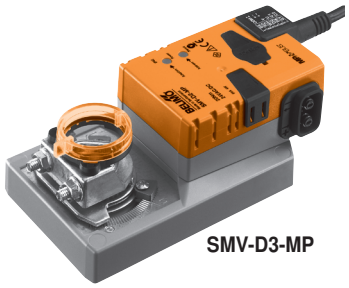
VAV-Compact controller with integrated pressure sensor, VAV controller and damper actuator for pressure-independent VAV and CAV applications in the comfort zone

- **Control:**
  DC 0/2 … 10V / MP-Bus
- **Integration in bus systems**
  - **DDC controller with MP interface**
  - **LonWorks®/Modbus systems**
  - **Fan optimiser systems**
- **With additional switch-on option for sensors and switches**
- **Diagnostic socket for Service and PC-Tool**
- **NFC interface for Smartphone operation**

LMV-D3-MP

NMV-D3-MP



SMV-D3-MP

LHV-D3-MP

Brief description

Application
The digital VAV-Compact has PI control characteristics and is used for pressure-independent control of VAV units in the comfort zone.

Pressure measurement
The integrated maintenance-free Belimo D3 pressure valve sensor is also suitable for very small volumetric flows. It is for this reason that it enables versatile applications in the comfort zone, e.g. in residential construction, offices, hospitals, hotels, cruise ships, etc.

Actuator
Three versions available, depending on the size of the VAV unit: 5 / 10 / 20 Nm.
– Rotary actuator, depending on the size
– Linear actuator 150 N with 100, 200 or 300 mm linear movement

Control function
VAV-CAV or Open-Loop operation for integration in an external VAV control loop.

Feedback
Damper position for fan optimiser systems, current volumetric flow or pressure value.

VAV – variable volumetric flow
For variable volumetric flow applications with a modulating reference variable, e.g. room temperature controller, direct digital control or bus system, it enables demand-related, energy-saving ventilation of individual rooms or zones. The operating range $\dot{V}_{min}$ …$\dot{V}_{max}$ can be connected via selectable mode.
The following are available: DC 2 … 10V / 0 … 10V / adjustable division / bus operation

CAV – constant volumetric flow
For constant volumetric flow applications, e.g. in step mode, controlled by means of a switch.
The following operating modes can be selected from: CLOSED / $\dot{V}_{min}$ / ($\dot{V}_{mid}$) / $\dot{V}_{max}$ / OPEN

Bus function
Up to eight Belimo MP devices (VAV / damper actuator / valve actuator) can be connected together over the MP-Bus and integrated into the following systems:
– LonWorks® applications with Belimo UK24LON interface
– Konnex applications with Belimo UK24EIB interface
– Modbus RTU applications with Belimo UK24MOD interface
– BACnet applications with Belimo UK24BAC interface
– DDC controller with integrated MP-Bus protocol
– Fan optimiser applications with optimiser COU24-A-MP or DDC with Optimiser function
A sensor (0...10V or passive), e.g. a temperature sensor or a switch, can optionally be integrated into the higher-level direct digital control or bus system via the MP-Bus.

Operating and service devices
MP types: onboard NFC interface for Android Smartphone Assistant App.
PC-Tool or service tool ZTH.., pluggable on the VAV-Compact (PP connection) or via MP-Bus.

Assembly and connection
The VAV-Compact device is connected using the prefabricated connecting cable.

Test function / test display
The VAV-Compact features two LEDs with a functional readiness display for commissioning and functional checking. Extended information with ZTH.. .

OEM factory settings
The VAV-Compact is mounted on the VAV unit by the unit manufacturer, who adjusts and tests it according to the application. The VAV-Compact is sold exclusively via the OEM channel for this reason.

