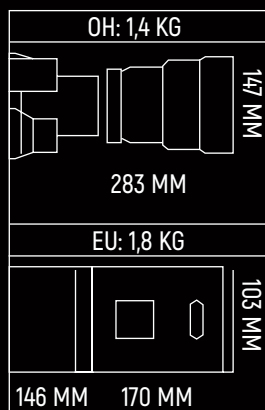


HYDRA BASELINE

THE MOST VERSATILE HIGH-END HYDRA STAR TRACKER



- PROVEN PERFORMANCE, ACCURACY AND ROBUSTNESS
- FLIGHT-PROVEN (TRL9) SINCE 2012 • EMBEDDED FDIR FUNCTIONS
- HIGHLY MODULAR SOLUTION: 1 TO 4 OPTICAL HEADS CONNECTED TO 1 OR 2 ELECTRONICS UNITS
- EXTRA MASS & COST OPTIMIZATION AT SYSTEM LEVEL
- 500+ OPTICAL HEAD IN ORBIT



ACCURACY AND PERFORMANCES

RELIABILITY AND LIFETIME

INTERFACES

ENVIRONMENTS

KEY FEATURES

- Up to 4 Optical Heads (OH) connected to spacecraft's on-board computer through SpaceWire interface (MIL 1355) with up to 8m- long cables
- HAS-2 CMOS sensor with Thermo-Electric Cooler (TEC)
- Electronics unit embedded software processes multiple OH data and delivers a fused quaterniion • Optics made of rad-hard materials
- Export control EU Dual Use 7A004a - ITAR Free
- EU available in option with additional shielding for GEO missions

END OF LIFE WORST CONDITIONS DATA

Bias	<11 arcsec
Thermo-elastic error	<0.055 arcsec/°C
Low Frequency Spatial Error @ 3σ	0.6 arcsec (XY) 4.6 arcsec (Z)
High Frequency Spatial Error @ 3σ	3.4 arcsec (XY) 27 arcsec (Z)
Temporal noise @ 3σ	2.3 arcsec (XY) 18 arcsec (Z)
Slew rate	≤5 deg/s in Acquisition ≤8 deg/s in Tracking
Acceleration	≤2 deg/s² in Acquisition ≤10 deg/s² in Tracking (30Hz)
Time from lost-in-space	2.2s typ
Sun/Earth Exclusion Angle	26 deg / 18.5 deg

No performance degradation with full moon in the field of view

EEE parts class	Level 1 & Level 2
Reliability (MIL-HDBK-217F @ 30°C)	Level 1: 110FIT (OH) 585FIT (EU) Level 2: 190FIT (OH) 866FIT (EU)
Lifetime	10 years LEO / 18 years GEO

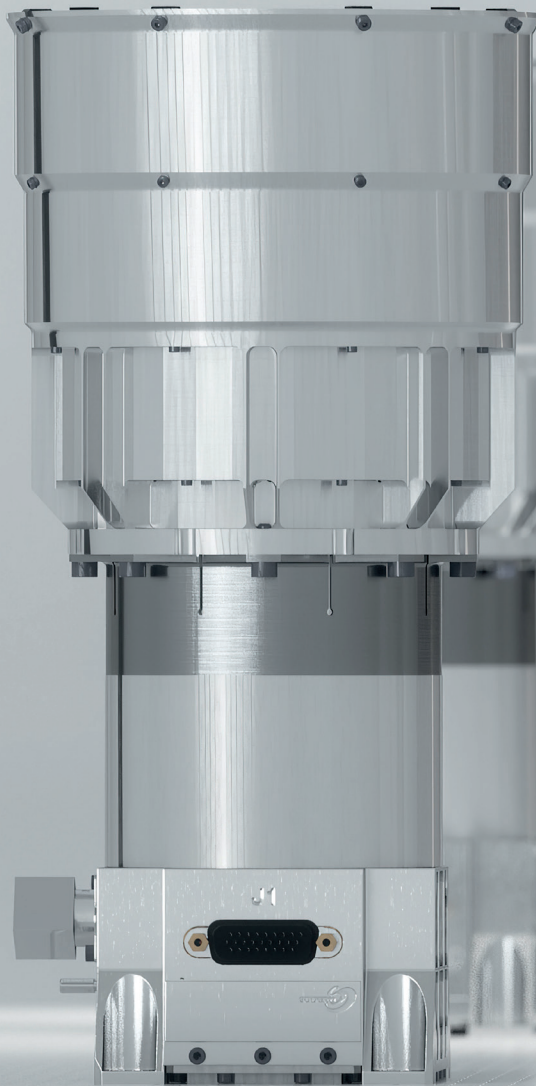
Robust to solar flare in acquisition and tracking

