

### VRD3-RE2-SET

VAV-Universal Retrofit Set for utilisation of existing VAV devices made by various manufacturers.

- VRD3-RE2-SET for air velocity up to 12 m/s.

#### Note

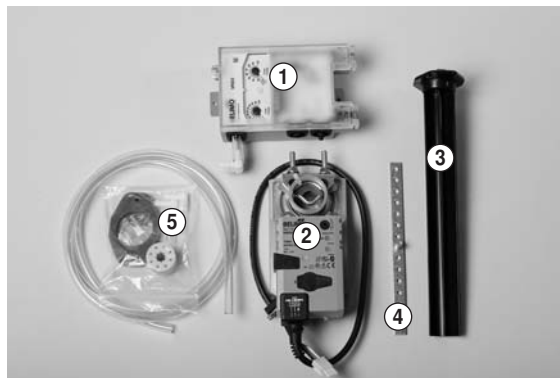
Suitable only for round VAV boxes.



### General Information

**Application** The VAV-Universal Retrofit Set makes possible an efficient replacement of VAV and CAV devices made by various manufacturers. Each package contains all of the component parts required for making the conversion.

#### Package contents



- ① VAV controller VRD3-RE2
- ② Damper actuator NM24A-V-RE2
- ③ Pick-up device ZPD-RE2
- ④ Anti-rotation strap
- ⑤ Form-fit insert 8 x 8 mm

#### installation instructions

These installation instructions describe the application of the VAV-Universal Retrofit Set VRD3-RE2-SET. For a detailed description, we draw your attention to the separate product documentation of the VRD3 and NM24A-V, see [www.belimo.eu](http://www.belimo.eu) | Documentation | Room and System Solutions.

Belimo Automation AG can at any time implement changes and improvements without prior notification. For the current edition of the operating instructions, see [www.belimo.eu](http://www.belimo.eu)

### Safety notes

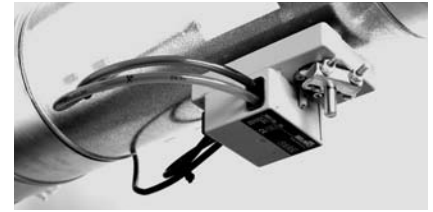


- The device is not allowed to be used outside the specified field of application, especially not in aircraft or in any other airborne means of transport.
- It may only be installed by suitably trained personnel. Any legal regulations or regulations issued by authorities must be observed during assembly.
- 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.
- 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.

Dismantling the existing VAV controller

Electrical connection

1. In the control cabinet, undo supply/signal cable to the outgoing terminals  
**Caution:** Observe and note connection sequence
2. Undo supply/signal cable to the VAV controller  
**Caution:** Observe and note connection sequence



Mechanical components

1. Dismantling the existing pick-up device
2. Dismantling the controller
3. Dismantling the actuator



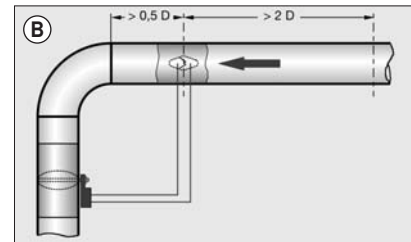
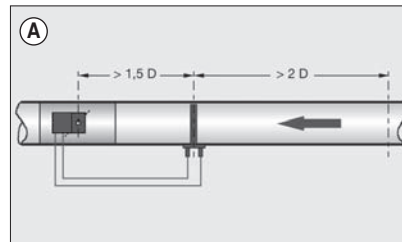
Installation of the new pick-up device

Measured value recording

The installation position and the inflow of the pick-up device are of decisive importance for measuring accuracy. If the measurement recording is positioned in an area of turbulence or if no sufficiently wide-ranging flow takes place, then measurement inaccuracies could occur under certain circumstances.