Type overview

Type	Torque	Power consumption	Rating	Weight
LMV-D3-MP	5 Nm	2 W	3.5 VA (max. 8 A @ 5 ms)	Approx. 500 g
NMV-D3-MP	10 Nm	3 W	5 VA (max. 8 A @ 5 ms)	Approx. 700 g
SMV-D3-MP	20 Nm	3 W	5.5 VA (max. 8 A @ 5 ms)	Approx. 830 g
LHV-D3-MP	150 N	2.5 W	4.5 VA (max. 8 A @ 5 ms)	Approx. 550 g

Technical Data

Supply	
Nominal voltage	AC 24V, 50/60 Hz DC 24V
Operating range	AC 19.2 … 28.8 V DC 21.6 … 28.8 V
Differential pressure sensor	
Type, principle of operation	Belimo D3 sensor, dynamic response
Operating range	0 … 600 Pa
Overload capability	±3000 Pa
Installation position	Any, no reset necessary
Materials in contact with medium	Glass, epoxy resin, PA, TPE
Control function	– VAV-CAV – Open-loop operation
Adjustment values	
$\dot{V}_{nom}$	OEM-specific nominal volumetric flow setting, suitable for the VAV unit
Δp @ $\dot{V}_{nom}$	38 ... 450 Pa
$\dot{V}_{max}$	20 … 100% of $\dot{V}_{nom}$
$\dot{V}_{min}$	0 … 100% of $\dot{V}_{nom}$
$\dot{V}_{mid}$	50% of $\dot{V}_{min}$ to $\dot{V}_{max}$
Classic control	
VAV mode for reference value input Y (Connection 3)	– DC 2 … 10V / (4 … 20 mA with 500 Ω resistance) – DC 0 … 10V / (0 … 20 mA with 500 Ω resistance) – Adjustable DC 0 … 10V } Input impedance min. 100 kOhm
Mode for actual value signal U_5 (Connection 5)	– DC 2 … 10V – DC 0 … 10V – adjustable: volumetric flow, damper position or differential pressure } max. 0.5 mA
CAV operating modes (constant volumetric flow)	CLOSED / $\dot{V}_{min}$ / ($\dot{V}_{mid}$ *) / $\dot{V}_{max}$ / OPEN * (* only with AC 24V supply)
MP-Bus function	
Address in bus operation	MP1 … 8 (classic operation: PP)
LonWorks® / Konnex / Modbus RTU / BACnet	with BELIMO Interface UK24LON / UK24EIB / UK24MOD / UK24BAC 1 … 8 BELIMO MP devices (VAV / damper actuator / valve)
DDC controller	DDC controllers/programmable controller with an integrated MP interface from various manufacturers
Fan optimiser (fan control)	with BELIMO Fan Optimiser COU24-A-MP
Sensor integration	Passive (Pt1000, Ni1000, etc.) and active sensors (0…10V), e.g. temperature, humidity 2-point signal (switching capacity 16 mA @ 24V), e.g. switches, occupancy switches
Operation and servicing	MP types: onboard NFC interface for Android Smartphone Assistant App, Pluggable / PC-Tool (V3.9 or higher) / service tool ZTH..
Communication	PP/MP-Bus, max. DC 15V, 1200 baud
Push-button	Adaption / addressing
LED display	– 24V supply – Status / bus function
Actuator	Brushless, non-blocking actuator with power-save mode
Direction of rotation	left / right or ↑ / ↓
Adaptation	Capture of setting range and resolution to control range
Gear disengagement	Push-button self-resetting without functional impairment
Sound power level	max. 35 dB (A), SMV-D3-MP max. 45 dB (A)
Actuator - rotating	
Angle of rotation	95°◁, adjustable mechanical or electronic limiting
Position Indication	Mechanical with pointer
Spindle holder	– Spindle clamp, spindle round 10 ... 20 mm / spindle square 8 ... 16 mm – Form fit in various versions, e.g. 8 x 8 mm
Actuator – linear	
Stroke	100, 200 or 300 mm, adjustable mechanical or electronic limiting
Connection	Cable, 4 x 0.75 mm²
Safety	
Protection class	III Safety extra-low voltage
Degree of protection	IP54
EMC	CE according to 89/336/EEC

