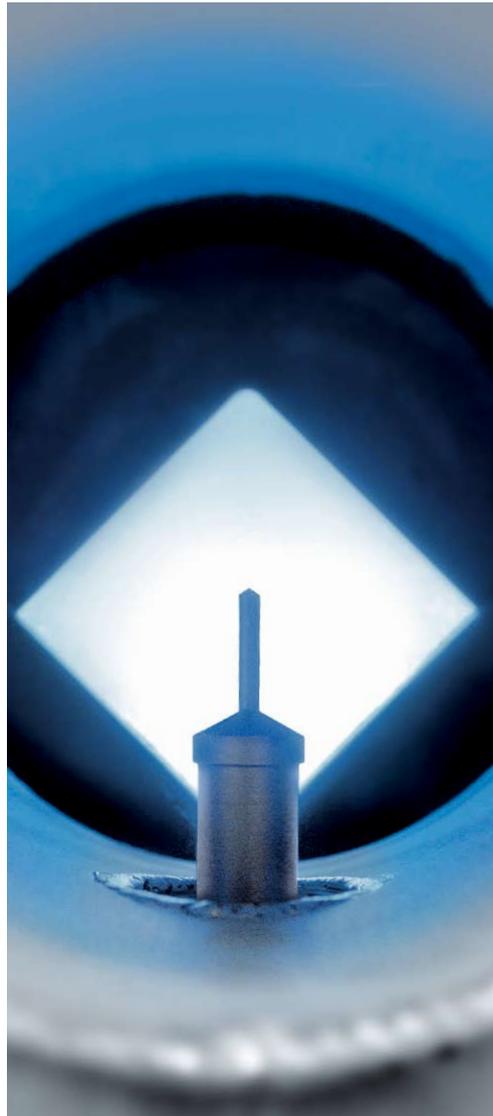


VACOMASS®

The modular air supply system
in wastewater treatment plants

Efficient and economical
plant operation made
possible by precise
control of air supply
and distribution







VACOMASS® Biology securely under control

When the biological stage of a sewage plant is under-supplied with oxygen, this will lead to process disruptions and consequently, the legally required limits for the effluent quality can be exceeded. However, if too much activation air is supplied, a significant increase in energy is consumed, resulting in uneconomical operation of the sewage treatment plant.

Therefore, only a well-designed regulation of the air supply and distribution according to actual demand can ensure both a controlled and economical plant operation.

The modular VACOMASS® air supply and distribution system comprises several system components which are optimized for this application and matched to each other for precise measurement, control and distribution of activation air in sewage treatment plants.

VACOMASS® ensures, depending on the pollution level and oxygen requirement, that controlled air supply according to actual demand occurs in the various basins, zones and cascades of your plant.

VACOMASS® therefore guarantees

- optimized degradation performance
- avoidance of disruptions to plant operation
- compliance with legally required limits in the discharge and
- economical operation of your sewage treatment plant.

With VACOMASS® your biological stage is under control and energy consumption is significantly reduced.

VACOMASS®

System components

The modular design of the VACOMASS® measurement and control system operates on the building block principle. Depending on plant size, control concept and specific requirements, the system components of the VACOMASS® product family can be supplied either individually or in combination with each other. The VACOMASS® system integration and precise calibration of the combined air flow measuring system in our CAMASS® flow calibration lab guarantees that all components fit to each other in a perfect manner ensuring highest precision for controlling the air supply.