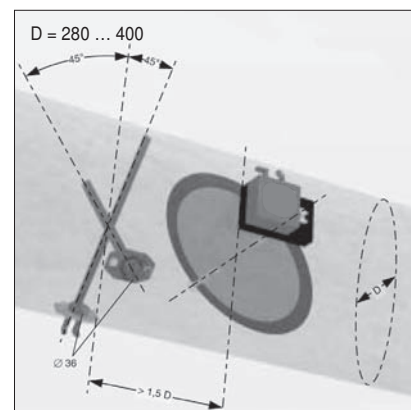
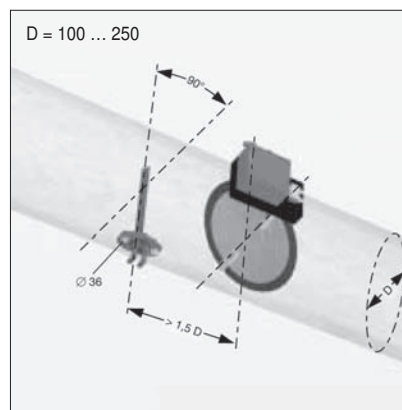
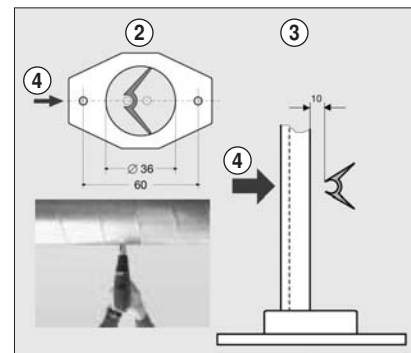
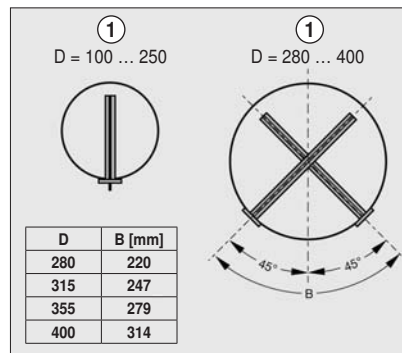
Placement

- Ⓐ Measurement site
- Ⓑ Maximum hose length 3 m per measurement line



Installation position

- ① Air duct
- ② Bore hole for mounting pick-up device
- ③ Clearance between the pick-up devices
- ④ Air direction



**Note**  
Two pick-up devices are required for VAV boxes from 280 to 400 mm.  
For this purpose use the ZPD-RE2-SET.

Installation of the new pick-up device (continued)

- Preparation** 1. Shorten the pick-up device to the diameter of the VAV unit. The auxiliary template is located on the packaging of the set.

**Note**

The specified lengths must be maintained without fail in order to ensure that the desired measuring accuracy can be achieved.



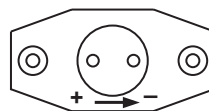
2. Mount pick-up device seal



3. Bore an opening in the duct; hole size: 36 mm $\varnothing$



- Installation** 1. Installation of the pick-up device in the duct  
**Caution:** Observe direction of arrow for air