FCC: see S4-VAV-Compact D3, US-relevant notes, page 47

Technical data *(continued)*

Safety

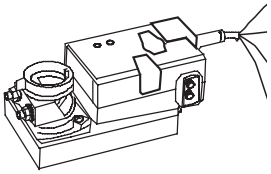
Mode of operation	Type 1 (in acc. with EN 60730-1)
Rated impulse voltage	0.5 kV (in accordance with EN 60730-1)
Control pollution degree	2 (in accordance with EN 60730-1)
Ambient temperature	0 … +50°C
Non-operating temperature	–20 … +80°C
Ambient humidity	5 ... 95% r.h., non-condensing (in accordance with EN 60730-1)
Maintenance	Maintenance-free

Connection

Connecting cable

The connection is made using the connecting cable mounted to the VAV-Compact device.

Note
- Supply via safety isolating transformer!
- Connections 1 and 2 (AC/DC 24V) and 5 (MP signal) must be routed to accessible terminals (room temperature controller, floor distributor, control cabinet, etc.) in order to enable access with the tool for diagnostic and service work.

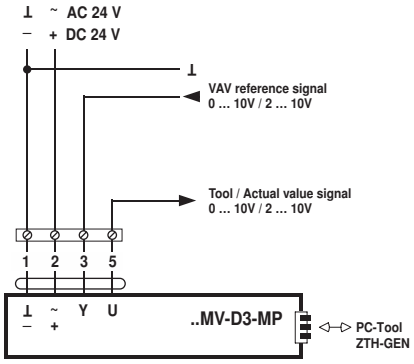


No.	Designation	Wire colour	Function
1	– ⊥	black	⊥ – AC/DC 24V supply
2	+ ~	red	~ + AC/DC 24V supply
3	Y	white	Reference signal VAV/CAV
5	U	orange	– Actual value signal – MP-Bus connection

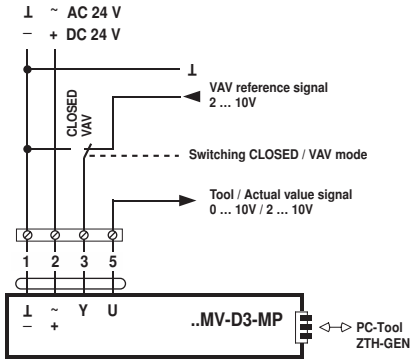
VAV – Variable operation $\dot{V}_{min}$…$\dot{V}_{max}$

Wiring diagrams

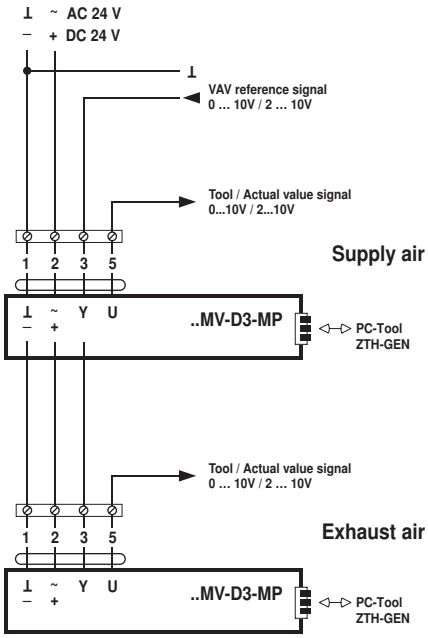
Example 1:
VAV with analogue reference signal



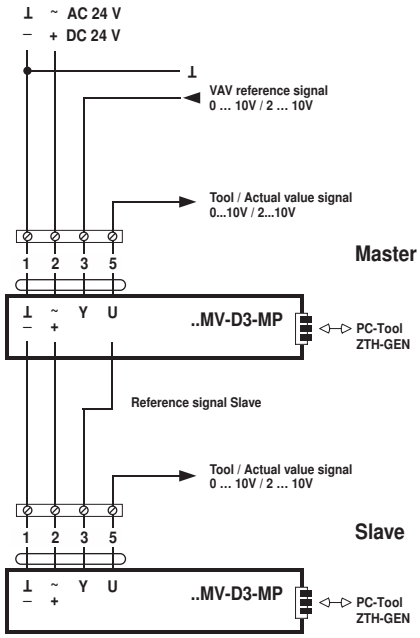
Example 2:
VAV with shut-off (CLOSE), 2 ... 10V mode