VACOMASS® flow meter



Flow meter based on thermal dispersion principle for precise monitoring of the air supply

VACOMASS® control valve



Diaphragm control valve with multi-turn actuator for precise control of air flows

VACOMASS® master

Electronic module featuring autonomous determination of the actual oxygen demand and local control of the air supply

VACOMASS® slave

Electronic module featuring local control of the air supply according to external air flow setting via VACOMASS® master or the PLC

VACOMASS® basic

Electronic module for simultaneous flow profile correction due to control valves and/or difficult piping situation

VACOMASS® biocontrol

Electronic module for load-dependent control of aeration time if intermittent nitrification/denitrification process is applied

VACOMASS® blower management

Electronic module for automatic and energy saving operation of blower stations

VACOMASS® econtrol

Electronic module for control and adjustment of minimum required header pressure according to actual air requirement

VACOMASS® flow conditioner

Flow conditioner for swirl reduction and damping of pulsation

VACOMASS® electronics

The microprocessor based electronics of the various VACOMASS® modules is located in DIN rail housings for easy installation in switch cabinets

VACOMASS® tune valve



Manually operated diaphragm valve with measuring stub for fine adjustment of air distribution

VACOMASS® blow-off valve



Safety blow-off valve to prevent blower trip-out



VACOMASS®

System integration

Moving towards the biological basin, the air must overcome several static and dynamic counterpressures, f.e. changes in water level, situation of the aerators and pressure drop of the piping. These counterpressures vary in time and can only be controlled with much difficulty. Therefore, even very small changes will have a significant influence on the air distribution. This is precisely where the VACOMASS® concept can be applied: Each VACOMASS® system continuously monitors the local air supply and, therefore, can immediately detect even the smallest deviation from setpoint. The local control immediately intervenes and consequently eliminates the influence of external disruptions on the air distribution.

Simultaneous flow profile correction

In the case of a compact VACOMASS® system, the thermal sensor is positioned directly upstream of the control valve. Thus the flow profile will fluctuate steadily during system operation. Without correction, this will lead to errors when measuring the air supply. In order to correct for these flow profile distortions, the setting of the control valve is indicated at any time. With this information, the flow signal – the command variable for precise control of the air supply – can be corrected automatically.

Optimized operation of the control valve

Conventional controllers alter the stroke of the control valve in a stepwise fashion. This inevitably leads to high switching frequencies as well as premature wear and tear of the drive and the valve. Contrast to this, the control characteristic curve of the valve and specific process data of the sewage plant are stored in each VACOMASS® module. In case of control deviations, the microprocessor based electronics calculates exactly the new setting of the control valve, thus allowing for precise adjustment in only one single control step.

Plausibility check

Each VACOMASS® system continuously monitors the air supply and checks this value for plausibility in relation to the valve setting. In this way, any disruptions, such as at the aerators, can be detected immediately. The VACOMASS® system reacts to each disruption without delay and automatically initiates appropriate countermeasures. To reduce the pressure drop on the aerators, a cyclic and selective cleaning procedure can be implemented. Thus not only efficiency of oxygen transfer can be improved but also pressure drop and power consumption can be reduced. Life time of aerators can be extended.

Redundant monitoring of the process parameters

The control of the air supply is carried out based on certain process parameters (O₂-level, pH-value, NH₄⁺-N, etc.). False measurements of these process data, however, can indicate an oxygen demand, which is too low thus resulting in an undersupply of activation air. In order to prevent this, VACOMASS® allows for redundant monitoring of specific process parameters. Thus, any malfunction or failure of a measuring probe can be detected immediately. For determination of the oxygen demand, only signals of the properly functioning probes continue to be considered.

Comprehensive alarm and safety functions

VACOMASS® provides comprehensive monitoring functions allowing each process disruption to be indicated immediately. Additionally, the control of the air supply can always be taken over via the process control system. Upon the occurrence of a fault, the control valve will automatically move into a safe position. In this way, VACOMASS® ensures a surplus of oxygen at any time. Consequently, a VACOMASS® installation improves significantly the operational safety of a sewage plant. Process disruptions, as well as unnecessary cost due to late detection of failures can be prevented.





Official acceptance of the VACOMASS® air supply systems for the municipal sewage treatment plant of Vienna in our CAMASS® Calibration Centre. Due to the precise simulation of the field operating conditions and its piping layout during the calibration of the VACOMASS® systems, an accuracy of 1.5% of the reading could be guaranteed for the measurement of the air supply.

