

VAV-Compact unit – with VAV controller, dynamic  $\Delta p$  sensor and damper actuator

- Field of application: VAV units in comfort applications
- Application: VAV/CAV, position control
- Belimo D3, dynamic flow sensor
- Functional range differential pressure 0...500 Pa
- Control communicative, modulating (0/2...10 V)
- Communication via Belimo MP-Bus
- Conversion of sensor signals
- Tool connection: Service socket, NFC interface



Picture may differ from product

**MP-BUS**


## Technical data

|                               |                                        |                                                                |
|-------------------------------|----------------------------------------|----------------------------------------------------------------|
| <b>Electrical data</b>        | Nominal voltage                        | AC/DC 24 V                                                     |
|                               | Nominal voltage frequency              | 50/60 Hz                                                       |
|                               | Nominal voltage range                  | AC 19.2...28.8 V / DC 21.6...28.8 V                            |
|                               | Power consumption in operation         | 3 W                                                            |
|                               | Power consumption in rest position     | 1.5 W                                                          |
|                               | Power consumption for wire sizing      | 5.5 VA                                                         |
|                               | Inrush current (I <sub>max</sub> )     | 8.0 A @ 5 ms                                                   |
|                               | Connection supply / control            | Cable 1 m, 4x 0.75 mm <sup>2</sup>                             |
| <b>Data bus communication</b> | Communicative control                  | MP-Bus                                                         |
|                               | Number of nodes                        | MP-Bus max. 8                                                  |
| <b>Functional data</b>        | Torque motor                           | 20 Nm                                                          |
|                               | Operating range Y                      | 2...10 V                                                       |
|                               | Input impedance                        | 100 kΩ                                                         |
|                               | Operating range Y variable             | 0...10 V                                                       |
|                               | Position feedback U                    | 2...10 V                                                       |
|                               | Position feedback U note               | Max. 0.5 mA                                                    |
|                               | Position feedback U variable           | Start point 0...8 V<br>End point 2...10 V                      |
|                               | V' <sub>max</sub> adjustable           | 20...100% of V' <sub>nom</sub>                                 |
|                               | V' <sub>mid</sub> adjustable           | >V' <sub>min</sub> ...<V' <sub>max</sub>                       |
|                               | V' <sub>min</sub> adjustable           | 0...100% of V' <sub>nom</sub> (<V' <sub>max</sub> )            |
|                               | Manual override                        | with push-button, can be locked                                |
|                               | Angle of rotation                      | 95°                                                            |
|                               | Angle of rotation note                 | adjustable mechanical or electrical limitation                 |
|                               | Mechanical interface                   | Universal shaft clamp 10...20 mm                               |
|                               | Position indication                    | Mechanical                                                     |
| <b>Measuring data</b>         | Measuring principle                    | Belimo D3, dynamic flow sensor                                 |
|                               | Installation orientation               | position-independent, no zeroing necessary                     |
|                               | Functional range differential pressure | 0...500 Pa                                                     |
|                               | Maximum system pressure                | 1500 Pa                                                        |
|                               | Burst pressure                         | ±5 kPa                                                         |
|                               | Height compensation                    | Adjustment of system height (range 0...3000 m above sea level) |
|                               | Condition measuring air                | 0...50°C / 5...95% RH, non-condensing                          |
|                               | Pressure tube connection               | Nipple diameter 5.3 mm                                         |
| <b>Safety data</b>            | Protection class IEC/EN                | III, Protective Extra-Low Voltage (PELV)                       |
|                               | Degree of protection IEC/EN            | IP54                                                           |

## Technical data

|             |                                        |                                      |
|-------------|----------------------------------------|--------------------------------------|
| Safety data | Degree of protection NEMA/UL           | NEMA 2                               |
|             | Housing                                | UL Enclosure Type 2                  |
|             | EMC                                    | CE according to 2014/30/EU           |
|             | Certification IEC/EN                   | IEC/EN 60730-1 and IEC/EN 60730-2-14 |
|             | Type of action                         | Type 1                               |
|             | Rated impulse voltage supply / control | 0.8 kV                               |
|             | Pollution degree                       | 3                                    |
|             | Ambient humidity                       | Max. 95% RH, non-condensing          |
|             | Ambient temperature                    | 0...50°C [32...122°F]                |
|             | Storage temperature                    | -20...80°C [-4...176°F]              |
|             | Servicing                              | maintenance-free                     |
| Weight      | Weight                                 | 0.91 kg                              |

