

HULLMOS®

HULL STRESS MONITORING SYSTEM

VERSION 1.0

**Innovative supplier
R. Rouvari Oy**

HULLMOS[®]

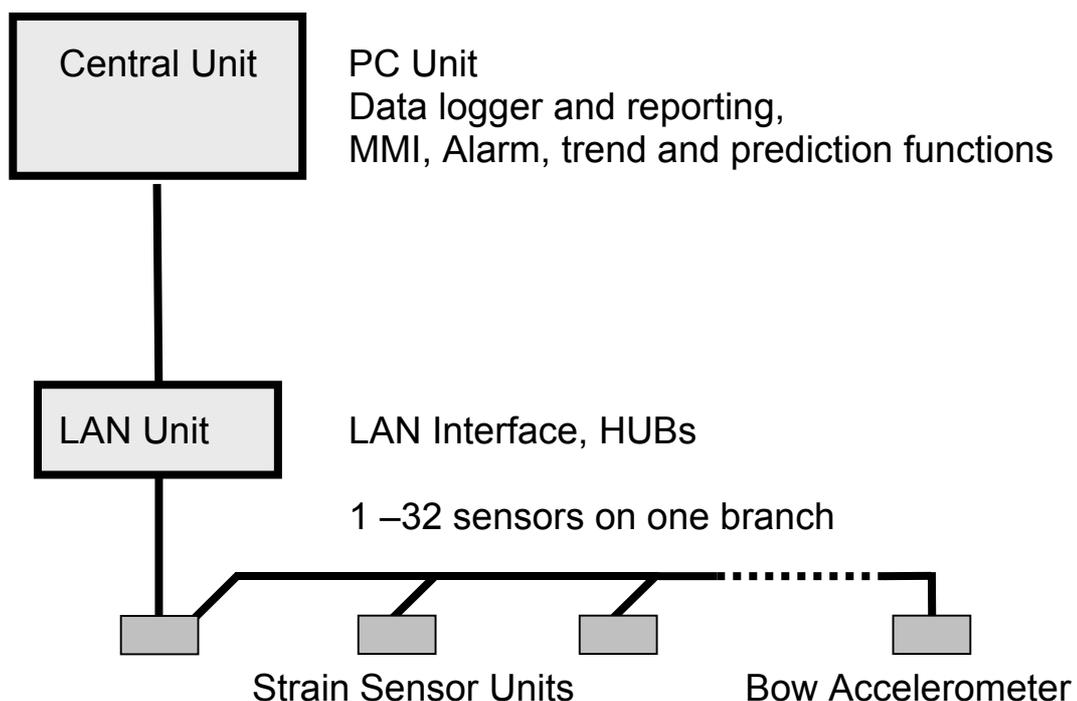
STRESS MONITORING – TECHNICAL SYSTEM DESCRIPTION

The Hull Stress Monitoring System **HULLMOS** is to prevent design stresses being exceeded. This is achieved by measuring the relative deformation, strain (stress) in the hull due to loading (still water strain) and due to waves (dynamic strain). The measured stress is analysed in a distributed way inside the sensors. The analysis methods used identify the static, dynamic and slow changing temperature components from the signal and calculate different signal characteristics. The results are transmitted to the central unit, normally on the bridge, to be further analysed, datalogged and displayed to the bridge personnel to assist the navigation.

HULLMOS is an integrated platform for strain, fatigue and motion monitoring

Sensors for strain and fatigue are either SBSG (Short Base Strain Gauge, 100 mm) or LBSG (Long Base Strain Gauge, 1700 mm). Off-the-shelf-type of sensors are used to measure motion and acceleration.

HULLMOS Monitoring System



Strain Sensor Usage and Installation

Typical installation places for the sensors are:

- onto the deck
- onto the bulkhead

The strain sensor is to be installed in such a way that it measures the deformation at the main hull girder.

