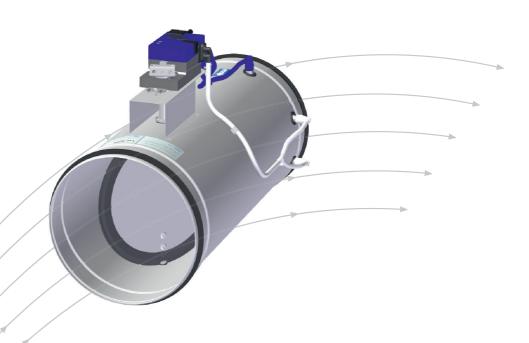
VAV controller



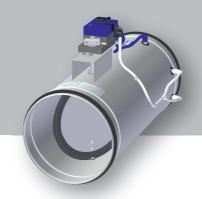
- New regulator handles larger working area
- · Low noise level
- Pressure independent
- Short overall length
- High measurement accuracy
- Can be installed directly in bend
- Flexible sound attenuator choice
- Separate service tool, PC-Tool and ZTH by Belimo





TROX Auranor Norge AS

PO Box 100 NO-2760 Brandbu Telefon +47 61 31 35 00 Telefaks+47 61 31 35 10 e-mail: firmapost@auranor.no www.trox.no





Leo is a volume flow controller which works independently of the duct pressure. It is the desired air flow rate at choked damper that determines the duct pressure required for the applicable unit/string. The VAV unit is based on dynamic measurement of volume flows, and controls the damper position to maintain the air flow rate required. When a change in duct pressure occurs, such as when other volume flow controllers on the branch open or close, the unit will compensate by adjusting the damper until the correct volume flow has been restored. The required air flow rate can, for example, be provided as a 0-10V signal from room thermostat / CO² sensor in the occupied zone covered by the unit. Minimum and maximum air flow rates can be set at the factory or during installation by using a service tool from Belimo. The VAV unit is designed to provide comfort ventilation at temperature conditions of between 0°C and 50°C and a relative humidity between 5% and 95% without condensation. A 4-conductor cable connects the controller to various control equipment in the room. Consistent use of a common reference system for all equipment is important. For the VAV controller, cable no. 1 is system-0. All control and measurement signals are linked up in accordance with this.

Wiring diagram for Leo in combination with various room control equipment is available at our website.

For energy-efficient operation, VAV systems are equipped with pressure sensors in the ductwork, which transmit control signals to branch dampers or to the fan frequency control. Please see schematic diagram in fig.1.

Explanation to fig. 1

- Pressure sensor for fan control
- 2) VAV unit
-)Motorised damper with pressure control system
- 4) Pressure sensor
- 5) Fan

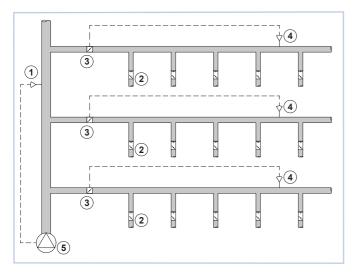


Fig. 1: Pressure conditions in VAV system

FUNCTION

Leo will always adjust to the air flow rate consistent with the signal transmitted from the room control equipment. The VAV unit comprises an adjustable damper and measuring station for air flow rate, and the measurement principle is dynamic measurement of the air flow. In the damper motor's control unit, the admission for the damper is regulated according to the desired in-value, e.g. from room thermostat. Leo has an adjustment range shown in table 2.

Deviation for working range 10 - 20% of Vnom:±25%

20 - 40%: <±10% 40 -100%: <±4%

If T-pipes are used, a spacing of at least 5 \times ØD is recommended in order to maintain the measurement accuracy.

The unit can also be utilised as a measuring station for volume flow only by using a so called open-loop function. To achieve this, the damper motor's measuring unit is separated from the control unit, and this will provide separate 0-10V signals for the controller's inlet/outlet (clamp no. 3 and 5). The damper can then be controlled by a different signal provider, such as a pressure sensor in the ductwork. Furthermore, the measuring station can transmit signals to an alternative VAV unit, e.g. central extract system. For change-over to open-loop, Belimo PC-Tool is used.