## Safety notes



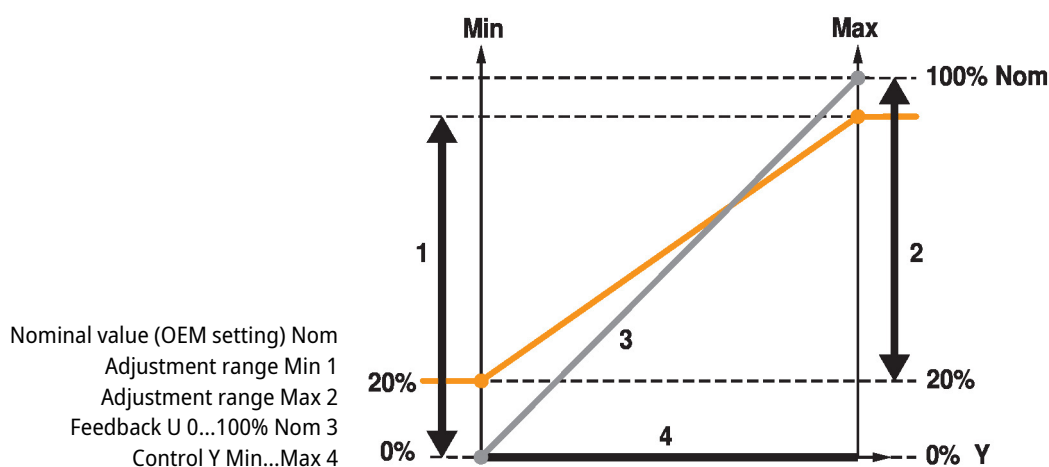
- The device must not be used outside the specified field of application, especially not in aircraft or in any other airborne means of transport.
- Outdoor application: only possible in case that no (sea) water, snow, ice, insolation or aggressive gases interfere directly with the device and that it is ensured that the ambient conditions remain within the thresholds according to the data sheet at any time.
- Only authorised specialists may carry out installation. All applicable legal or institutional installation regulations must be complied with 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.
- Cables must not be removed from the device.
- 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.

## Product features

|                                       |                                                                                                                                                                                                                                                            |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Application                           | The VAV-Compact unit is used for comfort applications for pressure-independent control of VAV units. See Technical brochure – VAV-Compact product range for volumetric flow applications.                                                                  |
|                                       | Pressure measurement                                                                                                                                                                                                                                       |
|                                       | The integrated differential pressure sensor is also suitable for very small volumetric flows. The maintenance-free sensor technology enables a wide range of applications in the HVAC comfort area such as in residential buildings, offices, hotels, etc. |
|                                       | Actuators                                                                                                                                                                                                                                                  |
|                                       | For the various applications and damper designs, various actuator variants with torque 5, 10 or 20 Nm are available to the VAV unit manufacturer.                                                                                                          |
|                                       | Control functions                                                                                                                                                                                                                                          |
|                                       | Volumetric flow (VAV/CAV) or position control (Open Loop)                                                                                                                                                                                                  |
|                                       | Application Variable Air Volume (VAV)                                                                                                                                                                                                                      |
|                                       | Variable air volume control in the V'min...V'max range, demand-dependent via a modulating reference variable (analogue or bus), e.g. room temperature or CO <sub>2</sub> controller for energy-saving air conditioning of individual rooms or zones.       |
|                                       | V'nom, Δp @ V'nom                                                                                                                                                                                                                                          |
| Application Variable Air Volume (VAV) | OEM-specific calibration parameters, suitable for the VAV unit                                                                                                                                                                                             |
|                                       | Adjustment range Δp @ V'nom: 38...450 Pa                                                                                                                                                                                                                   |
|                                       | V'max (Max)                                                                                                                                                                                                                                                |
|                                       | Maximum operating volumetric flow, adjustable 20...100% V'nom                                                                                                                                                                                              |
|                                       | V'min (Min)                                                                                                                                                                                                                                                |
| Application Variable Air Volume (VAV) | Minimum operating volumetric flow, adjustable 0...100% V'nom                                                                                                                                                                                               |