VACOMASS® Calibration

Only the exact calibration of an air supply system can provide a precise control of the airflow to the aeration basins of a sewage treatment plant. In order to ensure this, in our **CAMASS®** Calibration Centre we simulate in detail the operating conditions at which our **VACOMASS®** air supply and distribution systems will finally be operated. For this, the pressure and temperature conditions as well as the various flow rates that will also occur later in the sewage plant, are reproduced exactly during calibration.

In order to allow for simultaneous flow profile correction, mostly the **VACOMASS®** air supply and distribution systems are calibrated as a compact unit of control valve and flow meter. On the test stands of our **CAMASS®** Calibration Centre, the impact of varying valve positions on the raw signal of the thermal flow sensor will be determined precisely during that calibration. These data will be used to calculate the correction factors, which allow for precise air supply measurements even at fluctuating operating conditions and varying utilization rates of the sewage plant.

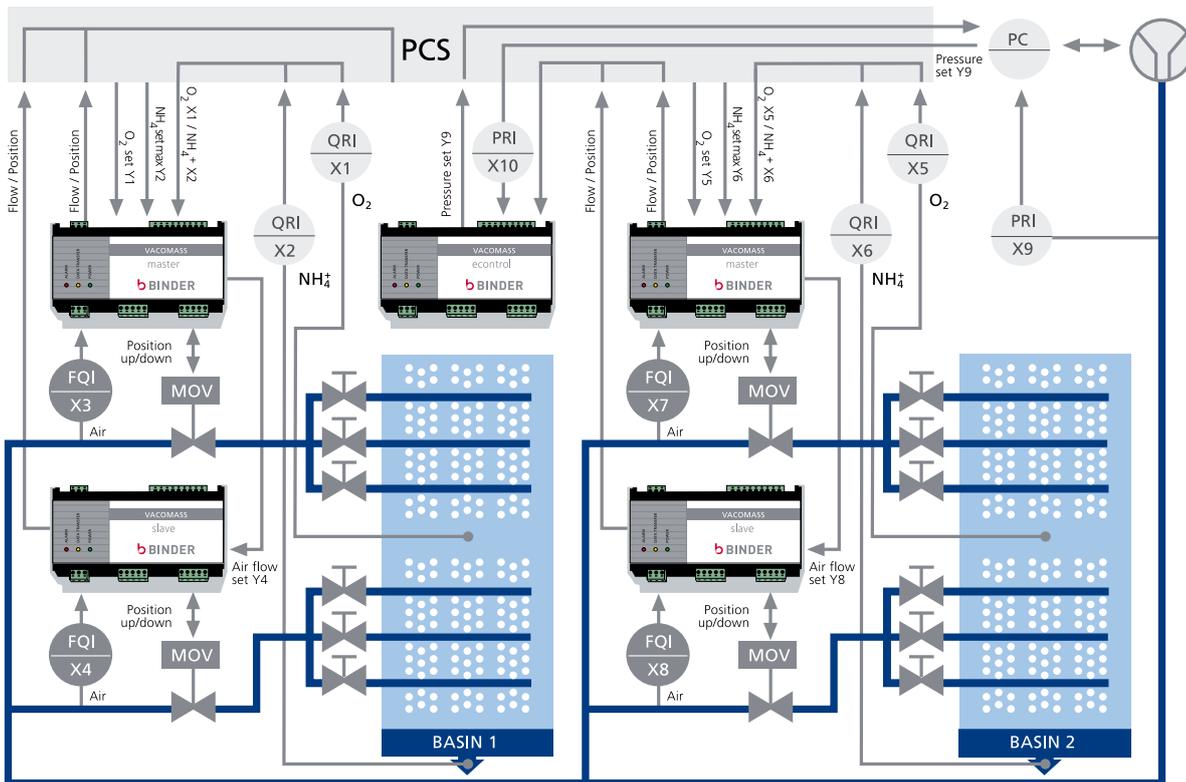
In simulating exactly the field installation situation during the calibration process, also the influence of the piping layout on the flow rate measurement due to flow profile distortions may be compensated.



