OEM customer specific VAV-Compact version consisting of a pressure sensor, digital VAV controller and damper positioning actuator for pressure independent VAV and CAV systems in comfort zone

- **Control (0)2 … 10 V**
- **Service socket for operating devices**

LMV-D3-MF-F
NMV-D3-MF-F

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Tel : + 31 229 262 300 info@air-concepts.nl
De Compagnie 22E+F 1689AG Hoorn The Netherlands

Brief description

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

Pressure measurement
The integrated D3 differential pressure sensor is also suitable for very small volumetric flows. The maintenance-free sensor technology enables versatile applications in the comfort zone: in residential construction, offices, hospitals, hotels, cruise ships, etc..

Actuator
2 different actuator variants (5 or 10 Nm) are available for different VAV unit structures.

Control function
Volumetric flow (VAV-CAV) or Open-Loop (for integration in an external VAV control loop).

VAV (VVS) – variable volumetric flow
Demand-dependant setting of volumetric flows $\dot{V}_{min}$ … $_{max}$ on a modulating reference variable (0/2 … 10 V), e.g. room temperature / CO2 controller or DDC, for energy-saving air conditioning in individual rooms or zones.

CAV (KVS) – constant volumetric flow
Step mode (via switching contact) for constant volume applications
CLOSED / $\dot{V}_{min}$ / $\dot{V}_{mid}$ / $\dot{V}_{max}$ / OPEN.

DCV – Demand Controlled Ventilation
VAV-Compact MF versions are not compatible with Fan Optimiser!
The integration in one DCV/Fan Optimiser system requires VAV-Compact versions with integrated Bus interface (MP, KNX, LON or MOD).
See www.belimo.eu for more information.

Operating and service devices
Service tool ZTH, PC-Tool service socket: locally pluggable or via PP connection.

Electrical connection
The connection is made with the integrated connection cable.

Sales, mounting and setting
VAV-Compact will be mounted by the VAV unit manufacturer (OEM), the application will be set and calibrated accordingly. The VAV-Compact is sold exclusively via the OEM channel for this reason.

Type overview MF versions

Type	Torque	Power consumption	Rating	Weight
LMV-D3-MF-F	5 Nm	2 W	3.5 VA (max. 8 A @ 5 ms)	Approx. 500 g
NMV-D3-MF-F	10 Nm	3 W	5 VA (max. 8 A @ 5 ms)	Approx. 700 g

Both MF versions are specially manufactured customer versions of VAV-Compact (OEM version). They have no Bus interface and therefore are not compatible with Fan Optimiser. These versions are customised and labelled specifically for OEM on the sensors, damper spindles and fastening systems used. See documentation of the VAV unit manufacturer.
Designation, e.g.: LMV-D3-MF-F ABC (ABC = Customer designation)

Other versions
The VAV-Compact is also available with a built-in interface for direct integration in MP-Bus systems, KNX, LONWORKS® and Modbus.
See www.belimo.eu for more information and documentation.

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 applications: possible only in the absence of direct effects on the actuator from (sea)water, snow, ice, sunlight and aggressive gases and when it is guaranteed that the ambient conditions do not deviate at any time from the limit values specified in the datasheet.**
- **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.**
- **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.**

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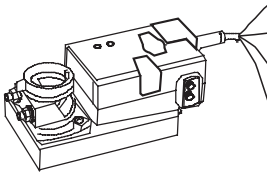
Electrical installation

Notes
– Supply via safety isolating transformer!
– It is recommended that the connections 1 to 5 (PP) are led to accessible terminals (e.g. floor distributor) in order to allow remote access for diagnostics and service work.