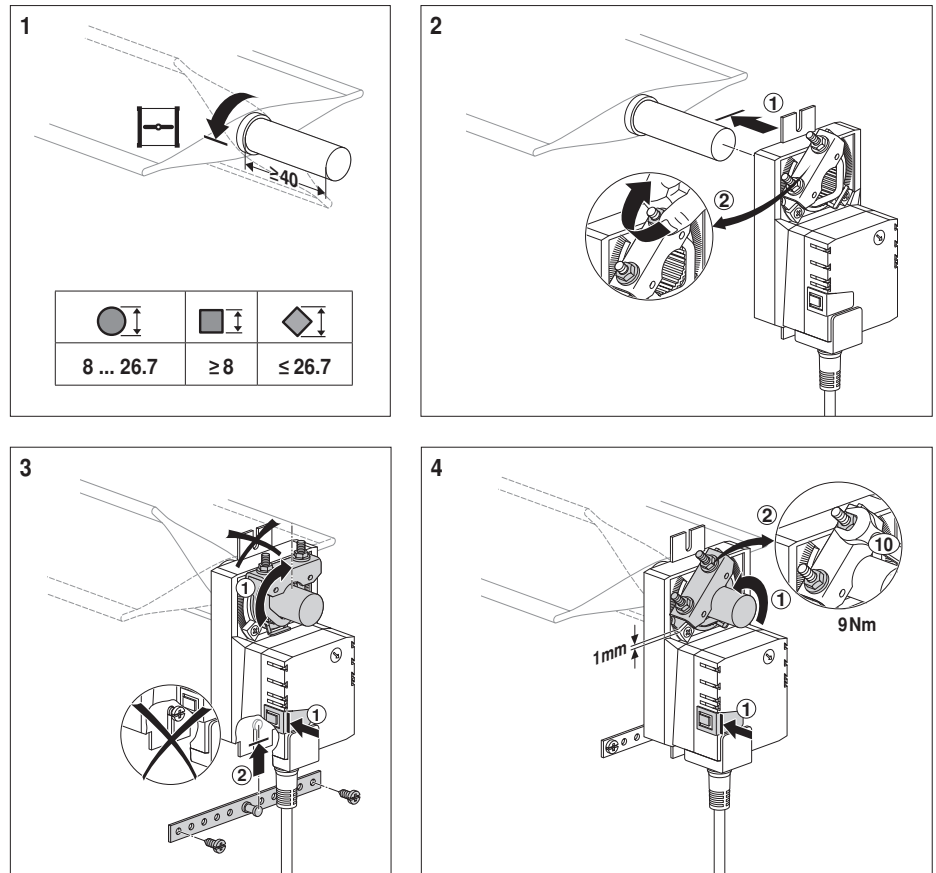


2. Mount pick-up device with accompanying screws

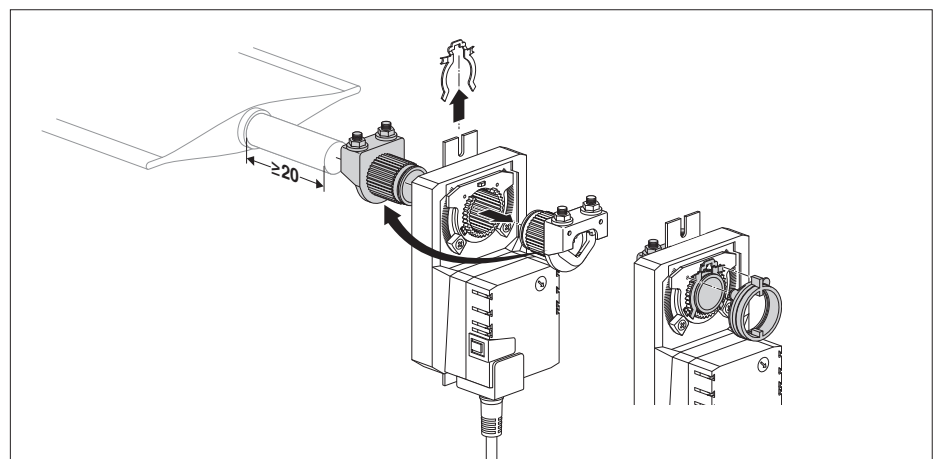


Installation of the new damper actuator

**Spindle clamp installation** The damper actuator for VAV boxes NM24A-V-RE2 is equipped with the base plate for form-fit mounting. The **front mounting clip may not be used under any circumstances** when the actuator is used with **clamp connection** (Illustration 3). Damage to the VAV unit and/or the damper actuator would be the result.

