

Battery Monitoring System

Battery cell data collected wirelessly



Nöjdhs

Battery monitoring system

To maintain a submarine battery in good condition it is necessary to continuously monitor data from the individual battery cells. This specifies a battery monitoring system based on individual cell probes placed in the battery cells. The probes transmit the collected data wirelessly to a central unit.

System overview

The Battery Monitoring System (BMS) is an independent wireless system intended for measurements of voltage, acid level and temperature for all battery cells. The busbar voltage drop between two cells is also measured. The measurements are performed by Cell Probes fitted on each battery cell.

The Cell Probes are sending data (wirelessly) via a Probe Interface to the Interface Unit. There is one or two Probe Interfaces and one Interface Unit per battery compartment.

The Interface Unit (IU) collects information from the Cell Probes (via the Probe Interface).

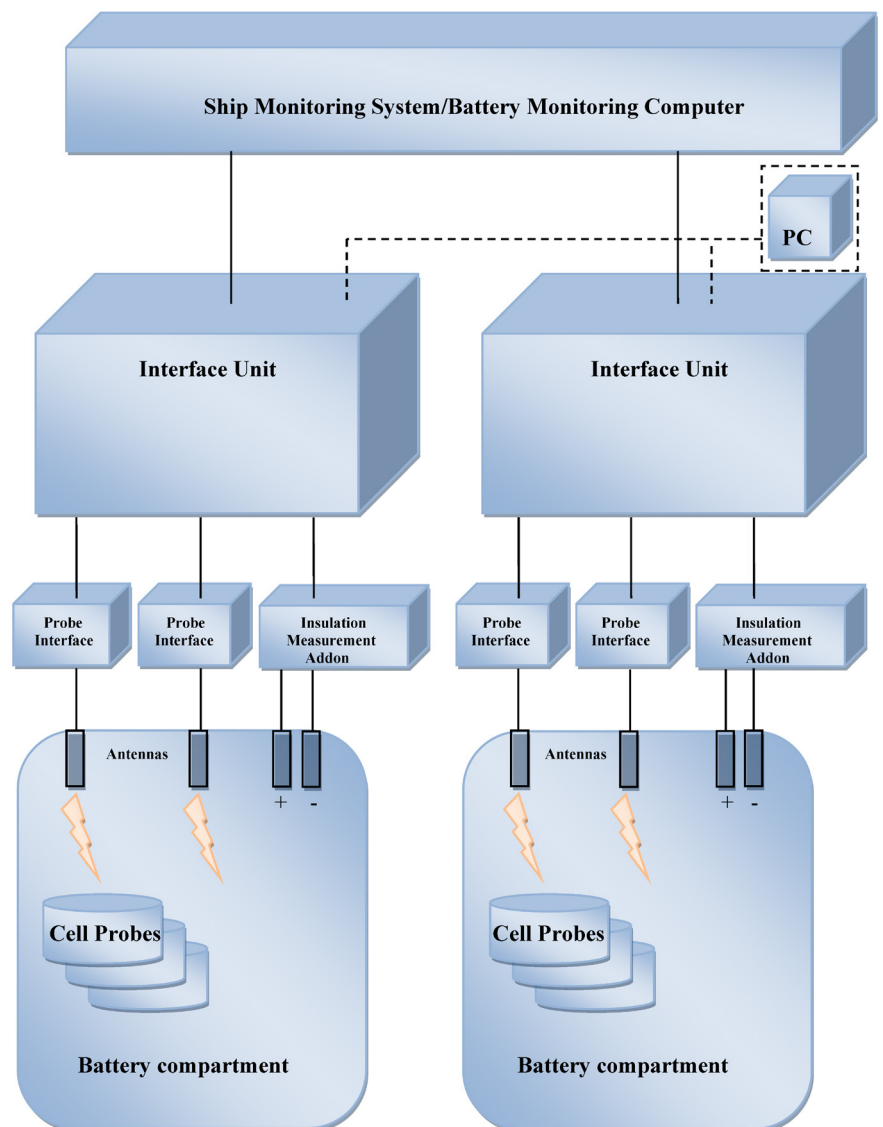
Depending on customer requirements insulation monitoring and collection of external signals, e.g. for total battery voltage and current can be added to the system as shown in the block diagram.

The IUs communicate with the operator system to be used. This operator system could be a Ship Monitoring System (SMS) or a dedicated Battery Monitoring Computer (BMC).

It is also possible to connect a PC directly to the Interface unit for service and maintenance of the system.

4 main benefits of using our wireless BMS for Submarine battery:

- Low maintenance
- Reduced cabling
- Reduced MTTR
- Simplified service/repair work



Block Diagram Battery Monitoring System

Battery monitoring computer

A Battery Monitoring Computer can be supplied in case that the Battery Monitoring System operates alone without a SMS (Ship Monitoring System). The BMC unit collects all information from Cell Probes and other measuring points via the IUs. The BMC is PC-based and can be supplied as a panel PC or other options on request.

The BMC is the operator interface of the system. In the BMC all monitoring, data storage and the residual capacity calculation is done, as well as setting up, maintaing and checking the status of the system.

Communication between the BMC and an external system is possible, interface to be agreed if it is desirable.