No.	Designation	Wire colour	Function
1	⊥ –	black	AC/DC 24 V supply
2	~ +	red	
3	◄ Y	white	Reference signal / override
5	► U	orange	Actual value signal / tool connection

See separate documentation for description of functions and applications

Technical Data

Electrical data	Nominal voltage	AC/DC 24 V, 50/60 Hz
	Operating range	AC 19.2 ... 28.8V / DC 21.6 ... 28.8V
	Performance data	See Overview of types (page 1)
	Connecting	Cable, 4 x 0.75 mm², preassembled
VAV controllers	Control function	VAV/CAV and Open-Loop
	$\dot{V}_{nom}$ 1)	OEM specific nominal volumetric flow setting, suitable for VAV unit
	Δp @ $\dot{V}_{nom}$ 1)	38 … 500 Pa
	$\dot{V}_{max}$	20 … 100 % of $\dot{V}_{nom}$, adjustable
	$\dot{V}_{mid}$	>$\dot{V}_{min}$ … <$\dot{V}_{max}$, adjustable
	$\dot{V}_{min}$	0 … 100 % of $\dot{V}$nom, adjustable (<$\dot{V}$max)
Analogue control - VAV	Mode (Y)	0 … 10 V / 2 … 10 V / (Y and U5 individually) adjustable, input resistance 100 kΩ (0/4 … 20 mA with 500 Ω resistance)
	Actual value signal (U)	0 ... 10 V / 2 ... 10 V, max. 0.5 mA Volumetric flow / damper position / Δp, selectable
Stepped control - CAV	Operating stages	CLOSED / $\dot{V}_{min}$ / $\dot{V}_{mid}$ *) / $\dot{V}_{max}$ / OPEN *) *) AC 24 V supply required
Operation and servicing	Service tool ZTH, PC-Tool	Local plug / Remote via PP connection
	LED	Supply and status display
	Push-button	Angle of rotation adaptation and test function
Actuator	Rotary version	Brushless, non-blocking actuator with power-save mode
	Direction of rotation 1)	Left / right, adjustable
	Angle of rotation	95°, adjustable mechanical or electronic limiting
	Gear disengagement	Push-button self-resetting without functional impairment
	Position indication	accessible (Tool)
	Spindle holder	Form fit
Volumetric flow measurement	Differential pressure sensor	Belimo D3 sensor, dynamic measurement principle
	Measurement range, operating range	–20 … 500 Pa, 0 … 500 Pa
	Overload capability	±3000 Pa
	Altitude compensation	Adaptation to system altitude (adjustable between 0 … 3000 m above sea level)
	Installation position	Any, no reset necessary
	Materials in contact with medium	Glass, epoxy resin, PA, TPE
	Measuring air conditions	Comfort zone 0 … 50°C / 5 … 95% rH, non-condensing
Safety	Protection class IEC/EN	III Safety extra-low voltage
	Degree of protection IEC / EN	IP54
	EMC	CE according to 2014/30/EU
	Certification IEC/EN	IEC/EN 60730-1 and IEC/EN 60730-2-14
	Rated current voltage Supply / control	0.8 kV
	Control pollution degree	3
	Ambient temperature	-30...50°C
	Non-operating temperature	-40...80°C
	Ambient humidity range	95% r.h., non-condensing
	Maintenance	Maintenance-free. Depending on the application, the differential pressure sensor (measuring cross, disc, …) of the VAV unit is checked occasionally and cleaned if required.

1) Setting by VAV manufacturer (OEM)

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VAV – variable operation $\dot{V}_{min}$...$\dot{V}_{max}$

Wiring diagrams

Description:

Damper CLOSED via 0 ... 10 V reference signal (Mode 2 ... 10 V)

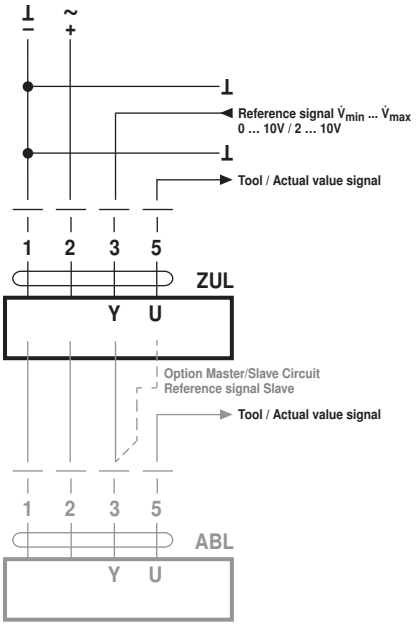
Setting parameters:
Mode 2 … 10 V, Shut off level 0.1 V or 0.5 V

If the required switching threshold of 0.1 V cannot be attained, the value can be switched to 0.5 V with PC-Tool.