Power supply	21V to 52V
Power consumption @ 30°C, 5V	7.7W typ. (2 OH ON, TEC OFF)
Output data	IL1553B or RS422 (AS/CS16)
Output rate	8Hz, 10Hz, 12Hz, 16Hz, 20Hz, 30Hz

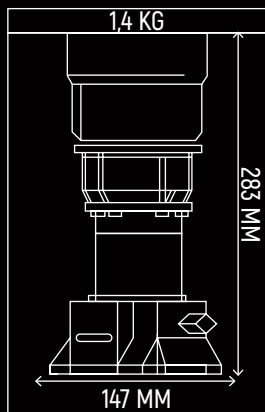
Temperature Range	-30°C / +60°C (Operation) -40°C / +70°C (Storage)
Random vibrations	OH: 30g RMS EU: 28g RMS
Shocks	OH: 2000g SRS EU: 2000g SRS

HYDRA ACCESS

HIGH-END HYDRA STAR TRACKER AVAILABLE OFF-THE-SHELF



- PROVEN PERFORMANCE, ACCURACY AND ROBUSTNESS
- FLIGHT-PROVEN (TRL9) SINCE 2014 • EMBEDDED FDIR FUNCTIONS
- STANDARDIZED HYDRA DEFINITION, SHORTENED LEAD-TIME AND OPTIMIZED COST
- CENTRALIZED PROCESSING (CP) VERSION ENABLING EXTRA MASS & COST OPTIMIZATION AT SYSTEM LEVEL
- 500+ OPTICAL HEAD IN ORBIT



ACCURACY AND PERFORMANCES

RELIABILITY AND LIFETIME

INTERFACES

ENVIRONMENTS

KEY FEATURES

- Up to 4 Optical Heads (OH) connected to spacecraft's on-board computer through SpaceWire interface (MIL 1355) with up to 8m- long cables
- HAS-2 CMOS sensor with Thermo-Electric Cooler (TEC)
- Software integrated in the spacecraft processor processes multiple OH data and can be made available for any processor
- Optics made of rad-hard materials
- Export control EU Dual Use 7A004a - ITAR Free

END OF LIFE WORST CONDITIONS DATA

Bias	<11 arcsec
Thermo-elastic error	<0.055 arcsec/°C
Low Frequency Spatial Error @ 3σ	0.6 arcsec (XY) 4.6 arcsec (Z)
High Frequency Spatial Error @ 3σ	3.4 arcsec (XY) 27 arcsec (Z)
Temporal noise @ 3σ	2.3 arcsec (XY) 18 arcsec (Z)
Slew rate	≤5 deg/s in Acquisition ≤8 deg/s in Tracking
Acceleration	≤2 deg/s ² in Acquisition ≤3 deg/s ² in Tracking
Time from lost-in-space	2.2s typ
Sun/Earth Exclusion Angle	26 deg / 18.5 deg

No performance degradation with full moon in the field of view

EEE parts class	Level 2
Reliability (MIL-HDBK-217F @ 30°C)	190FIT (OH)
Lifetime	10 years LEO / 18 years GEO

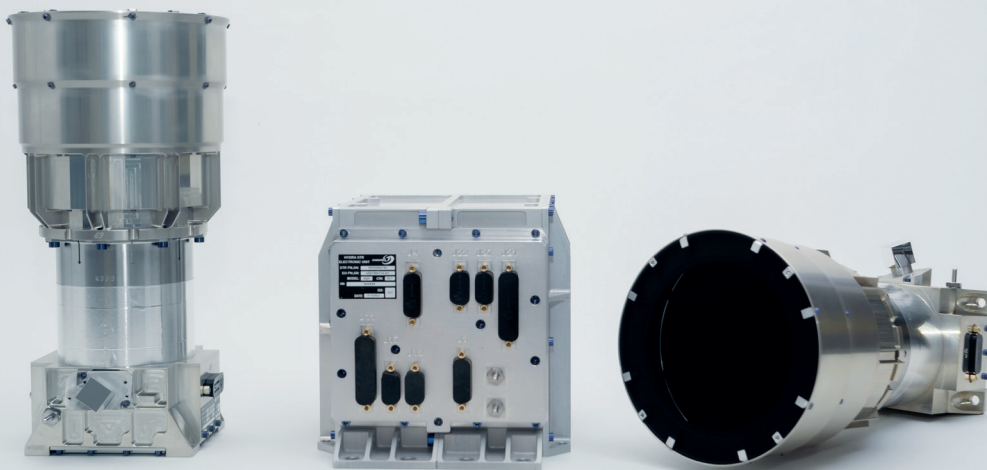
Robust to solar flare in acquisition and tracking