Example 3:
VAV with analogue reference signal
supply/exhaust air in parallel operation



Example 4:
VAV with analogue reference signal,
in Master/Slave operation



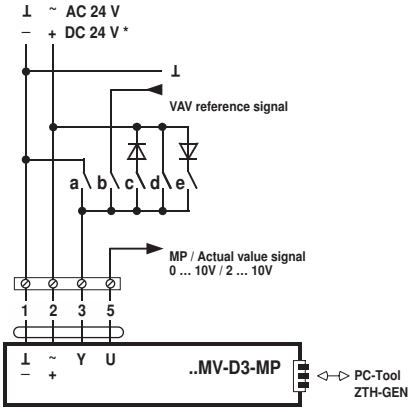
CAV – Step mode CLOSED / $\dot{V}_{min}$ / $\dot{V}_{mid}$ / $\dot{V}_{max}$ / OPEN

CAV control

Three options are available for the CAV control:
– CAV function Standard: 0.1 V shut-off level: CLOSED – $\dot{V}_{min}$ – $\dot{V}_{max}$ – OPEN (default setting)
– CAV function Standard: 0.5 V shut-off level: CLOSED – $\dot{V}_{min}$ – $\dot{V}_{max}$ – OPEN
– CAV function Old Generation (NMV-D2M): CLOSED – $\dot{V}_{min}$ – $\dot{V}_{mid}$ – $\dot{V}_{max}$ – OPEN

Note
«Standard 0.5 V shut-off» not use at:
– Mode 2 ... 10 V and MP bus operation
– Mode 2 ... 10 V and CAV control

Wiring diagrams



* Not available with DC 24 V supply.

Note
The contacts are mutually interlocking!

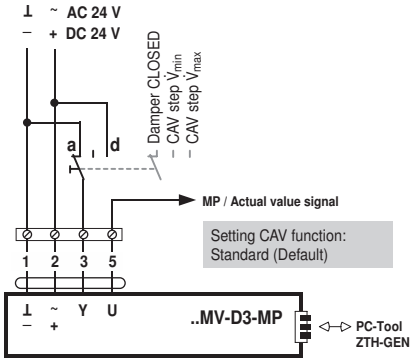
CAV function: Standard

Mode setting	–	0 ... 10 V	0 ... 10 V	0 ... 10 V	0 ... 10 V
	2 ... 10 V	2 ... 10 V	2 ... 10 V	2 ... 10 V	2 ... 10 V
Signal	⊥ –	0 ... 10 V 2 ... 10 V	~	~ +	~
Function	3	3	3	3	3
Damper CLOSED	a) CLOSED		c) CLOSED *		
$\dot{V}_{min}$ ... $\dot{V}_{max}$		b) VAV			
CAV – $\dot{V}_{min}$	All open – $\dot{V}_{min}$ active **				
Damper OPEN					e) OPEN *
CAV – $\dot{V}_{max}$				d) $\dot{V}_{max}$	

Legend
Contact closed, function active
Contact closed, function active, only in 2 ... 10 V mode
Contact open

* Not available with DC 24 V supply
** The damper is closed when the 0.5 V shut-off level is used.

Example:
CAV application CLOSED – $\dot{V}_{min}$ – $\dot{V}_{max}$ (mode 2 ... 10 V)



Note
In order to use the CAV step $\dot{V}_{mid}$, the Old Generation (NMV-D2M) CAV function must be selected.

