A pressure sensor, digital VAV controller and damper actuator all in one, providing a compact solution with a communications capability for pressure-independent VAV and CAV systems in the comfort zone

- **Control modulating, communicative, hybrid**
- **Conversion of sensor signals**
- **Communication via BACnet MS/TP, Modbus RTU, Belimo MP-Bus or conventional control**
- **Service socket for operating devices**

LMV-D3-MOD
NMV-D3-MOD

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

DCV – Demand Controlled Ventilation
In higher-level BACnet / Modbus system, for example with integrated optimiser function.

Mode of operation
The actuator is fitted with an integrated interface for BACnet MS/TP, Modbus RTU and MP-Bus, it receives the digital positioning signal from the upper system and returns the current status.

Converter for sensors
Connection option for a sensor (active or with switching contact). In this way, the analogue sensor signal can be easily digitised and transferred to the bus systems BACnet, Modbus or MP-Bus.

Parameterisation
The factory settings cover the most common applications. As desired, individual parameters can be adapted for specific systems or servicing with a service tool (e.g. ZTH EU).

Communication parameters
The communication parameters of the bus systems (address, baud rate, …) are set with the ZTH EU. Pressing push-button "Address" while connecting the supply voltage resets the communication parameters to the factory setting.
Quick addressing: The BACnet and Modbus address can alternatively be set using the buttons on the actuator and selecting 1 to 16. The value selected is added to the «Basic address» parameter and results in the effective BACnet and Modbus address.

Combination analogue - communicative (hybrid mode)
With conventional control by means of an analogue positioning signal, BACnet or Modbus can be used for the communicative position feedback

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

Type	Torque	Power consumption	Rating	Weight
LMV-D3-MOD	5 Nm	2 W	4 VA (max. 8 A @ 5 ms)	Approx. 500 g
NMV-D3-MOD	10 Nm	3 W	5 VA (max. 8 A @ 5 ms)	Approx. 700 g

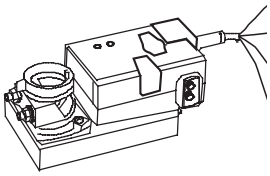
Other versions
The VAV-Compact is also available with a built-in interface for direct integration in MP-Bus systems, KNX and LONWORKS®.
See www.belimo.eu for more information and documentation.

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.

Electrical installation

Notes
– Supply via safety isolating transformer!
– Modbus signal assignment:
C_1 = D– = A
C_2 = D+ = B
– Supply and communication are not galvanically isolated.
– Connect earth signal for devices with one another.



No.	Designation	Wire colour	Function
1	⊥ –	black	AC/DC 24 V supply
2	~ +	red	
3			
5	► MFT	orange	MP connection
6	D–	pink	BACnet / Modbus (RS485)
7	D+	grey	

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)
	Connection	Cable, 6 x 0.75 mm², preassembled
Volumetric flow 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)
Sensor integration	input	0 … 32 V, input impedance 100 kΩ
	Sensor	Active Sensor (0 … 10 V) Switching contact (0 / 1) switching capacity 16 mA @ 24 V
Local override control	Override	CLOSED / $\dot{V}_{max}$ / OPEN, AC 24 V supply required
Communicative control	BACnet MS/TP Modbus RTU MP-Bus	(ex works)
Operation and service	Service tool ZTH, PC-Tool	Local plug / Remote via PP connection
	LED	Supply , status and communication display
	Push-button	Addressing, angle of rotation adaptation and test function
Actuator	Rotary/linear version	Brushless, non-blocking actuator with power-save mode
	Direction of rotation [1]	ccw / cw
	Angle of rotation	95°, adjustable mechanical or electronic limiting
	Gear disengagement	Push-button self-resetting without functional impairment
	Position indication	Mechanical or accessible (Tool, Bus-Master)
	Spindle holder	Spindle clamp for round and square shafts
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	0 ... +50°C
	Non-operating temperature	–20 ... +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.

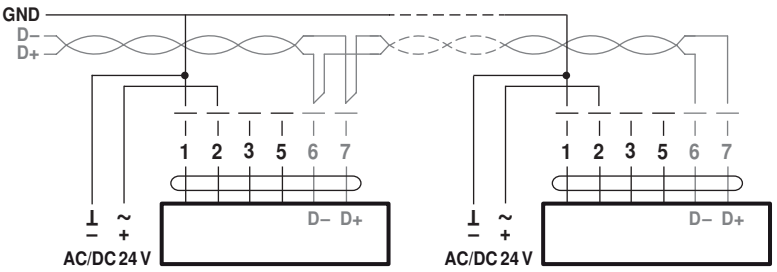
[1] Setting by VAV manufacturer (OEM)

Electrical installation

Notes

- Connection via safety isolating transformer.
- The wiring of the line for Modbus (RTU) / BACnet (MS/TP) is to be carried out in accordance with applicable RS485 regulations.
- Modbus / BACnet: Supply and communication are not galvanically isolated. Connect earth signal of the devices with one another.

