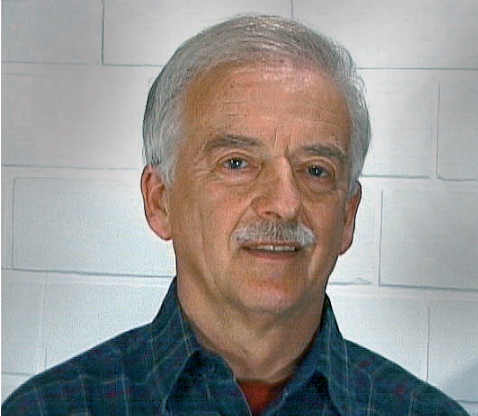


Hermes-Systeme combines industrial and building automation using a Profibus/MP-Bus gateway:

Improved quality, lower costs and a better energy balance



Werner Schrader, HVAC planning engineer at Bruns & Partner, Bremen, the engineering consultant responsible for planning.

An enthusiastic supporter of the MP-Bus®

«Once the planning stage for the Exxon-Mobil system concept was completed, we turned our attention to the question of how to implement it most efficiently. Since traditional wiring would have proved very expensive, we were greatly attracted by the MP-Bus from Belimo. It provided us with a much simpler, clearer and cheaper way to lay the required cables.

I first became aware of the advantages of MP-Bus technology after reading the article on 'Energy-optimised primary fan control with the MP-Bus from Belimo'. This article documents how MP-Bus technology allows the fans for central air conditioning to be controlled based on the actual damper position of each VAV controller.

Since the electrical motor power requirement of the fans is significantly lower in systems with variable air volume (VAV) control, this opens up completely new opportunities for energy optimisation. And that's not all – the classic pressure controls are eliminated.»



When the decision was taken to renovate the ventilation and air conditioning systems at the ExxonMobil site in Grossenkneten/Germany, ambitious goals were set by the project managers: the idea was to fuse the HVAC automation with the industrial automation while simultaneously optimising the energy balance.

No sooner said than done: the HVAC planning engineers at Bruns & Partner, the Bremen engineering consultant, and representatives of Hermes Systeme GmbH, Wildeshausen, the system supplier and integrator, opted for the UN-DP-Belimo gateway from A-M-Systeme. This gateway allows the industrial automation (Profibus DP) to be combined with the Belimo MP-Bus for HVAC actuators and sensors.

A big name in Germany's energy industry

ExxonMobil Production Deutschland GmbH, with headquarters in Hanover, is the leading player in the German upstream sector. It maintains facilities all over northern Germany – wherever natural gas and petroleum are produced, processed, transported and stored. The company employs around 1'150 people. About a fifth of Germany's natural gas needs – in the region of 14.5 billion cubic metres – are currently met by domestic suppliers. Exxon-Mobil Production Deutschland contributed approximately 10 billion cubic metres – just under two thirds – to this total in 2003. The biggest independently operating upstream unit in the ExxonMobil organisation, it produces gas and oil from 1'200 wells. 340 of these are gas wells.



Helmut Blekker, project superintendent at ExxonMobil, takes a look at the control cabinet with the process automation station (top) and the Profibus/MP-Bus gateways (bottom).

Sour gas, commonly encountered in North Germany, is purified in two modern natural gas treatment plants (in Grossenkneten and at NEAG in Voigtei/Nienburg district) by removing the hydrogen sulphide. The sour gas is pre-treated by the producer in order to protect the technical equipment and reduce pollutant emissions during the combustion process. ExxonMobil consequently produces some 3'000 tons of sulphur daily for use as a raw material in the chemical industry.

Fusion of industrial and building automation

Heterogeneous automation systems such as SIMATIC S7, VIPA, Moeller, Allen Bradley, etc. are used in production, industrial and process automation. For HVAC solutions that are based on such a system, users, planners and system integrators are relying more and more on the universality of the industrial standard.

