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Certified temperature measurement

Bernd Lienau

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Abstract

This disclosure relates to a device for measurement of a temperature in compliance with safety certificate regulations. Disclosed is also a method relating thereto and a control loop for usage of said device.

Description

This disclosure relates to a device for SIL-rated measurement of a temperature. When operating equipment, which may be subject to heating during operation, e.g. pumps, motors and the like, the temperature of said equipment may be measured to enable an emergency shutdown in case of overheating or a too low temperature.

In one example, a subsea pump is operated subsea by a topside power supply and shall be shut down when it is overheating. A subsea temperature sensor is connected to the subsea pump to measure the temperature of the subsea pump. The subsea temperature sensor is connected to a subsea control module, e.g. by cable or wireless, to send the sensor data to the subsea control module. The subsea control module may determine the temperature of the subsea pump by processing the sensor data or may send the data to a topside computer. The topside computer may use the transmitted data from the subsea control module (raw sensor data or processed sensor data) to determine the temperature of the subsea pump and to decide whether the subsea pump shall be shut down due to overheating. The topside computer may e.g. have received a pre-set temperature limit for operation of the subsea pump or may detect an unusual heating of the subsea pump compared to normal operation. In some examples, the topside computer may feed the temperature information to an operator, who decides whether to shut down the subsea pump. The subsea pump is shut down by disconnecting the topside power supply from the pump or by shutting down the topside power supply.

In some operations, the equipment may need a security certification e.g. an SIL rating of 2. In some examples, another SIL rating or another security certification may be required by the authorities or a customer.

Continuing with this example of an SIL rating of 2, the topside computer and the subsea control module may be obtained with an SIL rating of 2, however the subsea temperature sensor may not be purchasable. To overcome the lack of an SIL 2 rated subsea temperature sensor, the subsea temperature sensor may comprise an RTD sensor. The RTD sensor outputs a resistance depending on the measured temperature, enabling to obtain a calibrated current output for a set voltage input. The current output of the RTD sensor may be amplified by an SIL 2 rated converter for converting the output of the RTD sensor to a current of 4 to 20mA. In some examples, another current may be required for further processing by the subsea control module, so another SIL 2 rated converter may be used. In some examples, the subsea control module uses communication protocols such as RS232 or CanBus, which may require another form of conversion of the signal of the RTD sensor.

In some examples, the SIL 2 rated converter may be part of the subsea control module.

The RTD sensor is a “simple device” by SIL regulations and therefore may be equipped in the control loop for the subsea pump without breaching the SIL 2 regulations. Therefore, the combination of measuring the temperature with the RTD sensor and amplifying the output current of the RTD sensor with the SIL 2 rated converter complies with the SIL 2 regulation requirements. In addition, the

combination with the subsea control module and the topside computer for controlling the topside power supply and the subsea pump may be set up in a SIL 2 compliant assembly.

In some other examples, other regulatory requirements may require other converters, subsea control modules or topside computers.