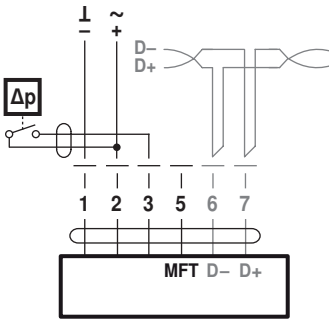
BACnet MS/TP / Modbus RTU



Cable colours:
1= black
2 = red
3 = white
5 = orange
6 = pink
7 = gray

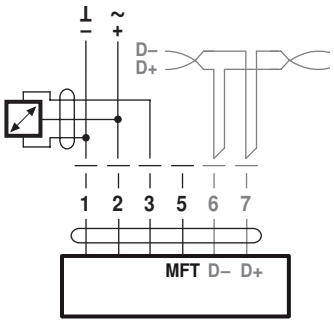
Signal assignement Modbus:
C_1 = D– = A
C_2 = D+ = B

Connection with switching contact, e.g. Δp-monitor



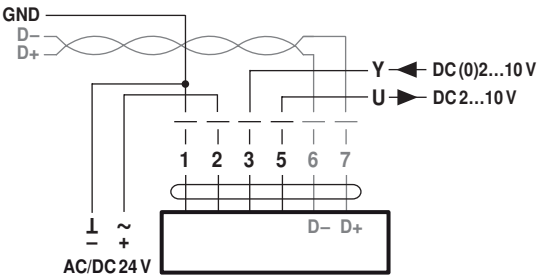
Switching contact requirements:
The switching contact must be able to switch a current of 16 mA at 24V accurately.

Connection of active sensors, e.g. 0...10 V @ 0...50°C

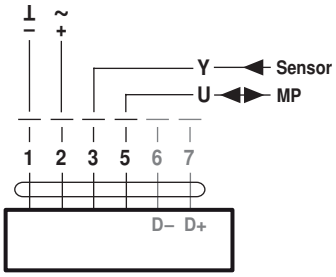


Possible voltage range:
0 ... 32 V (resolution 30 mV)

BACnet MS/TP / Modbus RTU with analog setpoint (hybrid mode)



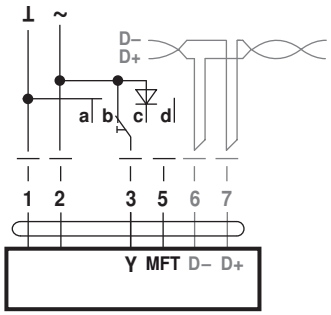
Operating on the MP-Bus



Electrical installation

Local override control

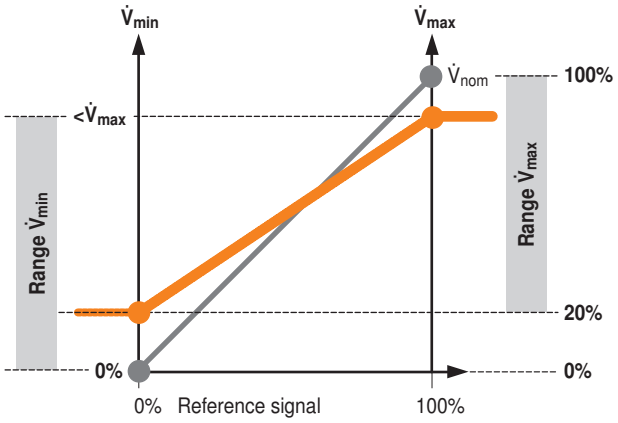
f no sensor is integrated, then connection 3 (Y) is available for the protective circuit of a local override control.
Options: CLOSED – $\dot{V}_{max}$ – OPEN
Note: Functions only with AC 24 V supply!



a Damper CLOSED
b $\dot{V}_{max}$
c Damper OPEN
d Bus mode

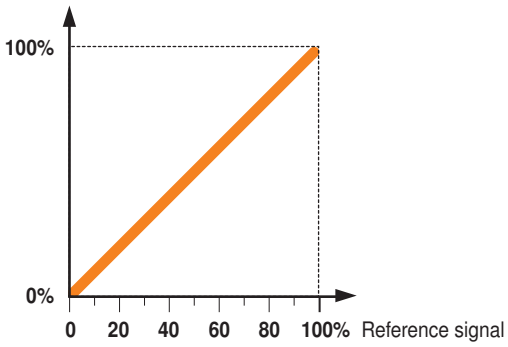
Control functions - VAV / CAV

VAV-operating volumetric flow – Setting and control



Open-Loop (separate external VAV-Control)

