Volume flow rate measuring units

Type VMRK

Variant with circular spigot

Static differential pressure transducer

Tested to VDI 6022

For the measurement of volume flow rates in ducts with contaminated air

Plastic circular volume flow rate measuring units for the recording or monitoring of volume flow rates

- Manual volume flow rate measuring
- Permanent volume flow rate measuring
- Recording of measured values for other controllers or for the LABCONTROL air management system
- Pressure transducer for the automatic recording of measured values, factory assembled and complete with wiring and tubing
- Casing made of flame-resistant polypropylene (PPs)
- Casing air leakage to EN 15727, class C

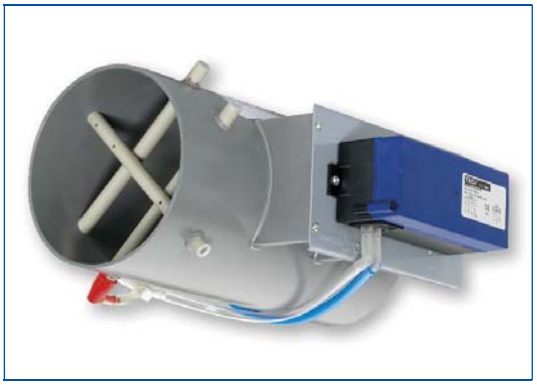
Optional equipment and accessories

- With flanges on both ends

Variants

Product examples

Volume flow rate measuring unit, variant VMRK



Volume flow rate measuring unit, variant VMRK-FL

4

Description

For detailed information on pressure transducers see chapter K5 – 4.2.

For detailed information on the LABCONTROL control system see the Control Systems catalogue.

Application
- Plastic circular volume flow rate measuring units Type VMRK for the manual or automatic measuring of volume flow rates
- Suitable for contaminated air
- Simplified commissioning, approval and maintenance
- Suitable for permanent installation because of low differential pressure

Variants
- VMRK: Volume flow rate measuring unit
- VMRK-FL: Volume flow rate measuring unit with flanges on both ends

Nominal sizes
- 125, 160, 200, 250, 315, 400

Attachments
- Static differential pressure transducer
- LABCONTROL components for air management systems

Accessories
- Matching flanges for both ends

Special features
- Measurement accuracy ± 5 % even with unfavourable upstream conditions
- Effective pressure range: approx. 5 – 250 Pa
- Low differential pressure of only about 15 – 24 % of the measured effective pressure

Parts and characteristics
- Ready-to-commission unit which consists of the mechanical parts and an optional pressure transducer
- Averaging differential pressure sensor for volume flow rate measurement; can be removed for cleaning
- Optional factory-assembled pressure transducers complete with wiring and tubing
- High measurement accuracy (even with upstream bend R = 1D)

Construction features
- Circular casing
- Spigot suitable for ducts according to DIN 8077
- Connecting nipple for tubes with 6 mm inside diameter

Materials and surfaces
- Casing made of flame-resistant polypropylene (PPs)
- Differential pressure sensor made of polypropylene (PP)

Installation and commissioning
- Installation orientation is relevant
- Static differential pressure transducer: Check zero point and correct, if necessary

Standards and guidelines
- Hygiene conforms to VDI 6022
- Casing air leakage to EN 15727, class C

Maintenance
- Maintenance-free as construction and materials are not subject to wear
- Zero point correction of the static differential pressure transducer should be carried out once per year (recommendation)

Attachments: VARYCONTROL differential pressure transducer for Type VMRK

Order code detail	Differential pressure transducer	Measurement principle
Universal		
BB0	Universal controller with separate differential pressure transducer TROX/Belimo	Static

Attachments: LABCONTROL differential pressure transducer for Type VMRK

Order code detail	Differential pressure transducer	Measurement principle
EASYLAB		
ELAB	EASYLAB TCU3 (recording of measured values for EASYLAB system)	Static
TCU-LON-II		
TM0	Electronic controller TCU-LON-II with LonWorks interface	Static