This offers the following advantages:

- Use of a single automation system for process, production and auxiliary systems
- Cost reduction through standardisation of the components on the automation level
- Quality of the HVAC automation on an industrial level
- Uniform operation and monitoring
- Reduction in the number of interfaces
- Simplification of maintenance and care.

This universality of the automation concept – from production to building management – enhances the efficiency, dependability and profitability of the complete system. In addition to operational reliability, this also ensures maximum flexibility.

Integration, networking and service from one source



The UN-DP-Belimo Profibus/MP-Bus gateway combines Profibus DP with the Belimo MP-Bus.

The HVAC sector is characterised by a multitude of field devices. Thanks to the UN-DP-Belimo Profibus/MP-Bus gateway, the system supplier and integrator can offer a complete solution that includes the wide range of HVAC components from Belimo. These components can be linked with the automation system as a complete unit with total communications capability. As a result, the customer receives everything from one source and only needs one responsible contact to guarantee optimum operation.

Renovation spawns redesign

The renovation work on the complex HVAC systems at the ExxonMobil site in Grossenkneten included the replacement of the existing Staefa Control AS 1000 system (discontinued by Siemens Building Technologies SBT) with a SIMATIC S7.

MP-Bus converted to Profibus DP

A gateway from A-M-Systeme was used to combine the Belimo MP-Bus, responsible for networking the HVAC actuators, with the industrial automation environment. The popular SIMATIC S7 system is now able to access a whole series of Belimo components – from damper, valve, fire damper and window ventilation actuators to VAV controllers – digitally over the MP-Bus.

H₂S limit values monitored for safety's sake

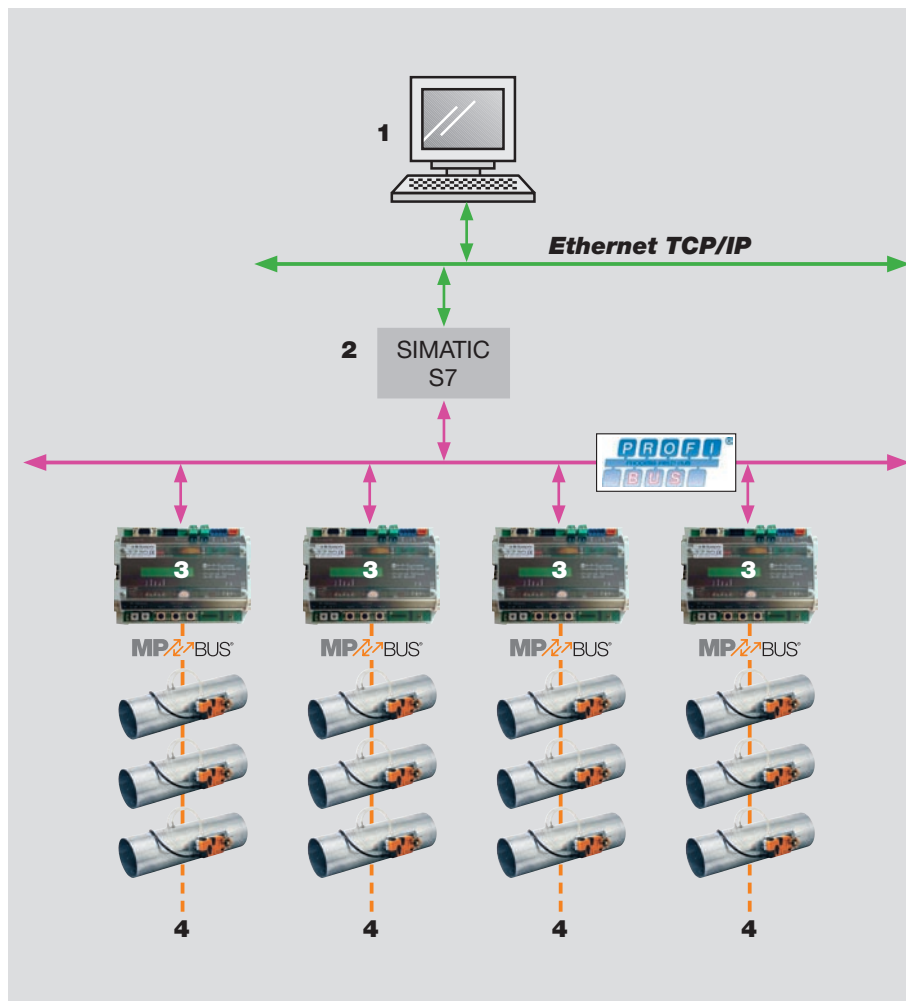
The ExxonMobil works building features a full air conditioning system with an air capacity of approximately 5'500 m³/h. The high safety requirements necessitate H₂S measurements in the supply air. Downstream VAV controllers are positively driven and the air circulation conditions set based on limit values (in ppm in the supply air).

