184</td><td></td><td>√</td><td></td></tr>
<tr><td rowspan="2">Inertia of centroid kg.mm²</td><td rowspan="2">P_X = 6635.851</td><td rowspan="2">P_Y =6635.851</td><td rowspan="2">P_Z =2837.181</td><td></td><td>√</td><td></td></tr>
<tr><td>Mea-sure-ment</td><td>Calc-ulatio-n</td><td>Esti-mate</td></tr>
<tr><td rowspan="5">Installation characteristics</td><td>Installed holes number：4</td><td colspan="2">Size of installed holes（tolerance） mm：Φ5.4±0.1</td><td>Material:2A12-T4</td><td colspan="3">Determination method（√）</td></tr>
<tr><td colspan="2">Installation contacting area mm² ： 6300</td><td colspan="5" rowspan="4">Note：</td></tr>
<tr><td colspan="2">Installation surface flatness：0.1mm</td></tr>
<tr><td colspan="2">Installation surface roughness Ra μm: 3.2μm</td></tr>
<tr><td colspan="2">Installation surface flatness：0.1mm/100mm×100mm</td></tr>
<tr><td colspan="2">Installation surface state：the installation area is oxidized by conduction, and the remaining area is oxidized black.</td></tr>
<tr><td colspan="8">Parameter relationship diagram:
Note: the determination method refers to the way to determine the weight of device.
 

Note：The origin of the coordinates lies in the geometric center of the outer surface of the lower shell (see "Instrument diagram");</td></tr>
<tr><td colspan="3">Edited（Date）：</td><td></td><td></td><td colspan="3"></td></tr>
<tr><td colspan="3">Signed（Date）：</td><td colspan="2">Mark</td><td>Changed number</td><td colspan="2">Signature, date</td></tr>
</table>

IDS 4：Instrument Diagram-Body

	File number	TYS-HSTA1-IDS				
	Sub-system name					
	Device name	HSTA1 Star Tracker	Stage mark			
	Device code				FM	



Note: This sketch should include body size, mounting size, mounting plane, mounting point (aperture and its tolerances, center distance and its tolerances), position tolerances for guide pins and holes, direction, location, type and number of electrical connectors , the operating hole, the lap (position and length), the registration measurement reference for calibration and testing.

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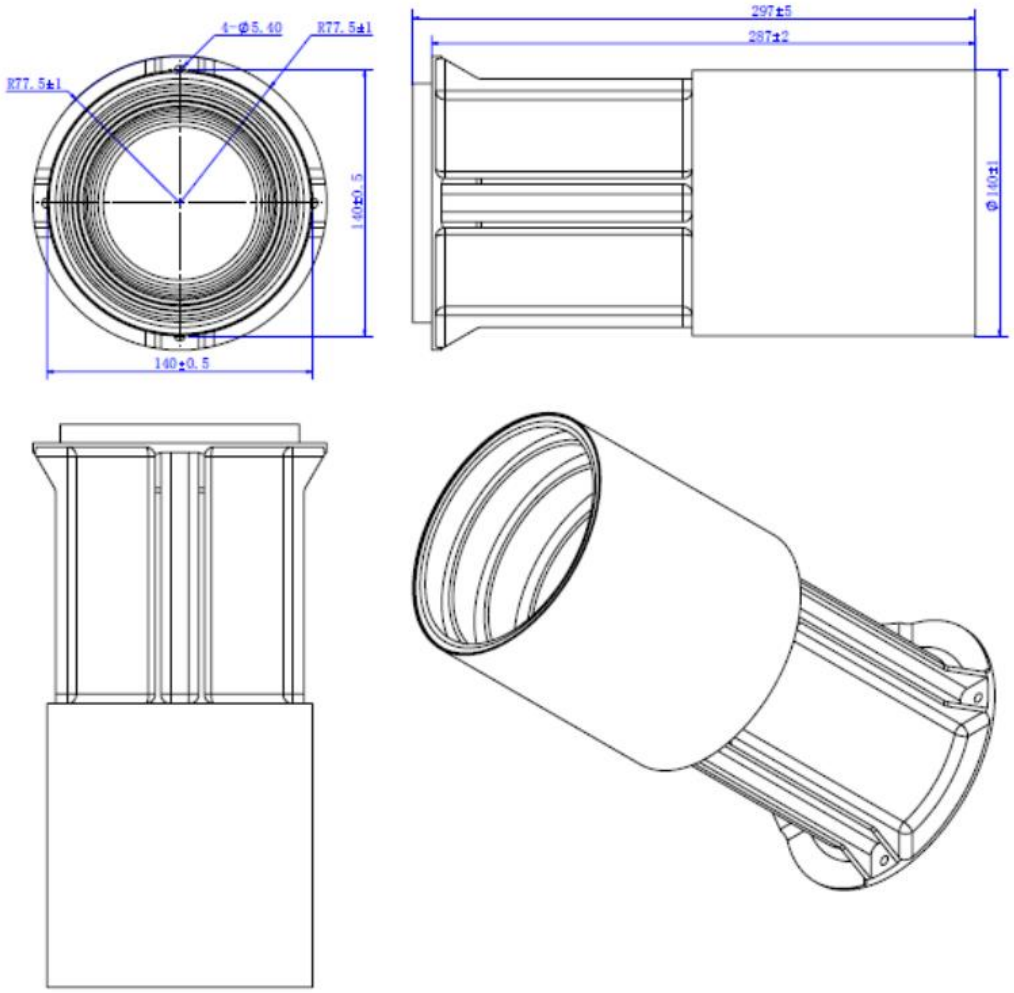
Signed（Date）：	Mark	Changed number	Signature, date