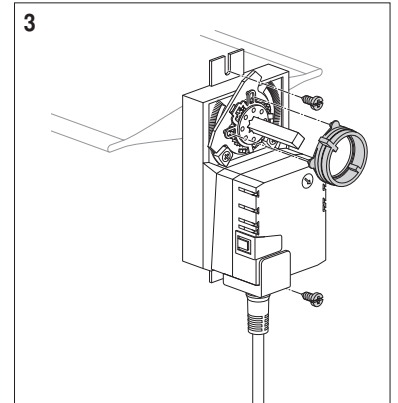
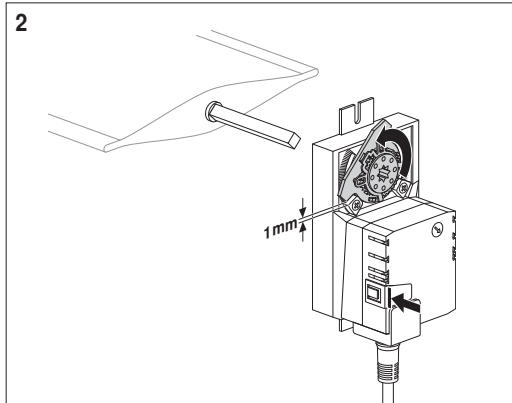
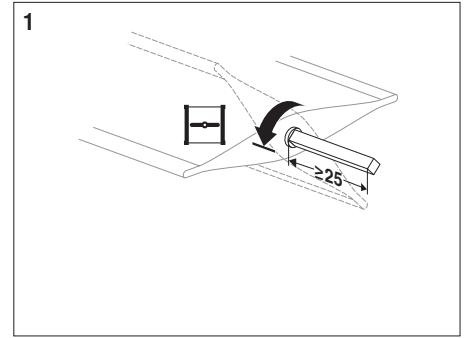
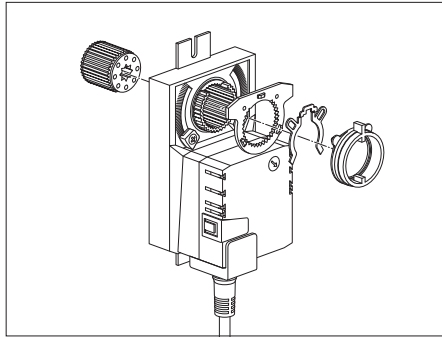


Spindle clamp installation with short axes



Installation of the new damper actuator (continued)

Installation with form-fit 8 x 8 mm



Adjusting angle of rotation limiter

**Note**

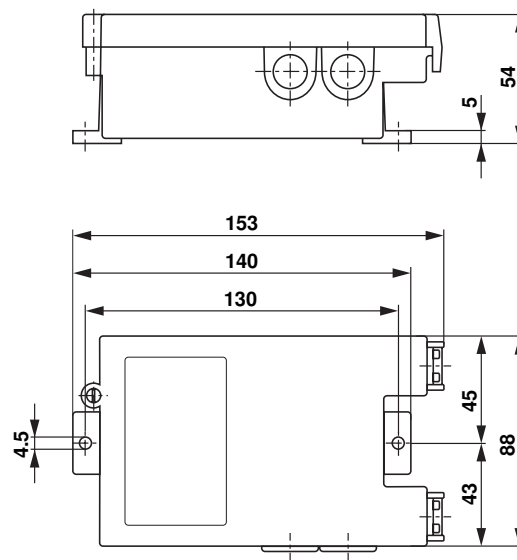
Incorrect settings can lead to damage to the damper blade and to a diminishment of the quality of the control.

The two mechanical end stops for angle of rotation limiting must be tailored to the conditions of the VAV unit and are therefore to be adjusted very carefully. The dismantled actuator is used as an orientation aid for placing the end stops.



Installation of the new VAV controller

Dimensional drawings



Mounting and connecting

1. Mount the VRD3-R2 VAV controller at a suitable position near the damper actuator NM24A-V-RE2.
2. Plug the NM24A-V-RE2 actuator with the plug-ready connecting cable into the controller.

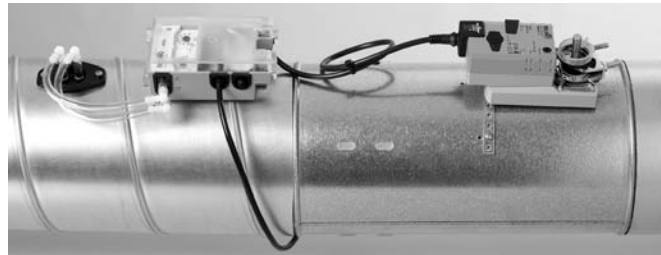
Installation of the new VAV controller (continued)

Attaching hoses to the controller and pick-up device

1. Mount the two accompanying angle pieces to the connection nipples of the pick-up device.



2. Attach hoses to VAV controller with pick-up device  
**Caution:** Observe connection ( $\pm$ )

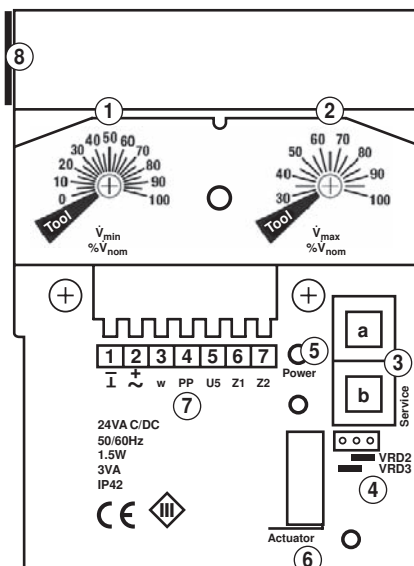


**Note**

Depending on the type of installation of the VAV controller and of the damper actuator, individual parts such as screws, positive fit inserts or universal mounting brackets are not required and remain left over after completion of the installation.