Power supply	5V±10%
Power consumption @ 30°C, 5V	OH: 0.7W typ (TEC OFF)
Output data	SpaceWire (MIL 1355)
Output rate	8Hz

Temperature Range	-30°C / +60°C (Operation) -40°C / +70°C (Storage)
Random vibrations	OH: 30g RMS
Shocks	OH: 2000g SRS

HYDRA TC

HIGH-END HYDRA STAR TRACKER OPTIMIZED FOR GEO MISSIONS



- PROVEN PERFORMANCE, ACCURACY AND ROBUSTNESS
- EMBEDDED FDIR FUNCTIONS
- TWO OPTICAL HEADS CONNECTED TO ONE REDUNDANT ELECTRONICS UNIT
- FLIGHT-PROVEN (TRL9) SINCE 2015
- 500+ OPTICAL HEAD IN ORBIT



ACCURACY AND PERFORMANCES

RELIABILITY AND LIFETIME

INTERFACES

ENVIRONMENTS

KEY FEATURES

- 2 Optical Heads (OH) connected to 1 fully redundant Electronics Unit (EU) through SpaceWire interface (MIL 1355) with up to 8m-long cables
- HAS-2 CMOS sensor with Thermo-Electric Cooler (TEC)
- Electronics unit embedded software processes multiple OH data and delivers a fused quaterniion
- Optics made of rad-hard material
- Export control EU Dual Use 7A004a - ITAR Free

END OF LIFE WORST CONDITIONS DATA

Bias	<11 arcsec
Thermo-elastic error	<0.055 arcsec/°C
Low Frequency Spatial Error @ 3σ	0.6 arcsec (XY) 4.6 arcsec (Z)
High Frequency Spatial Error @ 3σ	3.4 arcsec (XY) 27 arcsec (Z)
Temporal noise @ 3σ	2.3 arcsec (XY) 18 arcsec (Z)
Slew rate	≤5 deg/s in Acquisition ≤8 deg/s in Tracking
Acceleration	≤2 deg/s² in Acquisition ≤10 deg/s² in Tracking (30Hz)
Time from lost-in-space	2.2s typ
Sun/Earth Exclusion Angle	26 deg / 18.5 deg

No performance degradation with full moon in the field of view

EEE parts class	Level 1 & Level 2
Reliability (MIL-HDBK-217F @ 30°C)	Level 1: 110FIT (OH) 465FIT (EU) Level 2: 190FIT (OH) 606FIT (EU)
Lifetime	10 years LEO / 18 years GEO

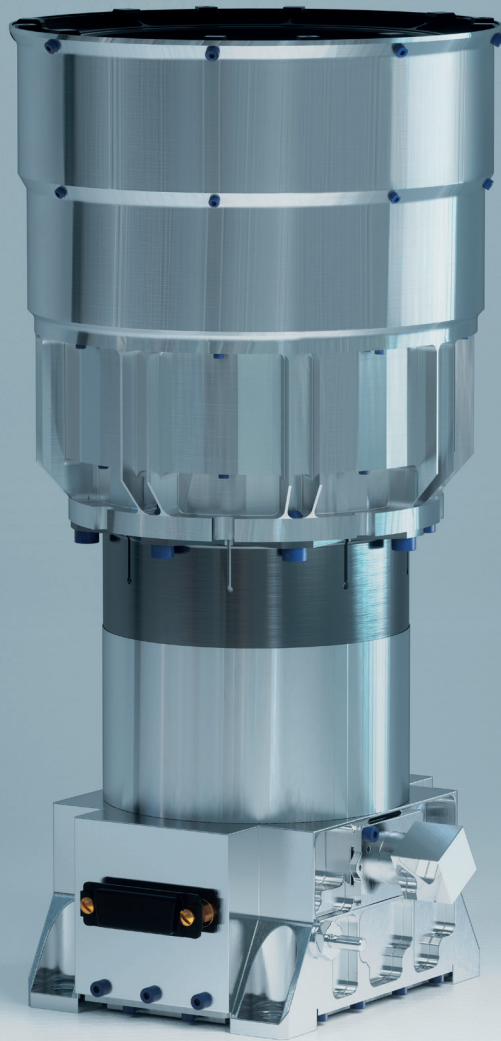
Robust to solar flare in acquisition and tracking