IDS 5：Instrument Diagram-Baffle

	File number	TYS-HSTA1-IDS				
	Sub-system name					
	Device name	HSTA1 Star Tracker	Stage mark			
	Device code				FM	



Note: This sketch should include body size, mounting size, mounting plane, mounting point (aperture and its tolerances, center distance and its tolerances), position tolerances for guide pins and holes, direction, location, type and number of electrical connectors , the operating hole, the lap (position and length), the registration measurement reference for calibration and testing.

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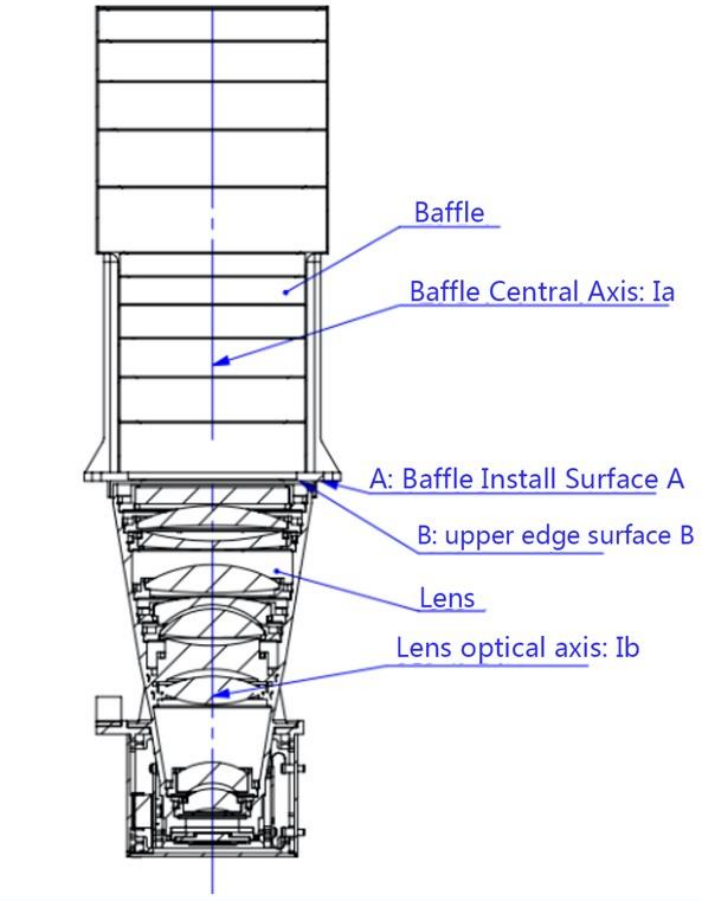
IDS 6：Instrument Diagram-Entirety

	File number	TYS-HSTA1-IDS				
	Sub-system name					
	Device name	HSTA1 Star Tracker	Stage mark			
	Device code				FM	



Note:

1.Baffle Central Axis Ia and Lens optical axis Ib share the axis,angle Error±0.5°.