## Product features

|                                                 |                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Application Constant Air Volume (CAV)</b>    | Constant volumetric flow control. If required, via step switching (switching contacts) for constant volumetric flow applications.<br>Steps: CLOSE / Min / Max / OPEN (Mid)                                                                                                                                                                                       |
| <b>Application Position Control (Open Loop)</b> | Position control for integration of the VAV-Compact into an external VAV control loop. Transmitter and actuator unit.<br><br>Max<br>Range: 20...100 % rotation range<br><br>Min<br>Range: 0...100 % rotation range                                                                                                                                               |
| <b>Demand Controlled Ventilation (DCV)</b>      | Output of the demand signal (damper position) to the higher-level automation system – DCV function.                                                                                                                                                                                                                                                              |
| <b>Configurable device</b>                      | The factory settings cover the most common applications. Single parameters can be modified with Belimo Assistant 2.                                                                                                                                                                                                                                              |
| <b>Bus operation</b>                            | Thanks to its MP-Bus functionality, the VAV-Compact can be easily integrated into a MP-Bus system. The communication interface and MP address is defined using service tools.<br><br>In bus mode, a sensor (0...10 V / passive) can optionally be connected, e.g. a temperature sensor or a switching contact, for integration into the higher-level bus system. |
| <b>Operating settings</b>                       | Control functions<br>Volumetric flow (VAV/CAV) or position control (Open Loop)<br><br>Operating settings Min/Max/Nom                                                                                                                                                                                                                                             |



**Operating and service tools** Belimo Assistant 2 or ZTH EU

## Accessories

| Tools                  | Description                                                                                                    | Type               |
|------------------------|----------------------------------------------------------------------------------------------------------------|--------------------|
|                        | Service tool for wired and wireless setup, on-site operation and troubleshooting.                              | Belimo Assistant 2 |
|                        | Belimo Assistant Link Bluetooth and USB to NFC and MP-Bus converter for configurable and communicative devices | LINK.10            |
|                        | Connecting cable 5 m, A: RJ11 6/4 LINK.10, B: 6-pin for connection to service socket                           | ZK1-GEN            |
|                        | Connecting cable 5 m, A: RJ11 6/4 LINK.10, B: free wire end for connection to MP/PP terminal                   | ZK2-GEN            |
| Electrical accessories | Description                                                                                                    | Type               |
|                        | Positioner for wall mounting                                                                                   | CRP24-B1           |
|                        | Positioner for wall mounting                                                                                   | SGA24              |
| Gateways               | Description                                                                                                    | Type               |
|                        | Gateway MP to BACnet MS/TP                                                                                     | UK24BAC            |

**Accessories**
**Description**

Gateway MP to Modbus RTU

**Type**

UK24MOD

**Electrical installation**


Supply from isolating transformer.

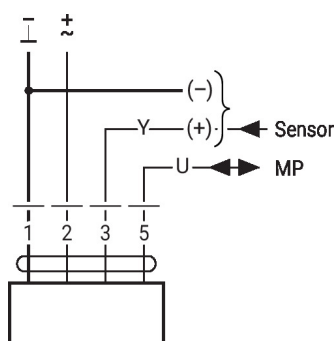
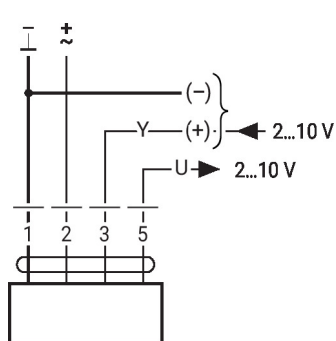
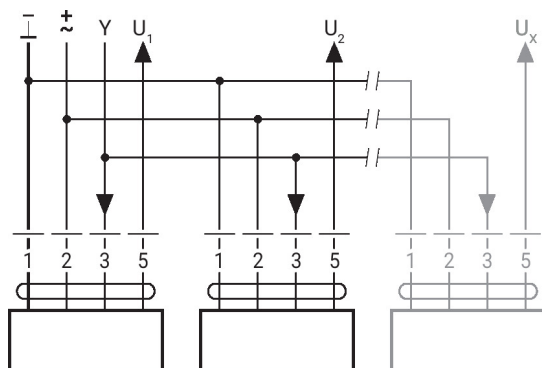
**Wire colours:**

