



Adaptive control system for pressure applications (STP)

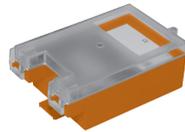
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Application

	VAV / CAV	STP (pressure)
Supply/exhaust air systems	•	
Extraction systems	•	
Duct/section pressure		•
Actuator variants	Standard actuator or fast runner Spring-return actuator with emergency position OPEN or CLOSED (see Damper actuators)	
Sensor variants	static or dynamic (see Pressure sensors)	
Optimiser function for energy-efficient fan control	• 1)	
Stage control		•
Modulating control		•
Local override functions	CLOSED / \dot{V}_{min} / \dot{V}_{mid} / \dot{V}_{max} / OPEN	CLOSED / P_{min} / P_{max} / Motor stop / OPEN
Bus integration	MP bus (MP partner systems), LONWORKS, KNX, Modbus, BACnet, COU24-A-MP	

① Controller platform



	VRP-M	
	VAV / CAV	STP
Supply	AC/DC 24 V	
Reference variable control	0 / 2 ... 10 V, 0 / 4 ... 20 mA	
Feedback, actual value	Volumetric flow 0 / 2 ... 10 V	Δp 0 / 2 ... 10 V
Tools	PC-Tool VRP-M module, Service-Tool ZTH-GEN	
Optimiser-compatible	•	
Suitable gateways	UK24LON, UK24EIB, UK24MOD, UK24BAC	
Suitable MP-masters	DDC systems from Belimo MP partners, COU24-A-MP	

② Pressure sensors

	VFP-100	VFP-300	VFP-600	VFD3
Measuring principle	static	static	static	dynamic
Pressure range	0 ... 100 Pa	0 ... 300 Pa	0 ... 600 Pa	selectable 0 ... 100 / 300 / 600 Pa ⁵⁾
Comfort zone	•			
Dusty air	Dusty to very dusty ²⁾			dusty ²⁾
Corrosive media	Corrosive air ³⁾			⁴⁾
Connection	Integrated cable/plug unit, suitable for VRP-M			

③ Damper actuators

	NM24A-V-ST	LMQ24A-SRV-ST	NMQ24A-SRV-ST	SF24A-V-ST
Function	Standard	Fast runners	Fast runners	Spring-return
Torque	10 Nm	4 Nm	8 Nm	20 Nm
Running time	110 ... 150 s	2.5 s	4 s	150 s
Emergency function				OPEN or CLOSED
Connection	Integrated cable/plug unit, suitable for VRP-M			

1) Limitation: Optimiser function requires actuator with standard running time, fast runners are not permitted.
 2) Independent of the sensor type, the pick-up device (unit component) must be tested at cyclical intervals and be cleaned as needed.
 3) The VAV unit (pick-up device, etc.) must be selected in accordance with the medium. The compatibility of the sensor materials is to be tested (see Technical data VFP-.. and VFD3).
 4) Compatible with duct cleaning agent and duct disinfecting agent.
 5) Differential pressure measurement up to 500 Pa.

Ready-to-connect system solution for section and duct pressure applications with standard and fast running VAV actuators

Control:

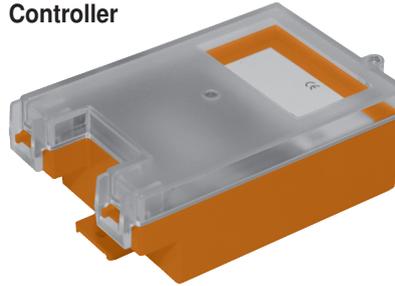
DC 2 ... 10 V / 0 ... 10 V or bus

Integration in

- DDC controller with MP interface
- EIB-Konnex, Modbus and BACnet systems
- LONWORKS® systems
- Diagnostic socket for Service and PC-Tool

System components

Controller



Adaptive digital PID differential pressure controller VRP-M

Pages 5 to 22

Sensors



Sensors with static differential pressure measurement

- VFP-100, measuring range 0 ... 100 Pa
- VFP-300, measuring range 0 ... 300 Pa
- VFP-600, measuring range 0 ... 600 Pa

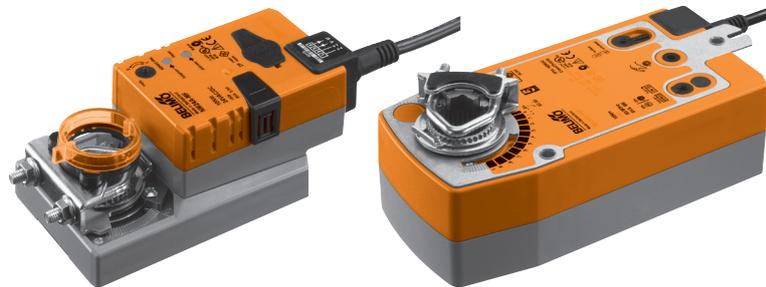
Pages 23 and 24

Sensor with dynamic differential pressure measurement for comfort applications

- VFD3, adjustable measuring range 0 ... 100 / 300 / 600 Pa

Pages 25 and 26

Actuators



- Standard actuator NM24A-V-ST
- Fast runners LMQ24A-SRV-ST and NMQ24A-SRV-ST
- Spring-return actuator with emergency setting function SF24A-V-ST

Pages 27 to 34

Brief description

Application	The ready-to-connect system solution forms an efficient control system for positive/negative pressure control circuits in section or duct 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 23).
Function	<p>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 an analogue signal. Switching the negative/positive pressure controllers is done by assigning the pressure sensor connections accordingly.</p> <p>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.</p> <p>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.</p> <p>The VRP-M STP can be integrated in an MP system via the MP bus connection.</p>

Safety notes



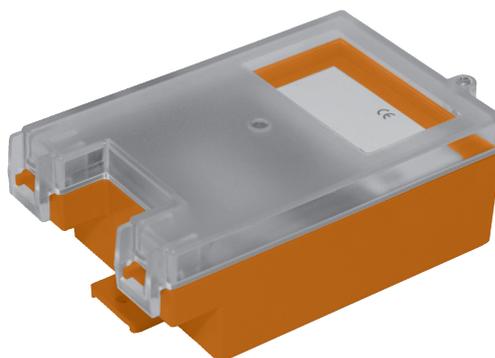
- The VRP-M system solution is not allowed to be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.
- Only components explicitly approved for this purpose by Belimo are allowed to be used for the VRP-M system solution.
- The equipment configuration and settings form part of the unit manufacturer's system solution (OEM) and are not allowed to be modified without the OEM's 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 pressure sensors with the medium to be controlled must be tested,
 - The specifications supplied by the damper manufacturer (design, place of installation) must be consulted and
 - The local technical regulations must be observed.
- Applications with fast running actuator LMQ24A-SRV-ST or NMQ24A-SRV-ST: The actuator moves first to the top, then to the bottom spindle end stops when the supply voltage is switched on for the first time or after pressing the «Adaption» push-button. It then moves into the position required by the system. The VRP-M control function is inoperative during this procedure.
- If the VRP-M 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 overall precision. 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	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 the components optimally matched with one another that are therefore only permitted to be used in the controller-sensor-actuator combinations specified by Belimo and selected by the damper manufacturer (see «System components», page 3).
STP – Variable pressure range	Variable pressure range by means of a modulating reference variable, e.g. supplied by a DDC controller or bus operation, The reference signal for the P_{\min} ... P_{\max} operating range can be set as follows: DC 2 ... 10 / 0 ... 10 V or bus operation
STP – Constant pressure	Constant pressure applications with operating modes (relays, switching contacts). The following operating modes are available: CLOSED / P_{\min} / P_{\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: <ul style="list-style-type: none"> – DDC controller with integrated MP bus protocol – EIB-Konnex-System with Gateway UK24EIB – LONWORKS® system with Gateway UK24LON – Modbus system with Gateway UK24MOD – BACnet system with Gateway UK24BAC See «Bus system», pages 20 to 22.
Diagnostics tool	PC-Tool VRP-M module, ZTH-GEN, can be plugged into the VRP-M or via external cable connection.

Adaptive digital PID pressure controller for VRP-M system solutions

- Control: 0 ... 10 / 2 ... 10 V or MP bus
- Diagnostic socket for Service or PC-Tool



Technical data

Electrical data	Nominal voltage	AC 24 V, 50/60 Hz DC 24 V
	Nominal voltage range	AC $\pm 20\%$ / DC $\pm 10\%$
	Power consumption	Operation 1.1 W (incl. Sensor VF., without damper actuator) Dimensioning 2.6 VA (incl. Sensor VF., without damper actuator)
	Connection	Actuator Plug, 6-pin Pressure sensor Plug, 4-pin Terminals 1 ... 7 7-pin screw terminals, 0.5 mm ² ... 1.5 mm ² VRP-M-Tool Plug, 3-pin
Functional data	Reference signal w (terminal 3) Range: \dot{V}_{\min} ... \dot{V}_{\max}	Input impedance >200 k Ω – DC 0 ... 10 / 2 ... 10 V or – 0 ... 20 / 4 ... 20 mA (with 500 Ω resistance)
	Actual value, volumetric flow U5 (terminal 5) Range 0 ... 100% \dot{V}_{nom}	DC 0 ... 10 / 2 ... 10 V, max. 5 mA
	OPEN operating mode – z1 (terminal 6)	OPEN, input impedance >300 k Ω
	CAV operating modes z2 (terminal 7)	CLOSED / P _{min} / Motor stop / P _{max} Contact current <1 mA
	Control characteristics	PID, adaptive
	Control tolerance	$\pm 5\%$ of \dot{V}_{nom}
	Ranges P _{nom}	Nominal pressure (sensor-dependent) 30 ... 100% of the sensor range
	P _{max}	30 ... 100% of P _{nom}
	P _{min} ¹⁾	0 ... 100% of P _{nom}
	LED display	AC/DC 24 V supply Pressure too high/too low, zero VFP-..sensor
	MP bus function (terminal 4) ²⁾ Address in bus operation Functionality Operation / service	MP 1 ... 8 (classic operation: PP) Adjustable with VRP-M-Tool and address push-button Slave VRP-M-Tool
Safety	Protection class	III Safety extra-low voltage
	Degree of protection	IP42
	EMC	CE according to 2004/108/EC
	Principle of operation	Type 1 (EN 60730-1)
	Ambient temperature	0 ... +50 °C
	Non-operating temperature	–20 ... +80 °C
	Ambient humidity	5 ... 95% r.h., non-condensing (EN 60730-1)
	Maintenance	Maintenance-free
Dimensions / Weight	Dimensions	See «Dimensions» on page 35
	Weight	Approx. 250 g (without sensor)

¹⁾ See «Creep flow limitation and minimum setting limit», page 10

²⁾ See «Bus operation», pages 20 to 22

Safety notes



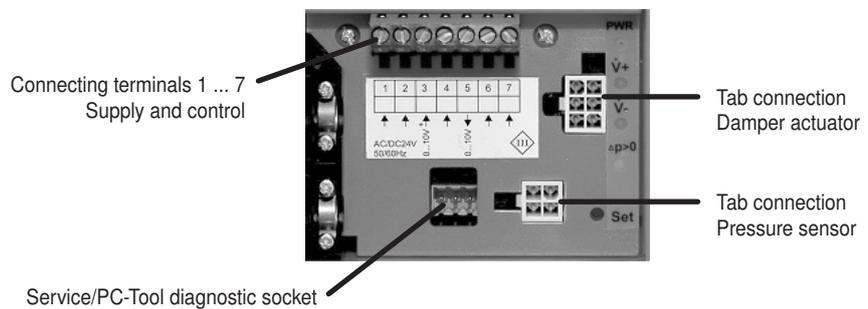
- The controller is not allowed to be used outside the specified field of application, especially not in aircraft or in any other airborne means of transport.
- The device does not contain any parts that can be replaced or repaired by the user.
- The manufacturer of the unit (OEM) is responsible for 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 must not be disposed of as household refuse. All locally valid regulations and requirements must be observed.