Pressurising with single room controls

Single room controls are installed in a total of 20 different rooms. The tough demands relating to employee safety necessitate constant pressurising here. If this is no longer the case, the persons concerned hear an acoustic signal. Under no circumstances must the highly toxic H₂S gases be allowed to enter the building without a prior alert. If ever an emergency situation arises, appropriate action is taken in accordance with a Work Instruction.

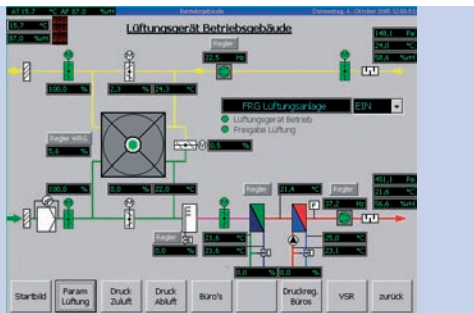
A VAV unit for supply and exhaust air, a setpoint adjuster, room temperature sensors and a motorised radiator control valve are installed in each of the 20 rooms. Pressure sensors in the hallways monitor the pressurising function. Motorised fire dampers are fitted into the transitions between the individual fire zones.

The base load for the rooms is operated via the radiators. If the temperature inside the rooms increases as a result of internal loads, the volume of the VAV units is likewise increased. The setpoint adjuster permits individual room temperature settings.

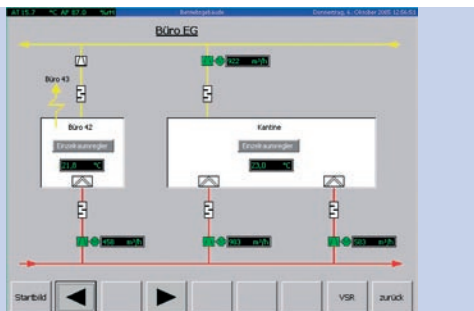


- 1) Building management system
2) Siemens SIMATIC S7 industrial automation station

- 3) UN-DP Belimo Profibus/MP-Bus gateway
4) Up to 8 MP-Belimo VAV controllers



Building management system, process display 1: Principle of primary air conditioning.



Building management system, process display 2: Diagram of the individual VAV zones and associated actual volumetric flows.



Project meeting (from left to right): Dietmar Heseding and Jörg Deitermann of Hermes-Systeme and Holger Buss of A-M-Systeme. Standing: Belimo consultants Martin Wild and Rainer Frase.



Group photo of the project stakeholders (from left to right): Jörg Deitermann (Hermes-Systeme), Holger Buss (A-M-Systeme), Martin Wild (Belimo CH), Rainer Frase (Belimo DE), Helmut Blekker (Exxon Mobil).