The tasks to be performed by the BMC are as follows:

- Presentation of battery system overview
- Presentation of data for all battery cells
- Presentation of deviating cells, i.e. cells with alarm
- Detection of fully charged battery
- Presentation of historical cell data, voltages and currents
- Creation of battery reports

Battery Monitoring Computer Technical Data

Dual supply	9-36 VDC or 100-240 VAC
Power consumption	100W
Communication with IU	Ethernet
Shock resistance	Half Sine Shock Pulse 72 g 3.5 ms
Vibration	MIL-STD-167-1A
EMC	MIL-STD-461-G

Battery monitoring system

Interface unit

The Interface Unit (IU) collects the information from all Cell Probes in one battery compartment. One IU is placed outside each battery compartment. The IU sends, via the Probe Interface, a request for data by sending the cell number and a code for what data is requested. The Probe Interface relays the request to the Cell Probe. The Cell Probe replies by sending the requested data back via the Probe Interface to the Interface Unit.

Other signals from external sensors can be connected to the IU depending on requirements for the specific system. Such signals can be Battery Voltage, Battery Current etc.

If requested, the IU can be supplied with Insulation Monitoring. The IU then measures the battery insulation which reference to the ship's hull. The procedure for the measurement is to introduce a high resistance value resistor between one pole and earth, while measuring the current between the other pole and earth. The same is then performed for the other pole. The position of the earth fault is then estimated by calculation. The position of the insulation problem is presented as a cell number. It should be noted that this procedure only gives a good estimation of the position when there is one earth fault. To resolve multiple faults more measuring points are needed.

The IU communicates all information to the SMS/HMI that stores all data and perform the presentation.



Differences may occur due to requirements

The Battery Monitoring Computer also operates as an HMI in case when a SMS is not present. A PC can be connected to the IU unit for service and maintenance of the system.



Differences may occur due to requirements

Interface Unit Technical Data

DC supply	24 (20-28) VDC
Power consumption	15W
Degree of protection	IP55
Shock resistance	Half Sine Shock Pulse 15g 20 ms
EMC	MIL-STD-461-G
Communication with PI	RS485 Point to point
Communication with supervisory system	Profinet IO
Dimensions (HxWxD)	300x300x210 mm
Weight	11 kg

Battery monitoring system

Probe Interface

The Probe Interface (PI) is the link between the Cell Probes and the Interface Unit. The Probe Interface communicates with the Interface Unit via a communication cable and with the probes via radio.

Two Probe Interfaces outside each battery compartment can be used if a higher redundancy is required or if the configuration of the battery compartment demand that.



Differences may occur due to requirements



Differences may occur due to requirements

Probe Interface Technical Data

DC supply	24 VDC
Power consumption	0.5W
Degree of protection	IP66
Shock resistance	Half Sine Shock Pulse 15g 20 ms
EMC	MIL-STD-461-G
Dimensions (HxWxD)	91x122x120 mm
Weight	1,2 kg

Antenna Technical Data

Atex classification	Ex e IIC T6 GB Ex tb IIIC T85 °C Db IP66
Weight	0,365 kg
Dimensions	210 x 38 mm
Degree of protection	IP66
Shock resistance	Half Sine Shock Pulse 72 g 3,5 ms
Vibration	MIL-STD-167-1A
EMC	MIL-STD-461-G



Differences may occur due to requirements

Cell probes

The Cell Probes are based on a microcomputer which measures cell voltage, acid level, temperature and bus bar voltage drop. The communication between the probes and the Probe Interface is by radio on the free ISM radio band at 2,4GHz.

The probes are power supplied by the cell voltage and internally stabilized for analog performance.

The cell voltage is measured with high accuracy by means of an A/D-converter. Other than measuring the cell voltage, the voltage drop between the cells positive pole and the negative pole of next cell with higher voltage is also measured. This function is to detect any loose connection between the two cells.

Continuous level measurement is made by a float and magnetic measurement. The float is mounted on an arm and the angle to the probe is measured. This is a method that gives a high resolution of the measured angle without losing any reliability.

Two LEDs in the top of the probe are used to indicate that the probe is working and communicating correctly, as well as giving error messages. Normally the LEDs are controlled by the operator.

The acid temperature is measured with a temperature sensor placed in the lower part of the center pin of the Cell probe. The probe is internally fused. The cables are Radox GKW-AX insulated with double insulation and acid retardant which minimize the risk of insulation faults.



Differences may occur due to requirements

Cell probes Technical Data

Power supply from cell	1.5-3.0 VDC	
Power consumption	0,5W	
Degree of protection	IP67	
ATEX classification	II 1/2G Ex e ib mb IIC T4 Ga/Gb	
Shock resistance	Half Sine Shock Pulse 700 g 1,5 ms, 72 g 3,5 ms	
Vibration	MIL-STD-167-1A	
EMC	MIL-STD-461-G	
Cell Voltage	1.5-3.0V DC	±5mV
Bus bar voltage drop accuracy	-500mV to 500 mV	±5mV
Electrolyte level range	55mm to 160 mm	±5 mm
Temperature range	0-60°C	±1°C
Weight	300 g	±20%



About us

Nöjdhs Elektronik AB and Nojdhs Underwater Technology PTE LTD belongs to the group TN Development AB. Included in the group TN Development AB is also Milab Microphones AB.

Nöjdhs Elektronik AB was founded in 1985 by Thomas Nöjd, who has a background in the Swedish Navy and in Kockums AB's submarine electrical design department. Nöjdhs Elektronik AB were one of the first companies in Sweden to use a PC-controlled milling machine for fast production of prototype PCBs.

The company has grown steadily, from 6 employees in 1990 to today's 35 employees divided on two locations, Singapore and Sweden.

Our customers are found mainly in the defence and in the industry. Defence related assignments, particularly in the underwater sector have helped us establish a special competence within this area. Defence projects have also set the standard for the quality and reliability of our products.

We provide customer specific designed solutions and production of electrical and electronic systems. We are specialised in rugged design for use in submarines, naval ships or other demanding environmental circumstances.

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