Application Description
AG/PC102-EN

High-Precision Differential Temperature Measurement for Heat Balancing

Chemical & Petrochemical

Instrumentation Solutions

- High-precision differential temperature measurement, even for very small temperature differences (ΔT = 1 ... 5 K)
- Optimized chemical reactions
- Shorter response time
- Cost savings through improved production efficiency

ABB Instrumentation

1 The Problem

Highly precise measurement of the temperature difference is an essential prerequisite wherever heat balancing is required for further process optimization.

In the chemical industry, for example, heat balancing on the reactor may reduce the response time and, thus, improve the production efficiency.

2 The Solution

The manufacturer chooses for his measurement setup a couple of high-precision 4-wire Pt100 temperature sensors. The deviation of these two sensors from each other must not be greater than 20 mK. The sensors are measured and calibrated in an available DKD calibration lab.

Environmentally ruggedized “heavy duty temperature sensors” are predominantly used for this purpose as they are perfectly suited for especially harsh operating conditions. They also excel by an extremely short response time (2.5 s to 3.5 s) and their possible usage in hazardous areas. Additionally, they comply with NAMUR recommendations NE21/23 and 24.

Fig. 2-1: Calibration setup of the measuring system

The entire system made up of the paired temperature sensors and a SensyCal FCU400-P flow computer unit is then commonly calibrated in the DKD calibration lab, and the overall measurement uncertainty (< 100 mK) is determined. Finally, a calibration certificate is issued.

3 Device Models

At the customer site either a field-mounting SensyCal FCU400-P flow computer unit is mounted on Z rails in a switch cabinet or a panel-mounting model is integrated in the cabinet door.

Fig. 3-1: FCU400-P flow computer unit as a field-mounting device placed on Z rails in a switch cabinet (right-hand side) or as a panel-mounting device integrated in the switch cabinet front door (left-hand side)

4 Function Diagram

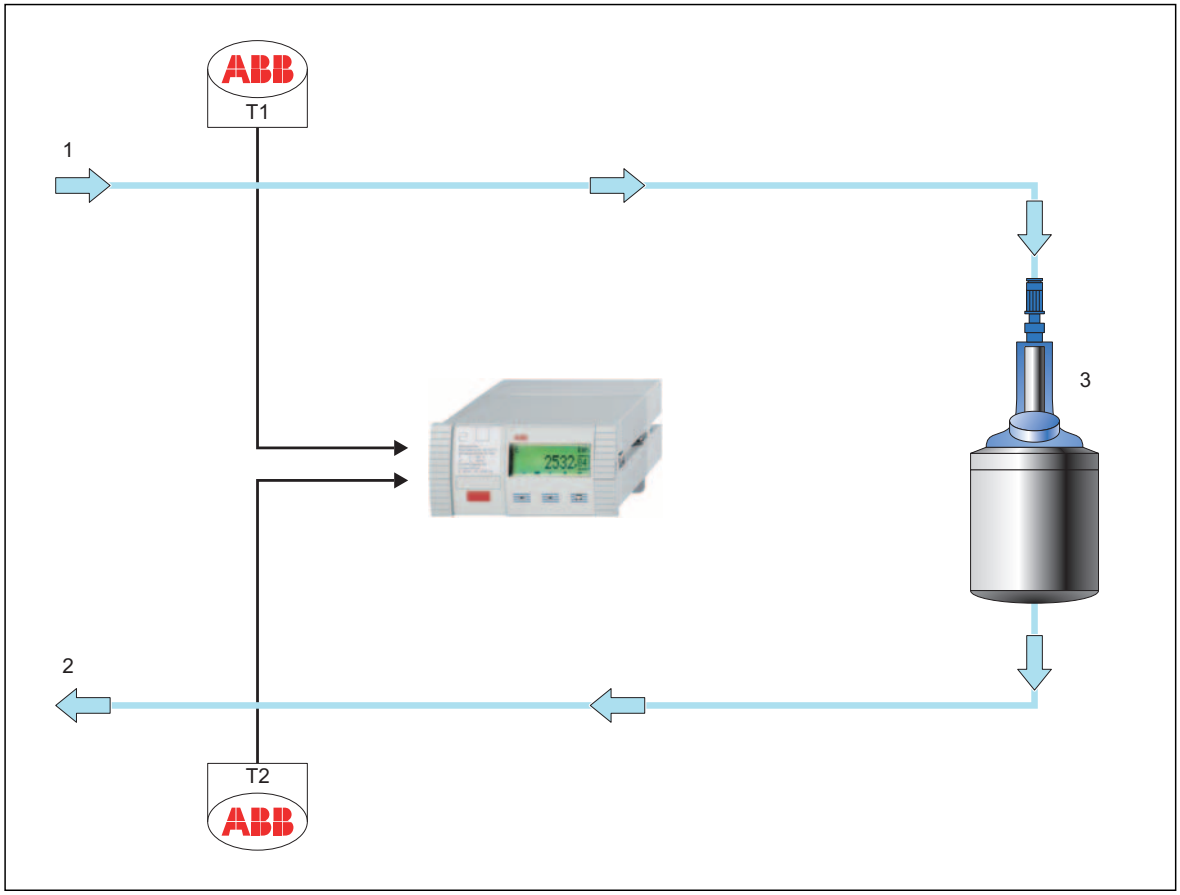

Fig. 4-1: Function diagram of differential temperature measurement

1 Flow line
2 Return line
3 Chemical reactor

5 Application Examples

Fig. 5-1: Powder production

Fig. 5-2: Granulate production

Fig. 5-3: Charge mixture

6 Customer Benefit

Heat balancing using high-precision differential temperature measurement optimizes the plant and, thus, increases the production efficiency. Significant savings can be achieved.

The use of MODBUS communication via RS485 also allows for online monitoring from the control room.

7 Features of the Components Utilized

Instrumentation	
	**SensyCal FCU400-P flow computer unit** • Panel-mounting or field-mounting on Z rails • Analog outputs for differential temperature and individual temperatures • Local indication of all parameters on the built-in display • MODBUS communication via RS485 for online-monitoring
	**Temperature sensor, e.g. SensyTemp TSP300** • Pt100, 4-wire, Class A to EN 60751 • Measuring range 0 ... 100 °C • Thermowell diameter 12 mm, tip diameter 5.5 mm • Temperature-sensitive length 15 mm • Insertion length 225 mm (variably adaptable) • Process flange DN 25, PN 40, type C • Use in liquids, under rough ambient conditions • Exchangeable measuring inset • Explosion-proof version with flame-proof enclosure • Extremely short response time

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