Application

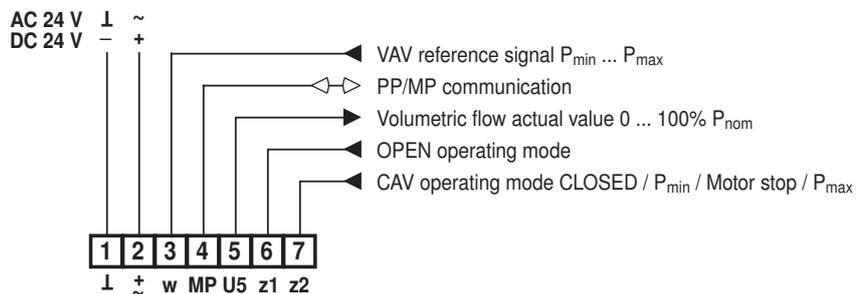
Together with a VFP-.. / VFD3 pressure sensor and a damper actuator, the VRP-M forms a control system for pressure controls.
 For more information, see «VRP-M system description», pages 3 and 4

Electrical connections

Front panel



Assignment of connecting terminals 1 ... 7



LED display and address push-button

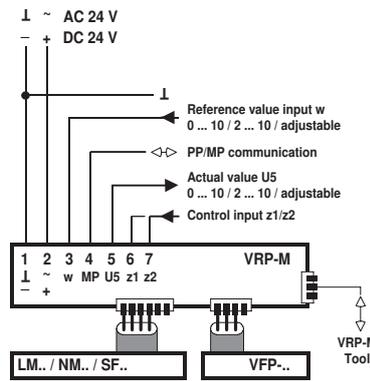


PWR	Green LED	LED on: – Supply AC/DC 24 V OK – Device ready for operation	LED off: – Supply failure – Device defective
	Flashing	– With Set push-button pressed down for MP addressing	
V+	Red LED	LED on: – Pressure > setpoint = damper closes or is closed	
V-	Red LED	LED on: – Pressure < setpoint = damper opens or is open	
$\Delta p > 0$	Yellow LED	Zero offset pressure sensor VFP-.. (for procedure, see page 9)	
Set		Push-button for assigning the MP address in bus operation (for procedure, see page 22)	

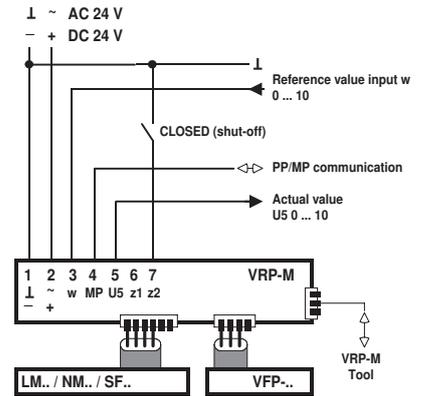
Electrical installation

Wiring diagrams STP
Modulating operation

Example 1:
With analogue reference signal

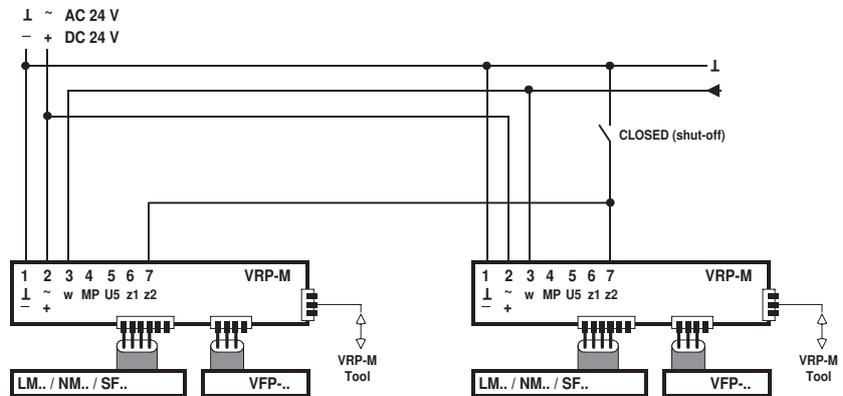


Example 2:
DC 0 ... 10 V with shut-off (CLOSED)



Conventional operation:
Functional description such as control priority
See pages 11 and 12

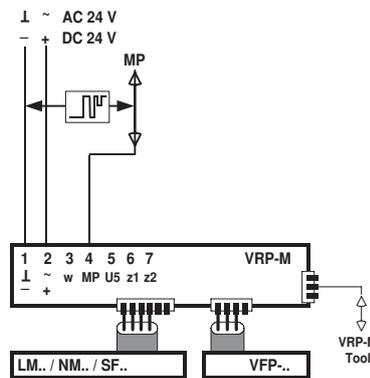
Example 3:
DC 0 ... 10 V with shut-off / parallel control



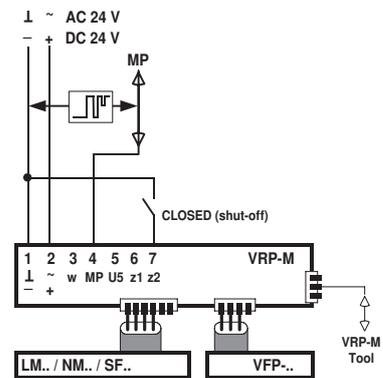
Notes

- Supply via safety isolating 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.

Example 4:
With bus control



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



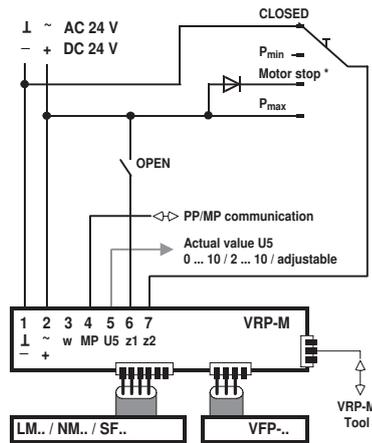
Bus operation:
See pages 20 to 22 for a functional description

Electrical installation

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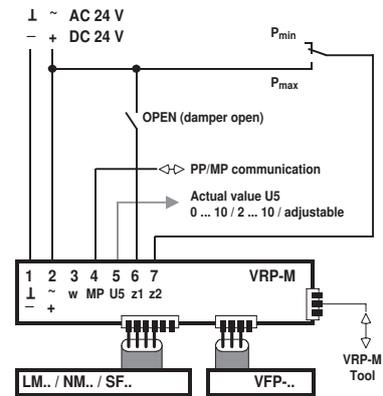
Wiring diagrams STP
Constant pressure operation

Example 1:



Example 2:

$\dot{V}_{min} - \dot{V}_{max} - OPEN$



Notes

- Supply via safety isolating transformer!
- We recommend routing connections 1, 2 (AC/DC 24 V), 4 (MP signal) and 5 (UF 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 following has been accomplished by the unit manufacturer for the system solution:
- Mounting on the damper unit
 - The static pressure sensor has been balanced to the zero point offset or the pressure range of the dynamic pressure sensor has been adjusted, respectively
 - The VRP-M has been correctly calibrated and parameterised to the $\Delta p @ \dot{V}_{nom}$ value of the application
 - The electrical connection has been made and checked
 - 24 V supply and control have been made ready for operation
 - The ventilators have been put into operation

- Procedure**
- Test the electrical connection
 - Check the zero offset with static pressure sensor or the pressure range setting with dynamic pressure sensor, respectively
 - Check the damper mobility
 - Test the damper angle of rotation setting, correcting it if necessary, and carry out an angle of rotation adaptation
 - Check the P_{min} / P_{max} setting, correcting it if necessary
 - Test the supply pressure (supply/exhaust air ventilator in operation and balanced)
 - Test the control signal setting, adjusting it if necessary

Damper actuator angle of rotation adaptation

Note
Fast runner damper actuators LMQ24A-SRV-ST and NMQ24A-SRV-ST
 Once the push button gear disengagement key is pressed, a synchronisation is carried out, i.e. the actuator moves CLOSED and returns to the setpoint position.

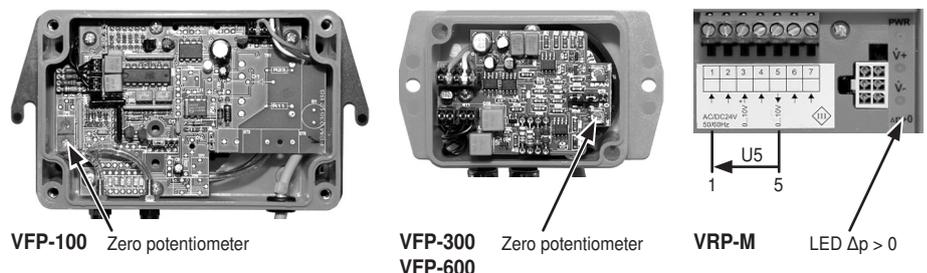
An angle of rotation adaptation must be carried out after each adjustment of the damper angle of rotation limitation.
 In the case of fast runner damper actuators LMQ24A-SRV-ST and NMQ24A-SRV-ST, it is mandatory that a angle of rotation adaptation be carried out after every adjustment of the angle of rotation limitation.

- Procedure:**
- Switch on the 24 V supply
 - Press the «Adaption» push-button (actuator travels CLOSED ... OPEN ... setpoint position)

Static pressure sensor VFP-.. Zero offset

- Disconnect both (!) hose connections from the sensor
- Remove the cover of the sensor housing
- Rotate the zero potentiometer inside the VFP-.. until the LED in the VRP-M [$p > 0$] lights up
- Rotate it back until the LED just gets off or rotate it back until the voltage U5 is $< 0.04 \text{ V} / 2.04 \text{ V}$ (Mode = 0 ... 10 V / 2 ... 10 V)
- Connect the hose connections to the sensor: observe + / - setting!

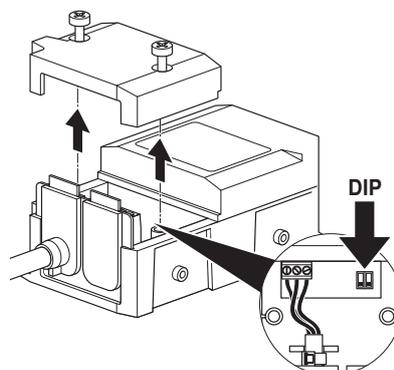
Note
Static pressure sensors VFP-..
 In the event of a mounting orientation that deviates from the perpendicular position, it is mandatory that a zero offset be carried out.