Power supply	23V to 55V
Power consumption @30°C 28V 30Hz	9.3W typ. (2 OH ON, TEC OFF)
Output data	MIL1553B (RS422 AS/CS16 option available)
Output rate	8Hz, 10Hz, 12Hz, 16Hz, 20Hz, 30Hz

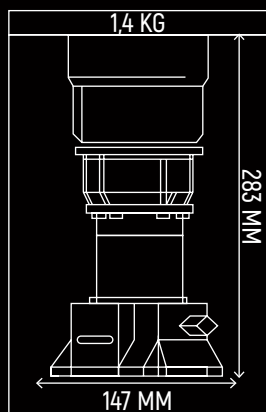
Temperature Range	-30°C / +60°C (Operation) -40°C / +70°C (Storage)
Random vibrations	OH: 30g RMS EU: 18g RMS (XY) / 28g RMS (Z)
Shocks	OH: 2000g SRS EU: 1600g SRS

HYDRA CP

HIGH-END HYDRA STAR TRACKER IN CENTRALIZED PROCESSING



- PROVEN PERFORMANCES, ACCURACY AND ROBUSTNESS
- EMBEDDED FDIR FUNCTIONS
- HYDRA OPTICAL HEAD ALONG WITH DEDICATED SOFTWARE HOSTED IN SPACECRAFT'S ON-BOARD COMPUTER
- EXTRA MASS & COST OPTIMIZATION AT SYSTEM LEVEL
- FLIGHT-PROVEN (TRL9) SINCE 2014
- 500+ OPTICAL HEAD IN ORBIT



ACCURACY AND PERFORMANCES

RELIABILITY AND LIFETIME

INTERFACES

ENVIRONMENTS

KEY FEATURES

- Up to 4 Optical Heads (OH) connected to spacecraft's on-board computer through SpaceWire interface (MIL 1355) with up to 8m- long cables
- HAS-2 CMOS sensor with Thermo-Electric Cooler (TEC)
- Software integrated in the spacecraft processor processes multiple OH data and can be made available for any processor
- Optics made of rad-hard materials
- Export control EU Dual Use 7A004a - ITAR Free

END OF LIFE WORST CONDITIONS DATA

Bias	<11 arcsec
Thermo-elastic error	<0.055 arcsec/°C
Low Frequency Spatial Error @ 3σ	0.6 arcsec (XY) 4.6 arcsec (Z)
High Frequency Spatial Error @ 3σ	3.4 arcsec (XY) 27 arcsec (Z)
Temporal noise @ 3σ	2.3 arcsec (XY) 18 arcsec (Z)
Slew rate	≤5 deg/s in Acquisition ≤8 deg/s in Tracking
Acceleration	≤2 deg/s ² in Acquisition ≤3 deg/s ² in Tracking (10Hz)
Time from lost-in-space	2.2s typ
Sun/Earth Exclusion Angle	26 deg / 18.5 deg

No performance degradation with full moon in the field of view

EEE parts class	Level 1 & Level 2
Reliability (MIL-HDBK-217F @ 30°C)	Level 1: 110FIT (OH) / Level 2: 190FIT (OH)
Lifetime	10 years LEO / 18 years GEO