Operation, setup, connection

Setup, connections



①	Operating volumetric flow setting $\dot{V}_{min}$ 0 ... 100% [in % of $\dot{V}_{nom}$ ]
②	Operating volumetric flow setting $\dot{V}_{max}$ 30 ... 100% [in % of $\dot{V}_{nom}$ ]
③	<b>Tool connection</b> a System plug: internal Belimo function, not for users b Service: connection for VAV adjustment tool ZTH-VAV
④	<b>Jumper for input w</b> (terminal 3) Function: - VRD2: VRD2-compatible - VRD3: VRD3 and L/N/SMV-D2-MP
⑤	<b>Power LED</b> , Function display 24 V
⑥	<b>Connection for V-actuator</b>
⑦	<b>Connecting terminals 1 ... 7</b>
⑧	<b>Connection D3 Sensor</b>

Operation, setup, connection (continued)

Connecting terminals 1 ... 7

Terminal	Designation	Function
1	⊥ / -	Supply 24 VAC/DC
2	~ / +	
3	w	Reference value input w jumper  VRD3 – Mode 0 ... 10/2 ... 10V switchable with ZTH-VAV – Function as with new VAV-Compact L/N/SMV-D2-MP: VAV: 0 ... 10/2 ... 10V = $\dot{V}_{min}$ ... $\dot{V}_{max}$ CAV: CLOSED/ $\dot{V}_{min}$ / $\dot{V}_{max}$ /OPEN
		Reference value input w jumper  VRD2 – Mode 0 ... 10/2 ... 10V switchable with ZTH-VAV – Function as with VRD2: VAV: 0 ... 10/2 ... 10V = $\dot{V}_{min}$ ... $\dot{V}_{max}$ CAV: not possible use Z1 / Z2
4	PP	PP interface for ZTH-VAV (no MP operation)
5	U5	Actual volumetric flow signal U5 – Mode 0 ... 10/2 ... 10V switchable with ZTH-VAV – Display range 0 ... 100% $\dot{V}_{nom}$
6	Z1	Override input Z1: Function OPEN
7	Z2	Forced control input Z2: function CLOSED/ $\dot{V}_{min}$ / $\dot{V}_{max}$

Notes

- Supply via safety isolation transformer!
- It is recommended that the PP connection (terminal 4) and the 24V be wired to readily accessible terminals in order to guarantee easy access with the VAV adjustment tool ZTH-VAV (e.t. at the room temperature controller CR24 or in the control cabinet).

**The VRD3 does not support any MP operation!**

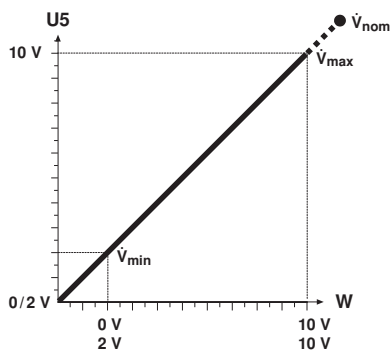
For a detailed description of the VAV controller VRD3, we draw your attention to the separate product information, see [www.belimo.eu](http://www.belimo.eu) | Documentation | Room and System Solutions.

Setting and first commissioning

Adjusting the volumetric flow

The adaptation of the VAV-Universal Retrofit Set to the nominal width of the VAV/CAV unit is accomplished by shortening the pick-up device in accordance with the auxiliary template (see page 3). No further calibration of the controller to the system is required. The adaptation of the volumetric flow to the system is accomplished with the setting of the two operating volumetric flow parameters  $\dot{V}_{min}$  and  $\dot{V}_{max}$ . The settings for  $\dot{V}_{min}$  and  $\dot{V}_{max}$  can be readily calculated with the aid of the table below and the associated formulas.

