Adaptive control system
for duct and room pressure applications

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<td></td>
</tr>
<tr>
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<td></td>
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<td></td>
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<tr>
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<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Motor stop function</td>
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<td></td>
</tr>
<tr>
<td>Bus integration</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>VAV: ( V_{\text{min}} \ldots V_{\text{max}} )</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>CAV: ( V_{\text{min}} / V_{\text{mid}} / V_{\text{max}} )</td>
<td>●</td>
<td></td>
</tr>
<tr>
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<td>●</td>
<td></td>
</tr>
<tr>
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<td>●</td>
<td></td>
</tr>
<tr>
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<td>●</td>
<td></td>
</tr>
</tbody>
</table>

System components
VRP-M control solution

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<thead>
<tr>
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<th>STP</th>
<th>VAV / CAV</th>
</tr>
</thead>
<tbody>
<tr>
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<td>AC/DC 24 V</td>
<td>AC/DC 24 V</td>
</tr>
<tr>
<td>Modulating control</td>
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</tr>
<tr>
<td></td>
<td>0 ... 20 / 4 ... 20 mA</td>
<td>0 ... 20 / 4 ... 20 mA</td>
</tr>
<tr>
<td>Stepped control</td>
<td>Contacts, switches</td>
<td>Contacts, switches</td>
</tr>
<tr>
<td>Bus function</td>
<td>MP2BUS®</td>
<td>MP2BUS®</td>
</tr>
<tr>
<td>– Optimiser COU24-A-MP</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>– LONWORKS® integration</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>– EIB/Konnex integration</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Settings, diagnostics</td>
<td>VRP-M-Tool</td>
<td>VRP-M-Tool</td>
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Pressure sensors for static differential pressure measurement

<table>
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<td>0 ... 100 Pa</td>
<td>0 ... 300 Pa</td>
<td>0 ... 600 Pa</td>
</tr>
<tr>
<td>Medium</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>– Slightly dusty air</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>– Very dusty air</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>– Corrosive gases</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Power supply</td>
<td>From VRP-M</td>
<td>From VRP-M</td>
<td>From VRP-M</td>
</tr>
<tr>
<td>VRP-M connection</td>
<td>Ready to connect</td>
<td>Ready to connect</td>
<td>Ready to connect</td>
</tr>
</tbody>
</table>

* For a list of sensor materials that come into contact with the medium, see «Technical data» for the VFP-.., page 21

Damper actuators

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
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<tbody>
<tr>
<td>Torque</td>
<td>4 Nm</td>
<td>8 Nm</td>
<td>10 Nm</td>
</tr>
<tr>
<td>Speed</td>
<td>2,5 s</td>
<td>4 s</td>
<td>110 ... 150 s</td>
</tr>
<tr>
<td>Power supply</td>
<td>From VRP-M</td>
<td>From VRP-M</td>
<td>From VRP-M</td>
</tr>
<tr>
<td>VRP-M connection</td>
<td>Ready to connect</td>
<td>Ready to connect</td>
<td>Ready to connect</td>
</tr>
</tbody>
</table>

STP functions
Ready-to-connect system solution for duct and room pressure applications

Control:
DC 2 ... 10 V / 0 ... 10 V or bus

Integration into
• DDC controller with MP interface
• EIB Konnex systems
• LONWORKS® systems

Settings and diagnostics with VRP-M-Tool

——

System description

VRP-M STP system

Ready-to-connect system solution for duct and room pressure applications

Controller:
Adaptive digital PID controller VRP-M (STP) for duct and room pressure controllers

Sensor
Pressure sensors for static differential pressure measurement
– VFP-100 with 0 ... 100 Pa measuring range
– VFP-300 with 0 ... 300 Pa measuring range
– VFP-600 with 0 ... 600 Pa measuring range

Actuator
– NM24A-V-ST damper actuator for standard applications

System components

| Controller | Adaptive digital PID controller VRP-M (STP) for duct and room pressure controllers | Pages 7 ... 20 |
| Sensor | Pressure sensors for static differential pressure measurement |
| | – VFP-100 with 0 ... 100 Pa measuring range |
| | – VFP-300 with 0 ... 300 Pa measuring range |
| | – VFP-600 with 0 ... 600 Pa measuring range |
| Actuator | NM24A-V-ST damper actuator for standard applications |
| | LMQ24A-SRV-ST / NMQ24A-SRV-ST damper actuator for fast-running applications |

Brief description

Application
This ready-to-connect system solution is an efficient control system for positive and negative pressure control circuits in duct or room pressure applications.

Field of application
In-house applications with neutral, contaminated or slightly aggressive air (air compatibility test essential, see «Technical data» for the VFP-.. sensors, page 21).

Function
The pressure difference on the static pressure sensor serves as an actual value x for the adaptive PID pressure controller. This signal (0...100 % $P_{nom}$) can be tapped at the VRP-M STP controller connection U5 as a 0 ... 10/2 ... 10 V signal. Switching the negative/positive pressure controllers is done by assigning the pressure sensor connections accordingly.

The actual value x is compared with the setpoint w set on the pressure controller and the connected actuator is actuated according to the resulting system deviation. The VRP-M STP controller can be actuated according to the function either as a constant controller ($P_{min}$ / $P_{max}$) or via the reference value input w with a 0 ... 10/2 ... 10 V modulating signal, in the range $P_{min}$ ... $P_{max}$. For special applications, there are control inputs available with the functions OPEN/CLOSED/Motor stop.

The VRP-M STP can be integrated in an MP system via the bus connection MP.

1) Please contact your Belimo representative for other actuator solutions, e.g. spring return.
Safety notes

• The VRP-M system solution is not allowed be used for applications outside the specified field of application, especially in aircraft or in any other airborne means of transport.
• Only components explicitly approved for this purpose by Belimo are allowed to be used for the VRP-M system solution.
• The equipment configuration and settings form part of the unit manufacturer’s system solution (OEM) and are not allowed to be modified without prior authorisation. All changes are liable to disrupt operation and cause damage to the system or injury to persons!
• Attention must be paid to the following during the planning phase and before the VRP-M system solution is operated:
  – The compatibility of the VFP-.. sensor with the medium to be controlled must be verified,
  – The specifications of the damper manufacturer (design, installation site) must be consulted,
  – All local regulations must be observed.
• Applications with fast-running actuator LMQ24A-SRV-ST / NMQ24A-SRV-ST: The first time the supply voltage is switched on or after the «Adaptation» pushbutton is pressed, the actuator moves to the upper and then to the lower stop. It then moves into the position required by the system. The VRP-M control function is inoperative during this procedure.
• If the VRP solution is operated in a bus system, the cycle times of the MP-Bus and the higher-level system must be taken into account.
• The damper manufacturer (OEM) is responsible for ensuring that the VRP-M-system solution is installed and set correctly as well as for the overall precision of the VAV unit.
  If replacement devices are ordered, they are configured by the OEM at the factory according to the installed system. The VRP-M system solution is sold exclusively via the OEM channel for this reason.

System characteristics

Control characteristics
Adaptive digital PID pressure controller (see «System components», page 3).

Pressure measurement
Static Belimo pressure sensors (see «System components», page 3).

Damper actuators
Belimo VAV damper actuators (see «System components», page 3).