Dynamic pressure sensor VFD3 Pressure range setting

The DIP switches for adjusting the pressure range are located under the VFD3 housing cover.

Note
Dynamic pressure sensor VFD3
 The pressure range of the VFD3 is set in the factory by the manufacturer of the VAV unit and configured accordingly in the VRP-M. It is mandatory that an adjustment of the pressure range requires an adaptation in the VRP-M configuration.
 The pressure range -20 ... 100 Pa cannot be used with the VRP-M.



DIP switch Position	Pressure range	Remarks
	0 ... 100 Pa	
	0 ... 300 Pa	Default setting
	0 ... 600 Pa	Differential pressure measurement up to 500 Pa
	-20 ... 100 Pa	Cannot be used with the VRP-M

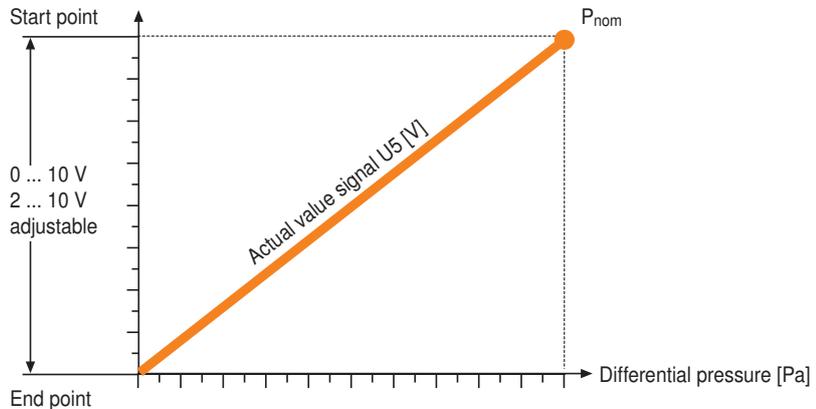
If necessary, the setting of the DIP switches can be sealed with a compatible lacquer. It is recommended for purposes of documenting the setting that the selected pressure range be marked on the housing cover with a waterproof felt-tip pen.
 The VFD3 is not equipped with an external zero adjustment.

Functions

Nominal pressure P_{nom}

P_{nom} corresponds to the highest possible pressure setting of the application within the permissible operating conditions. The P_{nom} values are specified and are programmed permanently by the damper manufacturer.

The actual value signal U_5 is always in reference to the P_{nom} . For this reason, changes in the operating pressure setting P_{min} and P_{max} have no influence on the U_5 V signal.



**Creep flow limitation
Minimum setting limit P_{min}**

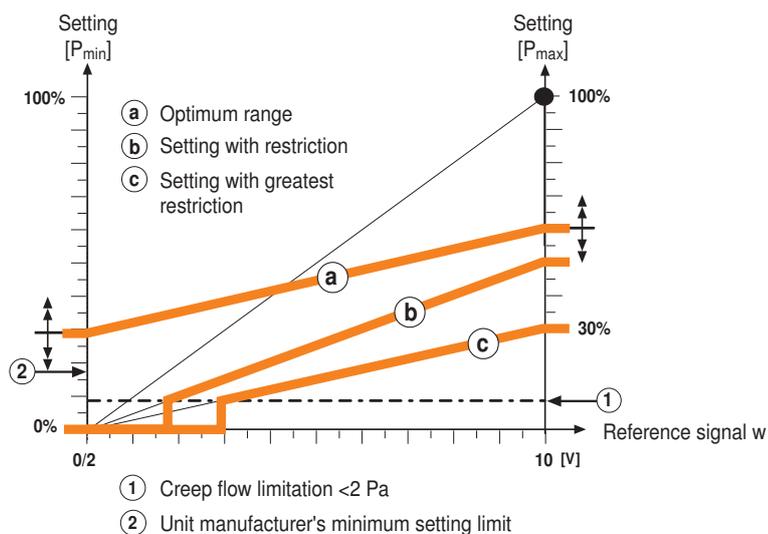
Creep flow limitation (1)

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.

Sensor	Pressure range	Limitation
VFP-100	0 ... 100 Pa	1 Pa
VFP-300	0 ... 300 Pa	3 Pa
VFP-600	0 ... 600 Pa	6 Pa
VFD3	0 ... 100 Pa	1 Pa
	0 ... 300 Pa	3 Pa
	0 ... 600 Pa	6 Pa

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.

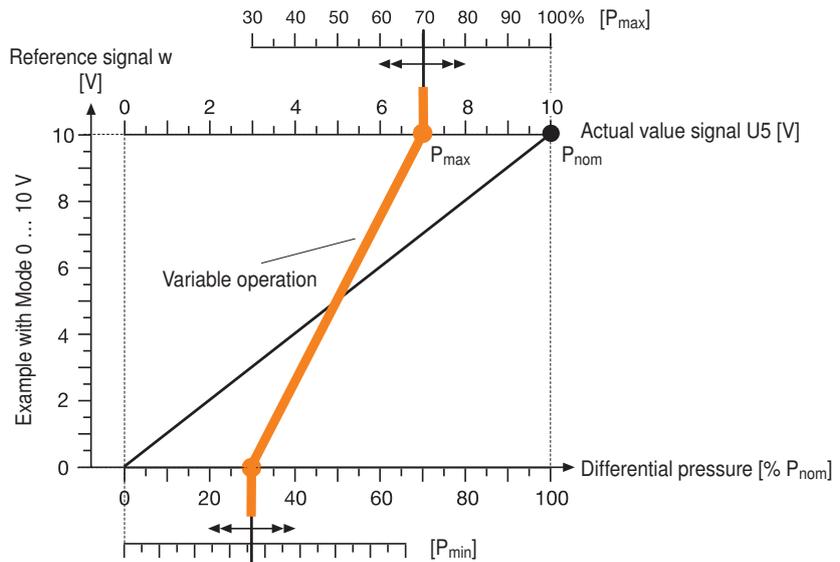


Functions

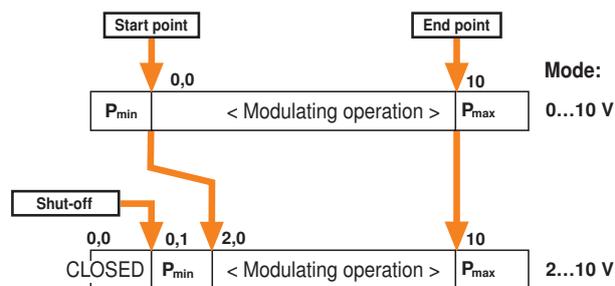
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Control tolerance The maximum permissible control tolerance is defined as a percentage of the nominal pressure P_{nom} . If the system deviation exceeds or undershoots this tolerance, the actuator is adjusted so that the actual value corresponds to the required setpoint.
 Control tolerance: $\pm 5\%$ of P_{nom}
 The two LEDs [+p] and [-p] will show the following when the maximum control tolerance is exceeded or undershot or when the actuator in movement must be corrected by the deviation:
 LED [+p]: actual value $>$ (setpoint + control tolerance) = damper closes
 LED [-p]: actual value $<$ (setpoint + control tolerance) = damper opens

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



Voltage level



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

For override control in STP operation, e.g. CLOSED or OPEN, the reference signal w (Input 3) can be overridden by wiring the control inputs 6 (z1) and 7 (z2).

STP operating modes
 CLOSED / P_{min} / Motor stop / P_{max} / OPEN

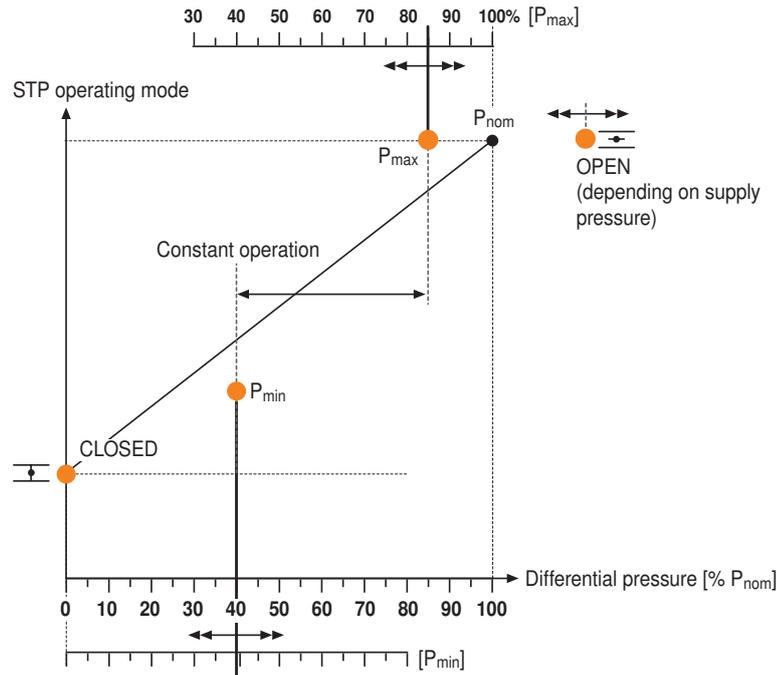
Five operating modes are available for step mode:
 – Shut-off operation – Damper CLOSED: The damper is moved into the CLOSED position in a defined manner.
 – Operating modes P_{min} / P_{max} : The VRP-M permanently regulates the selected pressure.
 – Motor stop
 – Damper OPEN: The damper can be opened for maximum ventilation, in which case the pressure control is deactivated!
 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.

Notes

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

Functions

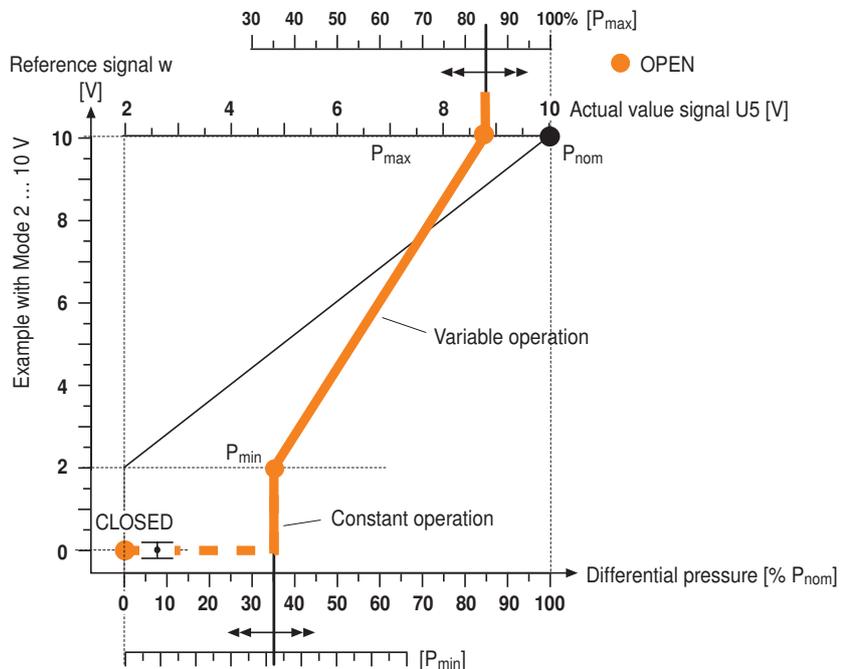
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STP – modulating operation with override
CLOSED / P_{min} / Motor stop / P_{max} / OPEN

If necessary, the modulating P_{min} ... P_{max} range can be overridden by fixed operating modes. The following operating modes are available:

- Shut-off operation, Damper CLOSED: The damper is moved into the CLOSED position in a defined manner.
- Operating modes P_{min} / P_{max}: The VRP-M permanently regulates the selected pressure.
- Motor stop
- Damper OPEN: The damper can be opened for maximum ventilation, in which case the pressure control is deactivated!