Control damper Y



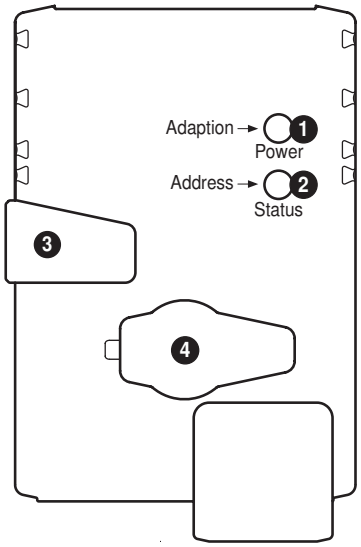
Setting and Tool function

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	
Modbus address	1...247 Baud rate and etc.		r/w	-	Modbus addressing
Address (MP)	PP		r/w	r/w	for Modbus applications: PP
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	for Modbus applications: 2…10
CAV function [2]	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	not relevant for Modbus applications
Positioning signal Y	Start value: 0.6 ... 30; Stop value: 2.6 ... 32	Volt	r	r/w	not relevant for Modbus applications
Feedback U	Volume / damper position / Δp		-	r/w	not relevant for Modbus applications
Feedback U	Start value: 0.0 ... 8.0; Stop value: 2.0 ... 10	Volt	-	r/w	not relevant for Modbus applications
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 %
Bus fail position	Last set point / Damper CLOSED V̇min / V̇max / Damper OPEN		-	r/w	
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 … 450 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		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) CAV setting for MP/MF type
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.

Display and operation



1 Push-button and LED display green

Off:	No power supply or malfunction
On:	In operation
Flashing:	In address mode: Pulses according to set address (1 ... 16) When starting: Reset to factory setting (Communication)
Press button:	In standard mode: Triggers angle of rotation adaptation In address mode: Confirmation of set address (1 ... 16)

2 Push-button and LED display yellow

Off:	Standard mode
On:	Adaption or synchronising process active or actuator in address mode (LED display green flashing)
Flickering:	BACnet / Modbus communication active
Press button:	In operation (>3 s): Switch address mode on and off In address mode: Address setting by pressing several times When starting (>5 s): Reset to factory setting (Communication)

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

Check power supply connection

1 Off and 2 On — Possible wiring error in power supply

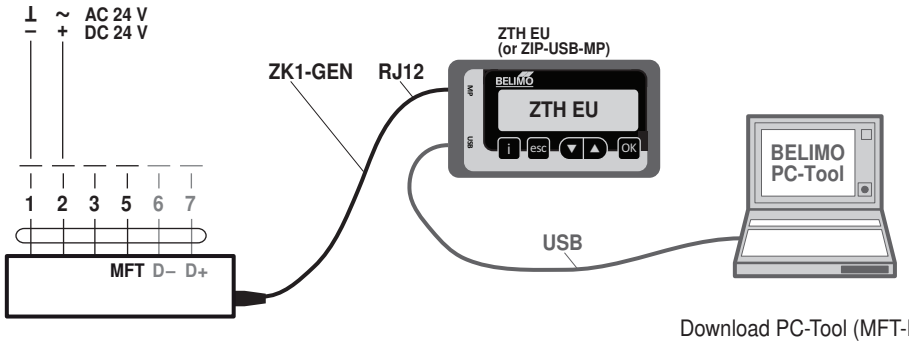
Quick addressing

1. Press the "Address" button until the green "Power" LED display is no longer illuminated.
   The green "Adaption" LED display flashes in accordance with the previously set address.
2. Set the address by pressing the "Address" button the corresponding number of times (1-16).
3. The green LED flashes in accordance with address that has been entered (1-16).
   If the address is not correct, then this can be reset in accordance with Step 2.
4. Confirm the address setting by pressing the green "Adaption" button.

If no confirmation occurs for 60 seconds, then the address procedure is ended.
Any address change that has been made will be discarded.
The resulting BACnet MS/TP and Modbus RTU address is made up of the set basic address plus the short address (e.g. 100+7=107).

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.

