

Air volume control with the Belimo Fan Optimiser:

Leibinger combines active energy saving with increased comfort



Reinhold Buschle, Head of Department responsible for building automation at Leibinger in Tuttlingen/DE.

Belimo's Fan Optimiser works miracles!

«When the decision was taken to renovate our ventilation system, my two top priorities were to optimise system operation and improve the satisfaction of the workforce. My attention was therefore immediately alerted when Wolfgang Schlayer of Belimo explained how the new Fan Optimiser allows the fans for central air conditioning to be controlled based on the actual damper position of the individual VAV units.

He quickly convinced me that the electrical motor power requirement of the fans in our own ventilation system with variable air volume (VAV) control would be significantly lower and that classic pressure control could be dispensed with.

The Fan Optimiser has also helped me solve another major problem: If the fans are running at very high speeds and the VAV units have to eliminate the excess pressure, this results in disturbing noise. Belimo's little 'miracle worker' has greatly reduced this former source of annoyance.»



Active energy optimisation and increased comfort for the workforce – these were the two ambitious goals set for the recently renovated ventilation system at Paul Leibinger GmbH & Co. KG's Tuttlingen/DE plant. A key role was played here by the Belimo Fan Optimiser.

For more than five decades, Leibinger has been a trustworthy supplier of mature and proven technology, reflected in a wide range of products from numbering machines to lasers, inkjets and camera systems for almost any application.

Under one roof – the pros and cons

Leibinger's cosmopolitan business culture and productive dynamism are reflected in the spacious architecture of its new building in Tuttlingen, which it has occupied since mid-1999. For the first time in the company's history, all product lines are united under one roof. In an age when mechanics and electronics are becoming increasingly inseparable, Leibinger creates crucial synergies.

At the same time, however, a powerful ventilation system is necessary to operate these systems – so powerful that several employees complained to Reinhold Buschle, the Head of Department responsible at Leibinger for building automation, about the high noise output. Most of these protests came from the foreman's office, which is surrounded by ventilation ducts and as such particularly exposed to unpleasantly loud

noise levels. All attempts to remedy this unacceptable state of affairs with structural measures were in vain.

Renovation – the perfect time for a rethink

The noise problem and the desire to cut energy consumption were behind the management's decision in 2005 to reappraise and renovate the complete ventilation system. A workable concept was developed together with the system integrator, Fiehn Gebäudeautomation GmbH in Königsfeld/DE.

The visit from Wolfgang Schlayer of Belimo Stuttgart came at exactly the right time: He explained most convincingly to Leibinger's Reinhold Buschle how the Fan Optimiser allows the fans for central air conditioning to be controlled based on the actual damper position of the individual VAV units. He argued that this would not only facilitate a substantial reduction in electricity consumption, but that it would also put a stop to the noise nuisance.



Leibinger's ventilation system

With a total length of 163 m, a width of 40 m and a ridge height of 12.5 m, Leibinger's new building was meticulously planned and subsequently erected to provide lasting cost savings. All ventilation subsystems were rigorously implemented with waste heat recovery. The company also generates its own electricity with the help of photovoltaic cells. If necessary, surplus power can be fed into the local electricity grid. Peak loads are additionally covered by Leibinger's in-house cogeneration plant.

Ventilation subsystems

The production shop is ventilated by a total of ten subsystems installed on the roof of the building. Each of these subsystems is equipped with waste heat recovery technology.

VAV control for demand-based ventilation

A central air conditioning plant ventilates the offices and day rooms by supplying air to ten distinct zones, each of which is controlled by VAV (Variable Air Volume) units according to demand. One supply and one exhaust air unit are provided in every zone.



Each VAV unit is equipped with an NMV-D2M (VAV-Compact) controller from Belimo.

Building automation control

Fiehn (the system integrator) employs a freely programmable DDC control system from TAC for open and closed-loop control. The VAV units are activated and deactivated by the TAC system according to the temperature.



Reinhold Buschle, responsible for building automation at Leibinger, keeps an eye on the system with the TAC Vista building management solution.



From right to left: Wolfgang Schlayer (Belimo) explains the advantages of the Fan Optimiser to Horst Krebs (Fiehn) and Reinhold Buschle (Leibinger).

No sooner said than done...

The responsible persons at Leibinger, Belimo and Fiehn subsequently got together to discuss details of their plan to optimise the ventilation system. They identified the following main benefits as a result of installing the Fan Optimiser:

- Potential noise reduction
- Significant energy saving
- Opportunity for a new operating concept
- Easy integration into the existing system
- NMV-D2M VAV-Compact controllers are already designed to interact with the Optimiser
- No other new equipment required apart from the Fan Optimisers.

Easy implementation with direct interface to the BMS

The Fan Optimiser presets the setpoints for the VAV controllers, and receives information about the opening angles of the VAV unit damper blades, via the Belimo MP-Bus®. Since the Belimo NMV-D2M VAV-Compact controllers already installed can be activated and deactivated either in the conventional way or over the MP-Bus, they needed no modification to operate with the Fan Optimiser.