Optimally matched components
The solution comprises optimally matched, ready-to-connect components. These are only permitted for use in the controller-sensor-actuator combinations specified by Belimo and selected by the unit manufacturer (see «System components», page 3).

STP – Variable pressure range
Variable pressure range based on a modulating reference signal, e.g. supplied by a DDC controller, room temperature controller, EIB Konnex or LONWORKS® system.
The reference signal for the \( P_{\text{min}} \) ... \( P_{\text{max}} \) working range can be set as follows:
- DC 2 ... 10 V / DC 0 ... 10 V / adjustable DC range / bus operation

STP – Constant pressure
Constant pressure applications with operating steps (relays, switching contacts).
The following operating steps are available: CLOSED / \( P_{\text{min}} \) / \( P_{\text{max}} \) / Motor stop / OPEN / bus operation

Bus function
Up to eight Belimo MP devices (VRP-M / VAV-Compact / damper actuator / valve) can be connected via the MP-Bus and integrated into the following systems:
- DDC controller with integrated MP-Bus protocol
- EIB Konnex system with Belimo UK24EIB interface
- LONWORKS® system with Belimo UK24LON interface
  See pages 18...20

Diagnostics tool
VRP-M-Tool, plugged either directly onto the VRP-M controller or via a terminal in the control cabinet (connection 4 – PP/MP)

Version overview – VRP-M system solution
Refer to www.belimo.eu for current information about compatibility, versions and functions.
Electrical installation

Wiring diagrams STP – modulating operation

Example 1: With analogue reference signal

Example 2: DC 0...10 V with shut-off (CLOSED)

Example 3: DC 0...10 V with shut-off / parallel control

Example 4: With bus control

Example 5: Typical application: MP with shut-off (CLOSED)

Conventional operation: See pages 10 and 11 for a description of functions such as control priority

Note
– Supply via safety isolation transformer!
– We recommend routing connections 1, 2 (AC/DC 24 V) and 4 (MP signal) to accessible terminals (floor distributor, control cabinet, etc.), in order to simplify access with the VRP-M-Tool for diagnostic and service work.

Bus control: See pages 18 to 20 for a description of functions
Electrical installation

Wiring diagrams

STP – constant pressure operation

Example 1:

P\textsubscript{min} – P\textsubscript{max} – OPEN

Example 2:

P\textsubscript{min} – P\textsubscript{max} – OPEN

Note
– Supply via safety isolation transformer!
– We recommend routing connections 1, 2 (AC/DC 24 V), 4 (MP signal) and 5 (US signal) to accessible terminals (floor distributor, control cabinet, etc.), in order to simplify access with the VRP-M-Tool for diagnostic and service work.

See pages 10 and 11 for a description of function.

* Function not available with DC 24 V supply.

Commissioning

Prerequisites
– The VAV / CAV unit must be mounted
– The VRP-M system solution must have been set and calibrated for the VAV / CAV unit by the unit manufacturer
– The electrical connection must have been made and checked
– The 24 V supply and control must be ready for operation
– The system fan must be in operation

Procedure
– Check the electrical connection
– Check the zero offset of the pressure sensor
– Check the damper mobility
– Check the supply pressure (the system fan must be in operation and calibrated)
– Check the P\textsubscript{min} / P\textsubscript{max} settings and correct them if necessary
– Control signal check settings, and adjust if necessary

Angle of rotation adaptation
The angle of rotation must be adapted whenever the angle of rotation limiting of the LMQ24A-SRV-ST / NMQ24A-SRV-ST damper actuator is adjusted.

Procedure:
– Switch on the 24 V supply
– Press the «Adaptation» pushbutton
– The actuator moves into the CLOSED...OPEN...setpoint position
– Disconnect both (!) hose connections from the sensor
– Remove the cover of the VFP-.. sensor housing
– Turn the zero potentiometer inside the VFP-.. until the LED in the VRP-M \[p > 0\] lights up
– Turn the zero point potentiometer slowly back until the voltage on U5 drops on a level <0.05 V.

Note
Fast-running damper actuator
LMQ24A-SRV-ST / NMQ24A-SRV-ST
A synchronisation is performed after the «Gear disengagement» switch is actuated; this means the actuator moves to CLOSED and returns to its nominal position.
Adaptive digital PID pressure controller for VRP-M system solutions
- Control: DC 0 ... 10 V / 2 ... 10 V or bus
- Diagnostics socket for VRP-M-Tool

**Technical data**

### Electrical data
- **Nominal voltage**: AC 24 V, 50/60 Hz, DC 24 V
- **Power supply range**: AC ±20% / DC ±10%
- **Power consumption**
  - In operation: 1.1 W (incl. VFP-.. sensor, without actuator)
  - For wire sizing: 2.6 VA (incl. VFP-.. sensor, without actuator)
- **Connection**
  - Actuator: Plug, 6-pin
  - Pressure sensor: Plug, 4-pin
  - Terminals 1 ... 7: Screw terminals, 7-pin, 0.5 mm² ... 1.5 mm²
  - VRP-M-Tool: Plug, 3-pin

### Functional data
- **Reference signal w (terminal 3)**: Input impedance >200 kΩ
  - Range: \( P_{\text{min}} \ldots P_{\text{max}} \)
  - DC 0 ... 10 / 2 ... 10 V or
  - 0 ... 20 / 4 ... 20 mA (with 500 Ω resistance)
- **Actual value U5 (terminal 5)**: DC 0 ... 10 / 2 ... 10 V, max. 5 mA
- **OPEN operating step – z1 (terminal 6)**: OPEN, input impedance >300 kΩ
- **STP operating steps z2 (terminal 7)**: CLOSED / \( P_{\text{min}} \) / Motor stop / \( P_{\text{max}} \)
  - Contact current <1 mA
- **Control characteristics**: PID, adaptive
- **Control tolerance**: ±5% of \( P_{\text{nom}} \)
- **Ranges**
  - \( P_{\text{nom}} \)
  - \( P_{\text{max}} \)
  - \( P_{\text{min}} \)
  - \( P_{\text{nom}} \)*
- **LED indicator**: AC/DC 24 V supply
  - Pressure too high / too low, sensor zero
- **MP-Bus function (terminal 4)**: MP 1 ... 8 (classic control: PP)
  - Address in bus operation is adjustable with VRP-M-Tool and address pushbutton
  - Slave
- **Operation / service**: VRP-M-Tool

### Safety
- **Protection class**: III Safety extra-low voltage
- **Degree of protection**: IP42
- **EMC**: CE according to 2004/108/EC
- **Mode of operation**: Type 1 (EN 60730-1)
- **Ambient temperature range**: 0 ... +50°C
- **Non-operating temperature**: −20 ... +80°C
- **Ambient humidity range**: 5 ... 95% r.H., non-condensing (EN 60730-1)
- **Maintenance**: Maintenance-free

### Dimensions/weight
- **Dimensions**: See «Dimensions» on page 29
- **Weight**: Approx. 250 g (without sensor)

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* See «Creep flow limitation and minimum setting limit», page 9
** For bus operation, see pages 18...20
Safety notes

- The controller is not allowed to be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- The device does not contain any parts that can be replaced or repaired by the user.
- The manufacturer of the unit (OEM) is responsible for ensuring that the VRP-M-controller is installed and set correctly as well as for the overall precision of the unit. If replacement devices are ordered, they are configured by the OEM at the factory according to the installed system.
- The VRP-M controller is sold exclusively via the OEM channel for this reason.
- The device contains electrical and electronic components and is not allowed to be disposed of as household refuse. All locally valid regulations and requirements must be observed.