Explanation of some of the terms used and options available with Leo VAV system:

VAV - variable air volume

For use of variable air volume flow based on a modulating reference signal, e.g. from room thermostat, DDC control or Bus system. The volume flow to rooms in use can thus be set as required, and this offers considerable savings in terms of ventilation energy consumption. The operating range for gmax and gmin can be set to the value required by selecting operating mode, either DC 2...10 V / 0...10 / adjustable / bus

CAV - constant air volume

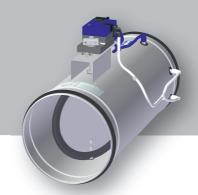
For system with constant volume flow to room. May feature a switch-controlled open/close function. The following operating modes are available:

DC2...10 V / 0...10 V / adjustable / bus.

Bus function

Up to 8 Belimo MP based units (VAV / damper motors / valves) can be connected to MP-Bus and thus be integrated in the following systems:

- LONWORKS® applications with Belimo UK24LON interface
- EIB Konnex applications with Belimo UK24EIB interface.
- DDC system with integrated MP-Bus Protocol.
- Fan control and optimising via COU24-A-MP. If required, a sensor (0-10V, e.g. a passive temperature sensor) or actuator can be integrated in superior DDS or Bus system via MP-Bus.



A DESIGN

Leo VAV is a complete measuring and control unit where the air flow rates in ventilation systems can be set as required.

At the measuring station, the differential pressure is measured via measuring rod integrated in the unit. The unit is installation-friendly in terms of straight ducting, and can thus be mounted in most ductwork sections. It is fully compliant with air

permeability class 4 for damper in closed position, and class C for leakage to the surroundings. Leo is equipped with VAV controller from Belimo. LMV-D3-MP-FK AU is used for dim. Ø100 - Ø400, and NMV-D3-MP AU is used for dim. Ø500 and Ø630. Controller specifications are provided in the table below.

Full technical documentation can be downloaded from www.belimo.eu.

If additional protection against structure-borne noise is required, e.g. for open installation, the unit can be delivered with external insulation and casing. This will reduce the level of noise emitted from the actual unit at high choke pressure and high velocity past the damper. However, this should be followed up with additional protection against structure-borne noise from the duct at both sides of the unit. Please see acoustic data section. The LEV sound attenuator is designed for VAV systems, and is available in 500mm and 1000mm lengths. LEV has a full attenuator cross-section, and this ensures a low-level pressure loss. It is insulated with mineral wool featuring a reinforced top layer to prevent fibres breaking away with the supply air. An extraction unit with mesh grille, ASN, in the same design as LEV is also available. Leo-D, LEV and ASN can be delivered pre-assembled with ducting clips and are equipped with adjustable brackets from factory.

	LMV-D3-MP-FK AU	NMV-D3-MP AU
Operating voltage	AC 24 V 50/60 Hz, DC 24 V	AC 24 V 50/60 Hz, DC 24 V
Power drain consumption	3 W	3,5 W
Dim effect	5 VA (max 5 A @ 5ms)	5,5 VA (max 5 A @ 5 ms)

Table 1: Technical specifications, Belimo VAV controller

MATERIALS AND SURFACE COATING

Leo comes in a galvanized steel design. The measurement unit is in aluminium. Tubing, nipples and motor casing are in plastic. Leo's connection collars are fitted with EPDM rubber gaskets.

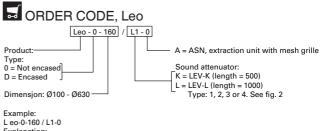
LEV is made of galvanised steel, and comes with mineral wool and a glass fibre layer as attenuation material. Connection collars are fitted with EPDM rubber gaskets.

ASN is made of galvanised steel and is equipped with an EPDM rubber gasket on the connection collar.

QUICK SELECTION

Leo	[m³/h]								
Dim.	Max [V _{nom}]	Min							
100	170	17							
125	265	26							
160	434	43							
200	700	70							
250	1060	106							
315	1750	175							
400	3619	361							
500	5655	565							
630	8973	897							

Table 2: The table shows max. and min. air volumes.



Explanation: Leo, not encased, dim. Ø160. Delivered with sound attenuator LEV-L, length 1000, type 1 Ø160.

