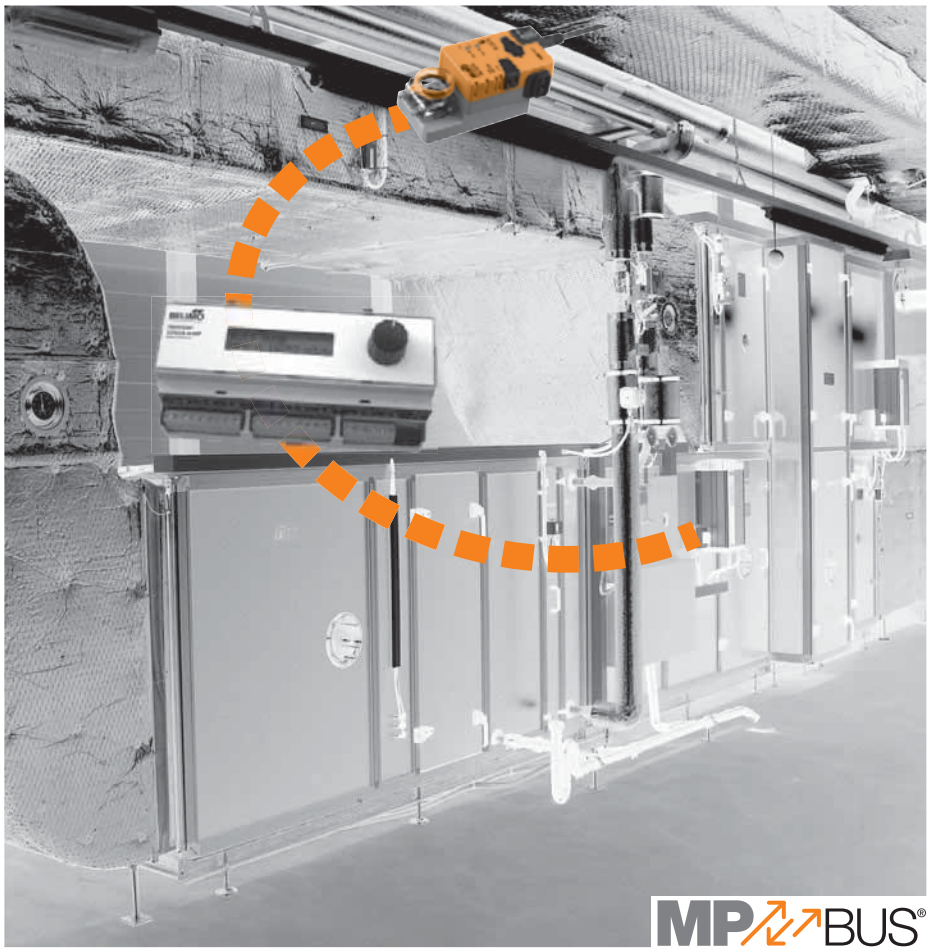


Fan optimiser COU24-A-MP

System solutions for energy-optimised operation of variable and constant volumetric flow systems in the room ventilation field