VACOMASS® Control Concepts

Depending on capacity and the relevant situation of each plant, individual design concepts are required for controlling the air supply. In addition, the investment cost as well as the available potential for energy savings play a decisive role.

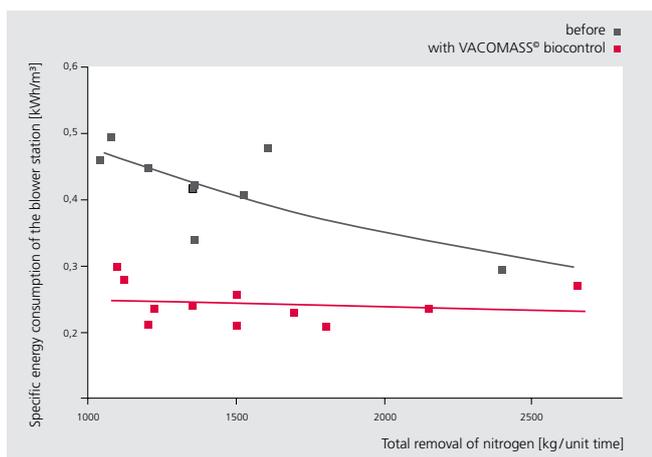
By combining the VACOMASS® system components you will be able to implement individual control concepts for regulation of the air supply including suitable control. This starts with simple installations to secure homogenous distribution, extending further to the implementation of a conventional oxygen control system, up to complex installations with local control of the air supply and suitably controlled pressure level of the blowers during aeration



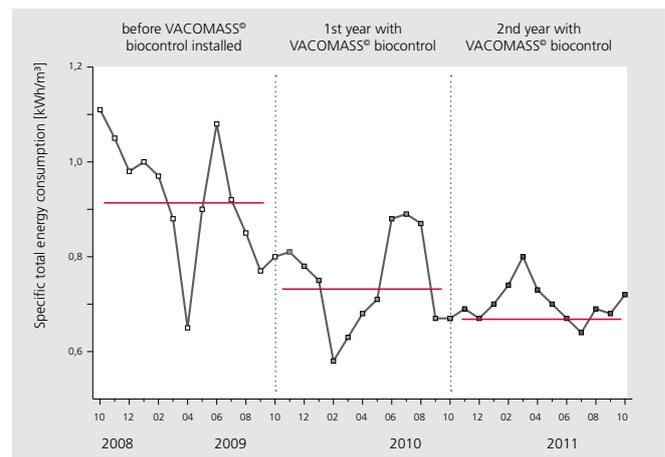
Example of a complex VACOMASS® installation

process and the load-dependent control of nitrification/denitrification time phases based on further process parameter like pH-value. VACOMASS® biocontrol controls the processes of nitrification and denitrification in intermittently aerated tanks. Based on further actual process parameters like pH-value, dissolved ammonia/nitrate concentration in the aeration tanks it can be recognized,

if nitrification process has almost finished and aeration can be interrupted. By switching the aeration off in time, over-aeration can be prevented and energy costs will be reduced. Furthermore the additional time can be used for denitrification which can then reduce nitrogen concentration in the effluent.



Reduction of effluent parameters with VACOMASS® biocontrol



Reduction of power consumption with VACOMASS® biocontrol

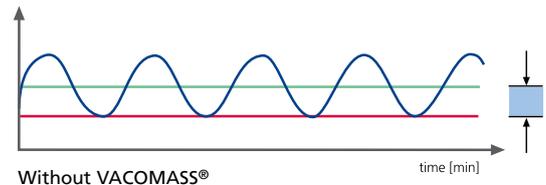
VACOMASS®

Cutting down the energy costs!