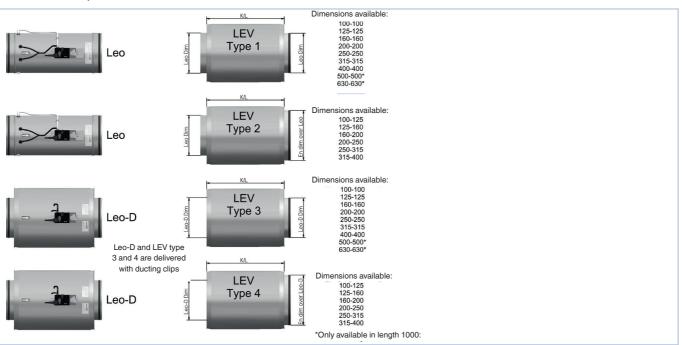
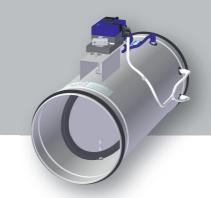


Fig. 2



L DIMENSIONS AND WEIGHT

Dim.	D	DA	В	L
100	99	102	220	400
125	124	127	245	400
160	159	162	280	400
200	199	202	320	400
250	249	252	370	600
315	314	317	435	600
400	399	402	520	600
500	499	502	620	705
630	629	632	750	835

Table 3

	Weight [kg]											
Dim.	Leo	Leo-D	LEV-500	LEV-1000	ASN							
100	1,6	3,2	3,3	5,8	1,5							
125	1,8	3,5	3,8	6,6	1,8							
160	2,1	4,1	4,5	7,8	2,1							
200	2,5	4,9	5,3	9,0	2,5							
250	3,8	8,0	6,4	11,0	3,1							
315	4,8	9,8	7,2	12,4	3,9							
400	6,0	12,0	9,6	15,6	5,0							
500	9,7	23,0	-	18,8	6,5							
630	12,5	28,0	_	23,1	8,7							

Table 4

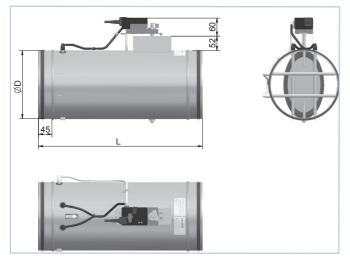


Fig. 3, Leo

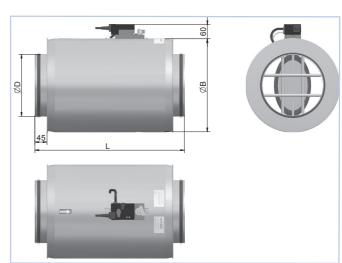


Fig. 4, Leo-D

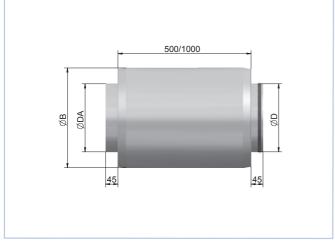


Fig. 5, LEV

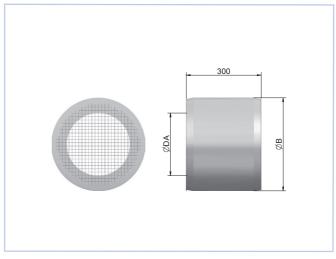


Fig. 6, ASN (extraction unit)





The diagrams provide a summary of the A-weighted sound power level from damper to duct, $L_{_{WA}}.$ Correction factors in the tables are used to calculate emitted sound power level at the respective frequencies, $L_{_{WA}}$ + KO. KO for two different damper settings is provided. Intermediary points can be estimated as shown in the example below.

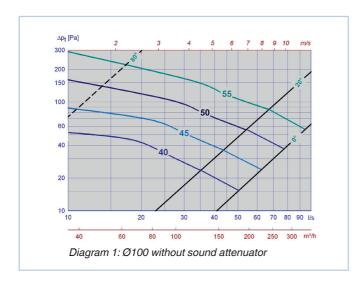
Example:

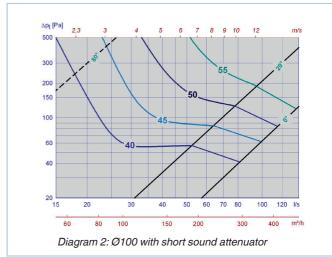
Leo Ø160 with short attenuator, 100 l/s, 100 Pa According to diagram 8, $L_{WA} = 47dB(A)$. We aim to find emitted sound power level at 250 Hz. Correction factors provided in table 6 are 5dB for closed damper and 2dB for open damper.