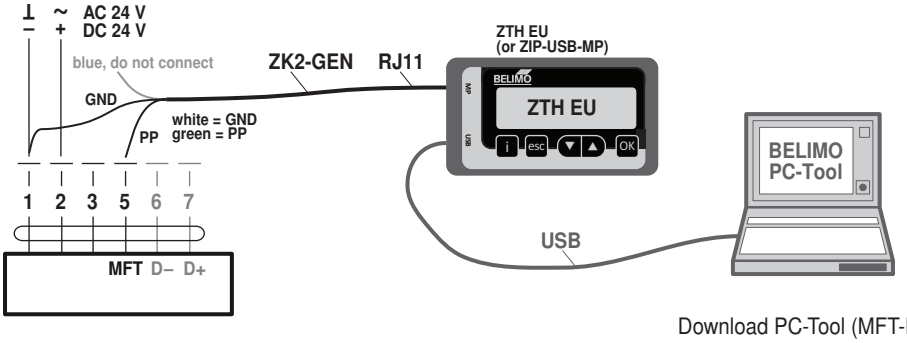


Download PC-Tool (MFT-P)
from www.belimo.eu

Display and operation

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 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

Accessories

VAV-Compact / VAV-Universal

Description
VAV-Compact: version with integrated MP-Bus, LonWorks® and KNX interface
VAV-Universal: VAV pressure controller, Δp sensors, actuator(spring-return, fast runner, etc.)
see www.belimo.eu for more information and documentation

Electrical accessories

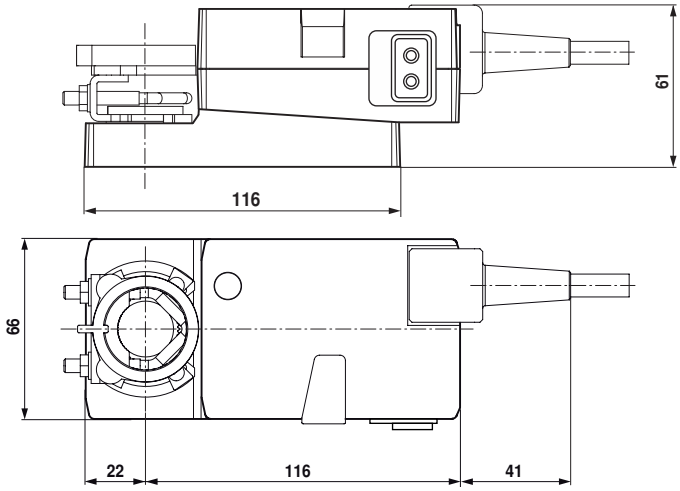
Description	Type
Connection cable 5 m, to ZTH / ZIP-USB-MP (RJ12) with service plug	ZK1-GEN
Connection cable 5 m, to ZTH / ZIP-USB-MP (RJ11) with free wire ends	ZK2-GEN

Tools

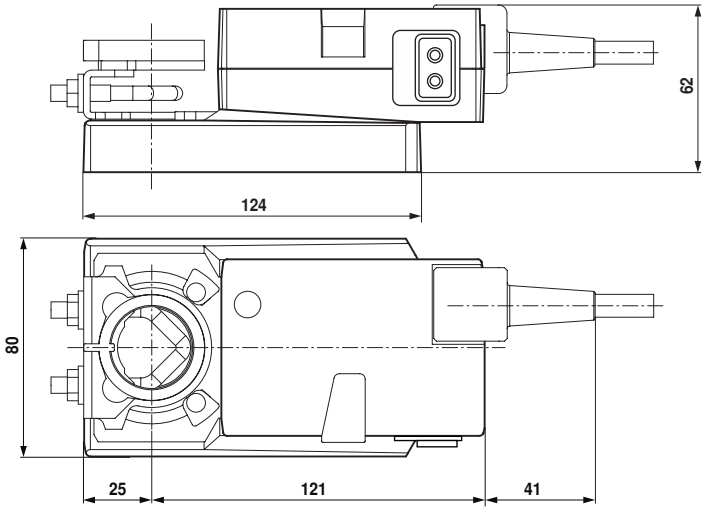
Description	Type
Service tool for parametrisable and communicative Belimo actuators / VAV controller and HVAC performance devices	ZTH EU
Belimo PC-Tool, software for adjustments and diagnostics	MFT-P
Adapter to Service Tool ZTH	MFT-C

Dimensions [mm]

Dimensional drawings LMV-D3-MOD



Dimensional drawings NMV-D3-MOD



Further documentation

- Tool connections
- Description Protocol Implementation Conformance Statement PICS
- Description Modbus-Register
- Overview MP Cooperation Partners
- MP Glossary
- Introduction to MP-Bus-Technology

	-MF	-MP	-KNX	LON	-MOD
		MP-BUS	KNX	LonMark	BACnet 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
Analog 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