Technical data

Nominal sizes	125 – 400 mm
Volume flow rate range	25 – 1680 l/s or 90 – 6048 m^3/h
Measurement accuracy	± 5 % of the measured value
Effective pressure range	approx. 5 – 250 Pa
Measuring unit differential pressure (pressure loss)	15 – 24 % of the measured effective pressure
Operating temperature	10 – 50 °C

Order code
VARYCONTROL

VMRK

VMRK – FL / 160 / GK / BB0
1 2 3 4 5

1 Type
VMRK Volume flow rate measuring unit, plastic

2 Flange
No entry: none
FL Flanges on both ends

3 Nominal size [mm]
125
160
200
250
315
400

4 Accessories
No entry: none
GK Matching flanges for both ends

5 Attachments (differential pressure transducer)
No entry: none
BB0 Static differential pressure transducer

Order example
VARYCONTROL

VMRK/160/BB0

Nominal size	160 mm
Differential pressure transducer	Static

4

Order code

LABCONTROL

EASYLAB

VMRK with EASYLAB for the recording of measured values

VMRK – FL / 160 / GK / ELAB / EC – E0 / ULZ / ...
1 2 3 4 5 6 7 8 9

1 Type
VMRK Volume flow rate measuring unit, plastic

2 Flange
No entry: none
FL Flanges on both ends

3 Nominal size [mm]
125
160
200
250
315
400

4 Accessories
No entry: none
GK Matching flanges for both ends

5 Attachments
ELAB EASYLAB TCU3

6 Equipment function
EC Extract air recording

7 Voltage range for the actual value signal
E0 Voltage signal 0 – 10 V DC
E2 Voltage signal 2 – 10 V DC

8 Module expansions
Option 1: Power supply
No entry: 24 V AC
T EM-TRF for 230 V AC
U EM-TRF-USV for 230 V AC, provides uninterruptible power supply (UPS)

Option 2: Communication interface
No entry: none
L EM-LON for LonWorks FTT-10A
B EM-BAC-MOD-01 for BACnet MS/TP
M EM-BAC-MOD-01 for Modbus RTU
I EM-IP for BACnet/IP, Modbus/IP and webserver
R EM-IP with real time clock

Option 3: Automatic zero point correction
No entry: none
Z EM-AUTOZERO Solenoid valve for automatic zero point correction

4

Order code

LABCONTROL

EASYLAB

VMRK with EASYLAB for fume cupboard control with external signalling (frequency converter)

VMLK – FL / 160 / GK / ELAB / FH – VS / ULZS / 200 – 800

1 2 3 4 5 6 7 8

1 Type
VMRK Volume flow rate measuring unit, plastic

2 Flange
No entry: none
FL Flanges on both ends

3 Nominal size [mm]
125
160
200
250
315
400

4 Accessories
No entry: none
GK Matching flanges for both ends

5 Attachments (control component)
ELAB EASYLAB controller TCU3

6 Equipment function
With face velocity transducer
FH-VS Face velocity control
With sash distance sensor
FH-DS Linear control strategy
FH-DV Safety-optimised control strategy
With switching steps
for on-site switch contacts
FH-2P 2 switching steps
FH-3P 3 switching steps
Without signalling
FH-F Volume flow rate constant value

7 Expansion modules
Option 1: Supply voltage
No entry: 24 V AC
T EM-TRF for 230 V AC
U EM-TRF-USV for 230 V AC, provides uninterruptible power supply (UPS)

Option 2: Communication interface
No entry: none
L EM-LON for LonWorks FTT-10A
B EM-BAC-MOD-01 for BACnet MS/TP
M EM-BAC-MOD-01 for Modbus RTU
I EM-IP for BACnet/IP, Modbus/IP and webserver
R EM-IP with real time clock

Option 3: Automatic zero point correction
No entry: none
Z EM-AUTOZERO Solenoid valve for automatic zero point correction

Option 4: Lighting
No entry: none
S EM-LIGHT Wired socket for the connection of lighting and for switching the lighting on/off using the control panel (only with EM-TRF or EM-TRF-USV)