Application

Together with the VFP-.. static pressure sensor and a Belimo NM-..ST or LMQ-..ST actuator, the VRP-M with «STP» function settings forms a control system for pressure control.
For more information, see «VRP-M system», pages 3 ... 6

Electrical connections

Front panel

Terminals 1 ... 7 for supply and control

Tab connection for damper actuator

Tab connection for pressure sensor

Diagnostics socket for VRP-M-Tool

Assignment of terminals 1 ... 7

AC 24 V
DC 24 V

STP reference signal $P_{\text{min}}$ ... $P_{\text{max}}$

PP/MP signal

Actual value 0 ... 100% $P_{\text{nom}}$

OPEN operating step

CAV operating step CLOSED / $P_{\text{min}}$ / Motor stop / $P_{\text{max}}$

LED indicator and address pushbutton

<table>
<thead>
<tr>
<th>PWR</th>
<th>Green LED</th>
<th>LED on:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>– AC/DC 24 V supply OK.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Device ready</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LED off:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Supply failure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Device defective</td>
</tr>
<tr>
<td>Blinking</td>
<td>If Set pushbutton pressed during MP addressing</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>V+</th>
<th>Red LED</th>
<th>LED on:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>– Pressure &gt; setpoint = damper closes or is closed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>V−</th>
<th>Red LED</th>
<th>LED on:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>– Pressure &lt; setpoint = damper opens or is open</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$\Delta p &gt; 0$</th>
<th>Yellow LED</th>
<th>Zero offset of VFP-.. pressure sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(refer to page 6 for procedure)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set</th>
<th>Pushbutton for assigning MP address in bus operation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(refer to page 20 for procedure)</td>
</tr>
</tbody>
</table>
Adaptive pressure controller

Functions

Nominal pressure $P_{\text{nom}}$  
$P_{\text{nom}}$ corresponds to the highest possible pressure setting of the application within the permissible operating conditions. The $P_{\text{nom}}$ values are specified and are programmed permanently by the damper manufacturer. The actual value signal $U_5$ is always in relation to $P_{\text{nom}}$. For this reason, changes in the operating pressure setting $P_{\text{min}}$ and $P_{\text{max}}$ have no influence on the $U_5$ V signal.

![Nominal pressure diagram](image)

Creep flow limitation  
Minimum setting limit $P_{\text{min}}$

Creep flow limitation (1)  
This function suppresses differential pressure signals in the zero region. Thanks to this limitation, undefined actuator movements in the effective pressure range of 1 ... 6 Pa are prevented.

<table>
<thead>
<tr>
<th>Sensor type</th>
<th>Limitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>VFP-100</td>
<td>1 Pa</td>
</tr>
<tr>
<td>VFP-300</td>
<td>3 Pa</td>
</tr>
<tr>
<td>VFP-600</td>
<td>6 Pa</td>
</tr>
</tbody>
</table>

Unit manufacturer’s minimum setting limit (2)  
An oversized damper can make it harder to regulate the lowermost pressure range. The lowest permissible pressure is specified by the manufacturer, which is approximately equivalent to 5 ... 12 Pa. Functional restrictions in this range can be avoided by complying with the unit manufacturer’s specified setting.

![Unit manufacturer’s minimum setting limit diagram](image)
Control tolerance
The maximum permissible control tolerance is defined as a percentage of nominal pressure $P_{\text{nom}}$. If the system deviation exceeds or undershoots this tolerance, the actuator is adjusted so that actual value corresponds to the required setpoint.

Control tolerance: $\pm 5\%$ of $P_{\text{nom}}$

The two LEDs [+p] and [-p] indicate when the maximum control tolerance is exceeded or undershot or when the deviation is being corrected by means of an actuator movement:
LED [+p]: Actual value > (setpoint + control tolerance) = damper closes
LED [-p]: Actual value < (setpoint + control tolerance) = damper opens

STP – operating pressure
$P_{\text{min}}$ ... $P_{\text{max}}$ setting
In variable operation, the pressure is specified by means of the reference signal in the $P_{\text{min}}$ ... $P_{\text{max}}$ range.
- $P_{\text{max}}$ forms the upper limit value as a function of the nominal pressure. Range 30 ... 100% of $P_{\text{nom}}$.
- $P_{\text{min}}$ forms the lower limit value as a function of $P_{\text{nom}}$. Range 0 ... 100% of $P_{\text{nom}}$.

Voltage level
In mode 2 ... 10 V, it is possible to achieve shut-off mode (damper CLOSED) by lowering the reference signal to 0.0 V.

For override control in STP operation, for example CLOSED or OPEN, the reference signal w (input 3) can be overridden by connecting control inputs 6 (z1) and 7 (z2).

STP operating steps
CLOSED / $P_{\text{min}}$ / Motor stop / $P_{\text{max}}$ / OPEN
Five operating steps are available for step operation:
- Shut-off operation – damper CLOSED: The damper is moved into the CLOSED position in a defined manner.
- Operating steps $P_{\text{min}}$ / $P_{\text{max}}$: The VRP-M adjusts the pressure to the fixed selected value.
- Motor stop
- Damper OPEN: The damper can be opened for maximum ventilation. Here, the pressure control doesn’t work!

The operating mode control signals are connected to inputs 6 (z1) and 7 (z2). If signals appear at these two inputs simultaneously, input 6 (z1) for the OPEN function takes priority.
STP – modulating override operation
CLOSED / $P_{\text{min}}$ / Motor stop / $P_{\text{max}}$ / OPEN

If necessary, the modulating range $P_{\text{min}}$ ... $P_{\text{max}}$ can be overridden by fixed operating steps. The following operating steps are available:
- Shut-off operation – damper CLOSED: The damper is moved into the CLOSED position in a defined manner.
- Operating steps $P_{\text{min}}$ / $P_{\text{max}}$: The VRP-M adjusts the pressure to the fixed selected pressure setting.
- Motor stop
- Damper OPEN: The damper can be opened for maximum ventilation. Here, the pressure control doesn’t work!

Priorities for reference value input 3 (w) and control inputs 6 (z1) / 7 (z2)

If several signals appear simultaneously, these are then handled according to the following priorities:

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Priority</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 z1</td>
<td>1</td>
<td>OPEN</td>
</tr>
<tr>
<td>7 z2</td>
<td>2</td>
<td>CLOSED / Motor stop / $P_{\text{max}}$</td>
</tr>
<tr>
<td>3 w</td>
<td>3</td>
<td>$P_{\text{min}}$ ... $P_{\text{max}}$</td>
</tr>
</tbody>
</table>
Adaptive pressure controller

System configuration

Settings by damper manufacturer (OEM)
The system solution selected by the manufacturer is mounted by the latter on the damper and configured according to the system requirements (as stated in the order). This configuration comprises the following settings.

