FLOWCON BUS ACTUATORS

THE *SMART* SOLUTION FOR HYDRONIC SYSTEMS

Remote Monitoring, Flow Limitation and Control –

Pressure Independent Control Valves [PICVs] have become the go-to solution in variable load systems with their easy selection and 100% authority.

The addition of smart actuators is beneficial in flow rate specified applications where remote setting is preferred, whether looking to reduce site commissioning time and costs, accessibility limitations or changing maximum load conditions.

FlowCon PICVs used in conjunction with a **FlowCon BUS actuator** allow for remotely programmed flow settings and feedback. Direct communication with the BMS is achieved through BACnet or Modbus with no requirement for a separate controller.

Remote monitoring using the BUS actuator allows for valve blocking protection, a communication failure mode in the event of an invalid control signal, leak detection when the ΔT is above 8 °K when the valve is closed for more than 6 hours and the ability to flush remotely on a schedule flush time.

As part of the commissioning procedure each control valve is programmed with valve type and the design flow settings. Each of the design flow settings is calculated on a 0-100% input signal, based on the valve's maximum capacity. Flow feedback can be configured as percentage value or as an estimated flowrate [l/h].

Delta T Monitoring and Control –

The purpose of a hydronic system is to transfer the thermal load into the controlled zone.

The transfer of this thermal load output can be lowered by a poor differential temperature (ΔT). The main cause of a low ΔT is unit overflows. This results in hot and cold spots in the building, causing comfort issues for the occupants. This key problem is termed as the 'low delta-T syndrome'.

A main concern in heating systems, especially with the use of condensing boilers as a high return temperature will not allow the boiler to condense and in turn then it becomes an expensive conventional boiler. In cooling systems, chillers are designed with a certain ΔT and flowrate. A low ΔT with a constant flow rate reduces the chiller capacity, causing inefficiency as the chillers must remain on to satisfy the load [1].

In addition to the previously mentioned comfort issues, overflows and a low ΔT can cause higher operational costs, such as increased expenditure for a higher pump demand than required, reduced lifespan of equipment and the cost of corrective design actions.

PICVs are most suitable for terminal unit applications by only delivering the designed amount of water, reducing the risk of overflow and maintaining a higher ΔT through the coil.

However, issues with low ΔT can occur in forced convection [fan] heat exchanger applications at low fan speeds when changing space temperatures command the valves to be opened, either in cooling or heating modes. The ΔT can be diminished through the lack of air volume being unable to remove more energy from the heat exchanger.

The diminished temperature difference can be recognised by using a ΔT system as a diagnostic tool to measure the actual ΔT and collecting the data points for improvement of the control strategy. Optimisation would be through utilising the ΔT control system to position the valve accordingly, to achieve the set ΔT design.

Installation of the supply and return temperature sensors on the FlowCon BUS actuator allows for differential temperature measurement, which can be used for the above mentioned ΔT monitoring and control strategy. As a control strategy the actuator will override the input signal and maintain the minimum ΔT by starting to close the valve when the specified ΔT is not achieved. The return set-point temperature will adjust on increases/decreases to the supply temperature, achieving optimal thermal output.

Thermal Power (Energy) Control –

Flow rate and differential temperature control can be used independently as a form of load control. Although a reduction in thermal power consumption can be obtained by controlling both variables through a differential temperature (ΔT) management system [2].

Measuring a ΔT with a known flow rate can be used to calculate a power output using the following equation [Eq.1]:

Eq.1:

$$Q = mc\,\Delta T$$

Thermal Power = Mass Flow * Specific Heat Capacity * Temperature Difference

Kw = kg/s * kJ/kg/°C * °C

Should the thermal power be limited under a control strategy it is important to consider the power saturation point of the coil – the point in which the coil cannot produce additional power regardless of increased flow rate, as shown by the waste zone in *Figure 1*. Designing a strategy with the power output value close to/higher than the saturation zone will lead to unnecessary overflows and a low ΔT. And so, implementing an efficient strategy based on thermal power control is achievable with the understanding that the coil saturation point is known. Monitoring, collecting and graphing data for the coil's heat transfer behaviour is beneficial before solely using the power output as a limiting variable.

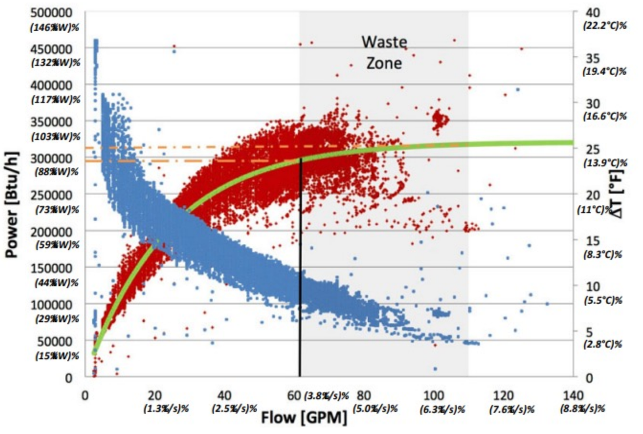

Figure 1: Coil performance [3]

Power [Btu/h]

ΔT [°F]

Thermal power is limited as a control strategy when the power output is the only known design variable. Unit control can be achieved as a power output without knowing water flow rates and ΔT. This is a controllable factor for comparing unit efficiency against the design load for the space.

The FlowCon BUS actuator with the two PT1000 sensors attached enables readings to the supply and the return temperature. Along with this an estimated flow reading and the heat capacity constant allow for an estimated power output reading by using the controller's built in PI-controller.

Return Temperature Control –

For a heating circuit the return temperature is a key indicator of system efficiency. A low return temperature results in a larger ΔT, meaning that lower flow rates are required for the same kW delivered. A lower return temperature means designers can reduce pipe sizes. Going down one pipe size reduces capacity by 36% and heat loss on average by 10%, going down two pipe sizes reduces the capacity by 62% and heat loss reduction by 19% [4]. Thereby reducing capital costs and power usage. Lower controlled return temperatures improve the efficiency of boilers, heat pumps and CHPs. System temperatures can be controlled through the individual return temperatures of space heating, HIUs and heat exchangers on the same network.

A general issue with standard minimum flow by-pass' situated at the end of line is that they contribute to raising the temperature of the network. Investigations have shown that it is possible to insert temperature-controlled valves instead of manual valves, resulting is significant cost reductions [4].

The project discussed in the referenced article [5] recommends installing temperature sensors in a fixed by-pass and monitor the system in periods of changing supply temperature, making periodical comparisons between changing conditions and a controlled fixed return system temperature.

The FlowCon BUS actuator with 1 PT1000 for return temperature measurement in combination to the controller's built-in PI-controller allows for control by return temperature.

The addition of the BUS actuator range effectively transforms the FlowCon Green PICV range into Smart Valves, retaining the well-known benefits, such as the compact size and removable inserts, which allow for most accurate set point selection and flexibility.

The BUS actuator can easily be retro-fitted in existing systems, enabling data gathering and finer control, thereby upgrading the existing valve population into energy valves and obviously, can be fitted in new installations, contributing to an enhanced control strategy, that optimises occupant comfort as well as energy consumption.

Contact our engineers or more detail on our energy and smart valve solutions.

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