1 = black

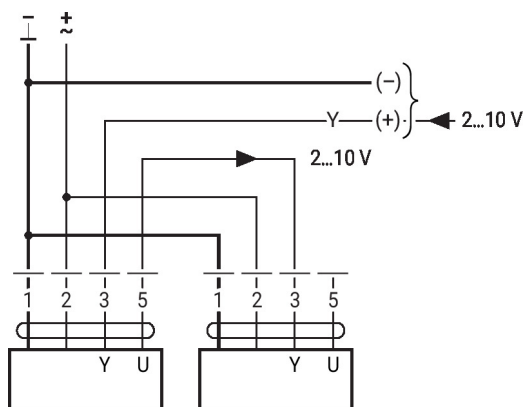
2 = red

3 = white

5 = orange

**MP-Bus**

**AC/DC 24 V, modulating**

**Parallel operation**


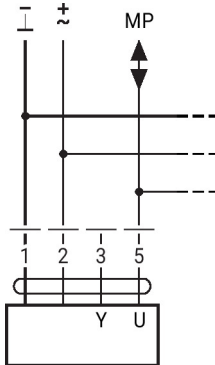
- Max. 8 actuators in parallel
- Parallel operation is permitted only on non-connected axes
- Do not fail to observe performance data with parallel operation

**Primary/secondary operation**


### Further electrical installations

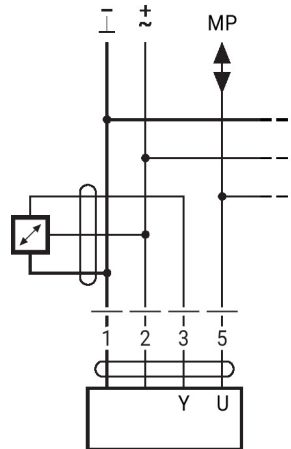
#### MP-Bus

Connection on the MP-Bus



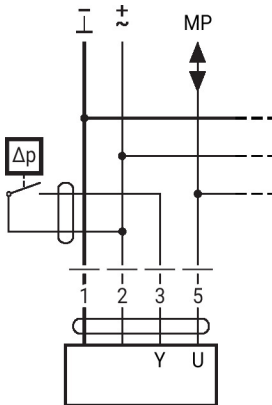
Max. 8 MP-Bus nodes

Connection of active sensors



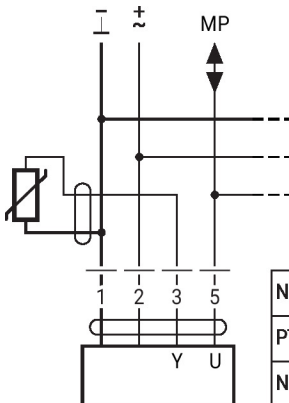
- Supply AC/DC 24 V
- Output signal 0...10 V (max. 0...32 V)
- Resolution 30 mV

Connection of external switching contact



- Switching current 16 mA @ 24 V
- Start point of the operating range must be configured on the MP actuator as  $\geq 0.5$  V

Connection of passive sensors



|        |                            |                                             |
|--------|----------------------------|---------------------------------------------|
| Ni1000 | -28...+98°C                | 850...1600 $\Omega$ <sup>2)</sup>           |
| PT1000 | -35...+155°C               | 850...1600 $\Omega$ <sup>2)</sup>           |
| NTC    | -10...+160°C <sup>1)</sup> | 200 $\Omega$ ...60 k $\Omega$ <sup>2)</sup> |

- 1) Depending on the type  
2) Resolution 1 Ohm  
Compensation of the measured value is recommended