**VRP-M Tool**
- Expert tab
- System information

**VRP-M System Information**
- **Function**
  - Pressure control [VRP-M STP]
- **Sensor**
  - VFP-100 Pressure signal
- **Actuator**
  - Fast (-SRV)

**Function**
Pressure (VRP-M STP)

**Sensor**
The pressure sensor type is specified to enable the pressure range to be adapted.

**Actuator**
The actuator type is specified to enable the running time characteristics to be adapted.

**Control – reference signal w, actual value signal U5**
The reference signal w and the volumetric flow actual value signal U5 are adapted to the MCR system.
Selection: DC 0 … 10 V / DC 2 … 10 V / adjustable (setting range 0 … 10 V)

**Calibration – P_{nom}**
The P_{nom} values are specified and fixed-programmed by the damper manufacturer. With the setting of P_{nom}, every VRP-M system solution is optimally adapted to the application. P_{nom} is equivalent to the highest possible pressure within the permissible operating conditions.

**Actual value signal U5**

![Graph showing VFP-100, VFP-300, VFP-600, and P_{nom} values](image)

**Replacement orders**
If replacement devices are ordered, they must be parameterised beforehand by the OEM at the factory according to the installed system. The VRP-M is sold exclusively via the OEM channel for this reason.

**Note**
The equipment configuration and settings form part of the damper manufacturer (OEM) and are not allowed to be modified without prior authorisation. All changes are liable to disrupt operation and cause damage to the system or injury to persons!
VRP-M Tool – Operating data settings

Adjustments on the system with VRP-M-Tool

The VRP-M-Tool can be used to adjust the operating data ($P_{\text{min}}$, $P_{\text{max}}$ settings) and the reference signals (mode setting – voltage range) directly on the system if necessary. The VRP-M-Tool adapter must be connected to the diagnostics socket on the VRP-M or to the MP connection routed to the terminals for this purpose (see Note on page 15).

Settings – pressure stages

With these parameters, the pressure stages required for the corresponding application are set. The settings are based on the pressure value calculated by the planning engineer and can either be preset by the manufacturer or adjusted on the system using the VRP-M-Tool.

System designation entry

Input field (16 characters) for specific system designations, e.g. MCR address, system name, item number in diagram, etc.
VRP-M Tool – Operating data settings (Continued)

VRP-M-Tool

Expert tab

1 Mode setting
Standard 0 ... 10 / 2 ... 10 V

2 Control
System-specific settings
– Reference signal w
– Volumetric flow actual value signal U5

Mode setting
Options: 0 ... 10 V / 2 ... 10 V / system-specific
The mode setting acts on the reference signal w and the actual value signal U5.
Variable settings are displayed here and can also be reset by selecting 2 ... 10 / 0 ... 10 V.
Variable settings are entered in the «Control» field above.

Control
Variable setting
It is sometimes essential to adapt the reference signal w or the actual value signal U5 to the
MCR system directly on the control system.
The reference signal w and the actual value signal U5 can be set to different values (e.g.
reference signal w: 2...10 V / actual value signal U5: 0...10 V).

Reference signal [w] / working range \( P_{\text{min}} \) \( \cdots P_{\text{max}} \)
Start point: DC 0.0 ... 8 V
Stop point: DC 2.0 ... 10 V

Volumetric flow actual value signal [U5] / display range 0 ... 100% \( P_{\text{nom}} \)
Start point: DC 0.0 ... 8 V
Stop point: DC 2.0 ... 10 V

3 VRP-M system information
– VRP-M Version
– Function pressure [VRP-M STP]
– Sensor type
– Actuator type

VRP-M-Tool – Availability

The current version of the VRP-M-Tool and the associated documentation can be downloaded from www.belimo.eu.
Connection of the VRP-M-Tool

The VRP-M-Tool required for settings and servicing can be connected either directly to the 3-pin service socket on the VRP-M controller or via the MP connection (terminal 4). For communication, a level converter is required, for example: ZIP-RS232.

Conventional operation (PP)

VRP-M runs with a locally connected reference signal (0 ... 10 V on connection 3). VRP-M detects that there is no tool connected and switches back to the connected analogue reference signal automatically after 120 s.

MP-Bus mode

VRP-M runs in the MP system, which means it obtains its reference signal via the connected MP master, e.g. UK24LON. The VRP-M-Tool can only be connected via the bus master in MP mode, otherwise there would be two MP masters connected to the MP-Bus. This means the local connection to the VRP-M cannot be operating at the same time as the MP master.

Note

- The service plug integrated in the VRP-M is not available with bus operation.
- The MP-Bus cannot be used to transmit control functions if it is also used to connect the VRP-M-Tool.

Workaround: Disconnect the MP-Bus (terminal 4) and use the local MP plug instead.
VAV adjustment and diagnostic tool ZTH-VAV

VAV adjustment and diagnostic tool with PP interface for Belimo VAV controllers. Connection via:
- Service socket on VAV controller
- MP/PP interface
- Control cabinet

Connection/power supply via Service socket on VAV controller, MP/PP interface, Control cabinet. Functions and Manual see Operating instructions VAV adjustment tool ZTH-VAV.

Configuration, operation

Start Configuration menu

<table>
<thead>
<tr>
<th>Action</th>
<th>Reaction</th>
<th>Continue with</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keep the (OK) button pressed while you connect the tool to the VAV controller.</td>
<td>«Configuration menu» appears on the display</td>
<td>(▼) button</td>
<td>Menu option «leave config-menu» or disconnect cable</td>
</tr>
</tbody>
</table>

Options

<table>
<thead>
<tr>
<th>Text</th>
<th>German * / English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units</td>
<td>m³/h *, l/s, cfm</td>
</tr>
<tr>
<td>Supply</td>
<td>DC/AC 24 V</td>
</tr>
<tr>
<td>MP tester</td>
<td>MP-Bus level tester</td>
</tr>
<tr>
<td>Expert Mode</td>
<td>0 * / 1</td>
</tr>
<tr>
<td>Advanced Mode</td>
<td>0 * / 1</td>
</tr>
</tbody>
</table>

* Default

Buttons, display

2 x 16 LC display, 2 x 16 characters with backlighting

- ▼▲ Scroll up / down, cancel
- – + Change value
- OK Confirm

Quick start guide, operating menu

A quick start guide in English and German is included with the ZTH-VAV as a sticker that can be affixed to the rear of the device. The operating menu adapts to the functionality of the connected VAV controller. Options that are not relevant are not shown.