2.Baffle Install Surface A and upper edge surface B is Parallel installation,the gap between the two reference plane is 2mm.

3.A support should be designed for star tracker body and baffle in a whole.

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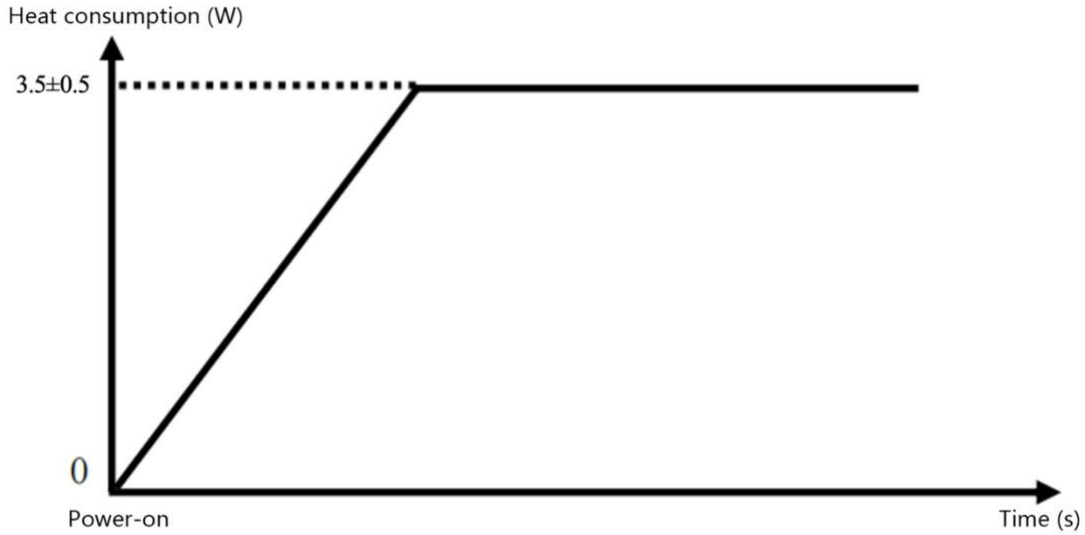
IDS 7：Thermal characteristics

	File number	TYS-HSTA1-IDS				
	Sub-system name					
	Device name	HSTA1 Star Tracker	Stage mark			
	Device code				FM	

Surface (except for mounting surface)	Aluminum alloy（2A12-T4）	Note: The inner surface of the baffle is treated with ultra black coating，ε_H：≥0.85，α_S：≥0.96
	Outside surface treatment: Black anodized	
	ε_H：≥0.85	
	Preparing state heat consumption W：0（per device）	

Electronic Start temperature ℃：-30~+40	Storage temperature range ℃：-10~+30	Heat capacity J/K：4000
Electronic Operating temperature range ℃：-30~+40	The best operating temperature range ℃：20±0.5	
Lens Operating temperature range ℃：-10~+30	Operating relative humidity range：≤60 %	
Operating state heat consumption W：3.5±0.5W（per device）	Storage relative humidity range：≤70 %	

Description:



