Installation VAV-Universal Retrofit-Set

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.

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 ¦ 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

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.

Note
Suitable only for round VAV boxes.
Installation

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

**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
Adjusting angle of rotation limiter

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.

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

Installation of the new VAV controller

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 (±)

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**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.

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### Operation, setup, connection

**Setup, connections**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1</strong></td>
<td>Operating volumetric flow setting $V_{\text{min}}$ 0 … 100% [in % of $V_{\text{nom}}$]</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Operating volumetric flow setting $V_{\text{max}}$ 30 … 100% [in % of $V_{\text{nom}}$]</td>
</tr>
</tbody>
</table>
| **3** | Tool connection  
   a) System plug: internal Belimo function, not for users  
   b) Service: connection for VAV adjustment tool ZTH-VAV |
| **4** | Jumper for input w (terminal 3)  
   Function:  
   – VRD2: VRD2-compatible  
   – VRD3: VRD3 and L/N/SMV-D2-MP |
| **5** | Power LED, Function display 24 V |
| **6** | Connection for V-actuator |
| **7** | Connecting terminals 1 … 7 |
| **8** | Connection D3 Sensor |
### Operation, setup, connection (continued)

#### Connecting terminals 1 ... 7

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Designation</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( / )</td>
<td>Supply 24 VAC/DC</td>
</tr>
<tr>
<td>2</td>
<td>( \sim ) / +</td>
<td>Reference value input w jumper ( \bullet ) VRD3</td>
</tr>
<tr>
<td>3</td>
<td>( w )</td>
<td>Reference value input w jumper ( \square ) VRD2</td>
</tr>
<tr>
<td>4</td>
<td>PP</td>
<td>PP interface for ZTH-VAV (no MP operation)</td>
</tr>
<tr>
<td>5</td>
<td>U5</td>
<td>Actual volumetric flow signal U5</td>
</tr>
<tr>
<td>6</td>
<td>Z1</td>
<td>Override input Z1: Function OPEN</td>
</tr>
<tr>
<td>7</td>
<td>Z2</td>
<td>Forced control input Z2: function CLOSED/( V_{min}/V_{max} )</td>
</tr>
</tbody>
</table>

#### 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.g. at the room temperature controller CR24 or in the control cabinet).

The VRD3 does not support any MP operation!

#### 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 \( V_{min} \) and \( V_{max} \).

The settings for \( V_{min} \) and \( V_{max} \) can be readily calculated with the aid of the table below and the associated formulas.

#### Table, formulas

<table>
<thead>
<tr>
<th>Diameter VAV-Box</th>
<th>( V_{nom} ) [l/s]</th>
<th>( V_{nom} ) [m³/h]</th>
<th>Formulas</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>97</td>
<td>349</td>
<td>( V_{max} ) in % = ( \frac{V_{max} \text{ [l/s, m³/h]}}{V_{nom} \text{ [l/s, m³/h]}} \times 100 )</td>
</tr>
<tr>
<td>112</td>
<td>125</td>
<td>450</td>
<td>( V_{min} ) in % = ( \frac{V_{min} \text{ [l/s, m³/h]}}{V_{nom} \text{ [l/s, m³/h]}} \times 100 )</td>
</tr>
<tr>
<td>125</td>
<td>153</td>
<td>551</td>
<td></td>
</tr>
<tr>
<td>140</td>
<td>195</td>
<td>702</td>
<td></td>
</tr>
<tr>
<td>160</td>
<td>250</td>
<td>900</td>
<td></td>
</tr>
<tr>
<td>180</td>
<td>315</td>
<td>1134</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>403</td>
<td>1451</td>
<td></td>
</tr>
<tr>
<td>224</td>
<td>525</td>
<td>1890</td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>617</td>
<td>2221</td>
<td></td>
</tr>
<tr>
<td>280</td>
<td>795</td>
<td>2862</td>
<td></td>
</tr>
<tr>
<td>315</td>
<td>1028</td>
<td>3701</td>
<td></td>
</tr>
<tr>
<td>355</td>
<td>1275</td>
<td>4590</td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>1676</td>
<td>6034</td>
<td></td>
</tr>
</tbody>
</table>