Notes

- P_{min}: All inputs (3 / 6 / 7) open
- Motor stop is not available with the DC 24 V supply.

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

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

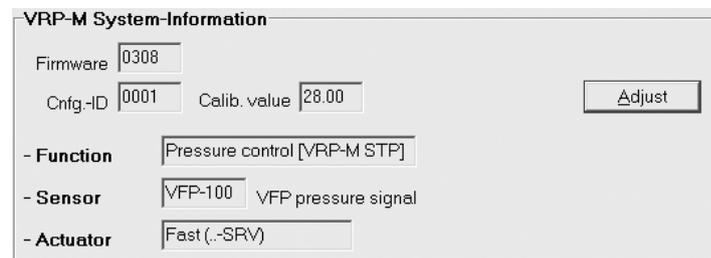
Terminal	Priority	Function
6	z1	1 OPEN
7	z2	2 CLOSED / Motor stop / P _{max}
3	w	3 P _{min} ... P _{max}

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



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.

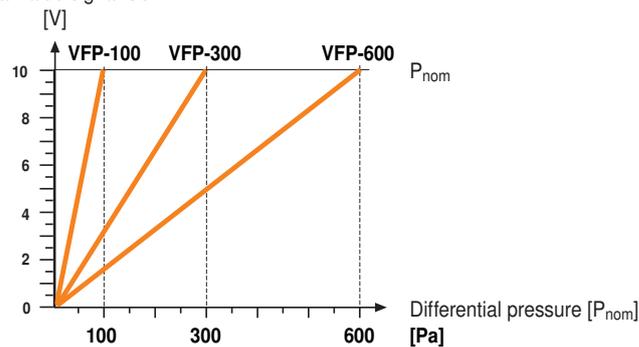
**Control – reference signal w ,
actual value signal U_5**

The reference signal w and the actual value signal U_5 are set to the MCR system. Selection DC 0...10 V / DC 2...10 V / adjustable (sequence matching in the 0...10 V range)

Setting – P_{nom}

The P_{nom} values are specified and programmed permanently 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 U_5



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

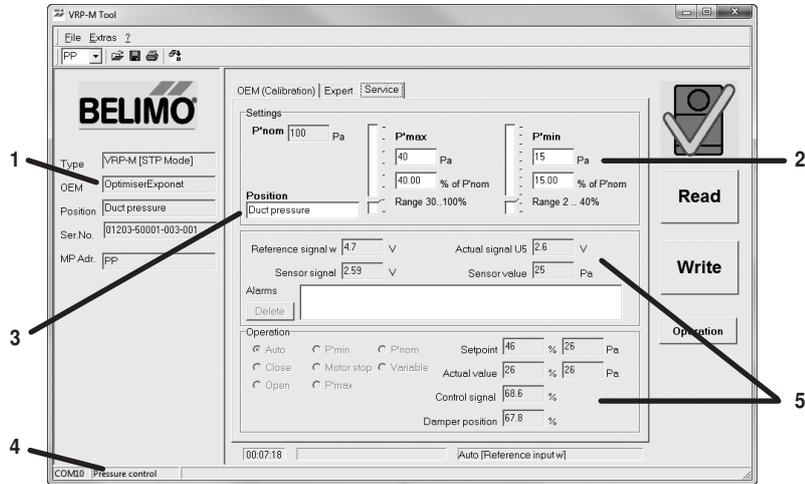
The equipment configuration and settings form part of the damper manufacturer's system solution (OEM) and are not allowed to be modified without prior authorisation. All changes are liable to disrupt operation and cause damage to the system or injury to persons!

PC-Tool VRP-M module – operating data setting

Adjustments on the system with PC-Tool

The VRP-M module enables, if needed, the adjustment of the operating data (P_{min} , P_{max} settings) and of the reference signals (Setting mode – Voltage range) to the requirements at the plant. The PC-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 pages 16 ... 17).

VRP-M-Tool Service tab

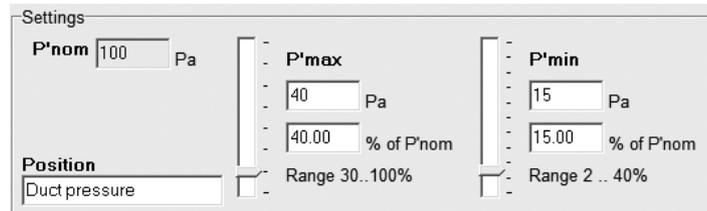


- 1 Identification
- 2 Adjustment of pressure stages
- 3 System designation entry
- 4 Pressure

- 5 Checking – Operation:
 - Reference signal display
 - Pressure [Pa]
 - Setpoint / actual value [Pa]
 - Operating mode selection:
 - AUTO / CLOSED / OPEN
 - P_{min} / P_{max} / Motor stop / P_{nom}
 - Variable setpoint (P_{min} ... P_{max})

Settings - pressure stages

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



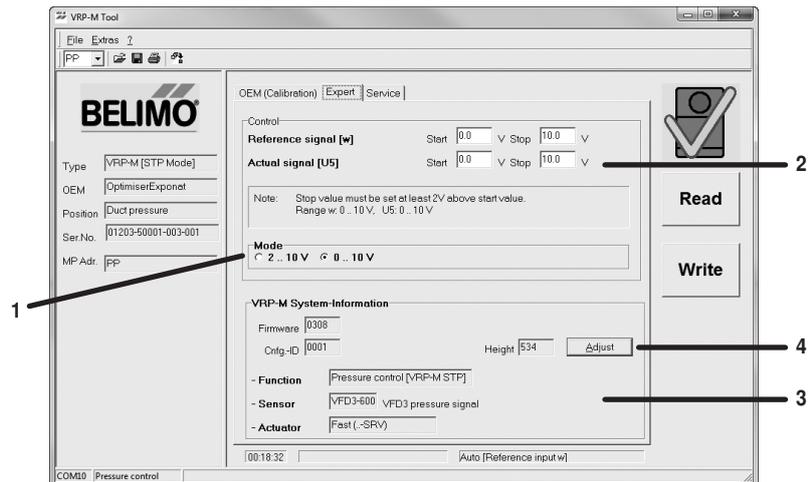
- P_{max} Range 30 ...100% of P_{nom}
Upper pressure value
- P_{min} Range 0 ...100% of P_{nom}
Control range x^* ...100% of P_{nom}
Lower pressure value
Shut-off operation (CLOSED) via P_{min} setting
If a shut-off function is required in modulating operation, it can be achieved with the setting P_{min} 0%

* P_{min} settings below the control range
 P_{min} values below the start value displayed in the range can be set, e.g. for dampers with shut-off function

System designation entry

Input field (16 characters) for specific system designations, e.g. MCR address, system name, item number in diagram, etc.

PC-Tool VRP-M module – Operating data settings (continued)

VRP-M module
'Expert' tab

- 1 **Mode setting:**
Standard 0 ... 10 / 2 ... 10 V
- 2 **Control Individual setting**
 - Reference signal w
 - Actual value signal U5
- 3 **VRP-M system information**
 - VRP-M version
 - Function pressure [VRP-M STP]
 - Sensor type
 - Actuator type
- 4 **Ambient conditions (VFD3)**
 - Height above sea level

Mode setting Options: 0... 10 V / 2...10 V / individual setting
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).

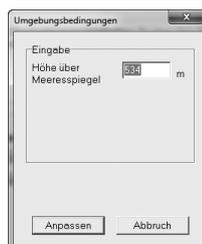
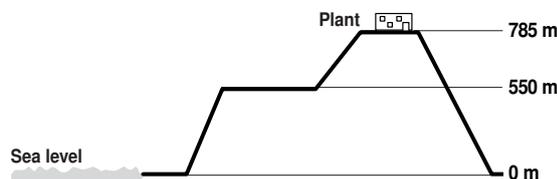
Reference signal [w] / operating range P_{\min} ... P_{\max}

Start point: DC 0.0 ... 8 V
Stop point: DC 2.0 ... 10 V

Actual value signal [U5] / display range 0 ... 100% P_{nom}

Start point: DC 0.0 ... 8 V
Stop point: DC 2.0 ... 10 V

Ambient conditions With this function, the VRP-M solution and the VFD3 sensor can be adjusted to the geographical environment of the plant.



Height above sea level as a relevant parameter can be entered as a corrective value for the VFD3 signal through the «Ambient conditions» adjustment marker in the Expert tab:

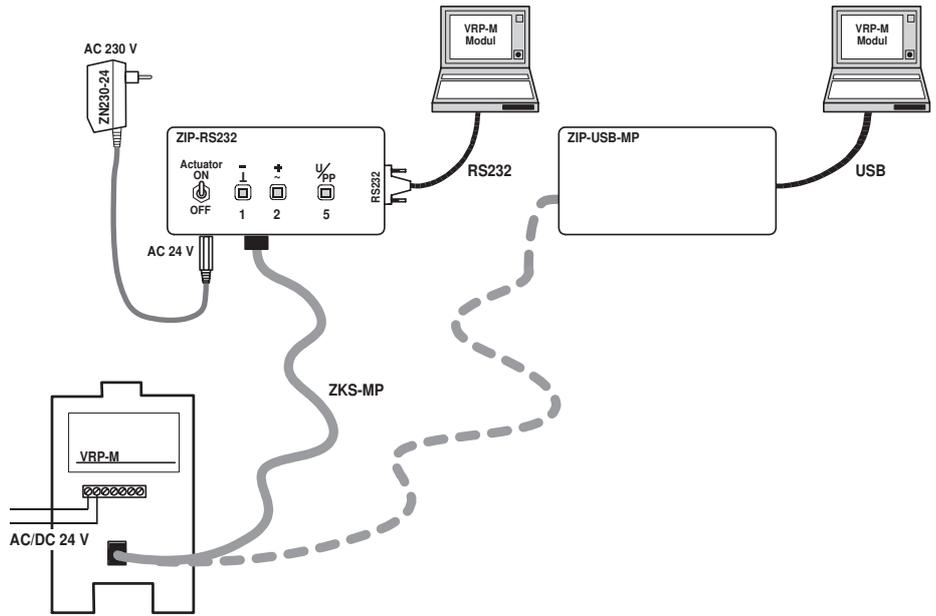
PC-Tool VRP-M module – Availability

The current version of the PC-Tool or the VRP-M module, respectively, and the associated documentation can be downloaded from www.belimo.eu.