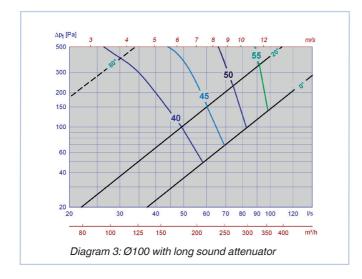
As our point is nearest to open damper, we will use 3dB. Emitted sound power level at 250 Hz is thus:

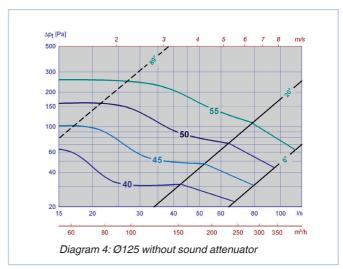
$$L_{W} \approx L_{WA} + KO \approx 47 + 3 \approx + 50dB$$

CALCULATION DIAGRAMS



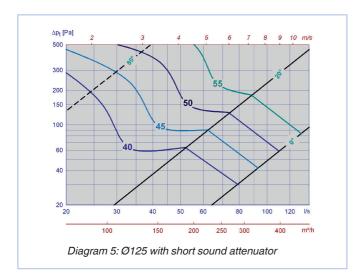


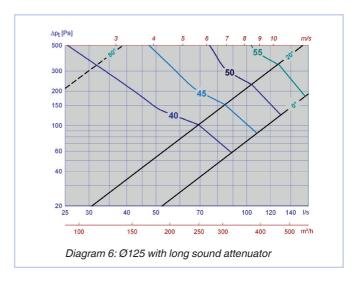


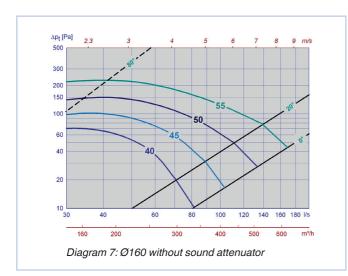


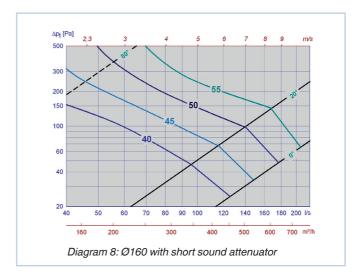


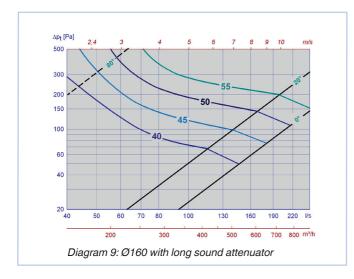


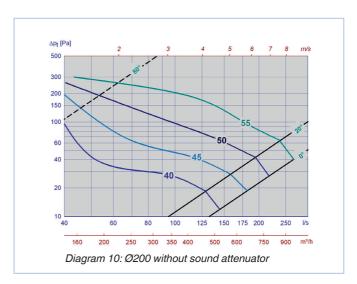






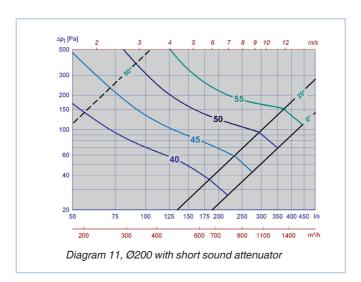


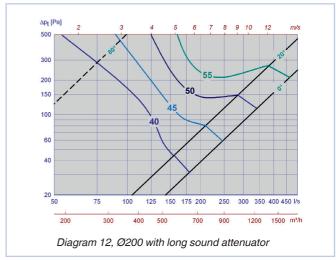


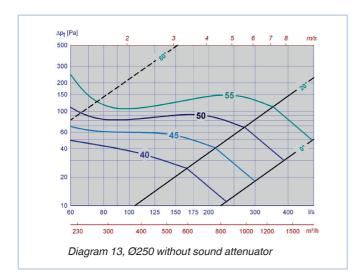


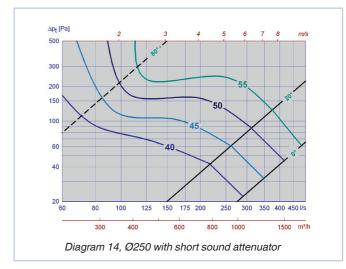


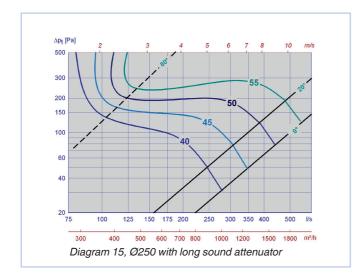


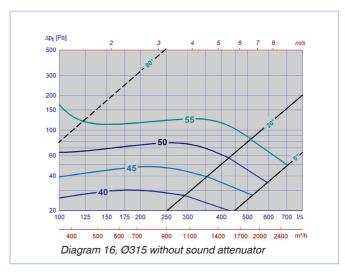






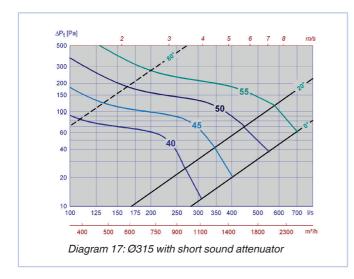


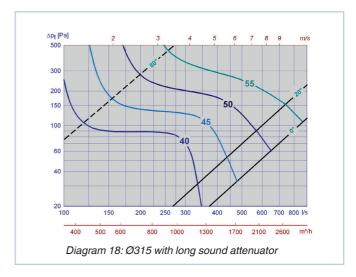


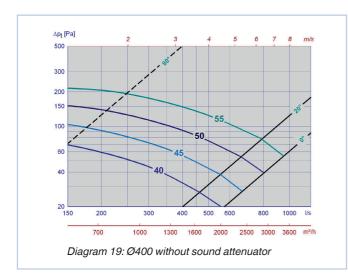


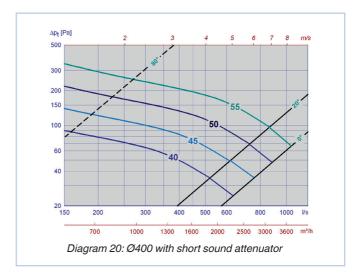


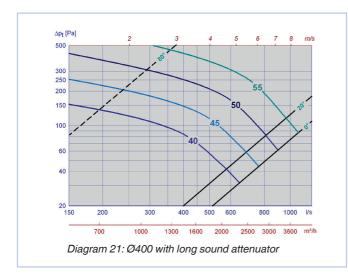


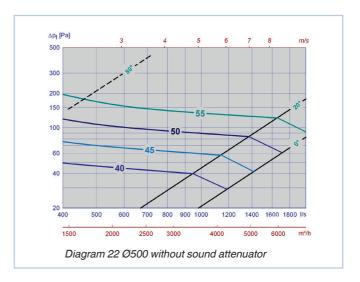




