Balancing and control of small terminal units

we knowhow

TA

Knowledge is power

At TA, we believe the best decision is the most informed decision. That's why the information in this brochure is designed to be simple and easy-to-remember. We hope it provides you with a useful overview of an important and complex subject. Inside, you'll find information on balancing and control, and TA's product range for small terminal units. Enjoy!

Why balance small terminal units?

It's a simple question, with an even simpler answer. Every hydronic system – and every terminal within a hydronic system – operates more effectively when balanced correctly (irrespective of size). Here's why.

With the best possible hydronic control comes the best possible indoor climate at the lowest possible energy cost. Achieving this happy state of affairs depends on meeting three key conditions:

1. The design flow must be available at all terminals.
2. The differential pressure across control valves must not vary too much.
3. Flows must be compatible at system interfaces.

And the best way of meeting these conditions? You guessed it, balancing.

The benefits of balancing

As well as revealing almost all threats to the functionality of your installation, balancing also lets you identify the cause of those threats, and the best solution. Here's a complete list of balancing benefits:

- Balancing improves comfort by preventing local underflows and ensuring flow compatibility
- Balancing ensures the installed power is deliverable (thereby making the HVAC investment pay off)
- Balancing valves shorten start-up time, improving comfort and saving energy
- Balancing helps detect construction errors prior to system handover
- Balancing is the only way to reveal pump oversizing, helping to reduce costs
- Balancing valves can detect an array of operational problems

Take control. But how?

The big decision. We've established the benefits of balancing, and now you need to figure out the optimum control mechanism for each unit. There's no easy answer but we've made it a whole lot easier for you to make a decision.

The benefits of control
There are two basic reasons to control a hydronic system:

- To improve comfort
- To minimise energy costs

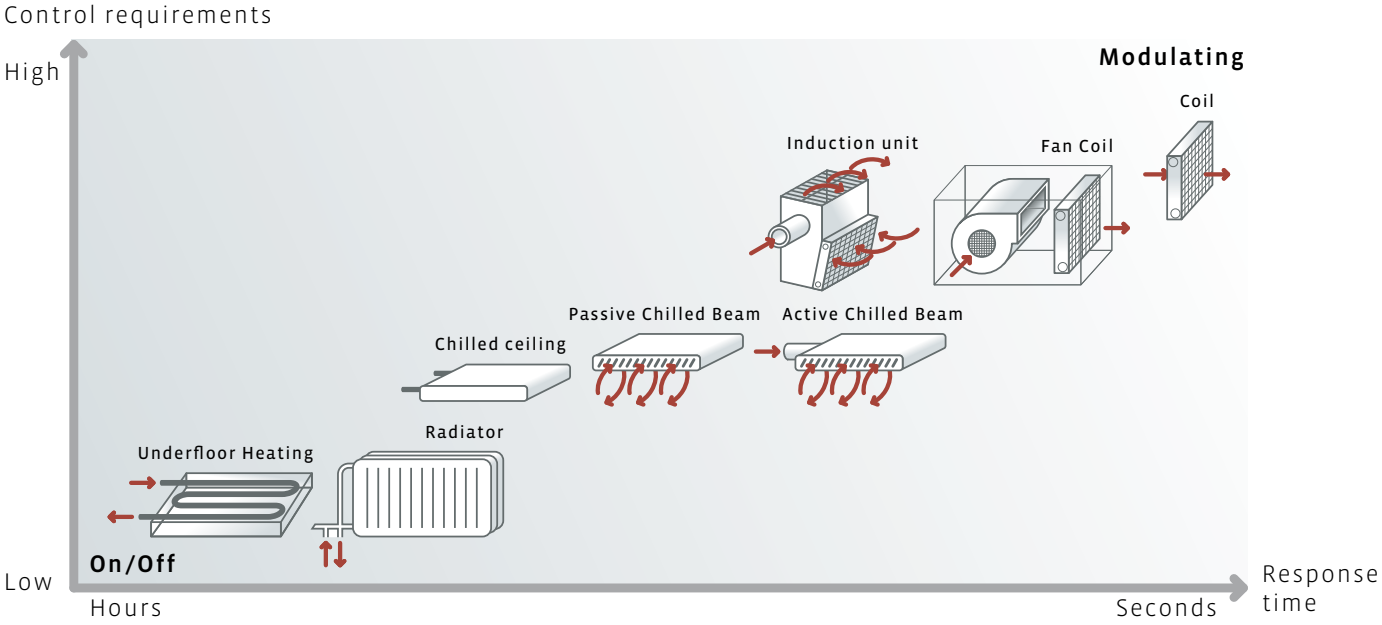
Together with operational supervision and follow-up, control makes up the building energy management system (BMS), which is the main tool for optimising both comfort and energy use. But what kind of control is optimal?