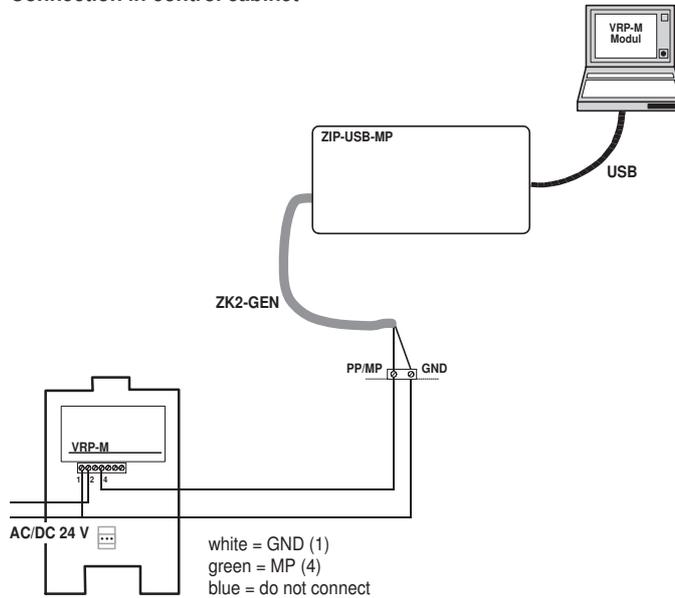
PC-Tool connection

The PC-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). A level converter ZIP-USB-MP or ZIP-RS232 is required for communication.

Conventional operation (PP) Connection via service socket

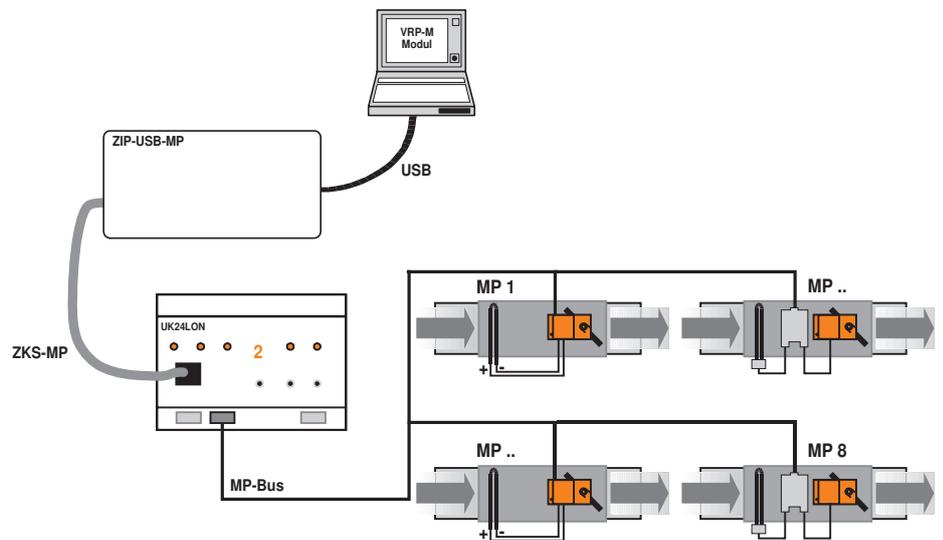


Connection in control cabinet



PC-Tool connection

MP bus operation The PC-Tool can only be connected via the bus master during MP bus operation because otherwise two MP masters would be connected on the same MP bus. This means the local connection to the VRP-M is not permitted to be operating at the same time as the MP master.

**Notes**

- The service plug integrated in the VRP-M is not available with bus operation.
 - The MP bus cannot be used to transmit open and closed-loop control functions if it is also used to connect the PC-Tool.
- Workaround: Undo MP bus (terminal 4) and use local MP plug or tool connection on the UK24...

Service-Tool ZTH-GEN



Service-Tool for parameterisable and communicative Belimo actuators and VAV controllers. Local connection via service socket on the device or remote control via MP/PP connection.

Connection and supply

The ZTH-GEN is supplied via the actuator/VAV controller. The connection is set up

- directly at the Service socket of the actuator/VAV controller or
- via the PP/MP connection, e.g. connection socket, in the control cabinet, room controller CR24

Local connection via service socket

Connection to	Cable type	Connection
VRP-M	ZK4-GEN	<p>1 ⊖ GND 2 ⊖ ~ / + 3 ⊖ 4 ⊖ PP</p>

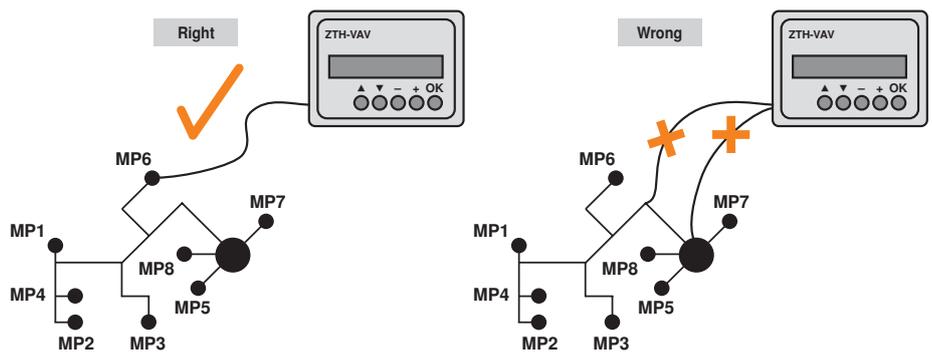
ZTH-GEN connection in MP bus system: The MP connection should be disconnected from the MP bus while the ZTH-GEN is operating.

Direction connection to terminals

Connection to	Cable type	Connection
VRP-M	ZK2-GEN	<p>white -1 ⊖ GND blue -2 ⊖ ~ / + 3 ⊖ turquoise- 4 ⊖ PP</p>

VAV-Universal actuators: The V actuators NM24A-S-ST, LMQ24A-SRV-ST and NMQ24A-SRV-ST, suitable for the VAV universal controller VRP-M (STP), have a tool connection, but are not tool-capable.

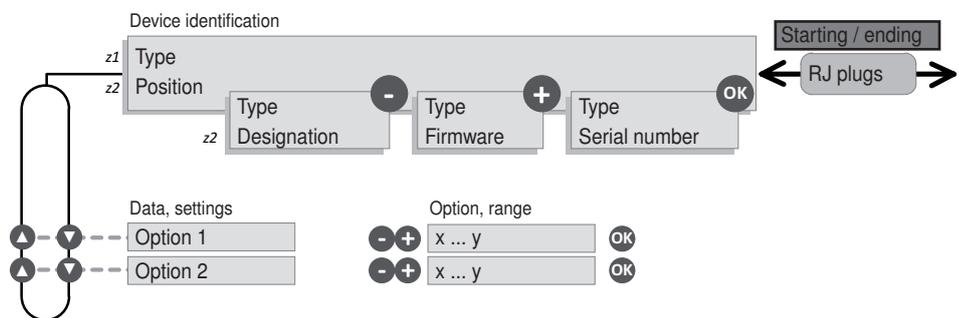
Connection in the MP bus system



Direct connection to the MP bus or MP master is not possible with the ZTH-GEN. Solution: Use the service socket on the VAV controller or temporarily disconnect the MP connection of the MP device from the MP bus and connect the ZTH-GEN to the MP connection.

Menu structure, handling

The operating menu can be run through from both sides ▼▲.



Starting / ending

The connection to the actuator/VAV controller is started by plugging in the RJ plug and terminated by unplugging it.

Configuration

- Start Configuration**
1. Press the key (OK) while simultaneously plugging in the connecting cable
 2. Configuration menu display appears

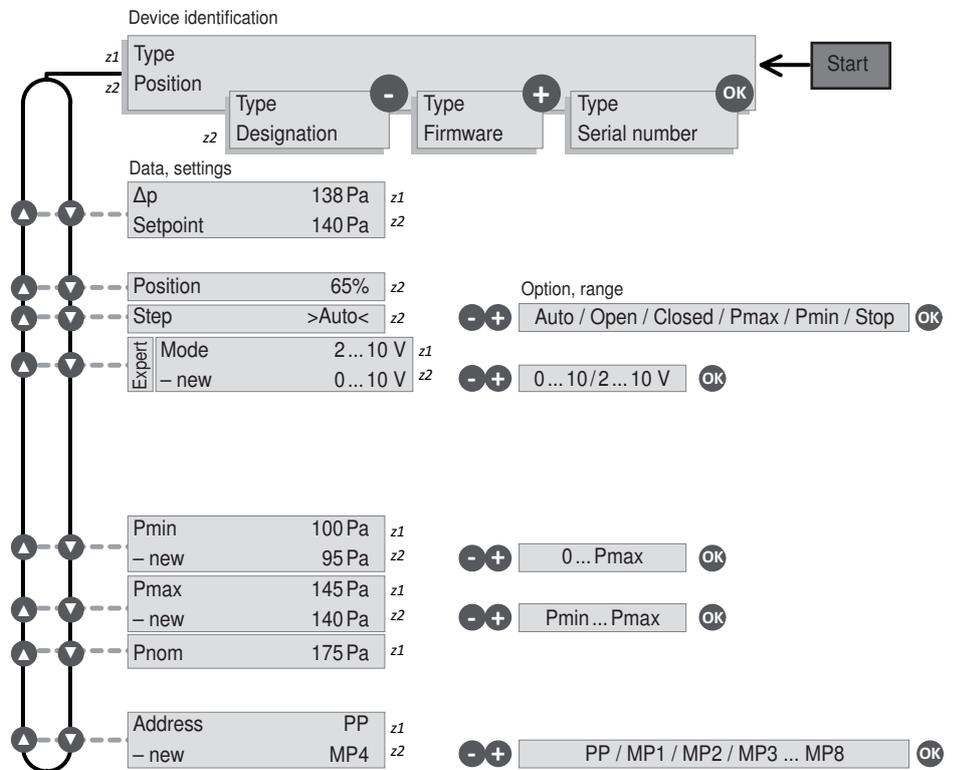
Configuration menu

Option / Display	Setting	Product range	Explanation
HW Version Vx.x FW Version Vx.x			Display of the current hardware and firmware version of the ZTH-GEN
Text	German / English	-	
VAV unit	m³/h / l/s / cfm	VAV	
EPIV unit	m ³ /h / l/min / gpm	Valves	
Supply. ... AC ... V VHW: ... %			Display of the current AC 24 V supply voltage, with direct connection to terminals (ZK2-GEN)
Start MP tester	OK	-	MP bus diagnostics tool for system integrators. The MP tester is not a component part of this documentation.
PICCV function	0 / 1	Valves	Belimo US Enable PICCV Wizard function
Expert Mode ¹⁾	0 / 1	VAV ³⁾	Enable VAV settings: – Switching mode, – Set V _{min} / V _{max} to original values (call up OEM setting)
Advanced Mode ²⁾	0 / 1	VAV ³⁾ Fire protection	Enable settings: – VAV: Direction of rotation, – BF-Top: Adaption
Exit Configuration	OK		

Activate options ¹⁾ and ²⁾ only as needed and with the respective know-how; the adjustment of the respective parameters requires special expertise.
³⁾ only for VAV-Compact

Functions for VAV product range

Menu tree



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 via the Belimo MP bus. The maximum of eight Belimo MP devices are supplied with a digital control signal by the higher-level bus master and then move to the position dictated by this signal.