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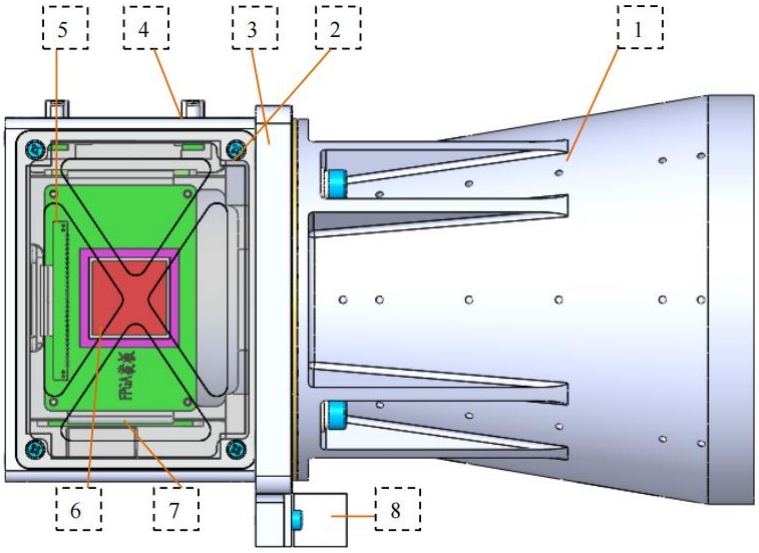
IDS 8：Thermal Diagram

	File number	TYS-HSTA1-IDS				
	Sub-system name					
	Device name	HSTA1 Star Tracker	Stage mark			
	Device code				FM	

Diagram：



1－Lens
2－Circuit box
3－Installing lugs（Contact surfaces）
4－Connector
5－Image processing circuit board
6－Image sensor & Circuit board
7－Power circuit board
8、Prism

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IDS 9：Power

	File number	TYS-HSTA1-IDS				
	Sub-system name					
	Device name	HSTA1 Star Tracker	Stage mark			
	Device code				FM	

Working mode (long term/short term/others）	Long term	Single non-long-term power-up working hours S		Device number	1

Voltage V	Voltage stability %	Ripple voltage mV （P-P）	Device starting current characteristics （peak/duration）	Power W
28	5%	300	2A/5ms	3.5±0.5

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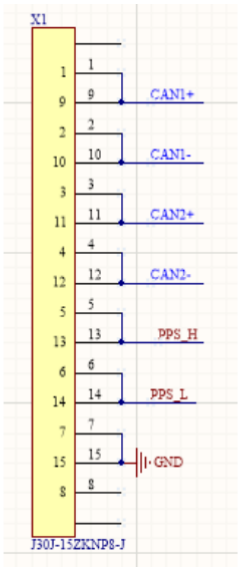
IDS 10: Electrical Connector Contact Assignment-X1

	File number	TYS-HSTA1-IDS					
	Sub-system name						
	Device name	HSTA1 Star Tracker		Stage mark			
	Device code					FM	

Name (by function)	X1 Communication Interface	Electrical connector code	J30J-15ZKNP8-J	Needle / Hole	Hole

Contact number	Signal (function) description	Voltage/V	Current/A	Polar	Remarks (shielded / twisted)
1,9	CAN1+	CAN2.0B Standard	CAN2.0B Standard	CAN1 Transmit+	1,2 twisted
2,10	CAN1-			CAN1 Transmit-	9,10 twisted
3,11	CAN2+	CAN2.0B Standard	CAN2.0B Standard	CAN2 Transmit+	3,4 twisted
4,12	CAN2-			CAN2 Transmit-	11,12twisted
5,13	PPS_H	RS422 Standard	RS422 Standard	PPS Receive+	5,6 twisted
6,14	PPS_L			PPS Receive-	13,14 twisted
7,15	GND	0V			two-point two-wire
8	none				



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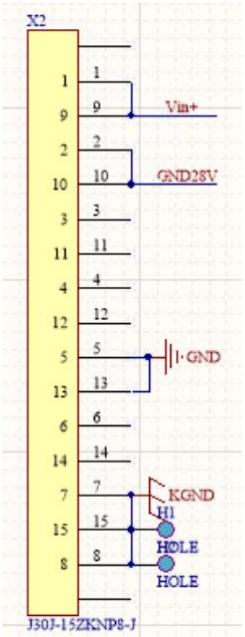
Signed (Date):	Mark	Changed number	Signature, date

IDS 11: Electrical Connector Contact Assignment-X2

	File number	TYS-HSTA1-IDS		
	Sub-system name			
	Device name	HSTA1 Star Tracker	Stage mark	
	Device code			FM

Name (by function)	X1 Power Connector	Electrical connector code	J30J-15ZKNP8-J	Needle / Hole	Hole