Table, formulas



Diameter VAV-Box	VRD3-RE2		Formulas
	$\dot{V}_{nom}$ [l/s]	$\dot{V}_{nom}$ [m³/h]	
100	97	349	
112	125	450	
125	153	551	
140	195	702	
160	250	900	
180	315	1134	
200	403	1451	
224	525	1890	
250	617	2221	
280	795	2862	
315	1028	3701	
355	1275	4590	
400	1676	6034	

$$\dot{V}_{max} \text{ in \%} = \frac{\dot{V}_{max} \text{ [l/s, m}^3\text{/h]}}{\dot{V}_{nom} \text{ [l/s, m}^3\text{/h]}} \times 100$$

$$\dot{V}_{min} \text{ in \%} = \frac{\dot{V}_{min} \text{ [l/s, m}^3\text{/h]}}{\dot{V}_{nom} \text{ [l/s, m}^3\text{/h]}} \times 100$$

Example

Data	Calculation/result
VAV unit diameter	180 mm
$\dot{V}_{nom}$ from Table	1134 m³/h
$\dot{V}_{max}$	1000 m³/h
$\dot{V}_{min}$	230 m³/h
	$\dot{V}_{max} = \frac{1000 \text{ m}^3\text{/h}}{1134 \text{ m}^3\text{/h}} \times 100 = \underline{\underline{88 \%}}$ $\dot{V}_{min} = \frac{230 \text{ m}^3\text{/h}}{1134 \text{ m}^3\text{/h}} \times 100 = \underline{\underline{20 \%}}$

Setting and first commissioning (continued)

**$\dot{V}_{min}$  /  $\dot{V}_{max}$  setting [Potentiometer or Tool (PP command)]**

Die operating volumetric flow settings  $\dot{V}_{min}$  and  $\dot{V}_{max}$  can be adjusted two different ways on the VRD3-RE2:

a) directly on the adjustment potentiometer (analogous to the VRD2)

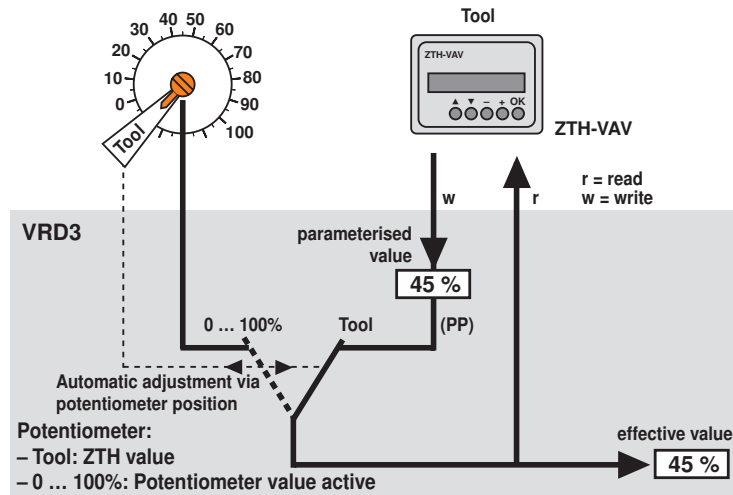
$\dot{V}_{min}$  0 ... 100% of  $\dot{V}_{nom}$

$\dot{V}_{max}$  30 ... 100% of  $\dot{V}_{nom}$

b) with VAV adjustment tool ZTH-VAV (PP command)

To write a value – with PP command - into the VRD3-RE2 both of the potentiometers  $\dot{V}_{min}$  and  $\dot{V}_{max}$  must be at the Tool position. If the potentiometer(s) is/are set to «Tool» with ZTH-VAV connected, then the menu may under certain circumstances need to be refreshed through actuation of the  $\uparrow \downarrow$  keys. For function, see following illustration:

Adjustment potentiometer  $\dot{V}_{min}/\dot{V}_{max}$



**Note concerning difference  $\dot{V}_{min}$  setting VRD3, VRD2**

The adjustment range of the operating mode  $\dot{V}_{min}$  with:

- VRD2 refers to 0 ... 100% of  $\dot{V}_{max}$
- VRD3 refers to 0 ... 100% of  $\dot{V}_{nom}$

The  $\dot{V}_{min}$  setting of the VRD3 thus behaves in compatible fashion with the new VAV generation (starting with 2006), i.e. VAV-Compact L/N/SMV-D2-MP, VRP-M.