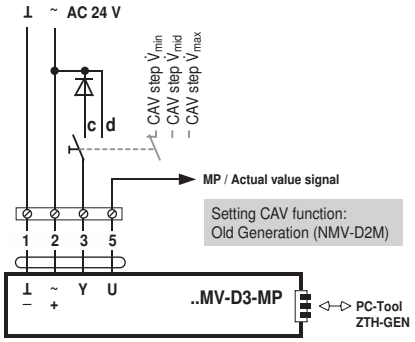
CAV function: Old Generation (NMV-D2M)

Mode setting	–	0 ... 10 V	0 ... 10 V	0 ... 10 V	0 ... 10 V
	2 ... 10 V	2 ... 10 V	2 ... 10 V	2 ... 10 V	2 ... 10 V
Signal	⊥ –	0 ... 10 V 2 ... 10 V	~	~ +	~
Function	3	3	3	3	3
Damper CLOSED	a) CLOSED				
$\dot{V}_{min}$ ... $\dot{V}_{max}$		b) VAV			
CAV – $\dot{V}_{min}$	All open – $\dot{V}_{min}$ active				
Damper OPEN					e) OPEN *
CAV – $\dot{V}_{max}$				d) $\dot{V}_{max}$	
CAV – $\dot{V}_{mid}$			c) $\dot{V}_{mid}$ *		

Legend
Contact closed, function active
Contact closed, function active, only in 2 ... 10 V mode
Contact open

* Not available with DC 24 V supply

Example:
CAV application $\dot{V}_{min}$ – $\dot{V}_{mid}$ – $\dot{V}_{max}$ (Mode 0 ... 10 or 2 ... 10 V)



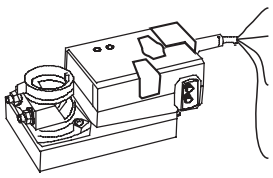
Note
– Supply via safety isolating transformer!
– Connections 1 and 2 (AC/DC 24V) and 5 (MP signal) must be routed to accessible terminals (room temperature controller, floor distributor, control cabinet, etc.) in order to enable access with the tools for diagnostic and service work.

MP-Bus operation – VAV / CAV operation

Connecting cable

The connection to the MP-Bus is made using the connecting cable mounted to the VAV-Compact device.

Note
- Supply via safety isolating transformer!
- Connections 1 and 2 (AC/DC 24V) and 5 (MP signal) must be routed to accessible terminals (room temperature controller, floor distributor, control cabinet, etc.) in order to enable access with the tools for diagnostic and service work.



No.	Designation	Wire colour	Function
1	– ⊥	black	⊥ – AC/DC 24V supply
2	+ ~	red	~ + AC/DC 24V supply
3	Y	white	Input for – Sensor interface – Override control
5	U	orange	MP-Bus connection

Wiring diagrams

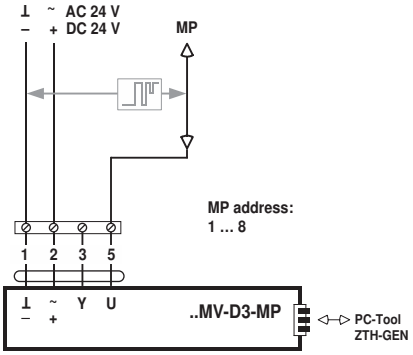
Control via MP-Bus

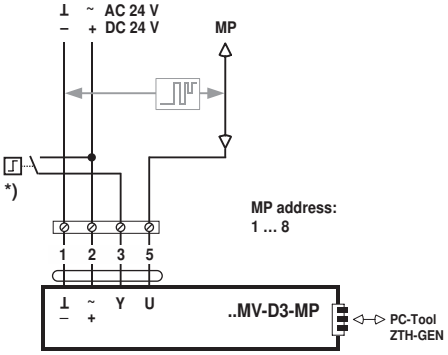
For detailed information, see S4-VAV-Compact D3, MP-Bus integration, page 33 … 42

MP-Bus control with integrated switch

For detailed information on sensor integration, see S4-VAV-Compact D3, MP-Bus integration, page 33 … 42

Note
- For further information about the connection, override controls, MP-Bus cables, etc., see S4-VAV-Compact D3, MP-Bus integration, page 33 … 42.
- This is a connection description. Depending on the application, the terminal allocation may vary. The connection and commissioning must be carried out by trained personnel.