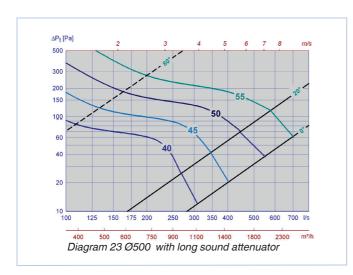


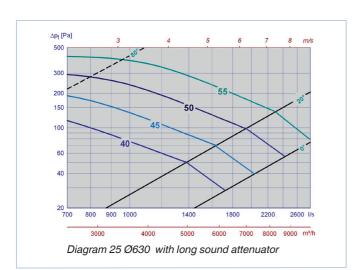


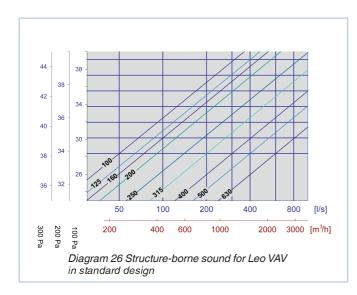


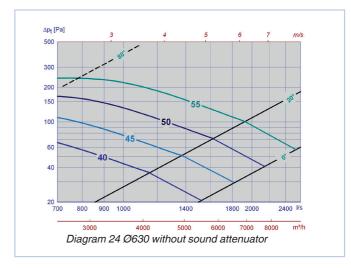












STRUCTURE-BORNE NOISE

Diagram 26 shows the VAV unit's emitted structure-borne noise to the surroundings as a result of air flow rate and pressure loss over the damper (fig. 7). The noise level is shown as A-weighted sound power level from the VAV unit to the room, $L_{\rm WA'}$ When high-level protection against structure-borne noise is required, such as for open installation and high choke pressure over the unit, use of Leo VAV in encased and insulated design as well as measures in terms of the actual ductwork in front of and behind the unit is recommended. In order to protect against noise emission, the full length of the ductwork leading into the room must also be insulated or encased. By using ducting with double casing (fig. 8), a noise reduction of 6 -10 dB can be achieved. Installation as shown in fig. 9 provides a noise reduction of 3 – 6 dB