In general, the installation is to exclude the effects of local stress concentrations caused e.g. by material discontinuities, welding and sandblasting. The sensor may be installed by using normal shipyard working standards for accurate installations.

The sensor is designed to be:

- easily tested
- easily calibrated and
- replaceable

SBSG Sensor Functional Description

The strain gauge is able to measure the strain with an accuracy of at least 5 micro strains. The linear range of the gauge is ± 1500 micro strains. The measuring bandwidth is selectable from 0 – 15 Hz up to 0-150 Hz (3dB/156 Hz, -72dB/235 Hz). The band is adjustable by software.

LBSG Sensor Functional Description

The Strain gauge is constructed according the class requirement with steel rod of 1500 - 2300 mm in length. The linear range of the gauge is ± 2000 micro strain with accuracy of at least 5 micro strains. The measuring bandwidth is 0-5 Hz

Capacity Specifications:

The sensor electronics is equipped with permanent memory capacity to facilitate such analysis methods as:

- signal mean value calculation
- signal standard deviation calculation
- signal peak value detection
- average zero (mean value)-crossing period detection
- rainflow analysis

The sensor has also non-permanent memory capacity to store:

- calculation parameters
- real time signal 2x10 sec.

The analysis methods are calculated in a distributed way, partly by the sensor software, partly by the upper software level. The sensor is equipped with a self-diagnostic function.

The analysis results are available on PC in well-specified format. Windows NT shared memory is used to integrate the strain analysis with the user interface (MMI) and other systems e.g. loading instrument.

Interface Specification

The sensor works from 12-24 VDC supply (floating system).

The sensor is designed to communicate through LAN.

LAN:

protocol	ARCNET
data rate	625 kbits/sec. or 1.25 Mbits/sec.
physical layer	RS485, shielded cable, twisted pair

The network is to facilitate the data transfer of functions and parameters such as:

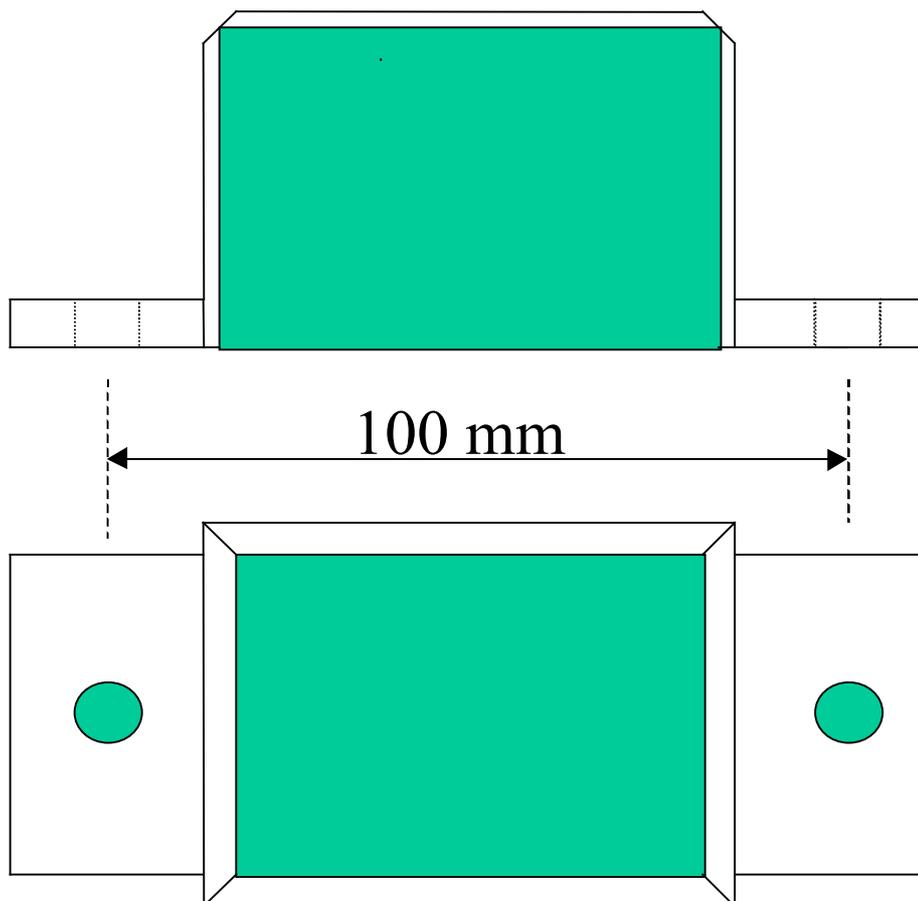
1. Time synchronising.
2. Results and midvalues of analysis methods to upper calculation level
3. Measured data containing:
 - time stamp
 - strainvalue to upper level with selectable frequency on request.
4. (Raw-)signal history for 10 sec.