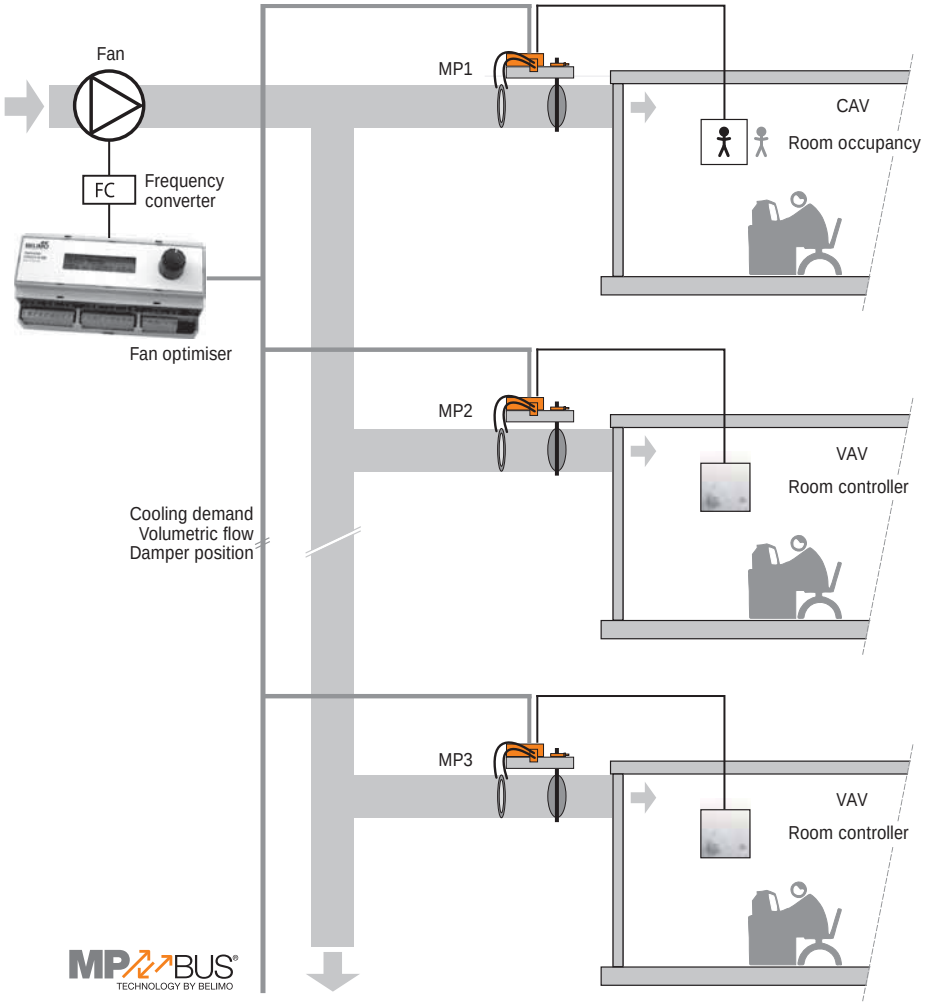
System description S4-COU24-A-MP • en • v1.0 • 03.2006 • Subject to modifications

System principle

The volumetric flow and its transport are the most determining factors for the energy consumption of the fans.

In the case of conventional, pressure-controlled systems, the supply pressure is selected to provide enough air to the most unfavourably placed VAV unit during full load operation.
The remaining oversupplied units have to eliminate the excess energy, i.e. the overpressure, by closing the dampers. These units are often operated in the most unfavourable range – in respect to control characteristics, noise and pressure loss.
The greatest energy loss occurs at partial load, which is often the largest part of the operating time of a VAV system.

Fan optimisation: Nominal volume (space requirement), actual volume and damper position are recorded via MP-Bus, analysed by the optimiser and specified as a setpoint for the frequency converter.
Result: The system is operated in the optimum range for energy consumption, noise and control characteristics.
The greatest potential energy savings are found in partial-load operation, a considerable share of the time for a VAV unit.



Fields of application

Variable and constant volumetric flow systems in the room ventilation field with fans that are controlled by a frequency converter.

Function

The system is operated by the fan optimiser – according to the current demand signals – with optimum damper positions. The objective is to keep the pressure loss through the VAV units as low as possible. This permanently reduces operating costs by decreasing the fan output.
The damper positions of each VAV unit are recorded, transferred via the MP-Bus to the fan optimiser and used there as a control variable to regulate the fan controlled by the frequency converter.
As a result of this technology – based on the Belimo MP-Bus – up to fifty per cent energy savings can be achieved compared to conventional systems with fans controlled by air-duct pressure.

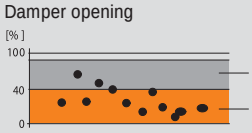
Proportionality laws

The proportionality laws form the basis of the volumetric flow transport.