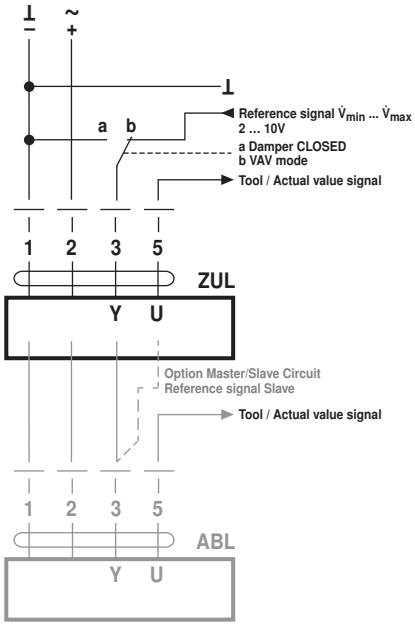
Function:	*Standard 0.1 V:*	*Shut-off level 0.5 V:*
Damper CLOSED	<0.1 V	<0.5 V
$\dot{V}_{min}$	>0.1 ... 2 V	>0.5 V ... 2 V
$\dot{V}_{min}$ ... $\dot{V}_{max}$	2 ... 10 V	2 ... 10 V

In CAV applications shut-off level must not be set to 0.5 V, otherwise the open connection 3 is interpreted as damper CLOSED.

Example 1:
VAV, analogue reference signal



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



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

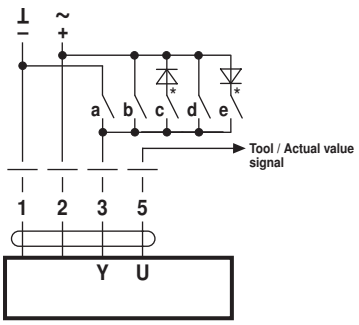
CAV control

VAV-Compact can be adapted to the desired CAV function pattern for constant volumetric flow applications with PC-Tool by using the "CAV function":
– Damper CLOSED – $\dot{V}_{min}$ – $\dot{V}_{max}$ – damper OPEN (standard)
– Damper CLOSED – $\dot{V}_{min}$ – $\dot{V}_{mid}$ – $\dot{V}_{max}$ – damper OPEN (NMV-D2M compatible)

Wiring diagrams

Notes

- Note that the contacts are mutually interlocking.
- DC supply: * c and e are not available with DC 24 V.
- Setting parameters in CAV applications:
  Mode 2 … 10 V, Shut-off level 0.1 V
  In CAV applications shut-off level must not be set to 0.5 V, otherwise the open connection 3 is interpreted as damper CLOSED.



PC-Tool "CAV Function" setting:
2 ... 10 V, Shut-off level 0.1 V

CAV Function CLOSED – $\dot{V}_{min}$ – $\dot{V}_{max}$ – OPEN (standard)

	a	b	c	d	e
Signal	⊥ –		~	~ +	~
Switching terminal 3	3	3	3	3	3
Mode 2 ... 10 V	CLOSED	$\dot{V}_{min}$	CLOSED *	$\dot{V}_{max}$	OPEN *
Mode 0 ... 10 V	$\dot{V}_{min}$	$\dot{V}_{min}$	CLOSED *	$\dot{V}_{max}$	OPEN *

PC-Tool "CAV Function" setting:
CLOSED – $\dot{V}_{min}$ – $\dot{V}_{max}$. Shut-off level CLOSED: 0.1 V

CAV function CLOSED – $\dot{V}_{min}$ – $\dot{V}_{mid}$ – $\dot{V}_{max}$ – OPEN

	a	b	c	d	e
Signal	⊥ –		~	~ +	~
Switching terminal 3	3	3	3	3	3
Mode 2 ... 10 V	CLOSED	$\dot{V}_{min}$	$\dot{V}_{mid}$ *	$\dot{V}_{max}$	OPEN *
Mode 0 ... 10 V	$\dot{V}_{min}$	$\dot{V}_{min}$	$\dot{V}_{mid}$ *	$\dot{V}_{max}$	OPEN *