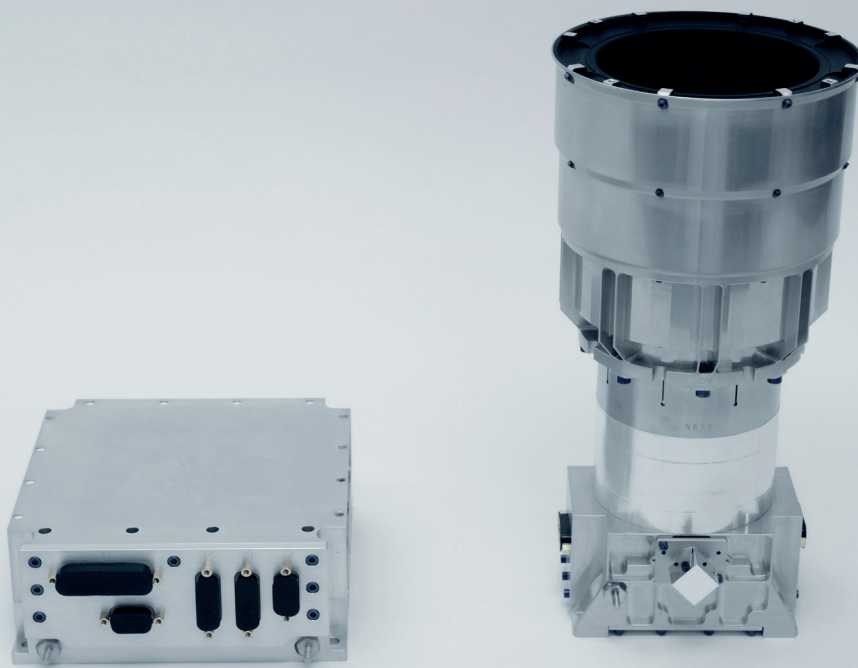
Robust to solar flare in acquisition and tracking

Power supply	5V±10%
Power consumption @ 30°C, 5V	OH: 0.7W typ (TEC OFF)
Output data	SpaceWire (MIL 1355)
Output rate	8Hz (10Hz option available)

Temperature Range	-30°C / +60°C (Operation) -40°C / +70°C (Storage)
Random vibrations	OH: 30g RMS
Shocks	OH: 2000g SRS

HYDRA M

HIGH-END HYDRA STAR TRACKER OPTIMIZED FOR MASS AND POWER



- PROVEN PERFORMANCE, ACCURACY AND ROBUSTNESS
- EMBEDDED FDIR FUNCTIONS
- LOW POWER DISSIPATION, LOW MASS & OPTIMIZED COST
- FLIGHT-PROVEN (TRL9) SINCE 2019
- 500+ OPTICAL HEAD IN ORBIT



ACCURACY AND PERFORMANCES

RELIABILITY AND LIFETIME

INTERFACES

ENVIRONMENTS

KEY FEATURES

- Up to 2 Optical Heads (OH) connected to 1 Electronics Unit (EU) through SpaceWire interface (MIL 1355) with up to 8m-long cables
- HAS-2 CMOS sensor without Thermo-Electric Cooler (TEC)
- Electronics unit embedded software processes multiple OH data and delivers a fused quaternion
- Optics made of rad-hard material
- Export control EU Dual Use 7A004a - ITAR Free

END OF LIFE WORST CONDITIONS DATA

Bias	<11 arcsec
Thermo-elastic error	<0.055 arcsec/°C
Low Frequency Spatial Error @ 3σ	0.6 arcsec (XY) 4.6 arcsec (Z)
High Frequency Spatial Error @ 3σ	3.4 arcsec (XY) 27 arcsec (Z)
Temporal noise @ 3σ	2.3 arcsec (XY) 18 arcsec (Z)
Slew rate	≤ 5 deg/s in Acquisition ≤ 8 deg/s in Tracking
Acceleration	≤ 2 deg/s ² in Acquisition ≤ 10 deg/s ² in Tracking (30Hz)
Time from lost-in-space	2.2s typ
Sun/Earth Exclusion Angle	26 deg / 18.5 deg

No performance degradation with full moon in the field of view

EEE parts class	Level 1 & Level 2
Reliability (MIL-HDBK-217F @ 30°C)	Level 1: 45FIT (OH) 513FIT (EU) Level 2: 125FIT (OH) 707FIT (EU)
Lifetime	10 years LEO / 5 years GEO

Robust to solar flare in acquisition and tracking

Power supply	21V to 52V
Power consumption @30°C 28V 30Hz	6.5W typ. (2 OH ON)
Output data	MIL1553B (RS422 AS/CS16 option available)
Output rate	8Hz, 10Hz, 12Hz, 16Hz, 20Hz, 30Hz

Temperature Range	-30°C / +50°C (Operation) -40°C / +70°C (Storage)
Random vibrations	OH: 30g RMS EU: 28g RMS
Shocks	OH: 2000g SRS EU: 2000g SRS