Closing the loop on efficient steam control

Eurotherm.

Steam heating solutions

Eurotherm™ provides a range of products, digital engineered solutions and services globally. Our expertise in temperature control allows us to supply solutions that suit the scale of your requirements, while helping to maximize efficiency, energy consumption, productivity, and ultimately your return on investment.

Sustainable world

We help our customers reduce energy and manufacturing costs with scalable control solutions that enable smart operations and support optimization of existing steam heating assets.

Automation and modernization

Many steam ancillaries and downstream applications are currently managed either through manual, pneumatic, or self-piloted control. Using innovative PID closed-loop control, Eurotherm temperature controllers can provide a significant increase in process accuracy and consequent product quality.

Improve efficiency

Improving system accuracy means less steam is required for process heating applications. Combined with steam flow data, Eurotherm systems offer real-time BTU calculation for analysis and optimization of heating processes.
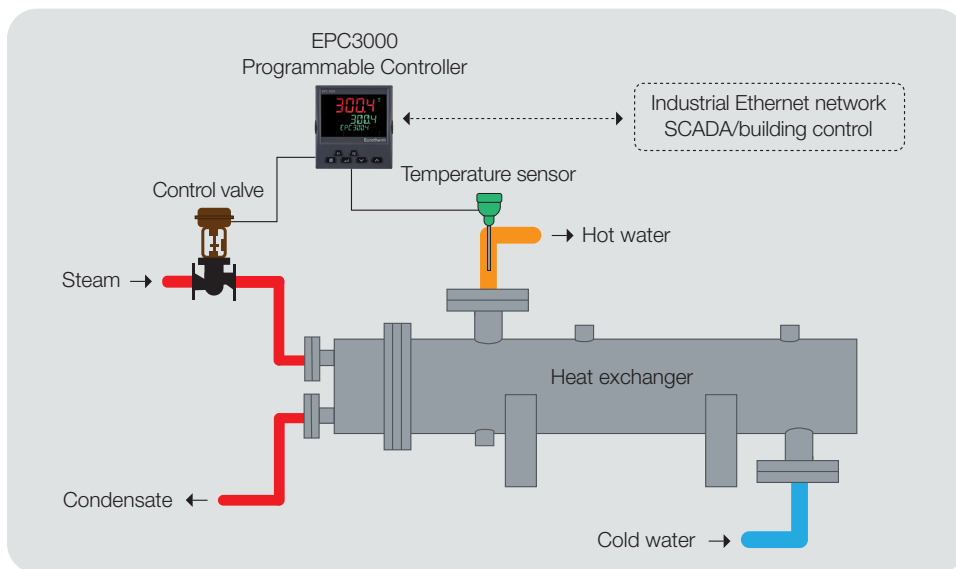
We have application expertise in:

- Heat exchanger control
- Direct steam injection
- Domestic hot water
- Clean steam generators
- Jacketed vessel heating
- Steam coil heating
- Sparging
- Steam pasteurization
- Sterilization
- Autoclaves
- Heat tracing
- Superheaters
- Desuperheaters
- Deaerators
- Split range and ratio control

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WATLOW.
Powered by Possibility

Steam temperature control overview

Temperature is the most controlled process in industry, and downstream/ancillary steam applications are no exception. Steam is used both as the direct heating medium, indirectly via jacketed containers or steam coils, or commonly via heat exchange to another fluid as shown in the diagram below.

EPC3000
Programmable Controller

Industrial Ethernet network
SCADA/building control

Control valve

Temperature sensor

→ Hot water

Steam →

Heat exchanger

Condensate ←

Cold water →

Emerging requirements

- High accuracy control
- Time-based control
- Preheat/warm-up cycles
- Communications with plant SCADA/DCS
- Remote visualization (web)
- Energy/BTU calculation
- High turndown ratio
- Dynamic load changes
- Autotune/continuous tuning
- Multi-parameter control
- Multi-zone control
- Mixing/metering

Eurotherm control features for demanding applications

Control cut-back

For applications in which overshooting the temperature setpoint could lead to damaged, scalded, or crystallized product, control cut-back incorporates calculations to help prevent overshoot, as the process temperature nears the required setpoint.