Environmental Specifications

Environmental Test Specifications for Instrumentation and Automation, Det Norske Veritas Certification Notes No 24, is followed.

Temperature	Open deck	-25C to + 70C
Vibration	Open deck	Frequency range: 3-13,2 Hz Amplitude: 1,0 mm (peak value) Frequency range: 13,2-100 Hz Acceleration amplitude: 0,7 g.
Enclosure		Fully sealed (SBSG) IP56 (LBSG)
Explosion hazardous env.		Exi, intrinsically safe (by separate zener barrier)

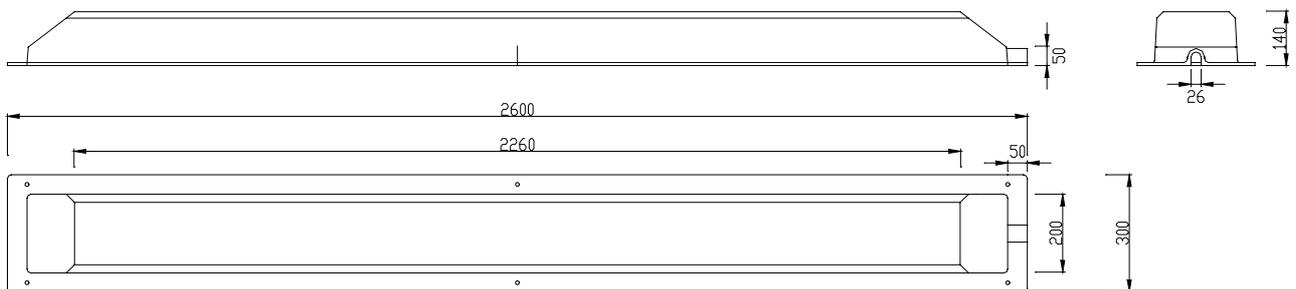
SBSG SENSOR (Short Base Strain Gauge)



HULLMOS[®] LBSG SENSOR



Total weight:
approx. 30kg



Rules and Standards

European Committee for Electrotechnical Standardisation (CENELEC), EN 50 014, “Electrical apparatus for potentially explosive atmospheres”, General requirements.

International Electrotechnical Commission (CE-IEC), 79-11, “Electrical apparatus for explosive gas atmospheres”, Intrinsic safety “i”.

Det Norske Veritas (DNV), Classification Notes “Instrumentation and automation-programmable electronic systems”.

Det Norske Veritas (DNV), Rules for Classification of Ships, “Instrumentation and automation”.

Det Norske Veritas (DNV), Certification notes “Environmental Test Specification for Instrumentation and Automation Equipment”.

Det Norske Veritas (DNV), Rules for Classification of Ships, “Electrical installations”.

Det Norske Veritas (DNV), Hull Surveillance System.

Innovative Supplier

R. Rouvari Oy

Museokatu 9B, FIN-00100 HELSINKI

Tel. +358 9 490 682, Fax +358 9 441782

E-mail: info@hullmos.com

www.hullmos.com www.rrouvari.fi