*) e.g. window contact

Dimensioning of supply and connecting cable

General

In addition to the actual wire sizing, attention must also be paid to the surrounding area and the cable routing.Signal cables must not be laid in the vicinity of load cables, objects liable to cause EMC interference etc. if possible. Paired or layer stranded cables improve immunity to interference.

24 V supply, dimensioning and cabling

The dimensioning and installation of the AC 24V supply, the fuse protection and the cables are dependent on the total operated load and local regulations. Account must be taken of the following performance data, including the starting currents of the actuators:
- Dimensioning values VAV-Compact controller, see Technical data
- Dimensioning values of further controlling elements etc. can be found in the current data sheets and product information
- Other devices which are intended to be connected to the same 24 V supply
- Reserve capacity for subsequent expansion, if planned.

MP-Bus integration – supply, dimensioning and cabling

See S4-VAV-Compact D3, MP-Bus integration, page 33 … 42

Tool connection

Settings and diagnostics

Belimo VAV operating and service devices

Smartphone operation – Belimo Assistant App
Service tool
– ZTH-GEN (replace by ZTH EU)
– Service tool ZTH EU
Belimo PC-Tool, with level converter
– ZIP-USB-MP
– ZTH EU (with integrated MP-USB converter)

For simple checking and adaptation of the VAV unit, the VAV-Compact can be operated via the integrated NFC interface using the Android Smartphone.
The more comprehensive settings and diagnostics of the connected VAV-Compact controller can – thanks to MP bus technology – be checked and adjusted easily and rapidly with the Belimo PC-Tool or with the ZTH.. service tool.

Smartphone – Belimo Assistant App

NFC-capable devices

– LMV-D3-MP, NMV-D3-MP, SMV-D3-MP and LHV-D3-MP with printed NFC mark

Non-NFC-capable versions

– All devices without NFC mark
– LMV-D3-MF
– ..-D3LON, ..-MOD and ..-KNX

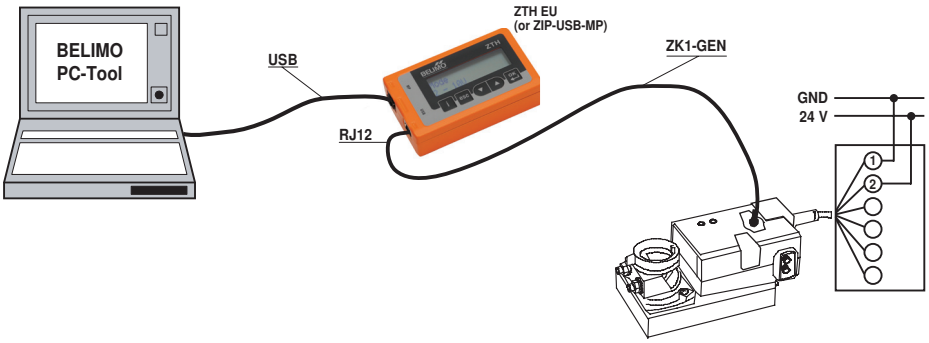
The NFC antenna range of the VAV-Compact is located between Belimo or the OEM logo and the NFC mark.
Align NFC-capable Android Smartphone, with Assistant App loaded, in such a way on the VAV-Compact that the two NFC antennas are above one another.

Depending on the model of the Smartphones, its antenna could be located at a different position
(see documentation for the Smartphone).

The Belimo Assistant App can be downloaded via the Google Play Store (www.google.xx).