Gain scheduling

Some applications have vastly different nonlinear responses across temperature ranges. An application that deviates far from the operating setpoint can take a long time period to return to a steady state using the operating set of PID parameters that are optimal for highest accuracy at the setpoint. A common use for gain scheduling is in a cold start scenario. Gain scheduling allows for multiple sets of PID parameters to be assigned to operating temperature ranges. A very aggressive set of PID values can shorten warm-up cycles, but would be inappropriate at the operating setpoint. The solution is to have multiple PID tuning sets that are automatically switched as the measured variable passes pre-assigned thresholds. The gain scheduler controls this process for smoother transitions in the control output.

Ratio control

The most common application for ratio control is in dosing, or metering control. Based on the measured variable, steam or steam additive output is changed in a fixed ratio for consistency and uniformity.

Split range control

Split range control is commonly used in applications with high turndown ratios of steam flow or temperature, which exceed standard component designs utilizing two steam control valves with different physical characteristics and port dimensions. The most common output division is 2/3:1/3, but any fractional split is possible.

Profile/sequential control (time vs temperature)

Profile control allows for fixed rates of change (ramp rate) in heating or cooling, and fixed periods of time that steam or a heated product via a heat exchange or a calorifier remains steady at a given setpoint. This is typically used in food and beverage manufacturing for consistency in cooking and batching, and safety in pasteurization.

Holdback/guaranteed soak control

Building on the components of profile control, for processing periods that require a specified soak time, the holdback or "guaranteed soak" feature can pause the start of the processing period until all measured variables are at the appropriate level. This feature is commonly integral to the safety of steam processes such as sterilization, batch pasteurization, and products shaped, hardened, or cured in autoclaves.

Cascade control

When two measured variables need to be controlled with a single valve, a cascade control loop is required. An example of this is a jacketed vessel, or mixer where knowing the temperature of both the steam and the heated product are critical for effective control. Minimizing the differential between the vessel wall temperature and product temperature prevents scalding or spoiling during heating and helps ensure homogenous consistency of the product during cooling. Another common requirement for cascade control is steam-fed water heaters where disturbances in steam flow rates can have the effect of degrading the temperature control performance and efficiency. Typically cascade control requires two separate controllers where one provides the primary control, and the additional controller provides the secondary control receiving its operating setpoint from the primary control.

Utilizing the advanced control loop of the nanodac™ recorder/controller, cascade control is easily achieved in a single control device with intuitive cascade loop tuning easily accessed in the advanced loop parameters.

Feedforward control

In any steam heating loop, a notable change in the steam flow, or sometimes even pressure can cause a significant disturbance of the control loop, which is making calculations on differential and offsets of process value and setpoint. By adding a second input to incorporate the measurement of upstream variables, the control circuit can anticipate these changes and minimize significant lag and/or deviations.

Eurotherm solution:

- Industry leading controls in standard dimension formats
- Precision control strategies
- User-friendly operation with scrolling text info
- Digital data management
- Energy monitoring/real time BTU calculation
- Panel mounted controls up to NEMA 4X/IP66 (controller dependent)
- Data analysis and reporting tools
- Free comprehensive PC configuration software (iTools)
- Unlockable software features for in-situ upgrade and expanded capabilities
- Robust design for reliability in demanding environments and highly regulated industrial processes
- Engineered solutions available