### Functions with specific parameters (configuration necessary)

| Contact | mode 2...10 V | mode 0...10 V |
|---------|---------------|---------------|
| a       | Close         | Min           |
| b       | Min           | Min           |
| c       | Close         | Close         |
| d       | Max           | Max           |
| e       | Open          | Open          |

- Note that the contacts are mutually interlocking
- DC 24 V supply: option c and d not available
- Setting for CAV application: mode 2...10 V, shut-off level 0.1 V

| Contact | mode 2...10 V | mode 0...10 V |
|---------|---------------|---------------|
| a       | Close         | Min           |
| b       | Min           | Min           |
| c       | Mid           | Mid           |
| d       | Max           | Max           |
| e       | Open          | Open          |

- Note that the contacts are mutually interlocking
- Setting parameters for CAV application:  $V_{min}$  -  $V_{mid}$  -  $V_{max}$  (NMV-D2M-compatible)

## Parameter and tool overview

## Settings and tool function

|                                                                           |                                                                                                                                         |                  | Tool              |                     |                    |                                                              |
|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------|---------------------|--------------------|--------------------------------------------------------------|
|                                                                           |                                                                                                                                         |                  | ZTH EU            | PC-Tool             | Belimo Assistant 2 |                                                              |
| Designation                                                               | Setting values, limits, explanations                                                                                                    | Units            |                   |                     |                    | Remarks                                                      |
| System-specific data                                                      |                                                                                                                                         |                  |                   |                     |                    |                                                              |
| Position                                                                  | 16 characters, e.g. Office 4 6th OG ZL                                                                                                  | String           | r                 | r/w                 | r/w                |                                                              |
| Designation                                                               | 16 characters: Unit designation, etc.                                                                                                   | String           | r                 | r/w <sup>1)</sup>   | r                  |                                                              |
| Address                                                                   | PP / MP1...8                                                                                                                            |                  | r/w               | r/w                 | r/w <sup>2)</sup>  | PP: 0...10 / 2...10 V<br>MP1...8: MP mode                    |
| V' max                                                                    | 20...100% [V' nom]                                                                                                                      | m³/h / l/s / cfm | r/w               | r/w                 | r/w                | >= V' min                                                    |
| V' mid                                                                    | V' min...V' max                                                                                                                         | m³/h / l/s / cfm | r/w               | r/w                 | r/w                |                                                              |
| V' min                                                                    | 0...100% [V' nom]                                                                                                                       | m³/h / l/s / cfm | r/w               | r/w                 | r/w                | <= V' max                                                    |
| Altitude of installation                                                  | 0...3000                                                                                                                                | m                | r/w               | r/w                 | r/w                | Adaptation of Δp sensor to altitude (meters above sea level) |
| Controller Settings                                                       |                                                                                                                                         |                  |                   |                     |                    |                                                              |
| Control function                                                          | Volumetric flow / Position control (Open Loop)                                                                                          |                  | –                 | r/w                 | r/w <sup>2)</sup>  |                                                              |
| Mode                                                                      | 0...10 / 2...10                                                                                                                         | V                | r/w <sup>2)</sup> | r/w                 | r/w <sup>2)</sup>  |                                                              |
| CAV function                                                              | CLOSE/V' min/V' max: Shut-off level CLOSE 0.1<br>CLOSE/V' min/V' max: Shut-off level CLOSE 0.5<br>V' min/V' mid/V' max: (NMV-D2M-comp.) |                  | –                 | r/w                 | –                  |                                                              |
| Positioning signal Y                                                      | Start value: 0...30; Stop value: 2...32                                                                                                 | V                | r                 | r/w                 | r                  |                                                              |
| Feedback U                                                                | Volume / Damper position / Δp                                                                                                           |                  | –                 | r/w                 | –                  | Definition of feedback signal                                |
| Feedback U                                                                | Start value: 0...8; Stop value: 2...10                                                                                                  | V                | –                 | r/w                 | –                  |                                                              |
| Behaviour when switched on (Power-on)                                     | No action / Adaptation / Synchronisation                                                                                                |                  | –                 | r/w                 | –                  |                                                              |
| Synchronisation behaviour                                                 | Y=0%<br>Y=100%                                                                                                                          |                  | –                 | r/w                 | –                  | Synchronisation at damper position 0 or 100%                 |
| Bus fail position                                                         | Last setpoint / Damper CLOSE<br>V' min / V' max / Damper OPEN                                                                           |                  | –                 | r/w                 | –                  |                                                              |
| Unit-specific settings                                                    |                                                                                                                                         |                  |                   |                     |                    |                                                              |
| V' nom                                                                    | 0...60'000 m³/h                                                                                                                         | m³/h / l/s / cfm | r                 | r/(w) <sup>1)</sup> | r                  | Unit-specific setting value                                  |
| Δp@V' nom                                                                 | 38...450                                                                                                                                | Pa               | r                 | r/(w) <sup>1)</sup> | r                  | Unit-specific setting value                                  |
| NFC interface                                                             | Read / Read and write                                                                                                                   |                  | –                 | r/(w) <sup>1)</sup> | r                  |                                                              |
| Print function label                                                      |                                                                                                                                         |                  | –                 | w                   | –                  |                                                              |
| Other settings                                                            |                                                                                                                                         |                  |                   |                     |                    |                                                              |
| Direction of rotation (for Y=100%)                                        | cw/ccw                                                                                                                                  |                  | r/w <sup>2)</sup> | r/w                 | r/w <sup>2)</sup>  |                                                              |
| Range of rotation                                                         | Adapted <sup>2)</sup> / programmed 30...95                                                                                              | °                | –                 | r/w                 | –                  |                                                              |
| Torque                                                                    | 100 / 75 / 50 / 25                                                                                                                      | %                |                   | r/w                 |                    | % of nominal torque                                          |
| Renovation of old systems (Retrofit of old VAV units with leaking damper) |                                                                                                                                         |                  |                   |                     |                    |                                                              |
| Suppress damper leakage                                                   | Yes / No                                                                                                                                |                  | –                 | r/w <sup>1)</sup>   | –                  | Suppresses volume display with damper closed                 |