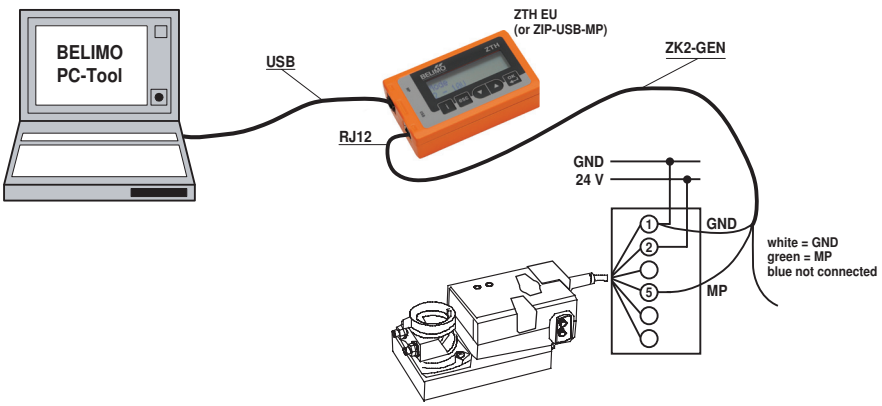
On-board service connection

The service connection integrated in the VAV-Compact enables rapid connection of the operating devices ZTH.. and PC-Tool.
For the PC-Tool connection, the PC is connected per USB cable with the level converter ZTH EU or ZIP-USB-MP.



MP connection (5)

The VAV-Compacts can also communicate with the Service tools via the MP connection (connection wire 5). The connection be set up during operations on-site, i.e. in the connection socket, on the tool socket of the Belimo room temperature controller CR24 or at the tier or control cabinet terminals.



Compatibility

Current overview

An overview of the compatibility of the VAV-Compact controller with current and replaced products can be found under www.belimo.eu.

VAV-Compact – Customer versions

A VAV-Compact in a customer version is a device which has been specially produced for a VAV unit manufacturer (OEM). These versions are adapted specifically for the sensors, damper spindles and fastening systems of the OEM.

Designation: ..V-D3-MP (1) yyy (2)

1 Product designation, 2 Customer designation

Retrofit – old Belimo or VAV controllers from third-party manufacturers

A special retrofit set is available for replacing old VAV controllers. Please contact your local Belimo representative!

Replacement devices

When replacement devices are ordered, they are parameterised at the OEM factory in accordance with the installed system.
The VAV-Compact controller is sold exclusively via the OEM channel for this reason.

Tool versions

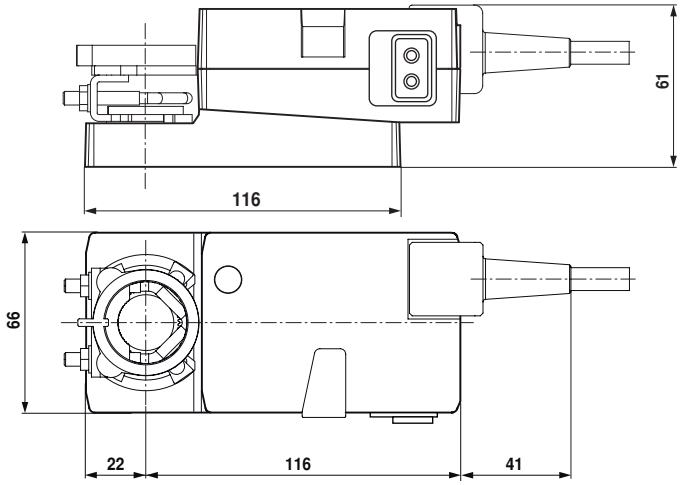
See www.belimo.eu

Safety notes

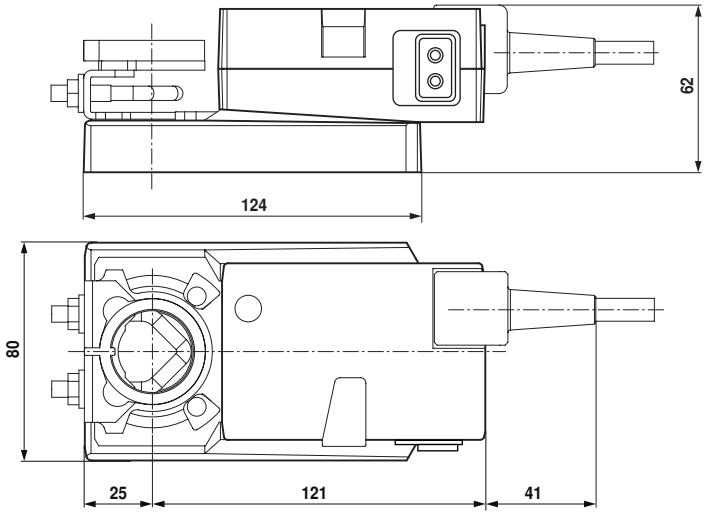
- **The device is not allowed to be used outside the specified field of application, especially in aircraft or in any other airborne means of transport.**
- **It may only be installed by suitably trained personnel. Legal regulations and regulations issued by authorities must be observed during installation.**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

