



Space

## INFRARED EARTH SENSOR

IRES is a two axis infrared Earth horizon sensor for accurate measurement of pitch and roll attitude angles with respect to the Earth disk centre. It is used in three-axes stabilised spacecrafts operating in GEO (Geostationary Earth Orbit) and MEO (Medium Earth Orbit).

Due to its extended acquisition and operational capabilities, IRES allows meeting transfer orbit operations of different launchers.

The operating principle is based on electro-mechanical modulation of the radiation coming from the Earth horizon in the 14-16.25 $\mu$ m band. Four IR (Infrared) beams in a single telescope swung by a mirror along a scan path of 45° Earth latitude North and South, generates Earth/Space and Space/Earth pulses.

These are compared in phase with the internal encoder reference to derive Pitch and Roll measurements.

IRES consists of an optical head packaged with the processing electronics in a single housing for the two axis measurement. Pitch and Roll are computed inside the sensor by means of a dedicated ASIC.

### HERITAGE

The company started developing infrared Earth sensors for the Earth horizon detection during 1960. Several IRES generations were developed (around 300 units sold), all based on the same earth horizon detection concept that provides pitch and roll direct output.

IRES has already experienced hundreds of years of successful in-flight life in the frame of many programmes.



IRES installed onboard of OLYMPUS

Historic program including infrared earth sensors include: AGILA, AMC12, AMC13, AMOS, APSTAR, ARABSAT, ARTEMIS, ASIASAT, ASTRA, DFH/FO, DFH3, DRS, ECS, EUTELSAT24, EUTELSAT1/2/3, EURASIASAT, KOREASAT-5, GSTV-V2A and GSTB-V2B, HISPAKSAT, INMARSAT, ITALSAT, MARECS, NAHUELSAT, OLYMPUS, ORION, OTS, RASCOM, SICRAL, SINOSAT, SIRIUS2, SKYNET, SYRACUSE-3A, SYRACUSE-3B, THAICOM, TURKSAT.

The latest generation of IRES (IRES-N2) is based on the same concept and offers the same performance and interfaces as the previous generation. IRES-N2 is based on pyroelectric detectors, is ITAR free and lower cost with respect to the previous IRES generation. IRES is installed on the GALILEO constellation satellites.

## TECHNICAL CHARACTERISTICS

### Operating modes

- Earth acquisition mode (Wide Scan)
- Earth pointing mode (Narrow Scan)
- Chord mode (single beam crossing).

### PERFORMANCE

Operating band	14-16.25 $\mu$ m wavelength
Earth acquisition mode	Between 15,300 and 53,000Km altitude
Operational capability	Up to 140,000Km altitude

### OPERATIONAL RANGE AT GEO

Pointing mode linear range	$\pm 5.5^\circ$ pitch; $\pm 2.5^\circ$ roll
Acquisition mode linear range	$\pm 11^\circ$ pitch; $\pm 2.5^\circ$ roll
Chord mode linear range	$\pm 23^\circ$ pitch; $\pm 14^\circ$ roll
Acquisition mode sign range	$\pm 22^\circ$ pitch; $\pm 13^\circ$ roll
Output data rate	10Hz
Accuracy	<0.05 deg random error ( $3\sigma$ )
	<0.02 deg bias error

### DATA INTERFACES

Type	Digital serial interface 32/48 bit or MIL-STD-1553B available
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### MECHANICAL INTERFACES

Dimensions	169.9mm x 163.8mm x 156mm
Mass	<2.5Kg

### ELECTRICAL INTERFACES

Type	24 to 50V
	75 to 100V unregulated power bus
Power consumption	<4W

### ENVIRONMENTAL CONDITIONS

Operating temperature	-30° to +60°C
Storage temperature	-40° to +70°C

### AMBIENT AND SPACE VACUUM PRESSURE

Vibration levels	Sine: 20g peak
Random	26g rms
Shock	2000g from 3 to 10kHz
Lifetime in GEO	> 15 years