For a detailed description of VAV controllers, please refer to the separate product documentation, which can be downloaded from www.belimo.eu | Documentation | Room & System Solutions.
VRP-M STP

Adaptive pressure controller

VAV adjustment and diagnostic tool ZTH-VAV (Continued)

Connection via local service socket

<table>
<thead>
<tr>
<th>Connection to</th>
<th>Cable type and order designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>L/N/SMV-D2-MP</td>
<td>ZK1-GEN</td>
</tr>
<tr>
<td>L/NMV-D2LON</td>
<td>ZK1-VAV</td>
</tr>
<tr>
<td>L/NMV-D2M, CR24</td>
<td>ZK1-VAV</td>
</tr>
<tr>
<td>VRP-M</td>
<td>ZK4-GEN</td>
</tr>
<tr>
<td>VRD3</td>
<td>ZK6-GEN</td>
</tr>
</tbody>
</table>

Connection via terminals

<table>
<thead>
<tr>
<th>Connection to</th>
<th>Cable type and order designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>L/N/SMV-D2-MP</td>
<td>ZK2-GEN</td>
</tr>
<tr>
<td>L/NMV-D2LON</td>
<td>ZK2-GEN</td>
</tr>
<tr>
<td>L/NMV-D2M</td>
<td>ZK2-GEN</td>
</tr>
<tr>
<td>NMV-D2, VRD2</td>
<td>ZK2-GEN</td>
</tr>
<tr>
<td>VRD3, VRP-M</td>
<td>ZK2-GEN</td>
</tr>
</tbody>
</table>

In a MP System

Right

Wrong
Bus operation

The VRP-M system solution can be interconnected with other Belimo MP actuators (damper actuators, valve actuators, VAV-Compact controllers, VRP-M system solutions) thanks to the integrated communication principle over the Belimo MP-Bus. Up to eight Belimo MP devices are supplied with a digital control signal by the higher-level bus master and then opened to the position dictated by this signal.

The switch-over from conventional to bus operation is automatic as soon as the MP actuator is assigned an MP address (1...8).

Belimo MP devices can be integrated into the following systems:
- LONWORKS®: The variables of Functional Profile 8110 can be used in conjunction with the Belimo UK24LON interface.
- EIB Konnex: Can be used with the Belimo UK24EIB interface
- DDC controller with an integrated MP-Bus protocol: Available from several manufacturers

**Damper position (From VRP-M version V3.x)**

(nvoAbsAngle – absolute actuator position in angular degrees (°))

The feedback signal, i.e. the network variable nvoAbsAngle, is not available for applications with NM24-V-ST actuators (old actuator generation).

**MP-Bus cycle time**

The MP-Bus cycle time must be noted when integrating setpoints and actual values. It is typically 2...8 s, depending on the number of connected bus users and integrated sensors.

The local VRP-M control function is not affected by the cycle time. The cycle time of the MP-Bus must always be taken into account, however, when selecting setpoints via the MP-Bus.

**Mode of operation**

**Sensor integration (From VRP-M version V3.x)**

The VRP-M can be connected to an additional active 0 ... 10 V signal in MP-Bus mode independently of the pressure control loop. The sensor signal is connected to the reference value input that is not used in MP-Bus mode (connection 3).

The VRP-M then acts as an analogue/digital converter for transmitting the sensor signal to the higher-level system. This system must know the physical address (which sensor is connected to which MP device) and be capable of interpreting the corresponding sensor signal.

**Active sensor connection**

Active 0 ... 10 V sensors for open and closed-loop control functions in the higher-level system, such as moisture or CO2 sensors. The cycle time must be taken into account in the implementation!

Reference signal w setting if an active sensor is connected: 0 ... 10 V

**Integration of switches, passive resistance sensors**

The VRP-M only supports active sensors with a 0 ... 10 V output; i.e. no switches or passive sensors (resistance elements) can be integrated.

**Principle of VRP-M in bus operation**

In bus operation, the VRP-M controller receives its reference signal from the higher-level control system and adjusts the pressure to the fixed selected value in the $P_{\text{min}}$ ... $P_{\text{max}}$ range. If necessary, the $P_{\text{min}}$ ... $P_{\text{max}}$ range can be overridden by fixed operating steps (control inputs $z_1$ and $z_2$) in bus operation.

The following operating modes are available:
- Shut-off operation – damper CLOSED: The damper is moved into the CLOSED position in a defined manner.
- Operating step $P_{\text{max}}$: The VRP-M adjusts the set pressure.
- Motor stop
- Flushing operation – damper OPEN: The damper can be opened for maximum ventilation.

Here, the pressure control doesn't work.
Adaptive pressure controller

Bus operation

(Continued)

**Pressure setting** $P_{\text{min}} / P_{\text{max}}$

The setpoint selected over the MP-Bus is resolved by means of the $P_{\text{min}}$ and $P_{\text{max}}$ settings on the VRP-M.

<table>
<thead>
<tr>
<th>Function</th>
<th>Volumetric flow</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_{\text{nom}}$</td>
<td>Nominal</td>
<td>OEM-specific value, depending on the application</td>
</tr>
<tr>
<td>$P_{\text{max}}$</td>
<td>Maximum</td>
<td>30 ... 100% of $P_{\text{nom}}$</td>
</tr>
<tr>
<td>$P_{\text{min}}$</td>
<td>Minimum</td>
<td>0 ... 100% of $P_{\text{nom}}$</td>
</tr>
</tbody>
</table>

* The minimum pressure setting $P_{\text{min}}$ varies according to the used setting and is also influenced by the creep flow limitation function (see «Creep flow limitation / minimum setting limit»).

**Open pressure setting**

The $P_{\text{min}}$/$P_{\text{max}}$ setting can be left open if necessary, i.e. $P_{\text{min}}$ 0% / $P_{\text{max}}$ 100%. In this case, the pressure limitation must be limited in the higher-level system. This operating setting allows the limitation of the pressure to be adjusted without altering the parameters on the pressure controller. Responsibility for the limiting function passes from the unit manufacturer to the system supplier or integrator.

**Priorities for bus signal (MP setpoint) and control inputs 6 (z1) / 7 (z2)**

If several signals appear simultaneously, they are processed according to the following table of priorities.

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Priority</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 z1</td>
<td>1</td>
<td>OPEN</td>
</tr>
<tr>
<td>7 z2</td>
<td>2</td>
<td>CLOSED / $P_{\text{min}}$ / Motor stop / $P_{\text{max}}$</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>MP override function</td>
</tr>
<tr>
<td>1</td>
<td>OPEN</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CLOSED</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>$P_{\text{max}}$</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$P_{\text{min}}$</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Motor stop</td>
<td></td>
</tr>
<tr>
<td>6 –</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>$P_{\text{nom}}$</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>MP setpoint 0 ... 100% = $P_{\text{min}}$ ... $P_{\text{max}}$</td>
<td></td>
</tr>
</tbody>
</table>

**Bus fail function**

The VRP-M saves the current setpoint, i.e. the last setpoint to have been received from a bus master (VRP-M-Tool, UK24LON). If the MP network fails, the connected VRP-M detects this and retains this setpoint until it receives a new one from the MP master.

**Initial setpoint after power failure**

The VRP-M starts with its MP initial status (setpoint 0%, corresponding to $P_{\text{min}}$ setting) if a power failure occurs in the intervening period.

**Note**

Motor stop stage is not available with the DC 24 V supply.

**Note**

Note the speed of the MP-Bus!
**MP-Bus**

**Topology**
The cables of up to eight actuators can be laid in a freely definable topology. The following topologies are permitted: Star-shaped, ring-shaped, tree-shaped or mixed forms.

![Up to 8 MP-Bus users](image)

**Connection**
The network consists of a 3-pin connection (MP communication and 24 V supply). Neither special cables nor terminating resistors are required. Power can be supplied either over the bus cable or from a local power supply.