PC-Tool "CAV Function" setting:
CLOSED – $\dot{V}_{min}$ – $\dot{V}_{mid}$ – $\dot{V}_{max}$ (NMV-D2M compatible)

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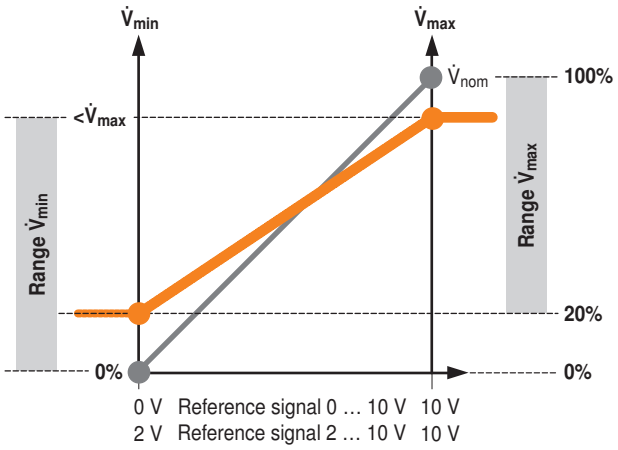
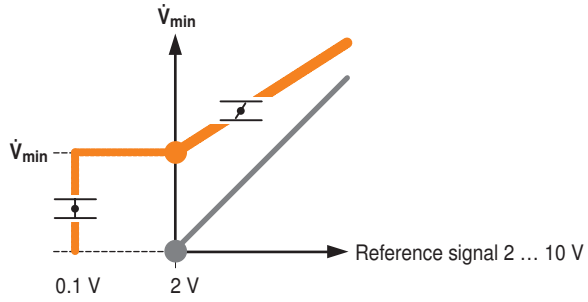
Control functions - VAV / CAV

VAV-operating volumetric flow – Setting and control



Damper CLOSED via 0 ... 10 V reference signal (Mode 2 ... 10 V)



Description:

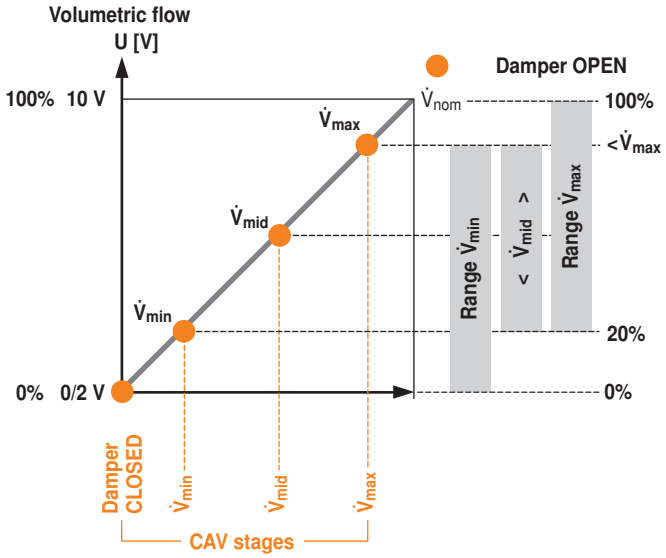
Setting parameters: Mode 2 … 10 V, Shut-off level 0.1 V or 0.5 V

If the required switching threshold of 0.1 V cannot be attained, the value can be switched to 0.5 V with PC-Tool.