What kind of control is right for you?
That depends on a number of factors:

- Comfort requirements
- Energy use requirements
- Controllability of the hydronic system
- Cost of control equipment
- Cost of installation and commissioning

With so many variables, this is rarely an easy choice. But one useful piece of advice is to simplify the level of control needed as much as possible. One way of doing this could be to simply lower the demands on accuracy and performance, but in practice this is not really an option. A much better way is to enhance controllability by improving the design of the hydronic system.

On/off or modulating?
As we've already outlined, this is not simple. The chart below sets out a basic rule of thumb, but perhaps the most useful piece of advice is to keep it simple! The more complex your system becomes, the greater the risk of control failures.



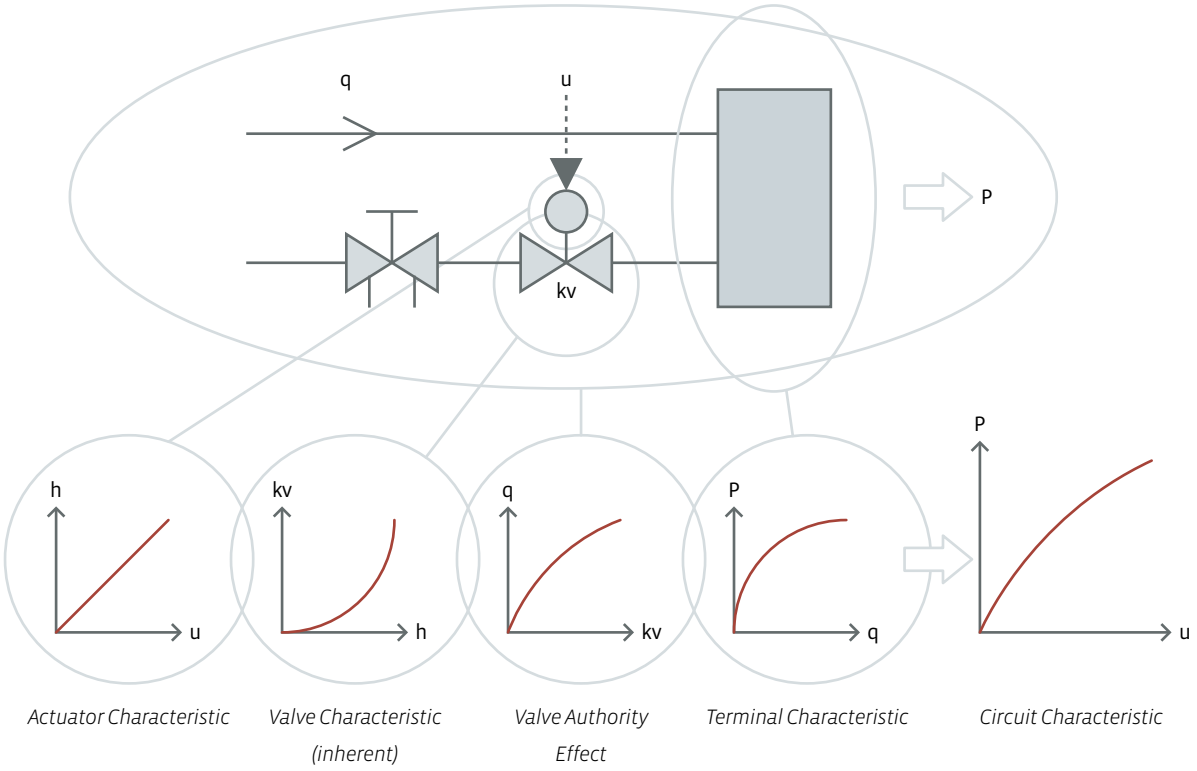
On/off
Where the control accuracy demands are not prohibitive, and the terminal unit in question is rather slow in response, on/off control will generally suffice.

Modulating
Hydronic systems with higher control accuracy demands, and those which are harder to control, require more sophisticated modulating control.