The switching from conventional to bus mode takes place automatically, as soon as an MP address (1...8) is assigned to the MP actuator.

The Belimo MP devices can be integrated in the following systems:

- LONWORKS®: The variables of Functional Profile 8110 can be used in conjunction with the Belimo UK24LON interface.
- EIB-Konnex: In connection with the Belimo UK24EIB interface
- DDC controller with an integrated MP bus protocol: Available from several manufacturers

MP bus cycle time

The cycle time of the MP bus 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.

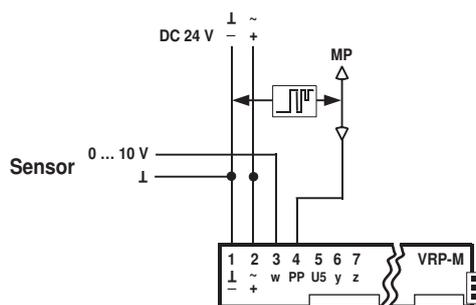
Principle of operation

Sensor integration (starting with VRP-M version V3.x)

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

The VRP-M acts in this capacity as an analogue/digital converter for the transmission of the sensor signal to the higher-level system. This must know the physical address (which sensor at which MP device) and be able to interpret the respective 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 specified value in the range P_{\min} ... P_{\max} .

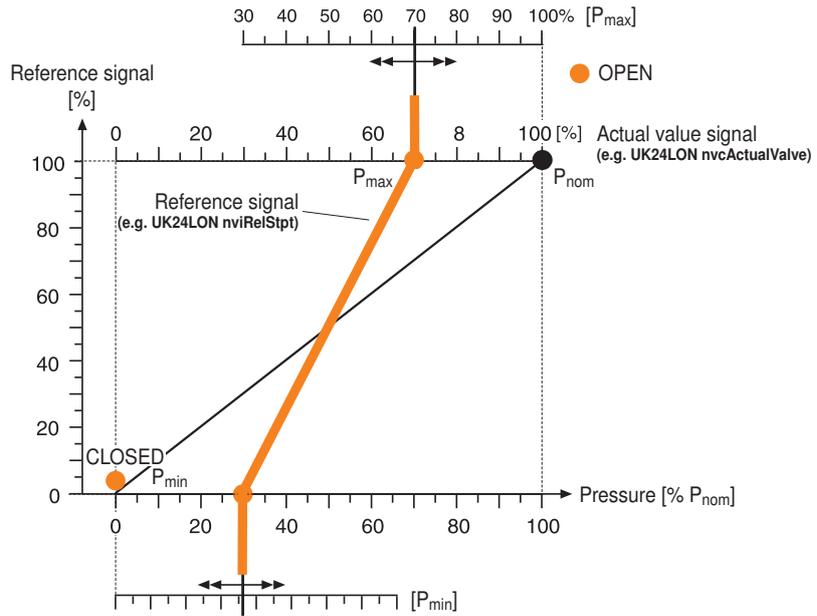
If needed, the VAV range P_{\min} ... P_{\max} can be overridden in bus operation by fixed operating modes (control inputs z1 and z2).

The following operating modes are available:

- Shut-off operation, Damper CLOSED: The damper is moved into the CLOSED position in a defined manner.
- Operating mode P_{\max} : the VRP-M adjusts the set pressure.
- Motor stop
- Flushing mode – Damper OPEN: The damper can be opened for maximum ventilation, in which case the pressure control is deactivated.

Bus operation

(continued)



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

Pressure setting P_{min} / P_{max}

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

Function	Volumetric flow	Range
P_{nom}	nominal	OEM-specific value, depending on the application 30 ... 100% of the sensor range
P_{max}	maximum	30 ... 100% of P_{nom}
P_{min}	minimum	0 * ... 100% of P_{nom}

* The minimum pressure setting P_{min} is dependent on the setting used, or is influenced by the creep flow limitation, respectively (see the function: «Creep flow limitation / Minimum setting limit»).

Open pressure setting

The P_{min} / P_{max} setting can be open if necessary, i.e. with a setting of P_{min} 0% / P_{max} 100%. In this case, the pressure 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.

Bus signal priorities (MP setpoint and control inputs 6 (z1) / 7 (z2))

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

Terminal	Priority	Function
6	z1	1 OPEN
7	z2	2 CLOSED / Motor stop / P_{max}
	3	MP override function 1 OPEN 2 CLOSED 3 P_{max} 4 P_{min} 5 Motor stop 6 – 7 P_{nom}
	4	MP setpoint 0 ... 100% = P_{min} ... P_{max}

Note
Note the speed of the MP bus!

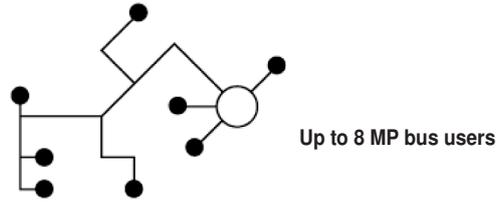
Bus fail function

Last setpoint
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.

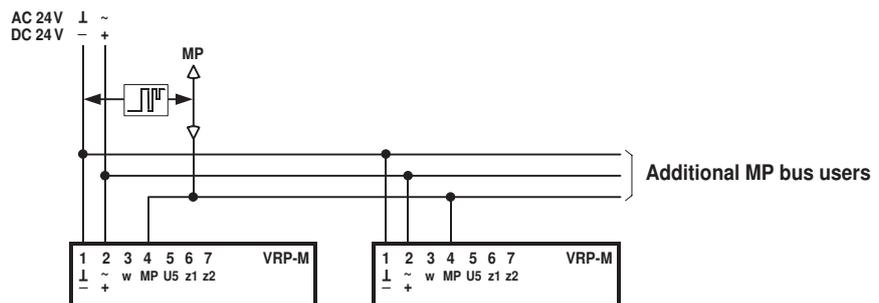
Initial setpoint after power failure
The VRP-M starts with its MP initial status (setpoint 0%, corresponding to the P_{min} setting) if a power failure occurs in the intervening period.

MP bus

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



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.



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
Dimensioning See «Technical data», page 5

Length of MP bus cable

The cable lengths are limited:

- By the sum of the performance data of the connected devices, e.g. VAV controllers, 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 products 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 VRP-M-Tool, UK24LON etc.
- For the procedure, see the documentation of the bus master used
- Procedure with VRP-M-Tool:
 - a) Select Addressing via serial number
Enter the serial number of the VRP-M (sticker on the VRP-M, display in the VRP-M-Tool)
 - b) Select addressing with acknowledgement on the VRP-M
Acknowledge the selected address by pressing the Set key on the desired VRP-M. If the Set key is pressed, then the Power LED will flash (green)



Static differential pressure sensors for neutral to slightly aggressive gases

- Measuring range, type-dependent, 0 ... 100 / 300 / 600 Pa
- Cable connection with plug suitable for VAV-Universal VRP-M


Overview of types

Type	Measuring ranges	Overload protection	Temperature sensitivity of zero	Weight
VFP-100	0 ... 100 Pa	Max. 500 Pa	±0.1% / K	Approx. 500 g
VFP-300	0 ... 300 Pa	Max. 1500 Pa	±0.05% / K	Approx. 280 g
VFP-600	0 ... 600 Pa	Max. 3000 Pa	±0.05% / K	Approx. 280 g

Technical data

Electrical data	Supply	DC 15 V (from VRP-M controller)
	Connection	1 m cable with 4-pin plug (suitable for VRP-M)
Functional data	Type, principle of operation	Pressure measurement by means of diaphragm (static, inductive)
	Measuring range	See «Type overview»
	Overload protection	See «Type overview»
	Measuring medium	Neutral to slightly aggressive gases
	Parts in contact with medium	Ni, Al, CuBe, PU
	Linearity	±1% of final value (FS)
	Switching differential	Max. 0.1% of final value
	Temperature sensitivity	Zero: See «Type overview» Measuring range: t = +10 ... 40 °C (reference temperature t ₀ = 25 °C)
	Mounting position	Upright (nipple on bottom or side)
	Position dependency	Max. ±4.5 Pa With 90° rotation ↺ around horizontal spindle
	Connection for pressure hoses	Hose nipple for hose with 4 ... 6 mm interior diameter
	Safety	Protection class
Degree of protection		IP42
EMC		CE according to 2004/108/EC
Principle of operation		Type 1 (EN 60730-1)
Ambient temperature		0 ... +50 °C
Non-operating temperature		-10 ... +70 °C
Ambient humidity		5 ... 95% r.h., non-condensing (EN 60730-1)
Dimensions / Weight	Maintenance	Maintenance-free
	Dimensions	See «Dimensions» on page 35
	Weight	See «Type overview»

Safety notes


- The pressure sensors must not 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.
Legal regulations and regulations issued by authorities must be observed during installation.
- 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.

Product features

Application Together with a VRP-M controller and a Belimo damper actuator, the VFP-.. static pressure sensors form a control system for pressure-independent variable (VAV) and constant (CAV) volumetric flow controls or for duct pressure controls (STP).
The pressure sensors are used for static differential pressure measurement with differential pressure sensors installed in air ducts. They can also be used with contaminated or mildly aggressive air ¹⁾. Their robust design makes them ideal for installation in laboratories, clean room systems and industrial applications.

Principle of operation A high-quality metal diaphragm is used in the sensor. The measured pressure produces a corresponding diaphragm stroke, which is detected inductively and converted to a pressure-linearised output signal.
The measuring signal is influenced by the mounting position due to the dead weight of the diaphragm. The sensor is calibrated in vertical position at the factory, although it can, if necessary, e.g. if installed in another position, be readjusted at the utilisation site.
The temperature is compensated to reduce drift to a minimum. The wear-free, inductive measurement method guarantees maintenance-free operation.

¹⁾ See «Technical data», page 23

For zero offset and more information, see «System description», page 9

Electrical installation

The ready-to-connect sensor unit is connected to the VRP-M controller with the 4-pin plug.