8 Operating values [m³/h or l/s]
Depending on the equipment function
VS: $\dot{V}_{min} – \dot{V}_{max}$
DS: $\dot{V}_{min} – \dot{V}_{max}$
DV: $\dot{V}_{min} – \dot{V}_{max}$
2P: $\dot{V}_1 / \dot{V}_2$
3P: $\dot{V}_1 / \dot{V}_2 / \dot{V}_3$
F: $\dot{V}_1$

Useful additions
Control panel for fume cupboard controller, for displaying the functions of the control system according to EN 14175
BE-SEG-** 2-character display
BE-LCD-01 40-character display

4

Volume flow rate ranges

Nominal size	$\dot{V}_{Nenn}$		$\dot{V}_{min}$		C-Wert		Δp_{st}	$\Delta\dot{V}$
	l/s	m³/h	l/s	m³/h	l/s	m³/h	%	± %
125	**150**	**540**	25	90	8.6	31	24	5
160	**250**	**900**	40	144	15.1	54	22	5
200	**405**	**1458**	65	234	24.3	87	19	5
250	**615**	**2214**	95	342	38.0	137	17	5
315	**1030**	**3708**	155	558	62.0	223	15	5
400	**1680**	**6048**	255	918	102.7	370	15	5

K value for air density 1.2 kg/m³, Δp_{st} in relation to the measured effective pressure

Volume flow rate calculation

Calculation conditions

- The volume flow rate is calculated based on the measured effective pressure.
- The effective pressure is measured using an electronic manometer or an inclined tube manometer
- Air density ρ = 1.2 kg/m³

Volume flow rate calculation for air density 1.2 kg/m³

$$\dot{V} = C \times \sqrt{\Delta p_w}$$

Volume flow rate calculation for other air densities

$$\dot{V} = C \times \sqrt{\Delta p_w} \times \sqrt{\frac{1.2}{\rho}}$$

Calculation example

Given data

- VMRK/160
- Δp_w = 100 Pa (manometer reading of effective pressure)
- Volume flow rate $\dot{V}$ [m³/h]

Unit data

- K value from table: K = 54 m³/h (15.1 l/s)