<sup>1)</sup> Write function accessible only for VAV manufacturers

<sup>1)</sup> Access only via Servicing level 2

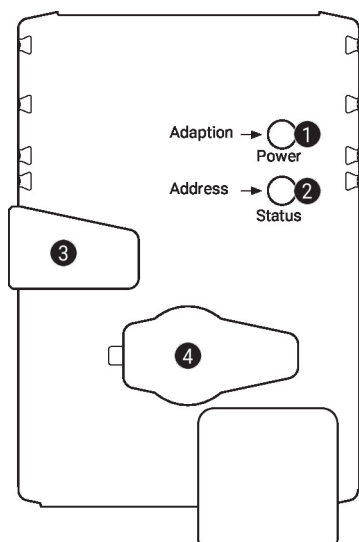
<sup>2)</sup> Within the mechanical limitation

## Parameter and tool overview

## Settings and tool function

| Designation             | Setting values, limits, explanations                              | Units            | Tool   |         |                    | Remarks                     |
|-------------------------|-------------------------------------------------------------------|------------------|--------|---------|--------------------|-----------------------------|
|                         |                                                                   |                  | ZTH EU | PC-Tool | Belimo Assistant 2 |                             |
| Operating data          |                                                                   |                  |        |         |                    |                             |
| Actual value / Setpoint |                                                                   | m³/h / l/s / cfm | r      | r       | r                  | T (Trend) display           |
| Damper position         |                                                                   | Pa / %           | –      | T       | T                  |                             |
| Simulation              | Damper OPEN/CLOSE<br>V'min / V'mid / V'max / Motor Stop           |                  | w      | w       | –                  |                             |
| Running times           | Operating time, running time<br>Ratio (relation)                  | h<br>%           | –      | r       | r                  |                             |
| Alarm messages          | Setting range enlarged, Mech. overload,<br>Stop&Go ratio too high |                  | –      | r/w     | –                  |                             |
| Serial number           | Device ID                                                         |                  | r      | r       | r                  | Incl. production date       |
| Type                    | Type designation                                                  |                  | r      | r       | r                  |                             |
| Version display         | Firmware, Config. table ID                                        |                  | r      | r       | –                  |                             |
| Configuration data      |                                                                   |                  |        |         |                    |                             |
| Print, send             |                                                                   |                  | –      | yes     | yes                |                             |
| Backup in file          |                                                                   |                  | –      | yes     | yes                |                             |
| Log data / Logbook      | Activities log                                                    |                  | –      | yes     | –                  | Incl. complete setting data |