Dynamic pressure value sensor for room ventilation applications in the comfort zone

- Adjustment range:
adjustable with DIP switch in the range between 0 ... 100 / 300 / 600 Pa
- Cable connection with plug, suitable for VAV-Universal VRP-M



Technical data

Electrical data	Nominal voltage	AC 24 V, 50/60 Hz / DC 15...24 V
	Nominal voltage range	AC 19.2 ... 28.8 V / DC 13.5 ... 28.8 V
	Power consumption	0.35 W
	Operation Dimensioning	0.75 VA
	Connection	Pre-mounted 1 m cable with 4-pin plug, compatible with VRP-M
Functional data	Type, principle of operation	Δp sensor with dynamic measurement principle
	Range of use, measuring medium	Outside air/exhaust air in the comfort zone with sensor-compatible media
	Medium temperature	0 ... 50°C
	Humidity of the medium	5 ... 95% r.h., non-condensating
	Materials in contact with medium	Glass, epoxy resin, PA, TPE
	Connection for pressure hoses	Hose nipple \varnothing 6 mm, with + and – connection designation
	Adjustment range	Can be selected with DIP switch: 0 ... 100 Pa 0 ... 300 Pa (default setting) 0 ... 600 Pa –20 ... 100 Pa (cannot be used with the VRP-M)
	Accuracy	± 1 Pa in the pressure range –20 ... 20 Pa $\pm 5\%$ in the pressure range 20 ... 500 Pa
	Zero	$< \pm 1\%$, no balancing required
	Loading capacity	± 5000 Pa
	Installation position	Any, no reset necessary
	Response time	< 50 ms (< 100 ms after Power-Up)
	Output signal	0 ... 10 V, max. load 1 mA
Safety	Protection class	III Safety extra-low voltage
	Degree of protection	IP40
	EMC	CE according to 2004/108/EC
	Principle of operation	Type 1
	Rated current voltage	0.8 kV
	Control pollution degree	3
	Ambient temperature	0 ... +50°C
	Non-operating temperature	–20 ... +60°C
Dimensions / Weight	Ambient humidity	0 ... 95% r.h., non-condensating
	Dimensions (H x W x D)	See «Dimensions» on page 35
	Weight	Approx. 170 g

Note

A setting of 0 ... 600 Pa can be measured differential pressures up to 500 Pa.

Safety notes



- The pressure sensors must not 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.
Legal regulations and regulations issued by authorities must be observed during installation.
- 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.

Product features

Application Recording of Δp values in conventional heating, ventilation and air conditioning room ventilation comfort applications, e.g.:

- Negative and positive pressure in the duct system with reference to the ambient pressure
- Volumetric flow of supply air/exhaust air in combination with Belimo VAV universal controller VRP-M

Principle of operation The integrated maintenance-free D3 pressure value sensor functions in accordance with the dynamic measurement principle. The differential pressure Δp present at the sensor is available at the analogue output as 0 ... 10 V value.

Note**Dynamic pressure sensor VFD3**

The pressure range of the VFD3 is set in the factory by the manufacturer of the VAV unit and configured accordingly in the VRP-M. It is mandatory that an adjustment of the pressure range requires an adaptation in the VRP-M configuration.

The pressure range $-20 \dots 100$ Pa cannot be used with the VRP-M.

Fast-running damper actuator for VRP-M system solution

- Torque 4 Nm
- Running time 2.5 s



Limitation

The use of VRP-M with fast running actuators is not permitted for the optimiser function!

Technical data

Electrical data	Supply	AC/DC 24 V (from VRP-M controller)	
	Power consumption	Operation	13 W @ nominal torque
		Rest position	1.5 W
	Dimensioning	23 VA	
	Connection	0.5 m cable with 6-pin plug (suitable for VRP-M)	
Functional data	Torque (nominal torque)	Min. 4 Nm @ nominal voltage	
	Direction of rotation	As an option with switch 0 / 1	
	Direction of motion at Y = 0V	In switch position 0 ↻ or 1 ↻	
	Angle of rotation	max. 95° \sphericalangle, mechanical end stops adjustable	
	Running time	2.5 s / 90° \sphericalangle	
	Sound power level	52 dB (A)	
	Position indication	Mechanical, plug-in	
Safety	Protection class	III Safety extra-low voltage	
	Degree of protection	IP54 in all mounting positions	
	EMC	CE according to 2004/108/EC	
	Principle of operation	Type 1 (EN 60730-1)	
	Ambient temperature	-30 ... +50 °C	
	Non-operating temperature	-40 ... +80 °C	
	Ambient humidity	95% r.h., non-condensing (EN 60730-1)	
Maintenance	Maintenance-free		
Dimensions / Weight	Dimensions	See «Dimensions» on page 35	
	Weight	Approx. 810 g	

Safety notes



- The 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. Legal regulations and regulations issued by authorities must be observed during installation.
- 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 of the angle of rotation (press the adaptation push-button).
- When calculating the torque required, the specifications supplied by the damper manufacturers (cross-section, construction, place of installation), and the ventilation 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.

Product features

- Simple direct mounting** Simple direct mounting on the damper spindle with a universal spindle clamp; a universal mounting bracket is enclosed to prevent the actuator from rotating.
- Manual override** Manual override with self-resetting push-button. The position calculation is synchronised in order to prevent deviations as a result of manual override. This synchronisation acts at the same time as a simple functional check (see below «Synchronisation»).
- 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%.

Caution!

An adaption must be carried out when the system is commissioned or whenever the end stops for angle of rotation limiting are adjusted (press the «Adaption» push-button once).



Adaption – 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 operating 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 actuator moves first to the top, then to the bottom spindle end stops when the supply voltage is switched on for the first time, i.e. at the time of commissioning or after pressing the «Adaption» key.

Home position

Actuation of the «Gear disengagement» key causes the actuator to move to home position. This function is performed by the actuator, even when the supply voltage is restored, if the «Gear disengagement» key was pressed during the electricity interruption.

Pos. direction of rotation switch	Home position
 	ccw Left end stop cw Right end stop

After this procedure, the actuator then moves into the position defined by the system.

Functional check

An extremely simple functional check of the dampers is possible: The gearbox can be disengaged simply by pressing the «gear disengagement» key on the housing. As long as the key 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.

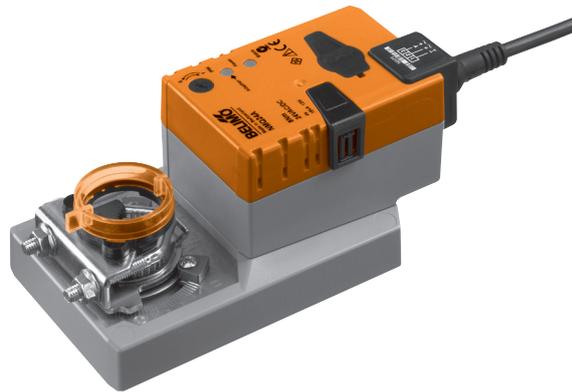
Display and operating elements



- ① Direction of rotation switch**
Switching over: Direction of rotation changes
- ② Push-button and LED display green**
Off: No power supply or fault
Illuminated: Operation
Press key: Initiates angle of rotation adaptation, followed by standard mode
- ③ Push-button and LED display yellow**
Off: Standard mode
Illuminated: Adaption or synchronisation process active
Press key: No function
- ④ Gear disengagement key**
Press key: Gearbox disengaged, motor stops, manual override possible
Release key: Gearbox engaged, synchronisation starts, followed by standard mode
- ⑤ Communication (PC-Tool, ZTH-GEN) is blocked for this actuator type**

Fast-running damper actuator for VRP-M system solution

- Torque 8 Nm
- Running time 4 s



Technical data

Electrical data	Supply	AC/DC 24 V (from VRP-M controller)	
	Power consumption	Operation	12 W @ nominal torque
		Rest position	1.5 W
		Dimensioning	18 VA
Connection	0.5 m cable with 6-pin plug (suitable for VRP-M)		
Functional data	Torque (nominal torque)	Min. 8 Nm @ nominal voltage	
	Direction of rotation	As an option with switch 0 / 1	
	Direction of motion for Y = 0 V	In switch position 0  or 1 	
	Angle of rotation	max. 95°  , mechanical end stops adjustable	
	Running time	4 s / 90° 	
	Sound power level	52 dB (A)	
	Position indication	mechanical, plug-in	
Safety	Protection class	III Safety extra-low voltage	
	Degree of protection	IP54 in all mounting positions	
	EMC	CE according to 2004/108/EC	
	Principle of operation	Type 1 (EN 60730-1)	
	Ambient temperature	-30 ... +50 °C	
	Non-operating temperature	-40 ... +80 °C	
	Ambient humidity	95% r.h., non-condensing (EN 60730-1)	
Maintenance	Maintenance-free		
Dimensions / Weight	Dimensions	See «Dimensions» on page 35	
	Weight	Approx. 930 g	

Safety notes



- The 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. Legal regulations and regulations issued by authorities must be observed during installation.
- 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 adaption is necessary when the system is commissioned and after each adjustment of the angle of rotation (press the Adaption push-button once).
- When calculating the torque required, the specifications supplied by the damper manufacturers (cross-section, construction, place of installation), and the ventilation 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.

Product features

- Simple direct mounting** Simple direct mounting on the damper spindle with a universal spindle clamp; a universal mounting bracket is enclosed to prevent the actuator from rotating.
- Manual override** Manual override with self-resetting push-button. The position calculation is synchronised in order to prevent deviations as a result of manual override. This synchronisation acts at the same time as a simple functional check (see below «Synchronisation»).
- 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%.

Caution!

An adaption must be carried out when the system is commissioned or whenever the end stops for angle of rotation limiting are adjusted (press the «Adaption» push-button once).



Adaption – 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 operating 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 actuator moves first to the top, then to the bottom spindle end stops when the supply voltage is switched on for the first time, i.e. at the time of commissioning or after pressing the «Adaption» key.

Home position

Actuation of the «Gear disengagement» key causes the actuator to move to home position. This function is performed by the actuator, even when the supply voltage is restored, if the «Gear disengagement» key was pressed during the electricity interruption.

Pos. direction of rotation switch	Home position
	Left end stop
	Right end stop

After this procedure, the actuator then moves into the position defined by the system.

Functional check

An extremely simple functional check of the dampers is possible: The gearbox can be disengaged simply by pressing the «gear disengagement» key on the housing. As long as the key 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.

Display and operating elements



- ① Direction of rotation switch**
Switching over: Direction of rotation changes
- ② Push-button and LED display green**
Off: No power supply or fault
Illuminated: Operation
Press key: Initiates angle of rotation adaptation, followed by standard mode
- ③ Push-button and LED display yellow**
Off: Standard mode
Illuminated: Adaption or synchronisation process active
Press key: No function
- ④ Gear disengagement key**
Press key: Gearbox disengaged, motor stops, manual override possible
Release key: Gearbox engaged, synchronisation starts, followed by standard mode
- ⑤ Communication (PC-Tool, ZTH-GEN) is blocked for this actuator type**

Damper actuator for VRP-M system solution

- Torque 10 Nm
- Running time 150 s


Technical data

Electrical data	Nominal voltage	AC 24 V, 50/60 Hz / DC 24 V (from VRP-M)	
	Power consumption	Operation	3.5 W @ nominal torque
		Rest position	1.25 W
		Dimensioning	6 VA
Connection		0.5 m cable with 6-pin plug (suitable for VRP-M)	
Functional data	Torque (nominal torque)	Min. 10 Nm @ nominal voltage	
	Position accuracy	±5%	
	Direction of rotation	As an option with switch 0 / 1	
	Direction of motion at Y = 2V	In switch position 0 ↻ or 1 ↻	
	Angle of rotation	max. 95° ↻ Mechanical end stops adjustable	
	Running time	150 s	
	Sound power level	max. 35 dB (A)	
	Position indication	mechanical, plug-in	
Safety	Protection class	III Safety extra-low voltage	
	Degree of protection	IP54 in all mounting positions	
	EMC	CE according to 2004/108/EC	
	Principle of operation	Type 1 (EN 60730-1)	
	Ambient temperature	-30 ... +50 °C	
	Non-operating temperature	-40 ... +80 °C	
	Ambient humidity	95% r.h., non-condensing (EN 60730-1)	
	Maintenance	Maintenance-free	
Dimensions / Weight	Dimensions	See «Dimensions» on page 35	
	Weight	Approx. 710 g	

Safety notes


- The 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.
Legal regulations and regulations issued by authorities must be observed during installation.
- 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.
- 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. All locally valid regulations and requirements must be observed.