Calculation procedure

$$\dot{V} = 15.9 \times \sqrt{100}$$

$$\dot{V} = 159 \text{ l/s}$$

4

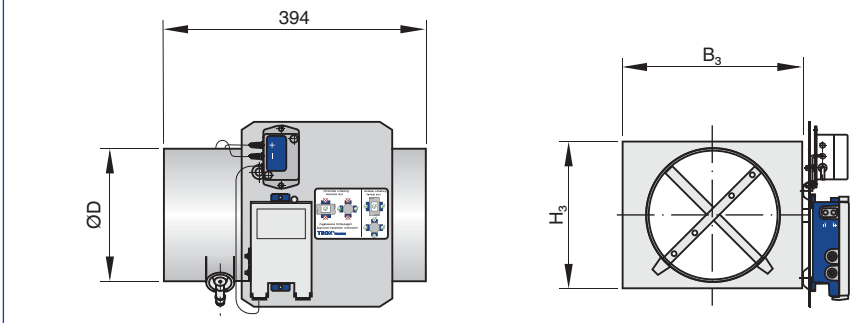
Description

- Volume flow rate measuring unit
- Spigot to make connections to the ducting

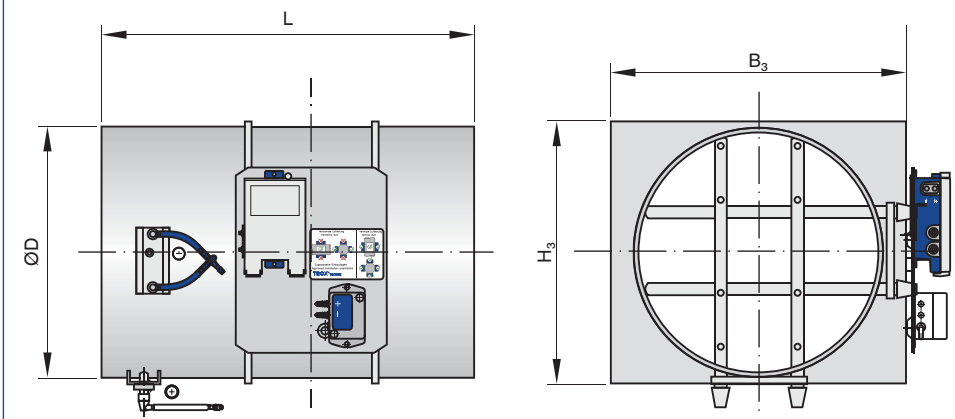
Volume flow rate measuring unit, variant VMRK

Dimensions

VMRK Nenngröße 125 – 200



VMRK nominal sizes 250 – 400



Dimensions [mm] and weight [kg]

Nominal size	ØD	L	B_3	H_3	m
	mm				kg
125	125	394	195	145	2.0
160	160	394	230	180	2.2
200	200	394	270	220	2.5
250	250	594	320	270	3.5
315	315	594	385	335	5.1
400	400	594	470	420	6.9

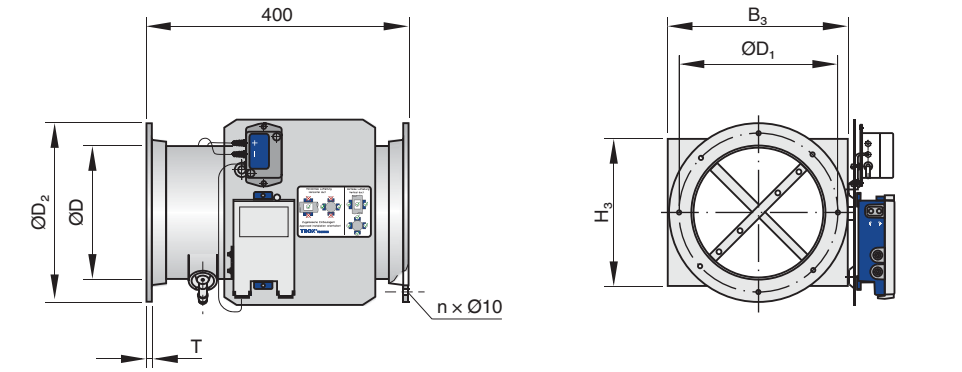
Description

- Volume flow rate measuring unit
- With flanges on both ends to make detachable connections to the ducting

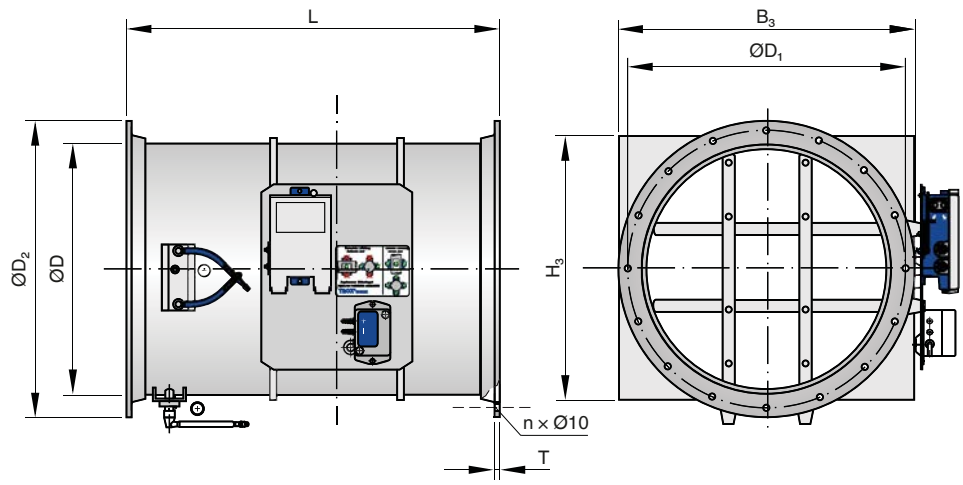
Volume flow rate measuring unit, variant VMRK-FL