- The volumetric flow is proportional to the speed $\left(\frac{\dot{V}_1}{\dot{V}_2}\right) = \left(\frac{n_1}{n_2}\right)$
- Pressure increases change to the second power with the volumetric flow ratio $\left(\frac{\Delta p_1}{\Delta p_2}\right) = \left(\frac{\dot{V}_1}{\dot{V}_2}\right)^2 = \left(\frac{n_1}{n_2}\right)^2$
- The power consumption changes to the third power with the volumetric flow ratio $\left(\frac{P_1}{P_2}\right) = \left(\frac{\dot{V}_1}{\dot{V}_2}\right)^3 = \left(\frac{n_1}{n_2}\right)^3$

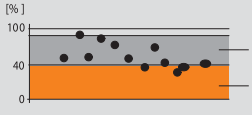
Damper diagrams

- Pressure-controlled system



Operating state
optimum range
unfavourable range (in respect to energy efficiency and control characteristics)

- Fan-optimised system



Operating state
optimum range
unfavourable range (in respect to energy efficiency and control characteristics)

Customer benefit

- Energy savings – up to fifty per cent lower energy consumption of fans due to reduced drop in pressure through the downstream VAV units.
- Lower costs – supply air and exhaust air pressure controls are eliminated.
- Cutting installation work – standard cables for three-pole MP-Bus
- Easier commissioning – since pressure controls do not have to be commissioned.
- System convenience – thanks to lower flow noise. The flow noise through the units and in the air duct system is reduced by the lower supply pressure.
- Increased operational reliability – pressure losses due to filter contamination are automatically compensated for. Complaints such as “the system does not supply enough air” are all part of the past now.
- Optimum cost-benefit ratio – the investment pays even with small and medium-sized buildings.
- Flexible system designs – for example as:
  - CAV system: volume changeover $\dot{V}_{min}/\dot{V}_{max}$ through motion detector
  - VAV system: demand-controlled via room temperature controller CR24-B1
  - VAV system: demand-controlled via DDC system controller
  - mixed VAV/CAV system
- Can be used for new systems, retrofitting for system optimisations and renovation of existing systems – all VAV-Compacts (LMV-D2M/NMV-D2M from 2001 and later) support the optimiser function!
- Simple engineering and efficient commissioning – thanks to preconfiguration, LCD display and self-adaptive control behaviour.

The fan optimisation is
- An effective measure with regard to the EU directive 2002/91/EC on the overall efficiency of buildings and the implementation measures derived for this, e.g.: DE: DIN V 18599.
- A permanent measure for reducing operating costs.

A quick amortisation
- The massive potential energy savings guarantee that the costs of the fan optimisation solution are quickly amortised.

Interfaces

Control

The energy requirements of the single-room/DDC controllers are transferred to the fan optimiser COU24-A-MP via analog signals or MP-Bus.

VAV controllers

As a result of the MP-Bus technology, the VAV controllers provide access to all relevant data such as the current actual volumetric flow, damper position etc. Setting and control functions are possible at any time with the Belimo PC-Tool.

Frequency converter

The frequency converter is controlled through a 0…10V analog output. In the case of mixed systems with VAV and mechanical CAV units, a minimum fan speed can be set.

System size

Unlimited system size; further fan optimisers can be operated in a sequential circuit via the cascade output of the fan optimiser.
Number of VAV/CAV units per fan optimiser: 1 to 8