Energy-optimised fan control via Belimo MP-Bus®

In systems with VAV zone control, it is still standard practice today to control the primary fan by means of the static pressure. This pressure is kept constant in the duct. The frequency converter which controls the fan is in turn activated by a pressure controller with a 0 to 10 V signal. However, this method has the drawback that the fan is not controlled according to actual demand. It consumes far too much electricity because it generates more speed than is really required. Since many VAV units therefore eliminate more pressure than necessary, this also results in disturbing noise.

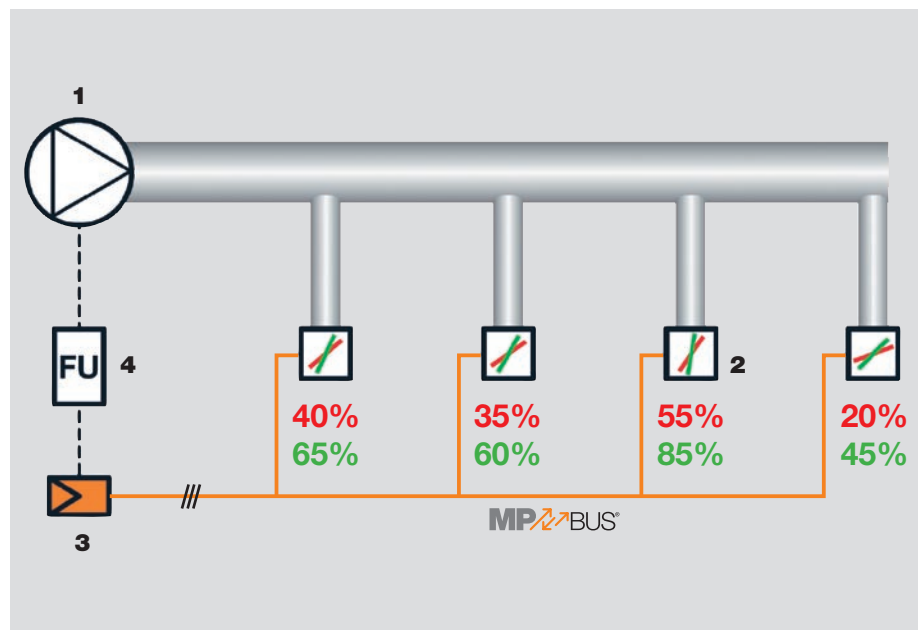
MP-Bus permits primary fan control based on damper position of VAV controllers

By linking the VAV units over the Belimo MP-Bus, the primary fan can be controlled in accordance with the damper position of the VAV controller in each zone. Using the MP-Bus, information about the actual damper positions can be made permanently available to the control system. This data can then be used as a control variable to facilitate energy efficient control of the fan. The damper angles are periodically determined via the MP-Bus. The damper which is open the widest serves as a reference. The speed of the fan is then reduced until the damper concerned is in the range above 85%. Since the electric power consumption (P) of the fan changes with a power of three in relation to the volumetric flow and speed ratios, it is extremely important to control the fan speed on the basis of demand.

Fan power consumption - volumetric flow - speed:

$$\frac{P_1}{P_2} = \left(\frac{\dot{V}_1}{\dot{V}_2}\right)^3 = \left(\frac{n_1}{n_2}\right)^3$$

Principle of fan control according to the damper position of the VAV units



- 1) Primary fan
- 2) VAV unit whose damper is open the widest and whose damper position therefore serves as a reference.
- 3) Speed controller which generates a demand based control signal for the frequency converter (4), causing the fan to turn at exactly the speed that keeps the damper of the VAV unit (2) in the 85% position.