Contact number	Signal (function) description	Voltage/ V	Current/ A	Polar	Remarks (shielded / twisted)
1,9	Vin+供电正（一次电源）	26~32V	≤0.23A	+	1,2 twisted 9,10 twisted
2,10	GND28V Negative power（one time Power Supply）	0	0	-	
5，13	Second ground GND	0	0	-	two-point two-wire
7，8，15	Structure Ground KGND	0	0	-	three-point three-wire
3，4，6，11，12，14	none			-	



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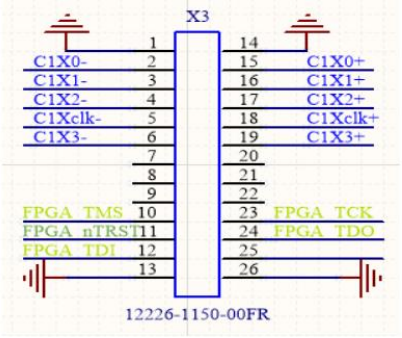
IDS 12: Electrical Connector Contact Assignment-X3

	File number	TYS-HSTA1-IDS	
	Sub-system name		
	Device name	HSTA1 Star Tracker	Stage mark
	Device code		FM

Name (by function)	X3	Electrical connector code	12226-1150-00FR	Needle / Hole	Hole

Contact number	Signal (function) description	Voltage/V	Current/A	Polar	Remarks (shielded / twisted)
5	C1Xclk-	LVDS Standard	LVDS Standard	Camera-Link1 Xclk-	Twisted shielded
18	C1Xclk+			Camera-Link1 Xclk+	
2	C1X0-	LVDS Standard	LVDS Standard	Camera-Link1 X0-	Twisted shielded
15	C1X0+			Camera-Link1 X0+	
3	C1X1-	LVDS Standard	LVDS Standard	Camera-Link1 X1-	Twisted shielded
16	C1X1+			Camera-Link1 X1+	
4	C1X2-	LVDS Standard	LVDS Standard	Camera-Link1 X2-	Twisted shielded
17	C1X2+			Camera-Link1 X2+	
6	C1X3-	LVDS Standard	LVDS Standard	Camera-Link1 X3-	Twisted shielded
19	C1X3+			Camera-Link1 X3+	
10	FPGA_TM			FPGA_TMS	Internal use, prohibit external use
11	FPGA_nTRST			FPGA_nTRST	
12	FPGA_TDI			FPGA_TDI	
23	FPGA_TCK			FPGA_TCK	
24	FPGA_TDO			FPGA_TDO	
1.13.14.26	GND	0	0		Second ground
7,8,9,20,21 ,22	None				



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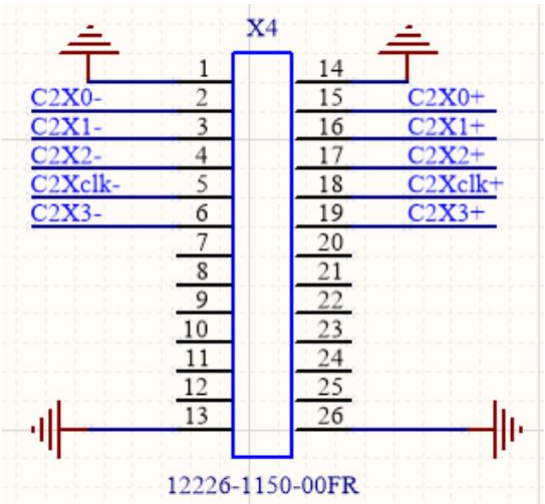
IDS 13: Electrical Connector Contact Assignment-X4

	File number	TYS-HSTA1-IDS	
	Sub-system name		
	Device name	HSTA1 Star Tracker	Stage mark
	Device code		FM

Name (by function)	X4	Electrical connector code	12226-1150-00FR	Needle / Hole	Hole