#### Example

<table>
<thead>
<tr>
<th>Data</th>
<th>Calculation/result</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAV unit diameter</td>
<td></td>
</tr>
<tr>
<td>( V_{nom} ) from Table</td>
<td></td>
</tr>
<tr>
<td>( V_{max} )</td>
<td>( \frac{1000 \text{ m³/h}}{1134 \text{ m³/h}} \times 100 = 88 % )</td>
</tr>
<tr>
<td>( V_{min} )</td>
<td>( \frac{230 \text{ m³/h}}{1134 \text{ m³/h}} \times 100 = 20 % )</td>
</tr>
</tbody>
</table>

For a detailed description of the VAV controller VRD3, we draw your attention to the separate product information, see www.belimo.eu | Documentation | Room and System Solutions.
Setting and first commissioning (continued)

**Vmin / Vmax setting**

[Potentiometer or Tool (PP command)]

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

a) directly on the adjustment potentiometer (analogous to the VRD2)
   - $V_{\text{min}}$: 0 ... 100% of $V_{\text{nom}}$
   - $V_{\text{max}}$: 30 ... 100% of $V_{\text{nom}}$

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

To write a value – with PP command - into the VRD3-RE2 both of the potentiometers $V_{\text{min}}$ and $V_{\text{max}}$ 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 ↑↓ keys. For function, see following illustration:

The $V_{\text{max}}$ value must always be set higher than the $V_{\text{min}}$ value; otherwise the VRD3-RE2 controller will operate with the $V_{\text{min}}$ 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.

<table>
<thead>
<tr>
<th>Option</th>
<th>Unit</th>
<th>Range/setting</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volumetric flow – actual value</td>
<td>%</td>
<td>0 ... 100% [of $V_{\text{nom}}$]</td>
<td>Commissioning, Service function</td>
</tr>
<tr>
<td>Volumetric flow - setpoint</td>
<td>%</td>
<td>0 ... 100% [$V_{\text{min}} ... V_{\text{max}}$]</td>
<td></td>
</tr>
<tr>
<td>Current pressure value</td>
<td>Pa</td>
<td>0 ... 300 Pa</td>
<td></td>
</tr>
<tr>
<td>Specify CAV steps</td>
<td></td>
<td>Auto – CLOSED – OPEN – $V_{\text{min}}$ – $V_{\text{max}}$ – Stop</td>
<td></td>
</tr>
<tr>
<td>Mode</td>
<td></td>
<td>0 ... 10V, 2 ... 10V</td>
<td></td>
</tr>
<tr>
<td>$V_{\text{min}}$ setting</td>
<td>%</td>
<td>0 ... 100% [of $V_{\text{nom}}$]</td>
<td></td>
</tr>
<tr>
<td>$V_{\text{max}}$ setting</td>
<td>%</td>
<td>30 ... 100% [of $V_{\text{nom}}$]</td>
<td></td>
</tr>
<tr>
<td>$V_{\text{nom}}$ VAV box</td>
<td>%</td>
<td>Nominal setting = 100%</td>
<td></td>
</tr>
<tr>
<td>$\Delta p$ @ $V_{\text{nom}}$</td>
<td>Pa</td>
<td>differential pressure pending with $V_{\text{nom}}$</td>
<td></td>
</tr>
</tbody>
</table>

* Function is displayed, starting with ZTH-VAV Firmware V1.02 or higher (starting 0.2008). See also Release Note ZTH-VAV, www.belimo.eu
VRD3-RE2 setting with VAV adjustment tool ZTH-VAV (continued)

<table>
<thead>
<tr>
<th>Connection</th>
<th>Connection to</th>
<th>Cable type and order designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>VRD3-RE2, RJ «Service» socket</td>
<td>ZK6-GEN</td>
<td>Accessories</td>
</tr>
<tr>
<td>PP connection (terminal 4), e.g. control cabinet terminals</td>
<td>ZK2-GEN</td>
<td>Accessories</td>
</tr>
</tbody>
</table>

For detailed documentation concerning the handling and function of the ZTH-VAV, see ZTH-VAV instruction manual at 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**

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 (\( V_{\text{max}} \) or \( V_{\text{min}} \)).
- Check whether the required amounts of air have been attained.

**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