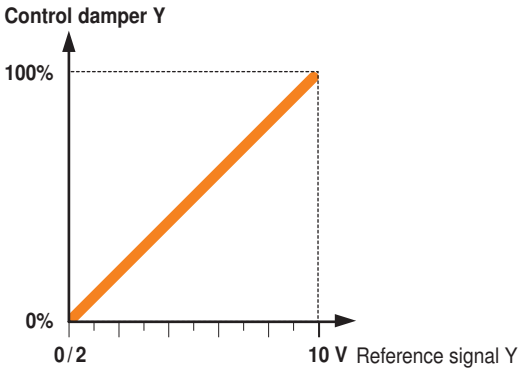
Function	Standard 0.1 V	Shut-off level 0.5 V
Damper CLOSED	<0.1 V	<0.5 V
V̇min	>0.1 ... 2 V	>0.5 V ... 2 V
V̇min ... V̇max	2 ... 10V	2 ... 10V

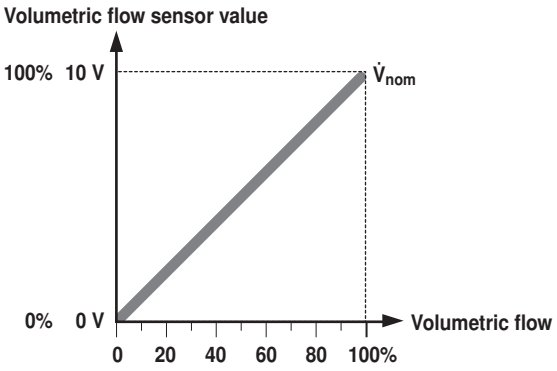
In CAV applications shut-off level must not be set to 0.5 V, otherwise the open connection 3 is interpreted as damper CLOSED.

CAV operating volumetric flow – setting



Open-Loop (separate external VAV-Control)





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Setting and Tool function

Designation	Adjustment values, limits, explanations	Units	Tools [5]		Remarks
			ZTH EU	PC-Tool	
System specific data					
Position	16 characters e.g.: Office 4 6.OG ZL	Text	r	r/w	
Designation	16 Characters: Unit designation, etc.	Text	r	r/w	
V̇max	20…100 % [V̇nom]	m³/h / l/s / cfm	r/w	r/w	>/= V̇min
V̇mid	V̇min…V̇max	m³/h / l/s / cfm	r/w	r/w	
V̇min	0…100 % [V̇nom]	m³/h / l/s / cfm	r/w	r/w	</= V̇max
System altitude	0…3000	Meter	r/w	r/w	Adaptation of Δp-Sensor to system altitude (above sea level)
Controller settings					
Controller function	Volumetric flow / open loop		-	r/w	
Mode	0…10 / 2…10	Volt	r/w [1]	r/w	
CAV function	CLOSED/V̇min/V̇max; Shut-off level CLOSED 0.1 V CLOSED/V̇min/V̇max; Shut-off level CLOSED 0.5 V V̇min/V̇mid/V̇max; (NMV-D2M comp.)		-	r/w	For an explanation see [2]
Positioning signal Y	Start value: 0.6 ... 30; Stop value: 2.6 ... 32	Volt	r	r/w	
Feedback U	Volume / damper position / Δp		-	r/w	Definition feedback signal
Feedback U	Start value: 0.0 ... 8.0; Stop value: 2.0 ... 10	Volt	-	r/w	
Response when switched on (Power-On) [4]	No action / Adaption / Synchronisation		-	r/w	
Synchronisation behaviour	Y=0 % Y=100 %		-	r/w	Synchronisation to damper position 0 or 100 %
Unit specific settings *) Write function only available for VAV manufacturer					
V̇nom	0 … 60'000 m³/h	m³/h / l/s / cfm	r	r/(w*)	Unit specific adjustment value
Δp@V̇nom	38 … 500 Pa	Pa	r	r/(w*)	Unit specific adjustment value
Label print function			-	w	Incl. customer logo
Other settings					
Direction of rotation (for Y = 100%)	cw/ccw or ▲/▼		r/w [1]	r/w	
Range of rotation	Adapted[3] / programmed 30…95	°	-	r/w	
Torque	100 / 75 / 50 / 25	%		r/w	% of nominal torque
Operating data					
Setpoint / actual value Damper position		m³/h / l/s / cfm Pa / %	r	r	Trend display with print function and data storage on HD
Simulation	Damper CLOSED / OPEN V̇min / V̇mid / V̇max / motor stop		w	w	
Running times	Operating time, running time Ratio	h %	-	r	
Alarm messages	Setting range enlarged, mech. overload, Stop&Go ratio too high		-	r/w	
Series number	Device ID.		r	r	incl. date of manufacture
Type	Type designation		r	r	
Version display	Firmware, Config table ID		r	r	
Configuration data					
Print, create PDF			-	Yes	
Save to file			-	Yes	
Log data / book	Activity log		-	Yes	incl. complete setting data