Product features

- Simple direct mounting** Simple direct mounting on the damper spindle with a universal spindle clamp, supplied with a universal mounting bracket to prevent the actuator from rotating.
- Manual override** Manual operation 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.
- Adaption** 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 protected, requires no limit switches and automatically stops when the end stop is reached.

Accessories

	Description	Data sheet
Electrical accessories	Auxiliary switch S..A..	T2 - S..A..
	Feedback potentiometer P..A..	T2 - P..A..
Mechanical accessories	Shaft extension AV6-20	T2 - Z-NM..A..

Electrical installation

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

Display and operating elements



- ① **Direction of rotation switch**
Switching over: Direction of rotation changes
- ② **Push-button and LED display green**
Off: No power supply or fault
Illuminated: Operation
Press key: Switches on angle of rotation adaptation followed by standard mode
- ③ **Push-button and LED display yellow**
Off: Standard mode
Illuminated: Adaption or synchronising process active
Press key: No function
- ④ **Gear disengagement key**
Press key: Gear disengaged, motor stops, manual override possible
Release key: Gear engaged, synchronisation starts, followed by standard mode
- ⑤ **Communication (PC-Tool, ZTH-GEN) is blocked for this actuator type**

Spring-return actuator with emergency setting function for VAV and CAV units in ventilation and air conditioning systems for building services installations

- Torque 20 Nm
- Running time 150 s


Technical data

Electrical data	Nominal voltage	AC 24 V, 50/60 Hz / DC 24 V (from VRP-M)	
	Power consumption	Operation	8.5 W @ nominal torque
		Rest position	3.5 W
		Dimensioning	11 VA
Connection	1 m cable with 6-pin plug (compatible with VRP-M)		
Functional data	Torque	Motor	Min. 20 Nm @ nominal voltage
		Spring-return	Min. 20 Nm
	Position accuracy	±5%	
	Direction of rotation	Motor	as an option with switch  / 
		Spring-return	As an option by installation L / R
	Direction of rotation for Y = 0 V	in switch position 1  or 0 	
	Manual override	With hand crank and interlocking switch	
	Angle of rotation	max. 95°↔ (can be limited by adjustable mechanical stop)	
	Running time	Motor	≤150 s / 90°↔
		Spring-return	≤20 s @ -20 ... 50°C / max. 60 s @ -30°C
	Sound power level	Motor	≤40 dB (A) @ 150 s running time
Spring-return		≤62 dB (A)	
Service life	Min. 60,000 emergency settings		
Safety	Protection class	III Safety extra-low voltage	
	Degree of protection	IP54	
	EMC	CE according to 2004/108/EC	
	Certification	Certified in accordance with IEC/EN 60730-1 and IEC/EN 60730-2-14	
	Principle of operation	Type 1.AA	
	Rated current voltage	0.8 kV	
	Control pollution degree	3	
	Ambient temperature	-30 ... +50°C	
	Non-operating temperature	-40 ... +80°C	
	Ambient humidity	95% r.h., non-condensing	
Maintenance	Maintenance-free		
Dimensions / Weight	Dimensions	See «Dimensions» on page 35	
	Weight	Approx. 2.3 kg	

Safety notes



- The 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. Legal regulations and regulations issued by authorities must be observed during installation.
- 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.
- 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.

Product features

Principle of operation	The actuator is controlled by the 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; a universal mounting bracket is enclosed to prevent the actuator from rotating.
Adjustable angle of rotation	Adjustable angle of rotation with mechanical end stop.
Adaption	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 protected, requires no limit switches and automatically stops when the end stop is reached.

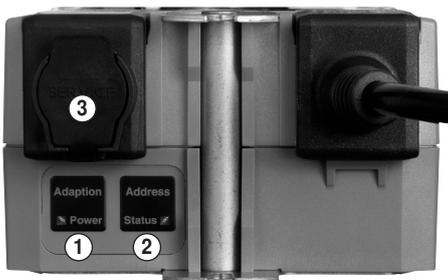
Accessories

	Description	Data sheet
Electrical accessories	Auxiliary switch S2A-F	
Mechanical accessories	Various accessories (spindle clamps, shaft extensions, etc.)	T2 - Z-SM..A..

Electrical installation

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

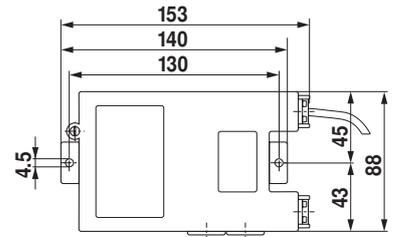
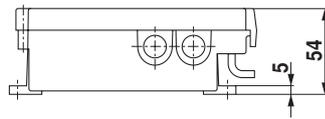
Display and operating elements



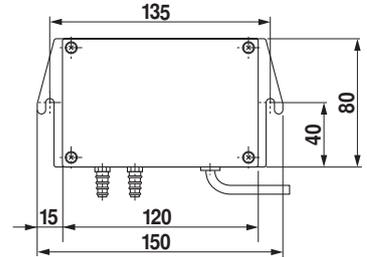
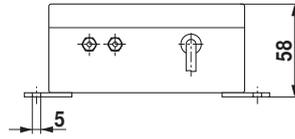
- Membrane key and LED display green**
 Off: No power supply or fault
 Illuminated: Operation
 Press key: Initiates angle of rotation adaptation, followed by standard mode
- Membrane key and LED display yellow**
 Off: Standard mode
 Illuminated: Adaption or synchronisation process active
 Press key: No function
- Communication (PC-Tool, ZTH-GEN) is blocked for this actuator type**

Operating elements The elements manual override, locking switch and direction of rotation switch are available on both sides.

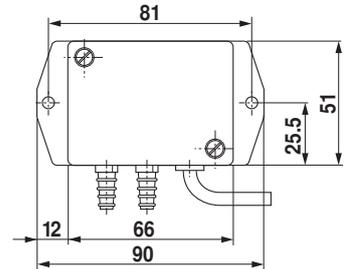
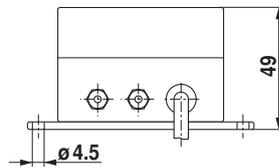
Dimensional drawings of VRP-M controller



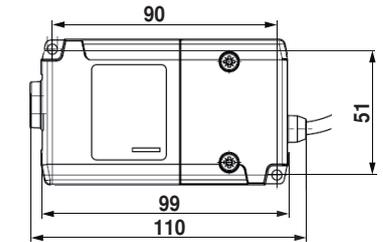
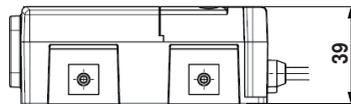
Dimensional drawings of VFP-100 sensor



Dimensional drawings of VFP-300 and VFP-600 sensors



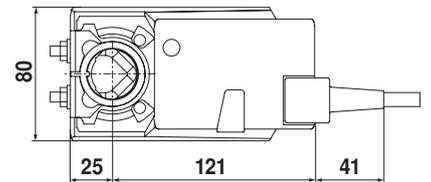
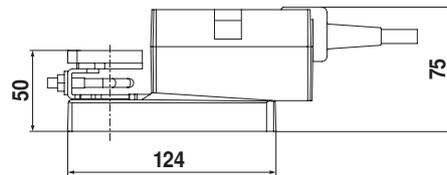
Dimensional drawings of VFD3



Dimensional drawings LMQ24A-SRV-ST

Damper spindle	Length	● I	■ I	◆ I
	≥40	8 ... 26.7	≥8	≤26.7
	≥20	8 ... 20	≥8	≤20

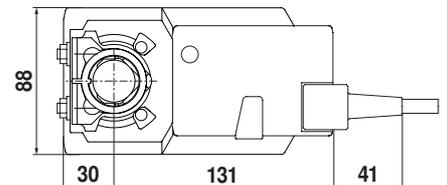
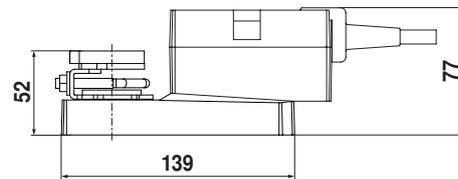
* Option (Accessory K-NA)



Dimensional drawings NMQ24A-SRV-ST

Damper spindle	Length	● I	■ I	◆ I
	≥42	8 ... 26.7	≥8	≤26.7
	≥20	8 ... 20	≥8	≤20

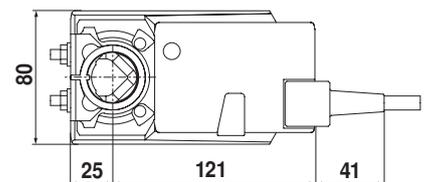
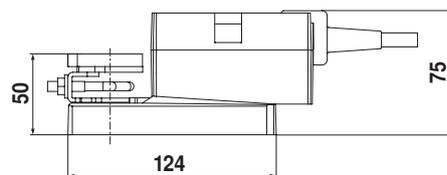
* Option (Accessory K-SA)



Dimensional drawings NM24A-V-ST

Damper spindle	Length	● I	■ I	◆ I
	≥40	8 ... 26.7	≥8	≤26.7
	≥20	8 ... 20	≥8	≤20

* Option (Accessory K-NA)



Dimensional drawings SF24A-V-ST

Variant 1a:

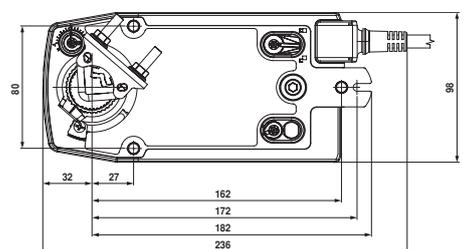
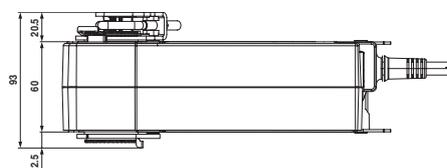
3/4"-spindle clamp (with insertion part) EU Standard

Damper spindle	Length	● I	■ I	◆ I
	≥85	10 ... 22	10	14 ... 25.4
	≥15			

Variant 1b:

1"-spindle clamp (without insertion part) EU Standard

Damper spindle	Length	● I	■ I
	≥85	19 ... 25.4 (26.7)	12 ... 18
	≥15		



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