Operation and display

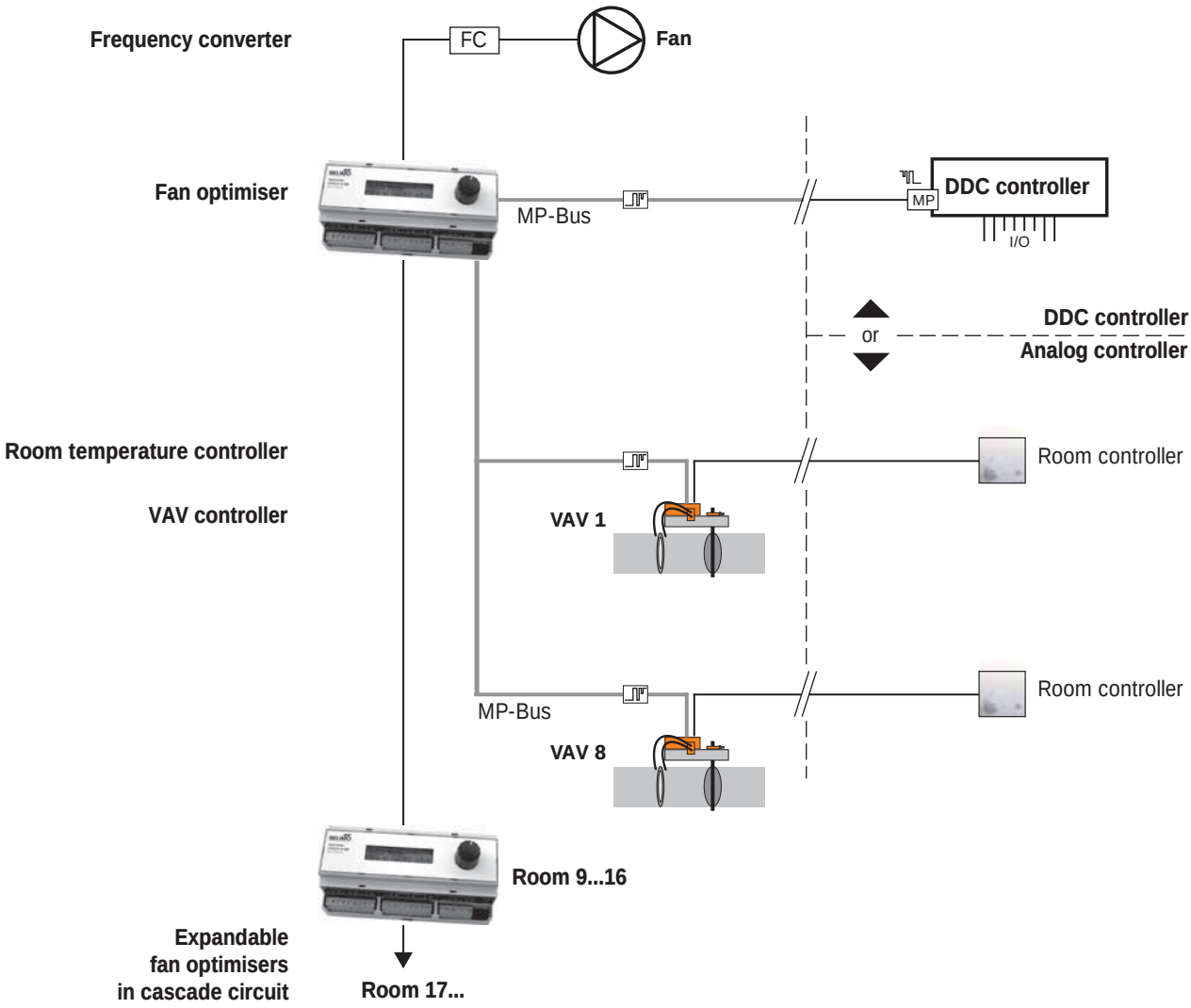
All relevant information (total, single, actual volume, damper positions, frequency converter setpoint etc.) are shown on the LCD display. User-guided setting and display menu with easy operation via encoder button.

VAV controllers

The VAV controllers can be addressed and controlled via the fan optimiser. In addition to the actual volumetric flow and damper position display, the operating volumetric flow settings $\dot{V}_{min}$ and $\dot{V}_{max}$ can be displayed and adjusted if necessary.
Furthermore, the PC-Tool (setting, trend recording, logging etc.) can be used. Connection via central RJ11 connection.

Note
Fan optimisations with Belimo VAV-Compact controllers can – as a result of their MP functions – also be realised in control devices with an integrated MP-Bus interface. In this case, the optimisation function must be realised in the application software of the control device. Alternatively, the fan optimiser COU24-A-MP can be integrated in such control solutions, which relieves the controller.
Control devices with integrated MP interface are available on the market from various DDC/PLC manufacturers.
Please contact your local BELIMO representative for more information.

Device equipment



VAV controllers

- ☐ Belimo VAV Compact, new generation
- ☐ Belimo VAV Universal
- ☐ LMV-D2-MFT-RM, LMV-D2-MP
- ☐ NMV-D2-MP
- ☐ VRP-M+NM24A-V-ST+VFP..

Room temperature controllers

- ☐ Belimo CR24-B1, -B2, -B3, according to the application
- ☐ Third-party controller for VAV control with 0...10V/2...10V output
- ☐ DDC controller with MP-Bus interface

Fan optimiser

- ☐ Belimo Fan optimiser COU24-A-MP

Frequency converter

- ☐ Standard model with 0…10V control

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