Dimensions

VMRK-FL nominal size 125 – 200



VMRK-FL nominal size 250 – 400



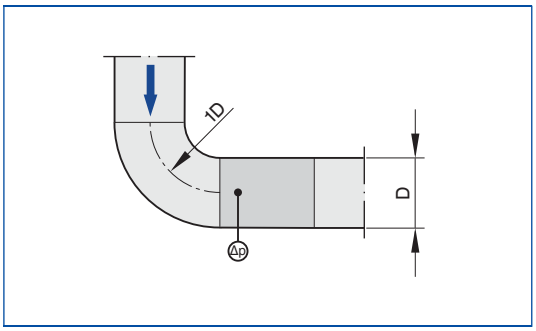
Dimensions [mm] and weight [kg]

Nominal size	ØD	L	B_3	H_3	$ØD_1$	$ØD_2$	n	T	m
	mm							mm	kg
125	125	400	195	145	165	185	8	8	2.2
160	160	400	230	180	200	230	8	8	2.6
200	200	400	270	220	240	270	8	8	3.0
250	250	600	320	270	290	320	12	8	4.4
315	315	600	385	335	350	395	12	10	6.1
400	400	600	470	420	445	475	16	10	8.2

Upstream conditions

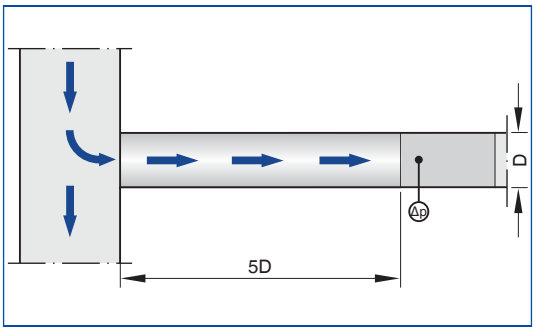
The volume flow rate accuracy ΔV̇ applies to a straight upstream section of the duct. Bends, junctions or a narrowing or widening of the duct cause turbulence that may affect measurement. Duct connections, e.g. branches off the main duct, must comply with EN 1505. Some installation situations require straight duct sections upstream.

Bend



A bend with a curvature radius of at least 1D – without an additional straight duct section upstream of the volume flow rate measuring unit – has only a negligible effect on the volume flow rate accuracy.

Junction

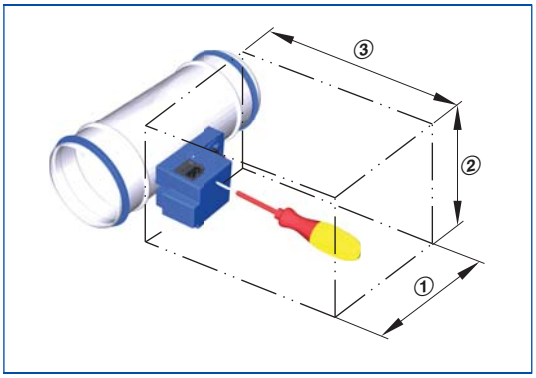


A junction causes strong turbulence. The stated volume flow rate accuracy ΔV̇ can only be achieved with a straight duct section of at least 5D upstream. Shorter upstream sections require a perforated plate in the branch and before the measuring unit. If there is no straight upstream section at all, the actual value signal may not be stable, even with a perforated plate.

Space requirement for commissioning and maintenance

Sufficient space must be kept clear near any attachments to allow for commissioning and maintenance. It may be necessary to provide sufficiently sized inspection access openings.