Explanations

1) Access only on operating level 2
2) Shut-off level 0.1 / 0.5V - Application: VAV mode, in Mode 2…10 V, Damper CLOSED via 0…10 V control signal.
If the required switching threshold of 0.1 V cannot be attained, the threshold can be switched to 0.5 V.
Note on CAV application: the shut-off level must not be set to 0.5 V. If the line 3 (Y) is open, damper will be CLOSED instead, min will be activated.
3) within the mechanical limit.
4) The first time the supply voltage is switched on, i.e. at the time of commissioning, the actuator carries out an adaption, which is when the operating range and position feedback adjust themselves to the mechanical setting range. The actuator then moves into the required position in order to ensure the volumetric flow defined by the positioning signal.
5) See www.belimo.eu for function and version history.

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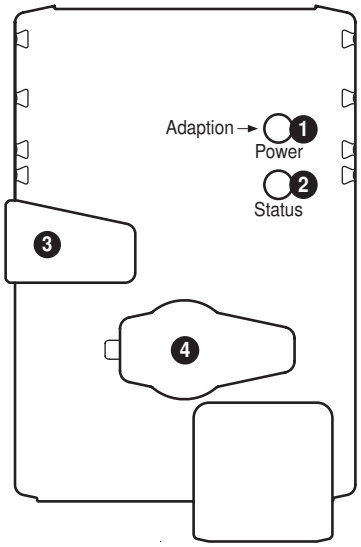
Display and operation



1 Push-button and LED display green

Off:	No power supply or malfunction
On:	In operation
Press button:	Triggers angle of rotation adaptation

2 Push-button and LED display yellow

Off:	Normal operation
On:	Adaption or synchronising process active

3 Gear disengagement button

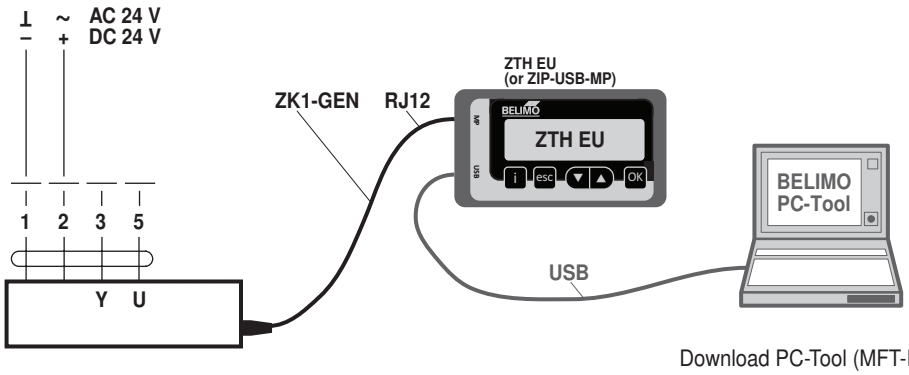
Press button:	Gear disengaged, motor stops, manual override possible
Release button:	Gear engaged, synchronisation starts, followed by standard mode

4 Service plug

For connecting parameterisation and service tools

ZTH / PC-Tool - local service connection

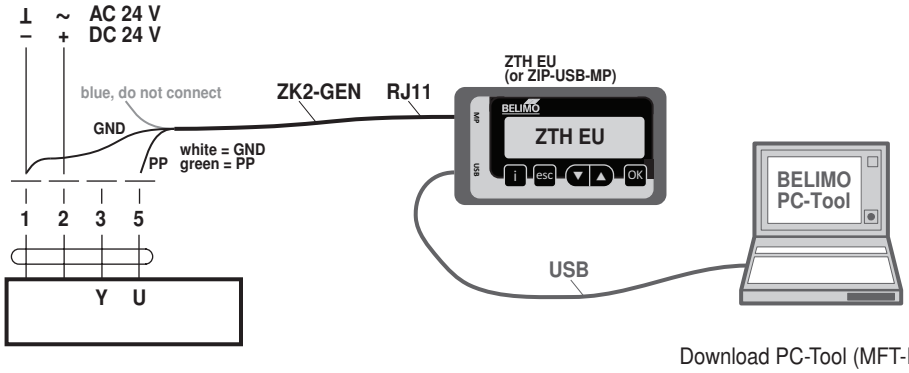
The settings and diagnostics of the VAV-Compact can be performed easily and rapidly with the Belimo PC-Tool or with the ZTH-EU service tool. When using the PC-Tool, the ZTH EU serves as an interface converter.