The  $\dot{V}_{max}$  value must always be set higher than the  $\dot{V}_{min}$  value; otherwise the VRD3-RE2 controller will operate with the  $\dot{V}_{min}$  volume as setpoint in CAV mode.

**VRD3-RE2 setting with VAV adjustment tool ZTH-VAV**

The entire BELIMO product range with PP connection can be set and controlled with the VAV adjustment tool ZTH-VAV. The connection to the VRD3-RE2 is provided by the RJ «Service» socket or at the PP connection (terminal 4), e.g. in the control cabinet.

Operating menu VRD3-RE2

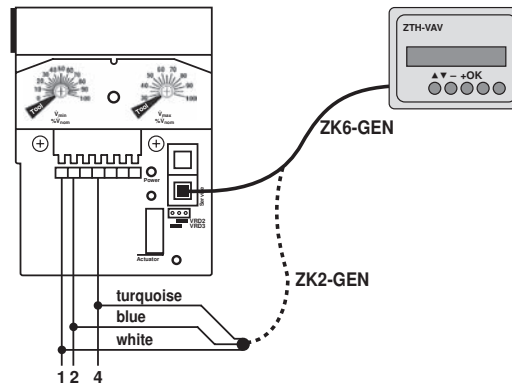
Option	Unit	Range/setting	Function
Volumetric flow – actual value	%	0 ... 100% [of $\dot{V}_{nom}$ ]	Commissioning, Service function
Volumetric flow - setpoint	%	0 ... 100% [ $\dot{V}_{min}$ ... $\dot{V}_{max}$ ]	
Current pressure value	Pa	0 ... 300 Pa	
Specify CAV steps	-	Auto – CLOSED – OPEN – $\dot{V}_{min}$ – $\dot{V}_{max}$ – Stop	
Mode	-	0 ... 10V, 2 ... 10V	
$\dot{V}_{min}$ setting	%	0 ... 100% [of $\dot{V}_{nom}$ ]	Settings, modifications
$\dot{V}_{max}$ setting	%	30 ... 100% [of $\dot{V}_{nom}$ ]	
$\dot{V}_{nom}$ VAV box	%	Nominal setting = 100%	OEM setting
$\Delta p$ @ $\dot{V}_{nom}$	Pa	differential pressure pending with $\dot{V}_{nom}$	

\* Function is displayed, starting with ZTH-VAV Firmware V1.02 or higher (starting 06.2008). See also Release Note ZTH-VAV, www.belimo.eu



## VRD3-RE2 setting with VAV adjustment tool ZTH-VAV (continued)

Connection	Connection to	Cable type and order designation
	VRD3-RE2, RJ «Service» socket	ZK6-GEN Accessories
	PP connection (terminal 4), e.g. control cabinet terminals	ZK2-GEN Accessories
		Accessories white - 1 ⊗ GND blue - 2 ⊗ ~ / + 3 ⊗ turquoise 4 ⊗ pp



For detailed documentation concerning the handling and function of the ZTH-VAV, see ZTH-VAV instruction manual at [www.belimo.eu](http://www.belimo.eu)

**Carry out adaption** An angle of rotation adaption of the damper actuator is recommended at the time of initial commissioning. An angle of rotation adaption must however be carried out after the adjustment of the angle of rotation limitations.

**Procedure:**

- Switch on the 24 V supply on the VRD3-RE2
- Press the «Adaption» pressure switch on the damper actuator (actuator travels CLOSED ... OPEN ... setpoint position)

**Performance check****Note**

Additional optimisation options can be achieved together with the single room controllers CR24. Information concerning these options can be found on the Belimo web site [www.belimo.com](http://www.belimo.com)

A performance check is recommended after the installation of the VAV controller and the completion of the adaption.

- Set the VAV controller with the ZTH-VAV to maximum and then afterwards to minimum air volume (« $\dot{V}_{max}$ »/« $\dot{V}_{min}$ »).
- Check whether the required amounts of air have been attained.