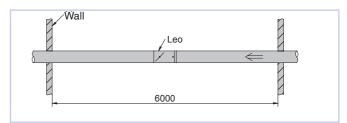


Fig. 7

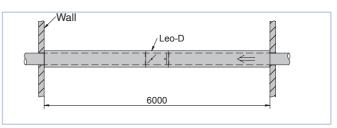


Fig. 8

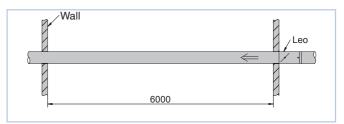


Fig. 9



Correction factor [KO], Leo - VAV without sound attenuator

		KO [dB]														
Leo	80º damper angle									20º damper angle						
Dim.	63	125	250	500	1ĸ	2к	4ĸ	8к	63	125	250	500	1ĸ	2к	4ĸ	8к
100	-1	0	0	-2	-4	-11	-17	-27	5	4	3	-2	-7	-10	-22	-31
125	-2	-3	-4	-4	-3	-9	-18	-26	9	8	3	-2	-8	-18	-24	-27
160	-3	-3	-6	-4	-2	-10	-18	-29	10	11	0	-5	-6	-13	-23	-31
200	4	4	-2	-3	-4	-11	-20	-30	6	6	-1	-2	-4	-12	-21	-30
250	-8	-5	-6	-4	-4	-6	-14	-19	8	7	-1	-1	-7	-15	-23	-29
315	-6	-3	-6	-6	-5	-7	-8	-15	10	9	0	-1	-7	-12	-20	-30
400	-11	-9	-8	-9	-5	-4	-16	-26	9	8	1	-3	-7	-11	-22	-28
500	2	3	0	-5	-6	-6	-13	-24	6	6	4	-2	-6	-15	-19	-16
630	-5	-3	-4	-4	-7	-5	-9	-20	5	7	3	-2	-5	-12	-22	-22

Table 5

Correction factor [KO], Leo - VAV with short sound attenuator

		KO [dB]														
Leo	80º damper angle									20º damper angle						
Dim.	63	125	250	500	1ĸ	2к	4ĸ	8к	63	125	250	500	1ĸ	2к	4ĸ	8к
100	12	11	5	-9	-22	-30	-30	-27	7	9	4	-2	-8	-16	-24	-29
125	13	13	2	-8	-19	-25	-25	-22	12	14	3	-11	-20	-28	-34	-33
160	12	12	5	-7	-17	-21	-21	-20	13	14	2	-7	-14	-20	-27	-28
200	9	9	3	-4	-11	-10	-14	-18	11	13	1	-6	-12	-17	-23	-25
250	7	9	3	-5	-11	-9	-11	-17	11	13	2	-5	-11	-16	-23	-27
315	3	5	1	-4	-8	-7	-11	-14	9	12	1	-5	-9	-12	-19	-28
400	-3	1	-2	-6	-8	-4	-14	-22	10	11	1	-4	-8	-12	-20	-24

Table 6

Correction factor [KO], Leo – VAV with long sound attenuator

		KO [dB]														
Leo	80º damper angle									20º damper angle						
Dim.	63	125	250	500	1ĸ	2к	4ĸ	8к	63	125	250	500	1к	2к	4ĸ	8к
100	14	12	0	-11	-19	-26	-25	-23	13	12	2	-3	-10	-20	-27	-27
125	14	13	0	-14	-16	-20	-21	-18	14	14	3	-9	-16	-25	-29	-27
160	16	14	2	-15	-19	-21	-22	-19	12	10	-3	-12	-20	-25	-30	-30
200	16	14	2	-12	-19	-17	-16	-15	16	15	-2	-11	-18	-23	-27	-26
250	12	11	3	-10	-11	-12	-12	-14	14	15	-1	-10	-15	-21	-26	-26
315	9	10	0	-8	-10	-8	-9	-10	11	15	-2	-8	-11	-17	-24	-28
400	-1	2	0	-10	-11	-3	-12	-19	13	13	1	-7	-11	-16	-23	-24
500	10	12	3	-9	-14	-11	-16	-21	12	11	6	-4	-8	-13	-19	-17
630	5	5	3	-4	-10	-8	-10	-16	10	11	6	-5	-8	-13	-20	-19