Circuit characteristic – think linear

The key to comfort

Good hydronic design is integral to ensuring successful control in modulating control systems. And a key indicator of the hydronic design quality is the circuit characteristic. This is the relationship of the control signal (u) to a control valve and the resulting thermal power (P) from the unit. The steeper the circuit characteristic curve, the higher the risk of control instability. A more linear shape will result in greater control, and, therefore, greater comfort.



Actuator Characteristic | *Valve Characteristic (inherent)* | *Valve Authority Effect* | *Terminal Characteristic* | *Circuit Characteristic*

How can we ensure a linear curve?

- By using a control valve with the correct valve characteristic adapted to the terminal characteristic and a good linear actuator.
- A hydronic design and balancing that minimise the impact of valve authority.

For a more detailed analysis of this issue, contact your TA sales engineer.

TBV-CMP – the control specialist

The latest addition to TA's range of valves for small terminal units delivers perfect control at any time, making it the most reliable pressure independent balancing and control valve around.

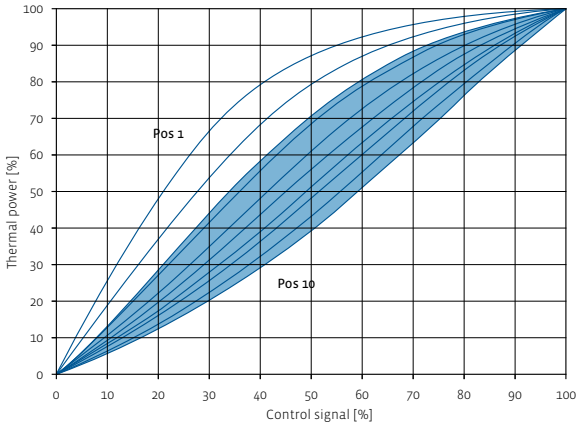
As previously mentioned, a hydronic system with a high level of controllability requires linear-shaped circuit characteristics. This in turn depends on optimum balancing, the choice of control valve and the stability of pressure levels in the system. The TBV-CMP offers all three of these functions in a single unit, making it a one-stop shop for total hydronic control.

Measurement capabilities of TBV-CMP

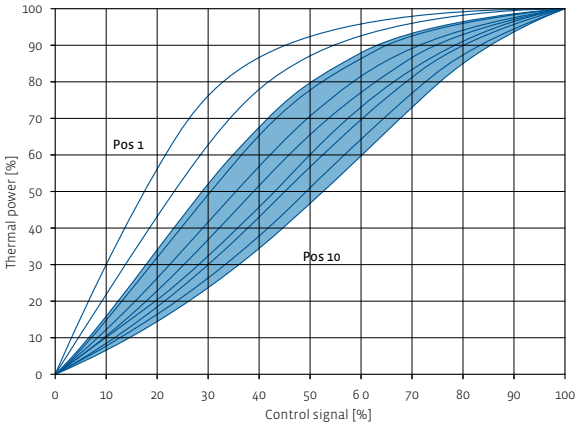
- Measuring of differential pressure over the control and pre-setting part of the valve in order to check and fine-tune the flow and deliver the balancing report.

- Measurement of the total pressure drop over the valve when closed makes it possible to get the available ΔH (necessary for troubleshooting).

The graphs below illustrate the circuit characteristic for different flow rate settings when using the TBV-CMP.



Heating coil (60/30 °C)



Cooling coil (16/22 °C)

Which solution to use?

So you're convinced of the importance of balancing your hydronic system, and you know whether you need on/off or modulating control. The last step is finding the right control and balancing valves for your terminal units. The charts below make that choice a simple one.

On/off

1. STAD + TBV-C — Normal solution for most system using on/off control
   STAP + TBV-C — Simplifies the balancing procedure and minimises the risk of noise

Modulating

2. STAP + TBV-CM — Normal solution for most modulating control systems
   STAD + TBV-CM — When acceptable valve authority can be obtained without Δp control
3. TBV-CMP — A more costly solution that ensures favourable circuit characteristic and simplifies commissioning

Balancing procedure	**On/off control**		**Modulating control**	
	No Δp control desired	Δp control desired	No Δp control required	Δp control required
Normal	STAD + TBV-C		STAD + TBV-CM	
Simplified		STAP + TBV-C		STAP + TBV-CM
Pre-setting				TBV-CMP

Regardless of the chosen solution, measuring is needed to obtain a fully controllable hydronic system. Whichever solution you opt for, you will be able to:

1. Verify the flow (i.e. check that the design flow is available at each terminal).
2. Receive full system documentation (the balancing report).
3. Perform trouble-shooting whenever necessary.

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