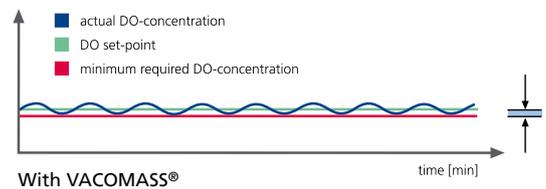
Approximately two thirds of the power consumption of a sewage treatment plant are related to the production of aeration air only. VACOMASS® precisely ensures air supply and distribution according to actual demand. Depending on the degree of utilization of the sewage plant, the control system allows as well an automatic adjustment of the blower pressure setpoint. Thus a VACOMASS® installation often results in power savings of up to 20%.

Lowering the oxygen concentration

Conventional control systems for the air supply intervene only after a certain time delay. For this reason, the oxygen concentration steadily fluctuates around the specified setpoint. To keep the O₂-concentration above a certain critical level, a higher setpoint must be realized.

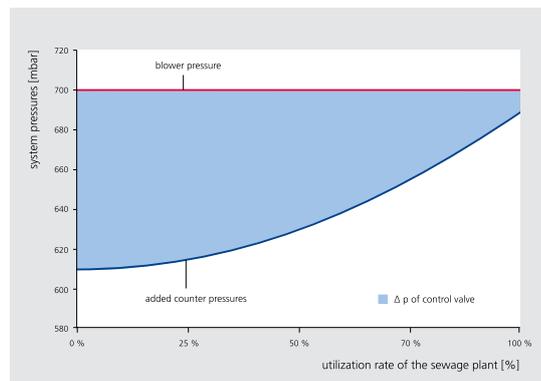


In contrast, VACOMASS® reacts immediately to each disruption and ensures a regulated air supply at any time. In most cases the setpoint for DO-level in the aeration basins can be decreased.

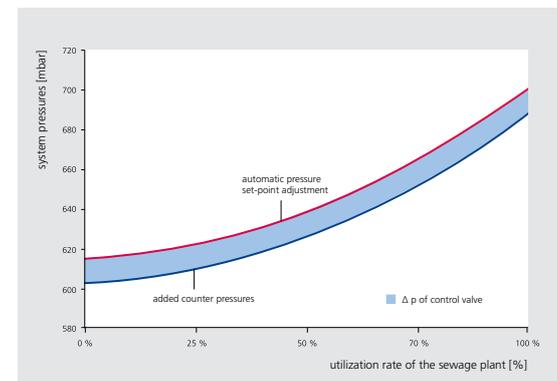


Even at the same load situation, in such case less air is required due to the smaller saturation deficit. This results in lower power consumption.

Control and automatic adjustment of header pressure setpoint



Without VACOMASS® econtrol



With VACOMASS® econtrol

In case of operating a plant under partial load conditions, the flow dependent counterpressures will decrease. At constant blower pressure, this is compensated by closing the control valve which results in an increased differential pressure.

Instead of throttling the air supply via the valve, however, it makes more sense to provide a variable adjustment of the blower

pressure according to the actual air demand. For this, VACOMASS® econtrol monitors the operating state of all VACOMASS® systems in order to determine the pressure necessary just to maintain sufficient air supply for the whole installation.

A lower pressure level, however, results in less energy consumption for the air supply thus ensuring an economical plant operation.

VACOMASS® Blower management

In modern sewage treatment plants, frequency controlled rotary piston blowers and highly efficient turbo compressors are readily in use. However, the strive for greater efficiency and lower energy consumption with accurate control even under fluctuating conditions is still on-going.

The effectiveness of the compressed air supply depends substantially on the blower management. An effective blower management system supervises not only the operation of the individual blowers, but transfers the automatic control of several blowers simultaneously to its system. The combination of differently large blowers with different operation modes (frequency-controlled, pole-changeable, without regulation), of different ages and possibly still, various manufacturers are amongst others, some of the challenges faced.

VACOMASS® blower management controls the supply of aeration air at a required pressure level, so that each of the compressor works as far as possible at the optimum operating point. Thus a high efficiency and low energy costs can be realized.

