Fuji Electric

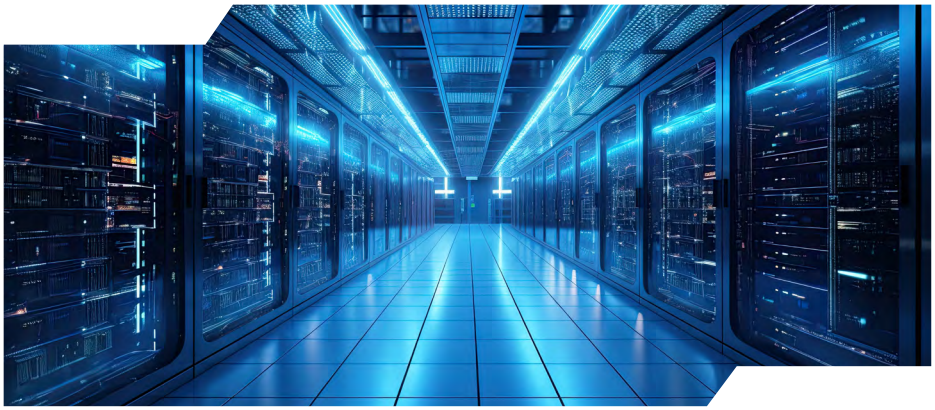
Innovating Energy Technology

Optimise liquid cooling circuits in high-density data center racks with the ultrasonic flow meter

Data centers

Keywords

- Liquid cooling for data center
- High-density racks
- Flow measurement
- Energy efficiency
- Cooling system supervision



The rise of digital technologies, cloud computing, artificial intelligence, and high-performance computing (HPC) is leading to a dramatic increase in energy density in data centers. Today's high-density IT racks can exceed several tens of kilowatts per rack, generating heat flows that traditional air-cooling systems can no longer efficiently vent.

In this context, liquid cooling (direct chip, heat exchanger at the back or dedicated hydronic circuits) is an essential solution.

These architectures rely on loops of water or heat transfer fluids flowing as close as possible to critical components, allowing for much more efficient heat transfer than air.

However, the widespread use of liquid cooling places new demands on it: precise flow control, hydraulic balance between racks, rapid detection of galleries and ensuring service availability. In addition, there are strong regulatory and normative constraints, including ASHRAE recommendations regarding IT environments, energy efficiency objectives (PUEs), as well as environmental commitments related to reducing water and energy consumption.

The challenges faced by data centers

Data center operators face complex problems related to the management of liquid cooling circuits.

Insufficient throughput in a high-density rack can cause processors to overheat locally, causing performance degradation or even critical downtime. Conversely, an uncontrolled overflow unnecessarily increases the energy consumption of the pumps and degrades the overall efficiency of the plant.

In large infrastructures, with dozens or even hundreds of cooling loops, the lack of reliable flow measurements makes it difficult to balance hydraulically and detect malfunctions such as exchanger fouling, air bubbles or leaks. For example, when adding new AI racks, a change in the hydraulic regime can impact the entire network without being immediately visible, compromising service continuity. Precise and robust measuring instruments then become an essential lever to guarantee performance, availability and energy sobriety.