![Connection diagram](image)

**Network**
Up to eight MP actuators can be connected in a network (VAV-Compact, VRP-M etc.).

**Supply with AC or DC voltage**
- Nominal voltage: AC 24 V, 50/60 Hz, DC 24 V
- Power supply range: AC 19.2...28.8 V, DC 21.6...26.4 V
- Wire sizing: See «Technical data», page 7

**Length of MP-Bus cable**
The cable lengths are limited:
- By the sum of the performance data of the connected devices, VAV controllers and actuators
- By the type of supply (AC 24 V or DC 24 V)
- By the cable cross-section

For more information about planning and installation, see www.belimo.com
- VAV-Compact Product Information
  - bus and communication systems section

**Addressing**
If the VRP-M system solution is integrated in a bus system, each connected VRP-M must be assigned an MP address in the range 1 ... 8.

**Procedure**
- Start the addressing procedure on the MP-Bus master with the VRP-M-Tool, UK24LON, etc.
- Refer to the bus master documentation for further details
- Procedure with VRP-M-Tool:
  a) Select the address by means of the serial number
     - Enter the serial number of the VRP-M (sticker on VRP-M, displayed in VRP-M-Tool)
  b) Select addressing with acknowledgement on the VRP-M
     - Acknowledge the selected address by pressing the Set pushbutton on the required VRP-M
     - The power LED (green) blinks when the Set pushbutton is pressed
Technical data sheet

VFP-.. sensors

Static differential pressures sensor
for neutral to slightly aggressive gases

Overview of types

<table>
<thead>
<tr>
<th>Type</th>
<th>Measuring ranges</th>
<th>Overload protection</th>
<th>Temperature sensitivity of zero</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>VFP-100</td>
<td>0 ... 100 Pa</td>
<td>max. 500 Pa</td>
<td>±0.1% / K</td>
<td>Approx. 500 g</td>
</tr>
<tr>
<td>VFP-300</td>
<td>0 ... 300 Pa</td>
<td>max. 5'000 Pa</td>
<td>±0.05% / K</td>
<td>Approx. 280 g</td>
</tr>
<tr>
<td>VFP-600</td>
<td>0 ... 600 Pa</td>
<td>max. 3'000 Pa</td>
<td>±0.05% / K</td>
<td>Approx. 280 g</td>
</tr>
</tbody>
</table>

Technical data

Electrical data
- Power supply: DC 15 V (from VRP-M controller)
- Connection: 1 m cable with 4-pin plug (compatible with VRP-M controller)

Functional data
- Measuring range: See «Overview of types»
- Overload protection: See «Overview of types»
- Measuring principle: Diaphragm differential pressure measurement (inductive)
- Medium: Neutral to slightly aggressive gases
- Parts in contact with medium: Ni, Al, CuBe, PU
- Linearity: ±1% of final value (FS)
- Hysteresis: Max. 0.1% of final value
- Temperature sensitivity: Zero
- Measuring range: See «Overview of types»
- t = +10 ... 40 °C (reference temperature t0 = 25 °C)
- Mounting position: Upright (connection on bottom or side)
- Position dependency: Max. ±4.5 Pa when rotated 90° < about horizontal axis
- Pressure port: Hose connection for hose with 4 ... 6 mm internal diameter

Safety
- Protection class: III Safety extra-low voltage
- Degree of protection: IP42
- EMC: CE according to 2004/108/EC
- Mode of operation: Type 1 (EN 60730-1)
- Ambient temperature range: 0 ... +50 °C
- Non-operating temperature: –10 ... +70 °C
- Ambient humidity range: 5 ... 95% r.H., non-condensating (EN 60730-1)
- Maintenance: Maintenance-free

Dimensions/weight
- Dimensions: See «Dimensions» on page 29
- Weight: See «Overview of types»

Safety notes

- The sensors are not allowed to be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- They may only be installed by suitably trained personnel. All applicable legal or institutional installation regulations must be complied with.
- The devices do not contain any parts that can be replaced or repaired by the user.
- The devices contain electrical and electronic components and are not allowed to be disposed of as household refuse. All locally valid regulations and requirements must be observed.
VFP-...

Static differential pressure sensors

<table>
<thead>
<tr>
<th>Product features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Application</strong></td>
</tr>
<tr>
<td><strong>Mode of operation</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The ready-to-connect sensor unit is connected to the VRP-M controller with the 4-pin plug.</td>
</tr>
</tbody>
</table>
Technical data

LMQ24A-SRV-ST actuator

Fast-running damper actuator for VRP-M system solution
- Torque 4 Nm
- Running time 2.5 s

Technical data

<table>
<thead>
<tr>
<th>Electrical data</th>
<th>Power supply</th>
<th>AC/DC 24 V (from VRP-M controller)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption</td>
<td>In operation</td>
<td>12 W at nominal torque</td>
</tr>
<tr>
<td></td>
<td>At rest</td>
<td>1.5 W</td>
</tr>
<tr>
<td></td>
<td>For wire sizing</td>
<td>18 VA</td>
</tr>
<tr>
<td>Connection</td>
<td>Cable 0.5 m with 6-pin plug (compatible with VRP-M controller)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Functional data</th>
<th>Torque (nominal torque)</th>
<th>Min. 4 Nm at nominal voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direction of rotation</td>
<td>Reversible with switch 0 / 1</td>
<td></td>
</tr>
<tr>
<td>Direction of motion at Y = 0 V</td>
<td>At switch position 0 ( \Rightarrow ) resp. 1 ( \Rightarrow )</td>
<td></td>
</tr>
<tr>
<td>Angle of rotation</td>
<td>Max. 95° ( \Rightarrow ), mechanical end stops adjustable</td>
<td></td>
</tr>
<tr>
<td>Running time</td>
<td>2.5 s / 90° ( \Rightarrow )</td>
<td></td>
</tr>
<tr>
<td>Sound power level</td>
<td>52 dB (A)</td>
<td></td>
</tr>
<tr>
<td>Position indication</td>
<td>Mechanical, pluggable</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety</th>
<th>Protection class</th>
<th>III Safety extra-low voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of protection</td>
<td>IP54 in any mounting position</td>
<td></td>
</tr>
<tr>
<td>EMC</td>
<td>CE according to 2004/108/EC</td>
<td></td>
</tr>
<tr>
<td>Mode of operation</td>
<td>Type 1 (EN 60730-1)</td>
<td></td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>(-30 \ldots +50^\circ C)</td>
<td></td>
</tr>
<tr>
<td>Non-operating temperature</td>
<td>(-40 \ldots +80^\circ C)</td>
<td></td>
</tr>
<tr>
<td>Ambient humidity range</td>
<td>95% r.H., non-condensing (EN 60730-1)</td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td>Maintenance-free</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimensions/weight</th>
<th>Dimensions</th>
<th>See «Dimensions» on page 29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>Approx. 810 g</td>
<td></td>
</tr>
</tbody>
</table>

Safety notes

- This actuator is not allowed to be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- It may only be installed by suitably trained personnel. Any legal regulations or regulations issued by authorities must be observed during assembly.
- The device may only be opened at the manufacturer’s site. It does not contain any parts that can be replaced or repaired by the user.
- The cable must not be removed from the device.
- Self adaptation is necessary when the system is commissioned and after each adjustment (press the adaptation pushbutton).
- When calculating the required torque, the specifications supplied by the damper manufacturers (cross section, design, installation site), and the air flow conditions must be observed.
- The device contains electrical and electronic components and is not allowed to be disposed of as household refuse. All locally valid regulations and requirements must be observed.
Fast-running damper actuator for VAV and CAV units

Product features

**Simple direct mounting**

Simple direct mounting on the damper spindle with a universal spindle clamp, supplied with an anti-rotation strap to prevent the actuator from rotating.