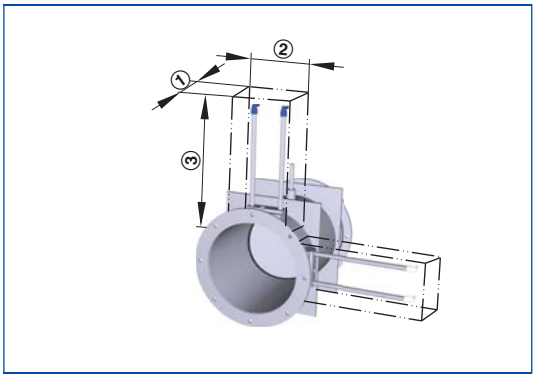
Access to attachments



Space required

Attachments	①	②	③
	mm		
Without attachments	200	200	200
VARYCONTROL			
Universal controller	300	320	300
LABCONTROL			
EASYLAB	350	350	400

Access to sensor tubes for cleaning

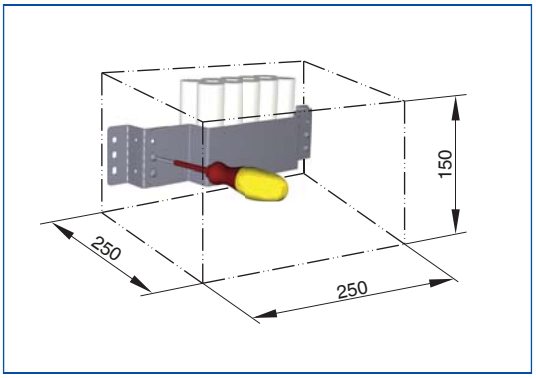


Space required

Nominal size	①	②	③
	mm		
125 – 200	100	100	D
250 – 400	100	160	D

D: Casing diameter

Access to attachments



Separate space for fixing and accessing the battery pack (LABCONTROL EASYLAB accessory)

Standard text

This specification text describes the general properties of the product. Texts for variants can be generated with our Easy Product Finder design programme.

Plastic (PPs) circular volume flow rate measuring unit for the measurement of volume flow rates in air conditioning systems, available in 6 nominal sizes. For the manual volume flow rate measuring or for the permanent monitoring of the actual value signal. Ready-to-commission unit which consists of the casing with an averaging differential pressure sensor. Spigot, suitable for ducts according to DIN 8077. Casing air leakage to EN 15727, class C.

Special features
- Measurement accuracy ± 5 % even with unfavourable upstream conditions
- Effective pressure range: approx. 5 – 250 Pa
- Low differential pressure of only about 15 – 24 % of the measured effective pressure

Materials and surfaces
- Casing made of flame-resistant polypropylene (PPs)
- Differential pressure sensor made of polypropylene (PP)

Technical data
- Nominal sizes: 125 – 400 mm
- Volume flow rate range: 25 to 1680 l/s or 90 to 6048 m^3/h
- Effective pressure range: approx. 5 – 250 Pa
- Measuring unit differential pressure (pressure loss): 15 – 24 % of the measured effective pressure
- Operating temperature: 10 to 50 °C

Attachments
Volume flow rate measurement with static differential pressure transducer emitting an actual value signal for integration into the central BMS.
- Supply voltage 24 V AC/DC
- Signal voltages 0 – 10 V DC or 2 – 10 V DC
- TCU-LON-II: Integration with LonWorks
- EASYLAB: Integration using either 0 – 10 V DC signals or expansion modules (LonWorks, BACnet MS/TP, Modbus RTU)