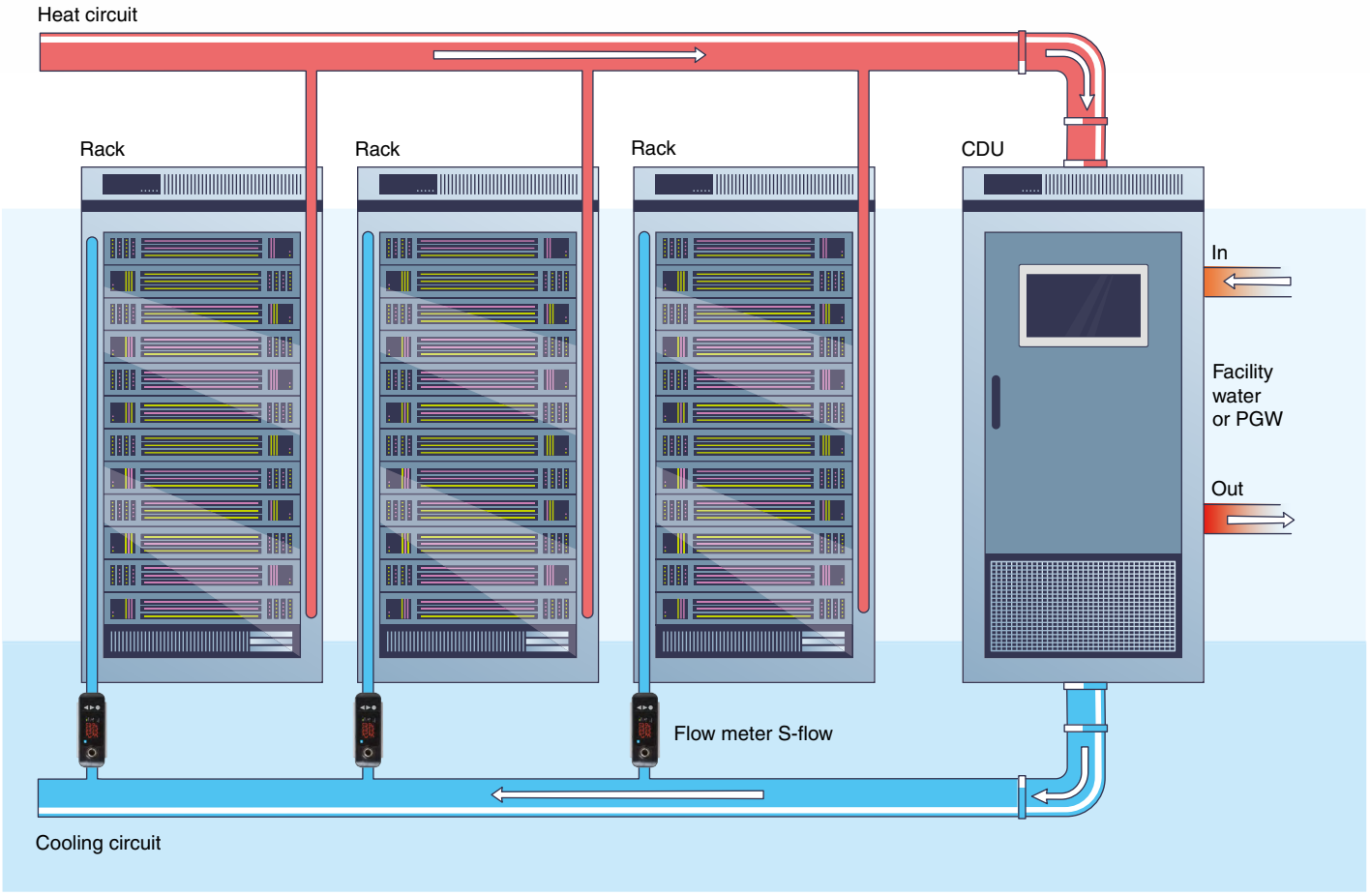
The S-Flow ultrasonic flow meter:

A suitable answer to liquid cooling systems

Fuji Electric's ultrasonic flow meter S-flow is particularly suitable for liquid cooling circuits in data centers. Based on the principle of ultrasonic transit time measurement, it allows accurate and reliable measurement of liquid flow without the mechanical parts moving, eliminating any further pressure loss in the circuit.

Its compact, integrated design makes it easy to install directly on the cooling loops of high-density racks, even in tight spaces. The S-flow ultrasonic flow meter is capable of measuring low to medium flow rates with excellent repeatability, an essential criterion for direct-to-chip cooling or rack-and-pinion rear exchangers, where flow stability conditions thermal performance.

Thanks to its analog and digital outputs, the S-flow flow meter can be easily integrated into data center supervision systems. It provides real-time data to adjust pumping regimes, quickly detect any operational anomalies, and optimise cold distribution as close as possible to the actual needs of IT equipment. Its non-contact technology also ensures high reliability over time, even with treated water or water/glycol mixtures commonly used in data centers.



Benefits for the data center application

+ **Secure cooling in high-density racks with accurate and continuous flow measurement**
+ **Optimise the energy efficiency of hydronic circuits by avoiding unnecessary overflows and losses**
+ **Improving plant availability through early detection of drifts and anomalies**
+ **Reduce maintenance costs without moving parts or fouling technology**
+ **Facilitate integration into existing monitoring architectures (BMS / SCADA)**

A solution to control cooling in high-density racks

Compact ultrasonic flow meter S-Flow

- **Accurate flow measurement without pressure loss**
  Transit time ultrasonic measurement, without obstructions in the pipeline.
- **Suitable for high-density liquid cooling circuits**
  Compatible with water and water/glycol mixtures used in direct-to-chip cooling.
- **Simple installation in constrained environments**
  Compact one-piece sensor, direct in-line integration.
- **Increased reliability and availability**
  Technology with no moving parts, insensitive to mechanical wear.

FSZ Flow meter

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