Building control network via BACnet/IP
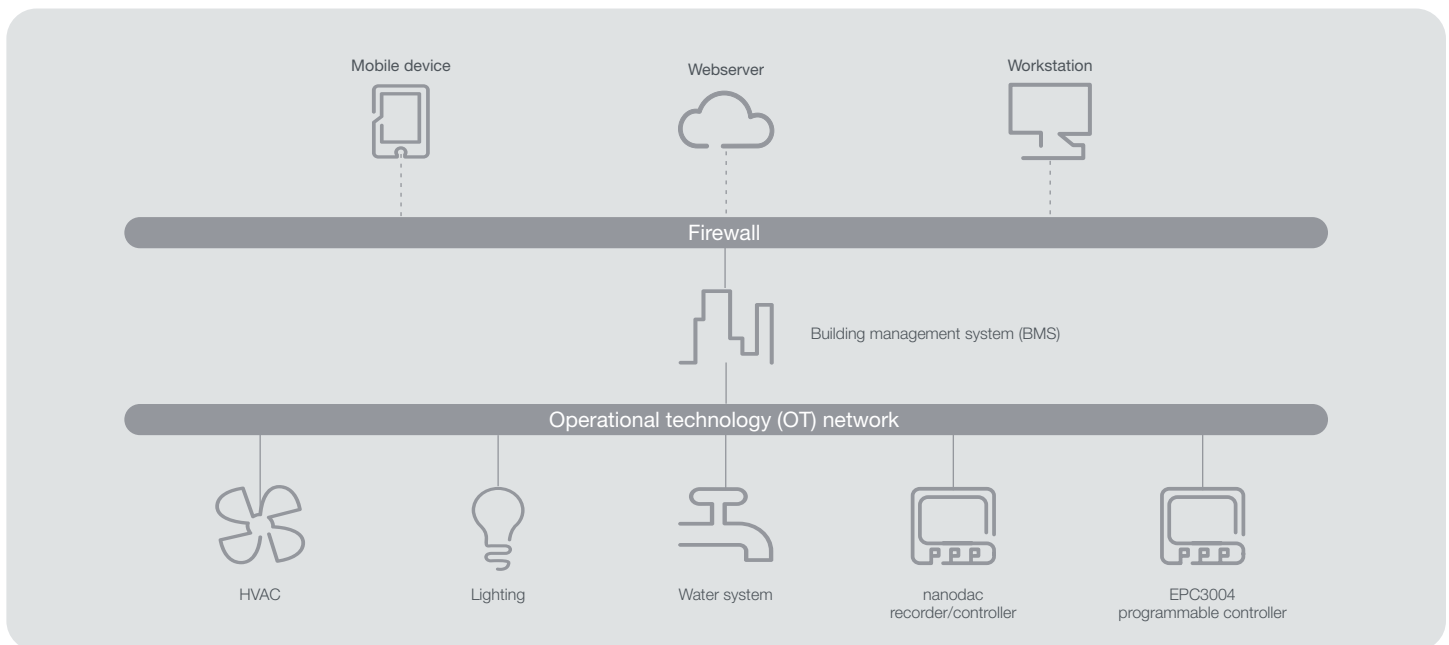
BACnet™ is widely used in heating, ventilation and air conditioning (HVAC), institutional hot water, and district energy networks. Eurotherm offers native BACnet/IP communication option on some controller and hybrid data recorder/controller ranges, via the onboard RJ45 connection.

Industry 4.0 ready technology

Eurotherm is fully committed to supporting the Industry 4.0 initiative and offers Ethernet connected products for fast access to process and diagnostic information as well as connectivity to external PLCs, SCADA systems, and IIoT technologies.

Our Ethernet connected devices for steam heating control solutions offer Modbus TCP as standard, with ODVA compliant Ethernet/IP™ also available as an option.

EPC2000/3000 programmable controllers are certified to Achilles® Communication Robustness Testing Level 1 for industry standard ethernet connected networks, and were the first Eurotherm controllers to be designed and certified to meet these stringent cybersecurity requirements.

Global Certification

- Certified to international standards such as CE, UL/cUL, CCC (exempt)
- Panel sealing up to NEMA 4X/IP66 (controller dependent)
- Aids compliance with Data Integrity requirements for life science and food & beverage including HACCP, HARPC, FDA 21 CFR Part 11, and ALCOA+ principles

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