Download PC-Tool (MFT-P)
from www.belimo.eu

ZTH / PC-Tool - remote connection

The VAV-Compact can communicate with the service tools via the PP connection (wire 5). The connection can be made in operating mode in the junction box, tool socket of room controllers CR 24 or the control cabinet terminals. When using the PC-Tool, the ZTH EU serves as an interface converter.



Download PC-Tool (MFT-P)
from www.belimo.eu

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Accessories

Room controller
(2 ... 10 V control)

Description	Type
Room temperature controller, AO: VAV; DI: Standby/EHO/C-O	CR24-B1
Room temperature controller, AO: VAV/Htg 3-point; DI: Standby/EHO/Ventilation	CR24-B2
Room temperature controller, AO: VAV/Htg EI-RH; DI: Standby/EHO/Boost	CR24-B2E
Room temperature controller, AO: VAV/Htg 3-point; H/C 0...10V; DI: Standby/EHO/C-O/Boost	CR24-B3
Residential ventilation controller, AO: 2 x VAV/Htg-Valve; DI: EHO/Override Kitchen+Bath	CRA24-B3
Contactor step control, 3 positions (Min/COMF/Max)	CRA24-B1P
Positioner, 0...100%	CRP24-B1

Electrical accessories

Description	Type
Connection cable 5 m, to ZTH / ZIP-USB-MP (RJ12) with service plug	ZK1-GEN
Connection cable 5 m, to ZTH / ZIP-USB-MP (RJ11) with free wire ends	ZK2-GEN

Tools

Description	Type
Service Tool, for MF/MP/Modbus/LonWorks® actuators and VAV controllers	ZTH EU
Belimo PC-Tool, software for adjustments and diagnostics	MFT-P

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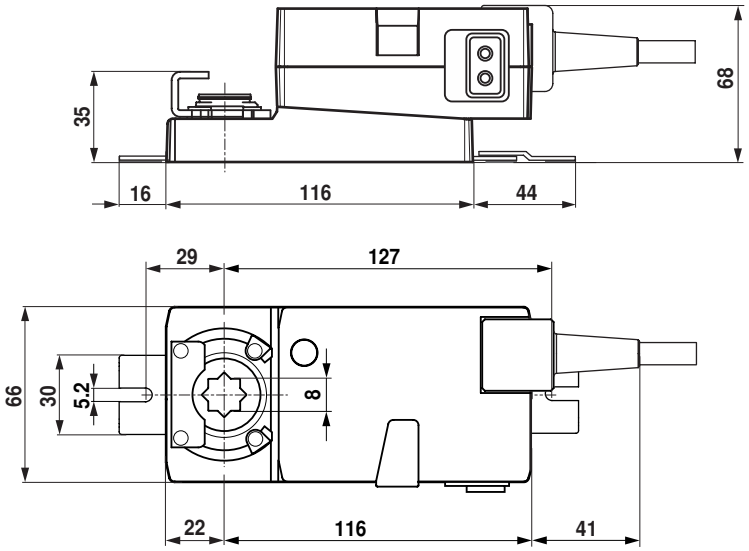
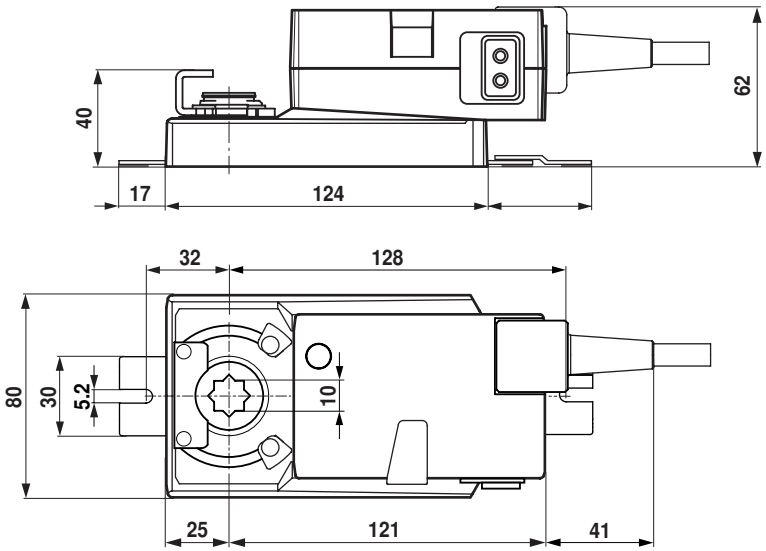
Dimensions [mm]

