Star Tracker HE-5AS

The Terma HE-5AS Star Tracker is a fully qualified design, offering a favorable combination of arc-second performance at an affordable price. Robust algorithms provide full autonomy in initial attitude acquisition and attitude update. Terma quality standards, documentation and component screening meet the requirements of discerning customers including the European Space Agency and the U.S. Department of Defense.

CAMERA
The Camera is separate to make it easier to accommodate on the satellite, and to minimize heat dissipation (<1.5W) near the sensor. The camera is a very compact unit, weighing less than 1.0 kg. The optics provides a 22º field of view and – although compact – provides enough aperture to track across the entire celestial vault. A cable provides digital data-link (LVDS) and power supply from the processor unit. The Camera can be supplied with a thermo-mechanically stable bracket.

BAFFLE
Standard baffles are available providing a Sun exclusion half angle as low as to 30º. Where the mission calls for a custom designed baffle, Terma has the know-how to optimize baffle design in dialogue with the customer.

PROCESSOR
The processing unit houses the star catalogue and the software algorithms for initial attitude determination and continuing attitude update. Also, the unit provides power to the camera. The interface towards the spacecraft is redundant RS-422 or MIL-STD-1553, and a power supply voltage from +22 V to +34 V. Dissipation is 5.5 W.

GROUND SUPPORT EQUIPMENT
The star tracker may be delivered with Ground Support Equipment, developed for ease of use and with comprehensive User Manuals. The options are:

- Optical Stimulus: A light-weight optical stimulator reproducing the star field for a fixed attitude. Requires only a power interface and mounts without tools directly onto the baffle.

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- Electrical Stimulus: Provides a stimulus reproducing the star field at any attitude. May be used stand-alone or to close the loop for avionics testing. The equipment is delivered as a PC, with interface cards, and provides both a user interface for the definition of attitude maneuvers, and an RS-422 interface for commanding from higher-level test equipment.
- EGSE: Provides TM/TC interface to the star tracker for unit testing. Delivered as a PC with software and interface cards.

HERITAGE

The HE-5AS Star Tracker is used on satellites owned by:

- European Space Agency
- U.S. Naval Research Laboratory
- U.S. Air Force Research Laboratory
- U.S. National Reconnaissance Office
- U.S. Missile Defense Agency

Independent test and validation of the star tracker have been jointly performed by the NRL and the AFRL under the DoD Foreign Comparative Test Program.

QUATERNION REFERENCE FRAME

The reference frame for quaternions is the Hipparcos Reference Frame, a barycentric inertial coordinate system consistent with the equatorial system for the mean equinox and equator of J2000: An Earthcentered system with the x-axis pointing toward the mean vernal equinox, and z-axis toward the mean rotating axis of the Earth on January 1, 2000 at 12 UTC.

OPTICAL HEAD	**HE-5AS**
Accuracy (EOL @ +30 °C, 1σ)	• <1 arcsec RMS pitch, yaw • <5 arcsec RMS roll
Update Rate:	• 4 Hz maximum
Acquisition Time	• 3 sec typical, 10 sec worst case
Slew Rate	• 0.5 deg/sec full performance • 2.0 deg/s reduced performance
Operating Temperature	• -40ºC to +70ºC (max. +20ºC on the camera for full • performance)
Power Dissipation	• 1.5 W in Camera • 5.5 W in Processor
Electrical Interfaces	• Power +22 V to +34 V • Dual TM/TC interface RS-422 or MIL-STD-1553B • Dedicated clock signal interface • LVDS interface between Camera and Processor
Radiation Hardness	• EEE components up 100 kRads (Si)
Dimensions and Mass	• Camera 120 by 120 by 33 mm, 1.0 kg • (note: optics protrude 58 mm inside baffle) • Processor 245 by 165 by 29 mm, 1.2 kg
Baffle Examples:	• 30º (sun exclusion), Ø234 by 346 mm, 800 g • 45º (sun exclusion), Ø167 by 203 mm, 470 g • 60º (sun exclusion), Ø160 by 211 mm, 530 g
Component Screening Standards	• MIL-B grade or full MIL-S grade • Additional screening on customer request
Data Package	• Management and PA plans and progress reports • CDR data package for product baseline • End-Item Data Package for all deliverables • Project specific documentation on customer request