Contact number	Signal (function) description	Voltage/V	Current/A	Polar	Remarks (shielded / twisted)
5	C2Xclk-	LVDS Standard	LVDS Standard	Camera-Link2 Xclk-	Twisted shielded
18	C2Xclk+			Camera-Link2 Xclk+	
2	C2X0-	LVDS Standard	LVDS Standard	Camera-Link2 X0-	Twisted shielded
15	C2X0+			Camera-Link2 X0+	
3	C2X1-	LVDS Standard	LVDS Standard	Camera-Link2 X1-	Twisted shielded
16	C2X1+			Camera-Link2 X1+	
4	C2X2-	LVDS Standard	LVDS Standard	Camera-Link2 X2-	Twisted shielded
17	C2X2+			Camera-Link2 X2+	
6	C2X3-	LVDS Standard	LVDS Standard	Camera-Link2 X3-	Twisted shielded
19	C2X3+			Camera-Link2 X3+	
1,13,14,26	GND	0	0		Second ground
7,8,9,10,11, 12,20,21,22, 23,24,25	None				



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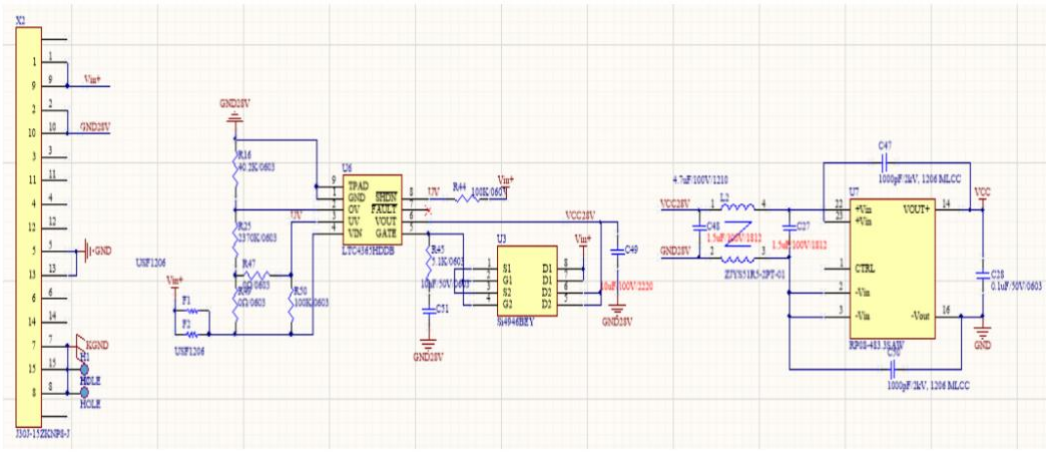
IDS 14: Electrical Interface Features-Power

	File number	TYS-HSTA1-IDS				
	Sub-system name					
	Device name	HSTA1 Star Tracker	Stage mark			
	Device code				FM	

Interface signal	Power supply
Signal characteristics	28V power and the ground are two-point two-wire.
Interface Circuit	
Explanation	

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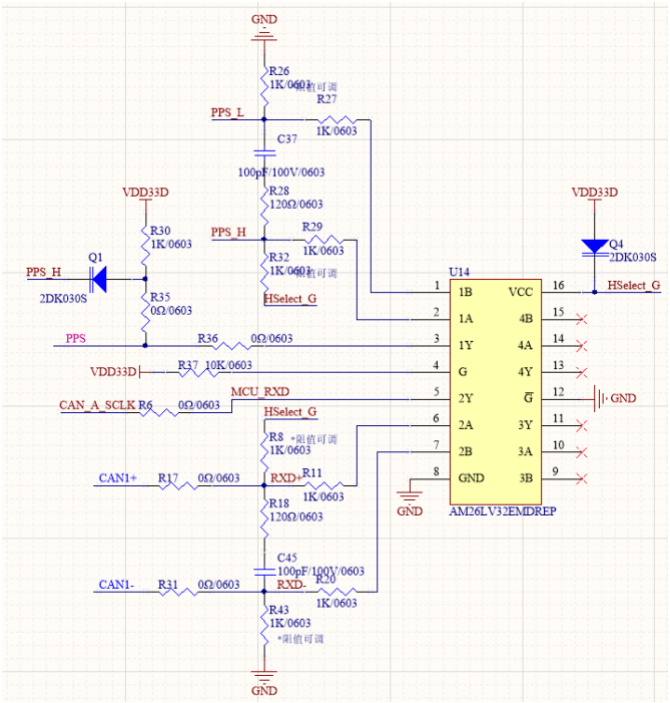
IDS 15: Electrical Interface Features-Second Pulse(Different)