## Operating controls and indicators


**1 Push-button and LED display green**

- Off: No power supply or malfunction
- On: In operation
- Press button: Triggers angle-of-rotation adaptation, followed by standard mode

**2 Push-button and LED display yellow**

- Off: Standard mode
- On: Adaptation or synchronisation process active
- Flickering: MP-Bus communication active
- Flashing: Request for addressing from MP client
- Press button: Confirmation of the addressing

**3 Manual override button**

- Press button: Gear train disengages, motor stops, manual override possible
- Release button: Gear train engages, synchronisation starts, followed by standard mode

**4 Service plug**

For connecting configuration and service tools

## Check power supply connection

- 1** Off and **2** On Possible wiring error in power supply



## Installation notes

- Installation situation** Mounting VAV-Compact control equipment:
- The VAV-Compact is assembled, set and calibrated on the VAV unit in the factory by the VAV unit manufacturer.
- Installation of the VAV unit:
- The VAV unit must be installed according to the specifications of the VAV unit manufacturer.
- Installation specification  $\Delta p$  sensor:
- No restrictions, but it must be avoided that any condensation can run into the sensor and remain there.
- Accessibility of control equipment:
- Accessibility to the control equipment must be guaranteed at all times.
- Pressure tube connections:
- The pressure tube connections must not come into contact with liquids or greasing agents of any kind, this includes any residue inside or on the surface of the pressure tubes.
- Servicing** Cleaning work during installation, commissioning or maintenance
- Belimo VAV devices are maintenance-free. We recommend dry removal of dust from the outside of the housing if necessary.
- The duct system and the VAV units are maintained on the occasion of the cleaning intervals required by law or by the specific system. Please observe the following points.
- Cleaning work on the damper, differential pressure pickup devices and pressure tubes
- When cleaning the duct system or the VAV unit, remove the pressure tubes on the VAV controller so that it will not be affected.
- Using compressed air, e.g. blowing out the differential pressure pickup devices or pressure tubes
- Before doing this work, disconnect the differential pressure pickup devices or pressure tubes from the differential pressure sensor.
- Connecting the pressure tubes
- To ensure the correct installation of the pressure tubes, we recommend marking them with + or – before disassembly.

## Service

Using Belimo Assistant 2, device parameters can be modified. Belimo Assistant 2 can operate on a smartphone, tablet or PC. The available connection options vary depending on the hardware on which Belimo Assistant 2 is installed.

For more information about Belimo Assistant 2, refer to the Quick Guide – Belimo Assistant 2.



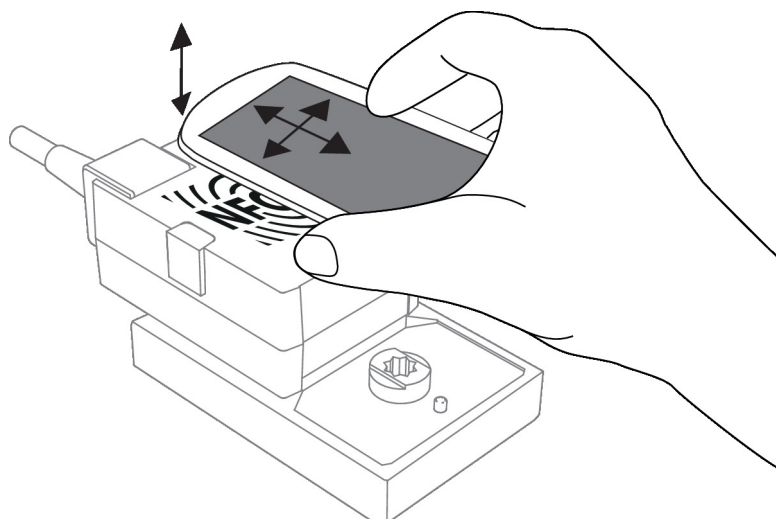
**Service**

**Wireless connection** Belimo devices marked with the NFC logo can be accessed either directly with an NFC-capable smartphone or with a Bluetooth-capable smartphone connected to Belimo Assistant Link.