After studying the wiring diagram for the Fan Optimiser, Horst Krebs of Fiehn realised that minor alterations would, however, be necessary in the control cabinet in order to integrate the Belimo solution. As Fiehn manufactures control cabinets itself, this did not present any great problems.

The individual VAV zones are activated by TAC Vista, the building management system, by means of a switching programme specified by Reinhold Buschle (responsible for building automation at Leibinger). Occupancy switches in each zone allow temporary comfort control in all non-activated rooms.

An unqualified success

In the meantime, the Fan Optimisers have been doing duty for two years, with experi-

ence so far altogether positive. Not a single complaint has since been received from the workforce about the ventilation system making too much noise. Even the foreman's office is happy with the improvement. A simple answer was ultimately found to a problem that structural measures were unable to solve.



Thanks to the Fan Optimiser, the foreman's office is no longer disturbed by excessive noise from the ventilation ducts that surround it.

The Fan Optimiser has enabled the average power consumption of the fans to be cut by 50%. And because the minimum and maximum volumetric flow limits (V_{MIN} , V_{MAX}) of the VAV units were also optimised when the Leibinger system was renovated, it was possible to realise further saving potentials at the same time: whereas the fans previously had a total power consumption of 22 kW (supply air fan 11 kW, exhaust air fan 11 kW), they now manage with just 4 kW each courtesy of the Fan Optimiser – equivalent to a reduction of approximately 65% per fan.

Only four Fan Optimisers were needed to renovate the complete system. Reinhold Buschle confirms that these huge energy economies have permitted the costs for the equipment to be recuperated in a very short time.

Individual operation – easy adjustment

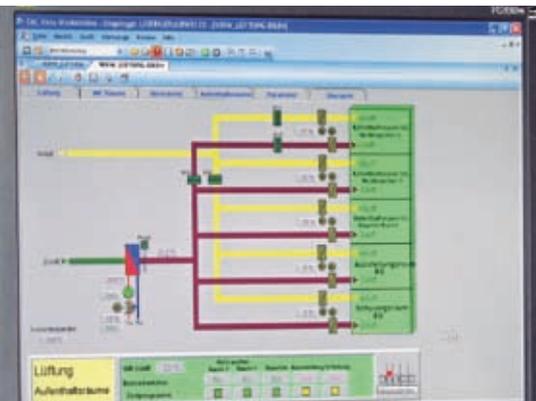
Access to the parameters is very straightforward, so that the individual VAV zones can be optimised at any time. Each VAV controller can be called up directly on the operating panel of the Fan Optimisers via the MP-Bus. The operating volumetric flow settings (\dot{V}_{MIN} and \dot{V}_{MAX}) can thus be adjusted in a few simple steps as and when necessary – without Reinhold Buschle having to be there physically.



The four Fan Optimisers (left) and the TAC DDC controllers.



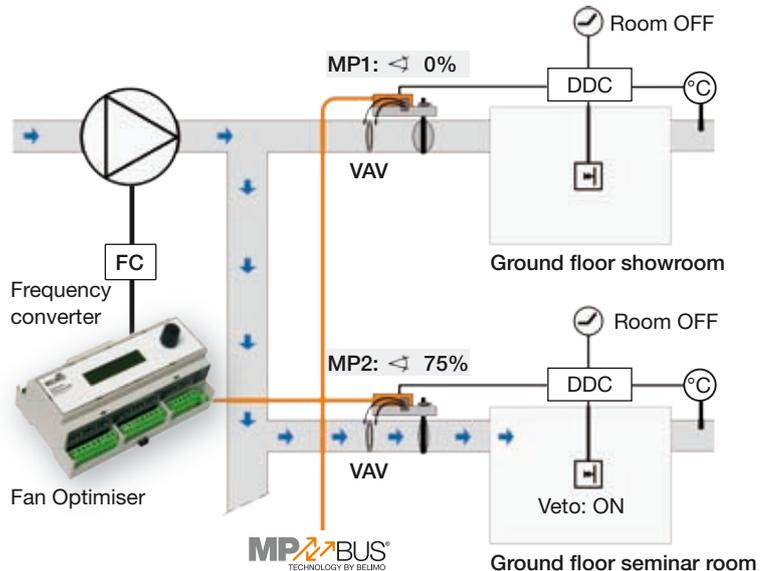
Reinhold Buschle adjusts the \dot{V}_{MIN} and \dot{V}_{MAX} parameters of the VAV controllers on the Fan Optimiser.