Only with the complete interaction of all components together makes a safe and efficient operation possible, to supply the right amount of oxygen to the aeration tanks; from the compressor management, to the load-dependent distribution of aeration air and finally to the process control of the intermittently denitrification process.

VACOMASS® components or supplied as a complete system, guarantee this also in your sewage treatment plant.

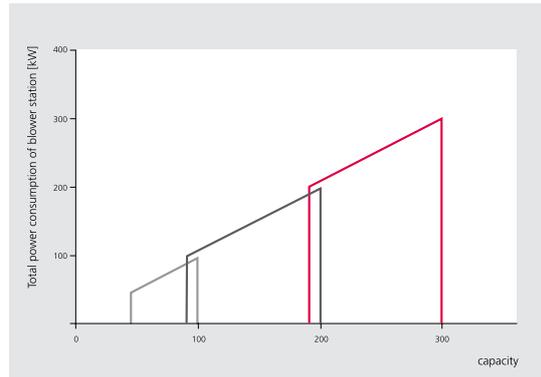
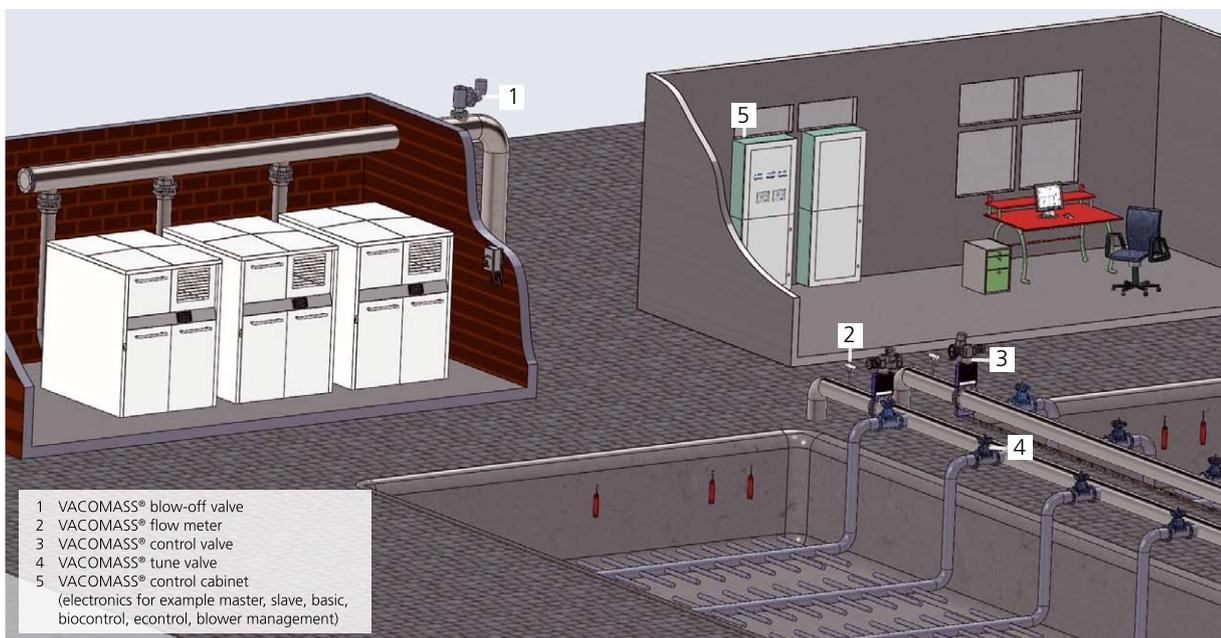


Figure of three overlapping blowers



Control cabinet of a project with 15 independent control loops and other special functions with modular hardware components



- 1 VACOMASS® blow-off valve
- 2 VACOMASS® flow meter
- 3 VACOMASS® control valve
- 4 VACOMASS® tune valve
- 5 VACOMASS® control cabinet
(electronics for example master, slave, basic, biocontrol, econtrol, blower management)

3-D Scheme of the biological step in a sewage treatment plant





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