Dimensions [mm]

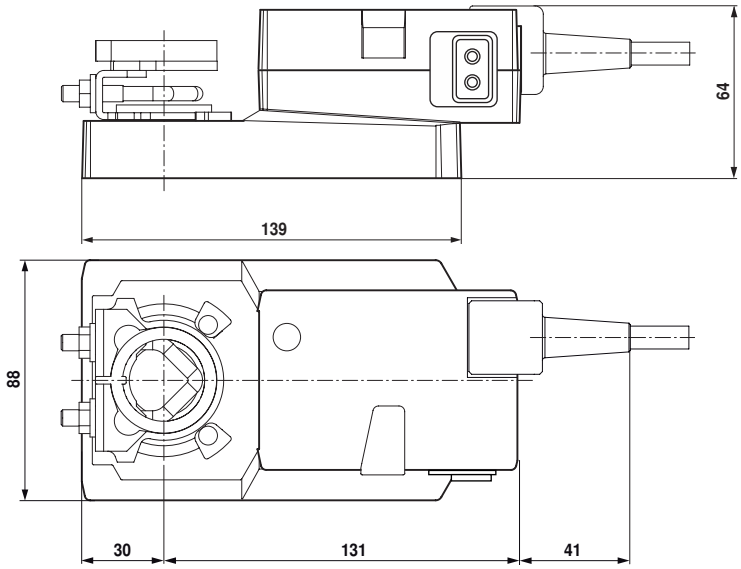
Dimensional drawings LMV-D3-..



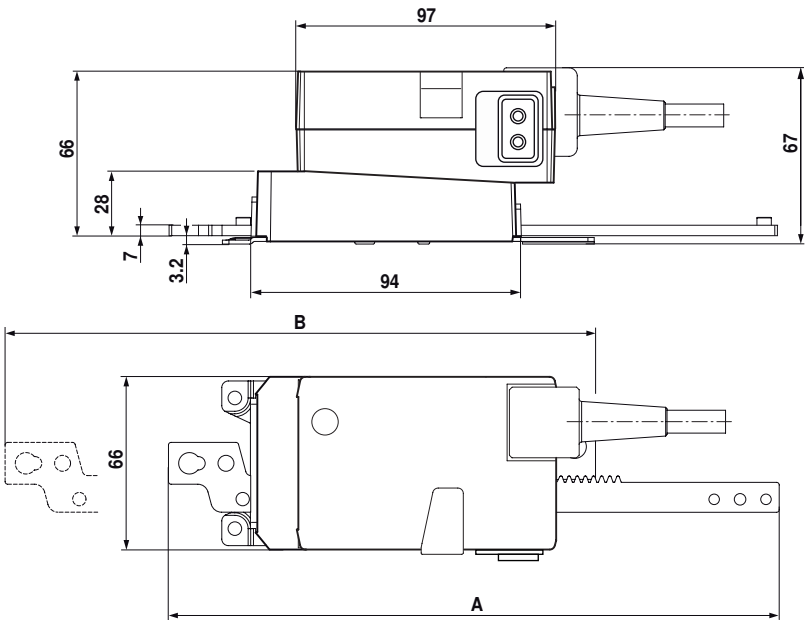
Dimensional drawings NMV-D3-..



Dimensional drawings SMV-D3-



Dimensional drawings LHV-D3-..



Type	Max. stroke	A	B
LHV-D3-MP100	100	233-5	264.2
LHV-D3-MP200	200	333.5	364.2
LHV-D3-MP300	300	433.5	464.2