**Manual control**

Manual operation with self-resetting pushbutton. The position calculation is synchronised in order to prevent deviations as a result of manual control. This synchronisation also permits a simple functional check (see «Synchronisation» below).

**Adjustable angle of rotation**

The angle of rotation is adapted to the available setting range by the manufacturer of the damper by means of integrated, mechanical end stops. Permissible range: 63 ... 100%.

**Adaptation to the available angle of rotation**

This function detects the upper and lower spindle end stops and stores them in the actuator. The running time and the working range are adapted to the available angle of rotation. Detection of the mechanical end stops enables a gentle approach to the end position and protects the actuator and damper mechanisms. The first time the supply voltage is switched on, i.e. after initial startup or after the «Adaptation» pushbutton is pressed, the actuator first moves to the upper and then to the lower spindle end stop.

**Home position**

Pressing the «Gear disengagement» switch causes the actuator to travel to the home position. The actuator also performs this function when the supply voltage is restored if the «Gear disengagement» switch was pressed during the power outage.

**Functional check**

Correct functioning of the dampers can be checked extremely easily: The gearing latch can be disengaged simply by pressing a switch «Gear disengagement» on the housing. As long as the pushbutton remains pressed, the damper can be operated manually.

**High functional reliability**

The actuators are overload-proof, require no limit switches and automatically stop when the end stop is reached.

**Electrical installation**

The ready-to-connect actuator unit is connected to the VRP-M controller with the 6-pin plug.

**Operating controls and indicators**

1. **Direction of rotation switch**
   Switching over: Direction of rotation changes

2. **Push-button and green LED display**
   Off: No voltage supply or fault
   On: Operation
   Press button: Switches on angle of rotation adaptation followed by standard operation

3. **Pushbutton and yellow LED display**
   Off: Standard operation
   On: Adaptation or synchronising process active
   Press button: No function

4. **«Gear disengagement» switch**
   Press button: Gear disengaged, motor stops, manual override possible
   Release button: Gear engaged, synchronisation starts, followed by standard operation

5. **The communication for this actuator is blocked**
# Technical data sheet

## NMQ24A-SRV-ST actuator

**Fast-running damper actuator**

for VRP-M system solution

- Torque 8 Nm
- Running time 4 s

## Technical data

<table>
<thead>
<tr>
<th>Electrical data</th>
<th>Power supply</th>
<th>AC/DC 24 V (from VRP-M controller)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption</td>
<td>In operation</td>
<td>12 W at nominal torque</td>
</tr>
<tr>
<td></td>
<td>At rest</td>
<td>1.5 W</td>
</tr>
<tr>
<td></td>
<td>For wire sizing</td>
<td>18 VA</td>
</tr>
<tr>
<td>Connection</td>
<td>Cable 0.5 m with 6-pin plug</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(compatible with VRP-M controller)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Functional data</th>
<th>Torque (nominal torque)</th>
<th>Min. 8 Nm at nominal voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direction of rotation</td>
<td>Reversible with switch 0 / 1</td>
<td></td>
</tr>
<tr>
<td>Direction of motion at Y = 0 V</td>
<td>At switch position 0 (\wedge) resp. 1 (\vee)</td>
<td></td>
</tr>
<tr>
<td>Angle of rotation</td>
<td>Max. 95°&lt;, mechanical end stops adjustable</td>
<td></td>
</tr>
<tr>
<td>Running time</td>
<td>4 s / 90°&lt;</td>
<td></td>
</tr>
<tr>
<td>Sound power level</td>
<td>52 dB (A)</td>
<td></td>
</tr>
<tr>
<td>Position indication</td>
<td>Mechanical, pluggable</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety</th>
<th>Protection class</th>
<th>III Safety extra-low voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Degree of protection</td>
<td>IP54 in any mounting position</td>
</tr>
<tr>
<td></td>
<td>EMC</td>
<td>CE according to 2004/108/EC</td>
</tr>
<tr>
<td></td>
<td>Mode of operation</td>
<td>Type 1 (EN 60730-1)</td>
</tr>
<tr>
<td></td>
<td>Ambient temperature range</td>
<td>(-30 \ldots +50^\circ\text{C})</td>
</tr>
<tr>
<td></td>
<td>Non-operating temperature</td>
<td>(-40 \ldots +80^\circ\text{C})</td>
</tr>
<tr>
<td></td>
<td>Ambient humidity range</td>
<td>95% r.H., non-condensating (EN 60730-1)</td>
</tr>
<tr>
<td></td>
<td>Maintenance</td>
<td>Maintenance-free</td>
</tr>
</tbody>
</table>

| Dimensions/weight | Dimensions | See «Dimensions» on page 29 |
|                  | Weight | Approx. 930 g |

## Safety notes

- This actuator is not allowed to be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- It may only be installed by suitably trained personnel. Any legal regulations or regulations issued by authorities must be observed during assembly.
- The device may only be opened at the manufacturer’s site. It does not contain any parts that can be replaced or repaired by the user.
- The cable must not be removed from the device.
- Self adaptation is necessary when the system is commissioned and after each adjustment (press the adaptation pushbutton).
- When calculating the required torque, the specifications supplied by the damper manufacturers (cross section, design, installation site), and the air flow conditions must be observed.
- The device contains electrical and electronic components and is not allowed to be disposed of as household refuse. All locally valid regulations and requirements must be observed.
Fast-running damper actuator for VAV and CAV units

Product features

Simple direct mounting
Simple direct mounting on the damper spindle with a universal spindle clamp, supplied with an anti-rotation strap to prevent the actuator from rotating.

Manual control
Manual operation with self-resetting pushbutton. The position calculation is synchronised in order to prevent deviations as a result of manual control. This synchronisation also permits a simple functional check (see «Synchronisation» below).

Adjustable angle of rotation
The angle of rotation is adapted to the available setting range by the manufacturer of the damper by means of integrated, mechanical end stops. Permissible range: 63 ... 100%.

Adaptation to the available angle of rotation
This function detects the upper and lower spindle end stops and stores them in the actuator. The running time and the working range are adapted to the available angle of rotation. Detection of the mechanical end stops enables a gentle approach to the end position and protects the actuator and damper mechanisms. The first time the supply voltage is switched on, i.e. after initial startup or after the «Adaptation» pushbutton is pressed, the actuator first moves to the upper and then to the lower spindle end stop.

Home position
Pressing the «Gear disengagement» switch causes the actuator to travel to the home position. The actuator also performs this function when the supply voltage is restored if the «Gear disengagement» switch was pressed during the power outage.

The actuator then moves into the position defined by the system.

Functional check
Correct functioning of the dampers can be checked extremely easily: The gearing latch can be disengaged simply by pressing a switch «Gear disengagement» on the housing. As long as the pushbutton remains pressed, the damper can be operated manually.