Table 7

Static internal damping for LEV, 500mm length

Leo	Attenuation [dB]											
Dim.	63	125	250	500	1k	2k	4k	8k				
100	5	13	17	27	42	43	33	16				
125	2	7	10	22	36	33	22	8				
160	1	5	9	19	30	26	14	6				
200	1	4	7	15	23	17	9	4				
250	1	3	6	13	19	12	6	3				
315	2	2	5	11	13	7	4	4				
400	1	1	4	10	9	4	2	3				

Table 8

Static internal damping for LEV, 1000 mm length

	1 3		,		3									
Leo		Attenuation [dB]												
Dim.	63	125	250	500	1k	2k	4k	8k						
100	6	16	27	43	50	50	40	26						
125	1	11	19	38	50	50	36	14						
160	1	8	15	33	50	49	24	10						
200	1	8	13	28	46	35	15	8						
250	1	5	11	24	41	26	10	5						
315	1	3	9	21	28	14	7	5						
400	3	2	8	18	18	8	5	4						
500	3	2	6	11	10	7	5	5						
630	1	2	4	11	9	5	4	4						

Table 9





INSTALLATION

In order to maintain the system's measurement accuracy, it is important to install units with spacing as shown in fig. 10. For installation of Leo, a service clearance in accordance with fig. 11 is recommended.



Fig. 10: Installation



Fig. 11: Installation

COMMISSIONING

For commissioning and service, the PC software Belimo PC-Tool is used. With this service tool, the controller units can be set to the desired minimum and maximum air flow rate, 0-10 V or 2-10 V control signal and open-loop. Functional tests, which can be in presented graphic format, for documentation of the controller's operation can be carried out. A service tool that does not require PC, Belimo ZTH-VAV, is also available.

For further information, please see www.belimo.eu or contact a member of our sales team.

MAINTENANCE

No specific maintenance requirements

* ENVIRONMENT

Enquiries regarding product declaration can be directed to our sales team, or information can be found at our website: www.trox.no

ACCESSORIES

Below is an overview of accessories suitable for Leo. For further system build and wiring diagram information, please contact a member of our sales team

Belimo CR24-B, temperature controller

CR24-B is a temperature controller for room applications. The controller is available in three designs, B1, B2 and B3, with one, two and three analogue outputs respectively. It comprises a range of control functions for energy optimisation of room climate and can be used as a combined cooling and heating system.



Full data sheet can be downloaded from www.belimo.eu.

A-Sence VAV, CO2- og temperaturregulator

A-Sense-VAV is a CO2 and temperature control unit which can be connected directly to the VAV controller and an internal heating and cooling. As a result, A-Sense-VAV can, in a simple and efficient manner, regulate ventilation, heating and cooling in the climate zone. Analogue outputs and relays are pre-set and can be changed by using PC and the service software. Control areas can also be altered with push buttons.

The sensor is controlled by a microprocessor to avoid any "drifting". Calibration is done at the factory and no further

calibration will be necessary for the first 5 years. A-Sense-VAV is equipped with a display for CO2 and temperature Full data sheet can be downloaded from www.micro-matic.no.

PIR-TFT-550B, movement detector

The PIR-TFT-550B movement detector is a passive, infrared sensor. Heat emitted by people or other sources within the surveillance zone is registered through a Fresnel lens. Any movement will cause the output relay to activate ventilation, lights or other equipment in accordance with pre-set delay. When the movement stops, the output relay will, in line with pre-set delay, deactivate the equipment. If the room temperature is higher or lower than the pre-set values, the output relay will activate even if there is no movement in the zone. When the room temperature has returned to a value within the set range and there is no movement in the zone, the output relay will deactivate.



The PIR-TFT-550B has a detection angle of up to 110° and can cover up to 15 metres in length. Brackets for ceiling/wall mounting are included. Full data sheet can be downloaded from www.micro-matic.no.

Belimo UK24, **Bus-interface**

UK24 LON and UK24 EIB are used for connection to LON or EIB Bus via the VAV controller's integrated MP-Bus. With Belimo MP-Bus. up to 8 VAV controllers can be connected to one UK24. Full data sheet can be downloaded from www. belimo.eu.



Belimo COU24-A-MP, fan optimizer

For optimum fan control, Belimo COU24-A-MP Fan Optimiser can be used. The system monitors the VAV controller's damper angle via MP-Bus and reduces the fan speed as much as possible. Full data sheet can be downloaded from www.belimo.eu.



Leo is developed and manufactured by:

The company reserves the right to make amendments without prior notice.