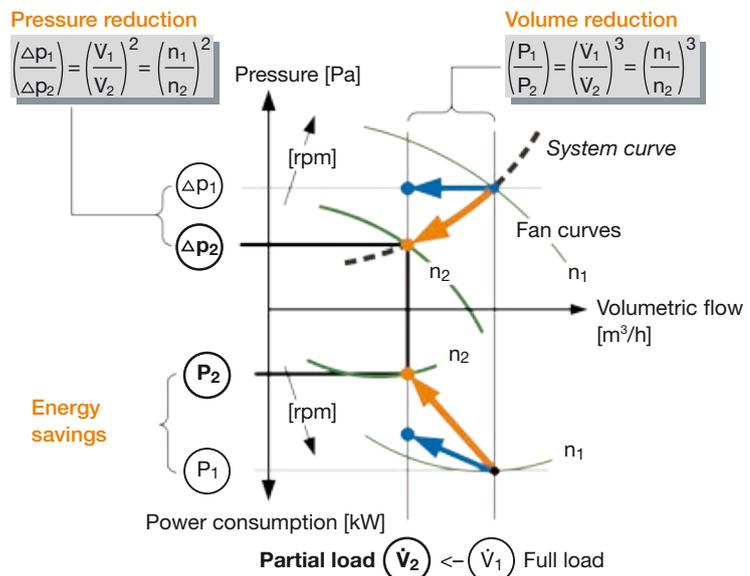
The VAV units and their current volumes are displayed on the screen of the building management system.

Fan Optimiser. Simple, reliable and instantly efficient.

Principle of operation of the COU24-A-MP Fan Optimiser



All offices, seminar rooms, etc. are controlled according to the room temperature on the basis of actual demand and activated by a time programme. The dampers in the various rooms are closed outside each zone's occupancy times. A veto button enables the ventilation to be switched off – or if necessary switched on outside the normal occupancy time – if a specific room needs to be separately conditioned.



In a system with conventional pressure control (blue), the air duct pressure is maintained at a constant full-load level Δp_1 . Each reduction in the volumetric flow rate $V_1 \rightarrow V_2$ causes the difference Δp_1 compared to the required system pressure Δp_2 to increase. The downstream VAV units are forced to eliminate the excess pressure by closing the dampers – leading to a higher overall pressure loss in the system.

In the Leibinger configuration, the damper position is integrated in the ventilation system – via the MP-Bus – as an on-demand variable. The Belimo Fan Optimiser (orange) reduces the system pressure – in accordance with the damper diagram – until the system pressure returns to the Δp_2 value on the system curve.

The result – a smaller pressure loss, less flow noise and much lower energy consumption.

Paul Leibinger GmbH & Co. KG, Tuttlingen/DE:

Shaping the future with ideas

Two core technologies of our modern industrial society are converging in a new, revolutionary discipline: «mechatronics» is rapidly emerging as a combination of mechanics and electronics. With its longstanding experience in the development and manufacture of innovative numbering machines, lasers, inkjets and camera systems, Leibinger is one of the pioneers in this area.

A staff of approximately 200 work in a production area of more than 10,000 m² at the company's facility in Tuttlingen/DE. The technical heart of this plant is formed by 70 CNC machines and numerous special machines designed in-house as well as Leibinger's own process controlled hardening and electroplating shop.

To guarantee the best possible support for its partners and customers in North and South America, Leibinger decided 30 years ago to establish a separate branch in the USA. Regular expansion and the introduction of new products eventually made it necessary to extend the square footage. Early in 2004, the US branch acquired a spacious new building. This move enables Leibinger to serve and satisfy the American markets even more effectively.



Two years after installing the Fan Optimiser – the project's masterminds take stock (from left to right): Kurt Truninger (Product Manager Belimo CH), Reinhold Buschle (Leibinger), Wolfgang Schlayer (Belimo DE) and Horst Krebs (Fiehn).



Consistent dedication to first-rate service is the hallmark of the company philosophy. To a manufacturer such as Leibinger that exports durable capital goods to more than 120 countries worldwide, efficient service is a vital element of overall product quality. This is optimally assured by a dense network of branch offices and agents in all corners of the globe.

More information:
www.leibinger-group.de

Fiehn Gebäudeautomation GmbH, Königsfeld/DE:

Total precision in building management

Fiehn Gebäudeautomation GmbH can look back on more than forty years experience as a system integrator in the area of I&C (instrumentation and control) for HVAC (heating, ventilation and air conditioning) systems.

Fiehn is equally at home in classic control engineering and state-of-the-art, cross-facility automation featuring PC-visualised management systems and OPC server based communication. The company also integrates the most diverse I&C (instrumentation and control) specifications using the latest LONWORKS® technology.

More information: www.fiehn.de

Control cabinets, the majority of which are custom-developed in-house for specific projects, are a further focus of Fiehn's business.

Fiehn's positive experience with the Fan Optimiser at Leibinger has since persuaded it to embed this solution in various other successful projects.

For more detailed information, please contact your Belimo representative:



BELIMO Automation AG, Brunnenbachstrasse 1, CH-8340 Hinwil, Tel. +41 (0)43 843 61 11, info@belimo.ch, www.belimo.com