	File number	TYS-HSTA1-IDS	
	Sub-system name		
	Device name	HSTA1 Star Tracker	Stage mark
	Device code		FM

Interface signal	Different second pulse
Signal characteristics	@Different second pulse, the second integer is aligned by the lower edge, and the negative pulse width is 1ms.
Interface Circuit	Seconds pulse circuit 
Explanation	R30、R35、Q1 are not weld @Different second pulse

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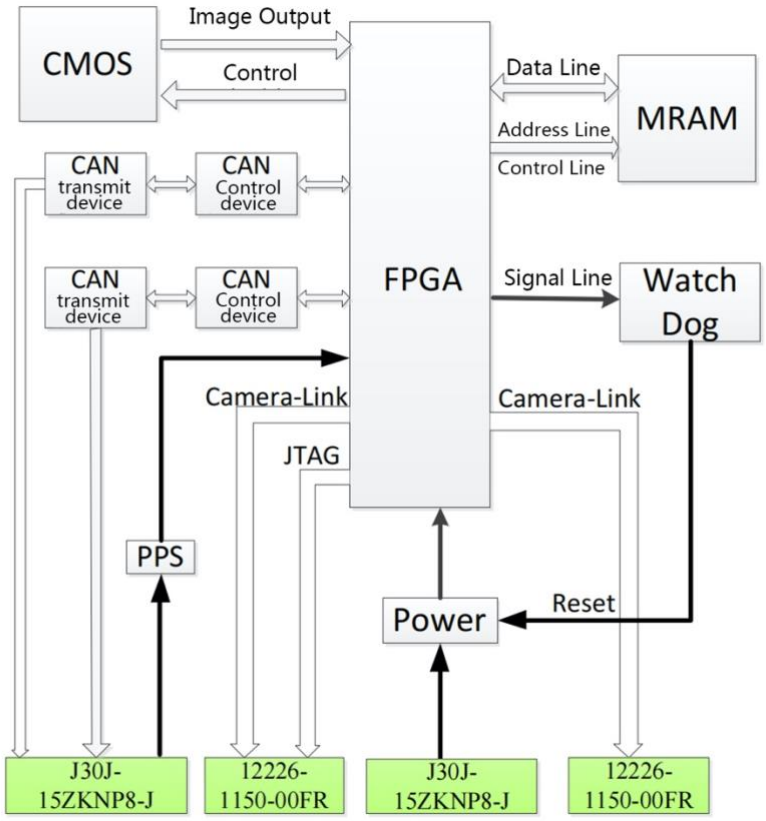
IDS 16：Circuit and Interface Schematics

	File number	TYS-HSTA1-IDS				
	Sub-system name					
	Device name	HSTA1 Star Tracker	Stage mark			
	Device code				FM	

Simplified diagram：



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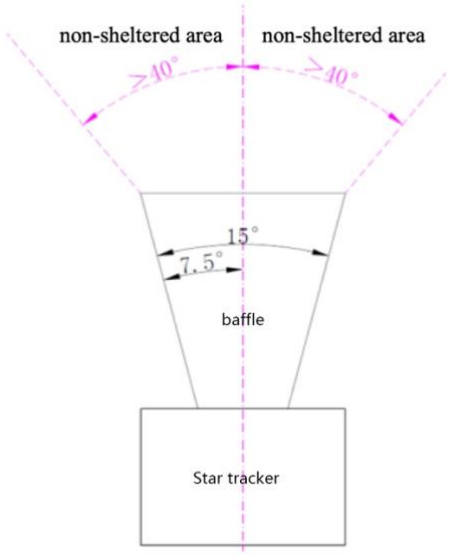
IDS 17：Installation requirements

	File number	TYS-HSTA1-IDS		
	Sub-system name			
	Device name	HSTA1 Star Tracker	Stage mark	
	Device code			F M



Be sure: Nothing sheltered in the field of view: the circular cone of 80° around the top of the Baffle.

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Signed (Date):	Mark	Changed number	Signature, date