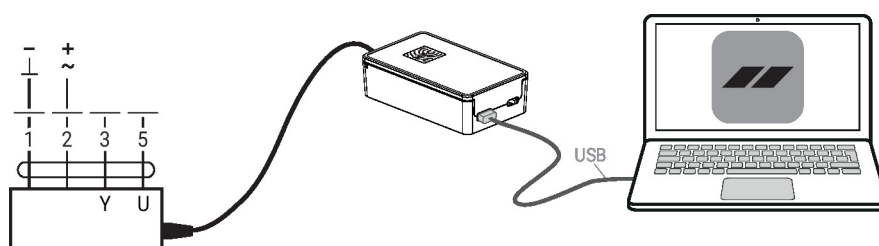
Requirement:

- NFC- or Bluetooth-capable smartphone or tablet
- Belimo Assistant 2 (Google Play and Apple App Store)

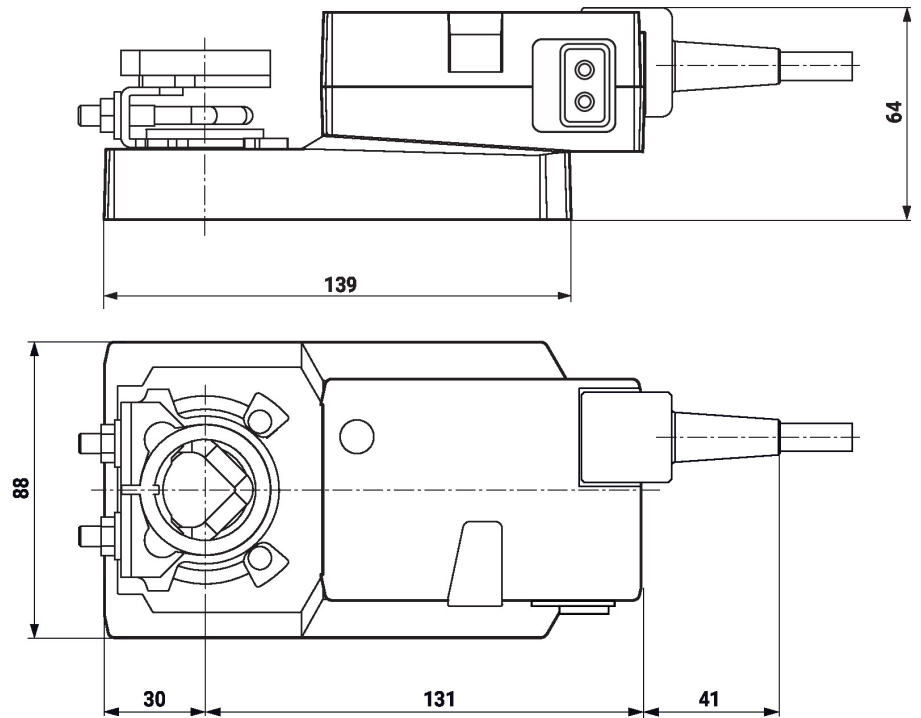
Align the NFC-capable smartphone or Belimo Assistant Link with the device's NFC logo so that both NFC antennas are superposed.



**Wired connection** Belimo devices can be accessed by connecting Belimo Assistant Link to the USB port on a PC or laptop and to the Service Socket or MP-Bus wire on the device.



## Dimensions



## Further documentation

- VAV-Compact product range for comfort applications
- Tool connections
- Overview MP Cooperation Partners
- Introduction to MP-Bus Technology
- VAV-Universal application description
- Volumetric flow and pressure control from Belimo, product range overview
- Quick Guide – Belimo Assistant 2