High functional reliability
The actuators are overload-proof, require no limit switches and automatically stop when the end stop is reached.

Electrical installation
The ready-to-connect actuator unit is connected to the VRP-M controller with the 6-pin plug.

Operating controls and indicators

1. Direction of rotation switch
   - Switching over: Direction of rotation changes

2. Push-button and green LED display
   - Off: No voltage supply or fault
   - On: Operation
   - Press button: Switches on angle of rotation adaptation followed by standard operation

3. Pushbutton and yellow LED display
   - Off: Standard operation
   - On: Adaptation or synchronising process active
   - Press button: No function

4. «Gear disengagement» switch
   - Press button: Gear disengaged, motor stops, manual override possible
   - Release button: Gear engaged, synchronisation starts, followed by standard operation

5. The communication for this actuator is blocked
**Technical data sheet**

## NM24A-V-ST actuator

**Damper actuator**
for VRP-M system solution

- Torque 10 Nm
- Running time 150 s

### Technical data

<table>
<thead>
<tr>
<th><strong>Electrical data</strong></th>
<th><strong>Nominal voltage</strong></th>
<th>AC 24 V, 50/60 Hz / DC 24 V (from VR.. controller)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption</td>
<td>In operation</td>
<td>3.5 W at nominal torque</td>
</tr>
<tr>
<td></td>
<td>At rest</td>
<td>1.25 W</td>
</tr>
<tr>
<td></td>
<td>For wire sizing</td>
<td>6 VA</td>
</tr>
<tr>
<td>Connection</td>
<td>0.5 m cable with 6-pin plug (compatible with VRP-M)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Functional data</strong></th>
<th><strong>Torque (nominal torque)</strong></th>
<th>Min. 10 Nm at nominal voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uni-rotation</td>
<td>±5%</td>
<td></td>
</tr>
<tr>
<td>Direction of rotation</td>
<td>Can be selected with 0 / 1 switch</td>
<td></td>
</tr>
<tr>
<td>Direction of motion at Y = 2 V</td>
<td>In switch position 0 or 1</td>
<td></td>
</tr>
<tr>
<td>Angle of rotation</td>
<td>Max. 95°, can be limited at both ends with adjustable mechanical end stops</td>
<td></td>
</tr>
<tr>
<td>Running time</td>
<td>150 s</td>
<td></td>
</tr>
<tr>
<td>Sound power level</td>
<td>Max. 35 dB (A)</td>
<td></td>
</tr>
<tr>
<td>Position indication</td>
<td>Mechanical, plug-on</td>
<td></td>
</tr>
</tbody>
</table>

### Safety

- Protection class: **III Safety extra-low voltage**
- Degree of protection: **IP54 in all mounting positions**
- EMC: **CE according to 2004/108/EC**
- Mode of operation: **Type 1 (EN 60730-1)**
- Rated impulse voltage: **0.8 kV (EN 60730-1)**
- Control pollution degree: **3 (EN 60730-1)**
- Ambient temperature range: **–30 ... +50°C**
- Non-operating temperature range: **–40 ... +80°C**
- Ambient humidity range: **95% RH, non-condensating (EN 60730-1)**
- Maintenance: **Maintenance-free**

### Dimensions/weight

<table>
<thead>
<tr>
<th><strong>Dimensions</strong></th>
<th>See «Dimensions» on page 29</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight</strong></td>
<td>Approx. 710 g</td>
</tr>
</tbody>
</table>

### Safety notes

- The damper actuator is not allowed to be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- It may only be installed by suitably trained personnel. All applicable legal or institutional installation regulations must be complied with.
- The device may only be opened at the manufacturer's site. It does not contain any parts that can be replaced or repaired by the user.
- The cable is not allowed to be removed from the unit.
- When the required torque is calculated, the cross section, design and installation site as well as the air flow conditions must be observed.
- The device contains electrical and electronic components and is not allowed to be disposed of as household refuse. The local and currently valid regulations and requirements must be observed.
Ready-to-connect operating unit

Product features

**Mode of operation**
The actuator is controlled with a Belimo VRP-M controller and travels to the position defined by the control signal.

**Simple direct mounting**
Simple direct mounting on the damper spindle with a universal spindle clamp, supplied with an anti-rotation strap to prevent the actuator from rotating.

**Manual override**
Manual override with self-resetting pushbutton possible (the gear is disengaged for as long as the button is pressed).

**Adjustable angle of rotation**
Adjustable angle of rotation with mechanical end stops.

**Adaptation**
Angle-of-rotation sensing and adaptation of the control range. Triggered by pressing a button on the actuator, with LEDs for status display.

**High functional reliability**
The actuator is overload-proof, requires no limit switches and automatically stops when the end stop is reached.

Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Data sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrical accessories</strong></td>
<td></td>
</tr>
<tr>
<td>Auxiliary switch S..A.</td>
<td>T2 - S..A.</td>
</tr>
<tr>
<td>Feedback potentiometer P..A.</td>
<td>T2 - P..A.</td>
</tr>
<tr>
<td><strong>Mechanical accessories</strong></td>
<td></td>
</tr>
<tr>
<td>Spindle extension AV6-20</td>
<td>T2 - Z-NM..A..</td>
</tr>
</tbody>
</table>

Electrical installation

The ready-to-connect operating unit is connected to the VRP-M-controller.

Operating controls and indicators

1. **Direction of rotation switch**
   - Switching over: Direction of rotation changes

2. **Push-button and green LED display**
   - Off: No voltage supply or fault
   - On: Operation
   - Press button: Switches on angle of rotation adaptation followed by standard operation

3. **Pushbutton and yellow LED display**
   - Off: Standard operation
   - On: Adaptation or synchronising process active
   - Press button: No function

4. **"Gear disengagement" switch**
   - Press button: Gear disengaged, motor stops, manual override possible
   - Release button: Gear engaged, synchronisation starts, followed by standard operation

5. The communication for this actuator is blocked
Dimensions

Dimensional drawings
VRP-M controller

Dimensional drawings
VFP-100 sensor

Dimensional drawings
VFP-300 and VFP-600 sensors

Dimensional drawings
LMQ24A-SRV-ST

<table>
<thead>
<tr>
<th>Damper spindle</th>
<th>Length</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>≥40</td>
<td>8 ... 26.7</td>
<td>≥8</td>
<td>≤26.7</td>
<td></td>
</tr>
<tr>
<td>≥20</td>
<td>8 ... 20</td>
<td>≥8</td>
<td>≤20</td>
<td></td>
</tr>
</tbody>
</table>

* Option (accessory K-NA)

Dimensional drawings
NMQ24A-SRV-ST

<table>
<thead>
<tr>
<th>Damper spindle</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥42</td>
<td>8 ... 26.7</td>
</tr>
<tr>
<td>≥20</td>
<td>8 ... 20</td>
</tr>
</tbody>
</table>

* Option (accessory K-SA)

Dimensional drawings
NM24A-V-ST

<table>
<thead>
<tr>
<th>Damper spindle</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥40</td>
<td>8 ... 26.7</td>
</tr>
<tr>
<td>≥20</td>
<td>8 ... 20</td>
</tr>
</tbody>
</table>

* Option (accessory K-NA)
All inclusive.