Dimensional drawings LMV-D3-MF-F



Dimensional drawings NMV-D3-MF-F



VAV-Compact
Model overview / feature comparison

BELIMO

	-MF	-MP	-KNX	LON	-MOD
		MP-BUS	KNX	LonMark	Modbus
Field of application: Supply and exhaust air in the comfort zone and sensor-compatible media	X	X	X	X	X
AC/DC 24 V supply	X	X	X	X	X
Integrated Δp sensor, dynamic D3, measuring range:	–20 … 500 Pa	–20 … 500 Pa	–20 … 500 Pa	–20 … 500 Pa	–20 … 500 Pa
Actuator variants: – Rotary actuator – Linear actuator	5 / 10 Nm –	5 / 10 / 20 Nm 150 / 200 / 300 mm	5 / 10 / 20* Nm 150* / 200* / 300* mm	5 / 10 / 20* Nm 150* / 200* / 300* mm	5 / 10 / 20* Nm 150* / 200* / 300* mm
VAV function $\dot{V}_{min}$ … $\dot{V}_{max}$	X	X	X	X	X
CAV stages $\dot{V}_{min}$ / $\dot{V}_{mid}$ / $\dot{V}_{max}$	X	X	–	–	–
Open Loop (external V control)	X	X	X	X	X
DCV (Optimiser function)	–	DDC MP Partners Belimo fan optimiser	Yes, programmable	Yes, programmable	Yes, programmable
Analogue control	0/2 ... 10 V	0/2 ... 10 V	–	–	–
With bus control	–	X	X	X	X
Bus specification	–	Belimo MP bus	KNX S mode	LonWorks FTT-10A	Modbus RTU RS485
Direct integration DDC MP Partners	–	X	–	–	–
Integration via Gateway – BACnet – KNX – LONWORKS® – Modbus RTU	–	 X X X X	–	–	–
Number of bus devices	–	8 per strand	64 per line segment	64 per bus segment	32 per strand
Sensor integration – passive (resistance) – active (0…10 V) – Switching contact	–	 X X X	 – X X	 – X X	 – X X
Optional control function	–	–	–	Temperature / CO_2	–
Local forced (override)	–	CLOSED / $\dot{V}_{max}$ / OPEN	CLOSED / $\dot{V}_{max}$ / OPEN	CLOSED / $\dot{V}_{max}$ / OPEN	CLOSED / $\dot{V}_{max}$ / OPEN
Aids	–	MP-Bus Tester MP Monitor	ETS Product database	–	–
Integration tools	–	PC-Tool	ETS	LNS Tool + Plug-in	…
TypeList function (Retrofit, OEM)	–	X	(–)	(–)	(–)
Tool connection (U – PP/MP)	PP	PP/MP	PP	PP	PP
Service socket ZTH / PC-Tool	X	X	X	X	X
NFC interface	–	X	–	–	–
Assistant App	–	X	–	–	–
Service tool ZTH EU	X	X	X	X	X
PC-Tool – Parameter – Save data – Trend, Logbook – Label Print	X	X	X	X	X

* on request