Belimo MP-Bus® at a glance

Multi-point technology

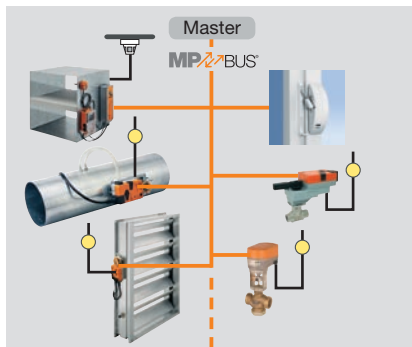
The MP-Bus was developed by Belimo as a simple actuator and sensor bus. Up to eight different HVAC control devices (air dampers, VAV units, fire dampers, window ventilation systems and control valves) can be combined via the three conductors of the MP-Bus and controlled as a bundled unit by an MP master.

Master/slave principle

MP masters are PLC or DDC controllers with MP interface or Belimo «gateways» to fieldbus systems such as LonWorks®, EIB/Konnex® or Profibus DP® (A-M-Systeme).

Good to know:

Belimo provides the MP specifications to all interested manufacturers of DDC controllers, so that they can implement a corresponding MP interface in the hardware and software of their products.



Integration of analogue sensors

One conventional sensor (e.g. temperature or humidity sensor, switch, etc.) can be integrated for each Belimo MP actuator via the MP-Bus. The actuator digitizes its analogue signals and transmits them to the MP master over the MP-Bus.

Minimum wiring expenses

The combination of several control devices in an MP-Bus reduces wiring expenses dramatically – up to 90%, as application examples show. The wiring requires neither special cables nor terminating resistors. The MP-Bus makes it possible to realise network topologies with a star, ring, tree or hybrid form.

MP-BUS®

For more information, visit:
www.belimo.com

Hermes-Systeme GmbH:

Specialised in automation and electrical systems

The ExxonMobil project was coordinated by Hermes-Systeme GmbH of Wildeshausen. Established in 1985, the company is active in the automation and electrical systems engineering sector. Hermes-Systeme currently employs more than 120 people.

Hermes-Systeme is a full-service provider of automation solutions. Its portfolio covers everything from the initial design, implementation and complete commissioning through in-house software engineering to initial briefing in the field and spans the following areas of activity:

- Industrial automation
- Building automation; facility management
- Water technology
- Swimming pool technology
- Waste water purification technology
- Refrigeration systems
- Heating and air conditioning systems
- Central instrumentation and control
- Information technology

The people behind the projects



Jörg Deitermann, Project Manager:

«Since the majority of our work concerns industrial automation technology, we were very keen to integrate the ExxonMobil project into the existing bus systems (Profibus DP). This proved to be surprisingly easy thanks to the Profibus/MP-Bus gateway from A-M-Systeme. All the data points supplied by the VAV units, such as the actual value (actual volumetric flow), setpoint, actual damper position, \dot{V}_{NORM} , \dot{V}_{MAX} and \dot{V}_{MIN} , are available for optimisation in the .gsd (device master data) file. The fact that the sensors and switches are integrated directly on the actuators also cuts the costs for the I/Os.»

Michael Beeken, System Integrator: «Significant economies were achieved with the help of the MP-Bus technology. The numbers of cables and terminals were massively reduced and the procedure was simplified.



This led to considerable time savings during the installation and commissioning phases, and the wiring work was completed with practically no hitches whatsoever. It's good to know that, thanks to the direct digital connection from the VAV units to the building management system via the MP-Bus, our customers are able to adapt the system-specific limit values for each VAV unit at any time according to demand. What's more, the \dot{V}_{MIN} and \dot{V}_{MAX} limit values can be easily adjusted and matched by Hermes-Systeme remotely as and when necessary.»

For more information, visit:
www.hermes-systeme.de

UN-DP-Belimo gateway: The key to integration

The .gsd file supplied by A-M-Systeme is required to use the gateway network with Profibus DP. It contains all MP-Bus-capable Belimo actuators. The system integrator designs the system with the aid of the data points in this .gsd file.

For more information on the UN-DP-Belimo Profibus DP/MP-Bus gateway as well as A-M-Systeme GmbH, visit: www.a-m-systeme.de

For more detailed information, please contact your Belimo representative:

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