Sizing data
- $\dot{V}[m^3/h]$

Order options

VARYCONTROL

1 Type
VMRK Volume flow rate measuring unit, plastic

2 Flange
No entry: none
☐ **FL** Flanges on both ends

3 Nominal size [mm]
☐ **125**
☐ **160**
☐ **200**
☐ **250**
☐ **315**
☐ **400**

4 Accessories
No entry: none
☐ **GK** Matching flanges for both ends

5 Attachments (differential pressure transducer)
No entry: none
BB0 Static differential pressure transducer

4

Order options

LABCONTROL

EASYLAB

1 Type
VMRK Volume flow rate measuring unit, plastic

2 Flange
No entry: none
☐ **FL** Flanges on both ends

3 Nominal size [mm]
☐ **125**
☐ **160**
☐ **200**
☐ **250**
☐ **315**
☐ **400**

4 Accessories
No entry: none
☐ **GK** Matching flanges for both ends

5 Attachments
ELAB EASYLAB TCU3

6 Equipment function
☐ **EC** Extract air recording

7 Voltage range for the actual value signal
☐ **E0** Voltage signal 0 – 10 V DC
☐ **E2** Voltage signal 2 – 10 V DC

8 Module expansions
Option 1: Power supply
No entry: 24 V AC
☐ **T** EM-TRF for 230 V AC
☐ **U** EM-TRF-USV for 230 V AC, provides uninterruptible power supply (UPS)

Option 2: Communication interface
No entry: none
☐ **L** EM-LON for LonWorks FTT-10A
☐ **B** EM-BAC-MOD-01 for BACnet MS/TP
☐ **M** EM-BAC-MOD-01 for Modbus RTU
☐ **I** EM-IP for BACnet/IP, Modbus/IP and webserver
☐ **R** EM-IP with real time clock

Option 3:
Automatic zero point correction
No entry: none
☐ **Z** EM-AUTOZERO Solenoid valve for automatic zero point correction

4

Order options

LABCONTROL

EASYLAB

1 Type
VMRK Volume flow rate measuring unit, plastic

2 Flange
No entry: none
☐ **FL** Flanges on both ends

3 Nominal size [mm]
☐ **125**
☐ **160**
☐ **200**
☐ **250**
☐ **315**
☐ **400**

4 Accessories
No entry: none
☐ **GK** Matching flanges for both ends

5 Attachments (control component)
ELAB EASYLAB controller TCU3

6 Equipment function
With face velocity transducer
☐ **FH-VS** Face velocity control
With sash distance sensor
☐ **FH-DS** Linear control strategy
☐ **FH-DV** Safety-optimised control strategy
With switching steps
for on-site switch contacts
☐ **FH-2P** 2 switching steps
☐ **FH-3P** 3 switching steps
Without signalling
☐ **FH-F** Volume flow rate constant value

7 Expansion modules
Option 1: Supply voltage
No entry: 24 V AC
☐ **T** EM-TRF for 230 V AC
☐ **U** EM-TRF-USV for 230 V AC, provides uninterruptible power supply (UPS)

Option 2: Communication interface
No entry: none
☐ **L** EM-LON for LonWorks FTT-10A
☐ **B** EM-BAC-MOD-01 for BACnet MS/TP
☐ **M** EM-BAC-MOD-01 for Modbus RTU
☐ **I** EM-IP for BACnet/IP, Modbus/IP and webserver
☐ **R** EM-IP with real time clock

Option 3:
Automatic zero point correction
No entry: none
☐ **Z** EM-AUTOZERO Solenoid valve for automatic zero point correction

Option 4: Lighting
No entry: none
☐ **S** EM-LIGHT Wired socket for the connection of lighting and for switching the lighting on/off using the control panel (only with EM-TRF or EM-TRF-USV)

8 Operating values [m^3/h or l/s]
Depending on the equipment function
VS: $\dot{V}_{min} - \dot{V}_{max}$
DS: $\dot{V}_{min} - \dot{V}_{max}$
DV: $\dot{V}_{min} - \dot{V}_{max}$
2P: $\dot{V}_1 / \dot{V}_2$
3P: $\dot{V}_1 / \dot{V}_2 / \dot{V}_3$
F: $\dot{V}_1$

Useful additions
Control panel for fume cupboard controller, for displaying the functions of the control system according to EN 14175
☐ **BE-SEG-**** 2-character display
☐ **BE-LCD-01** 40-character display

Volume flow rate measurement

Basic information and nomenclature

- Product selection
- Principal dimensions
- Nomenclature
- Construction
- Sizing and sizing example

Product selection

	Type			
	VMR	VME	VMRK	VMLK
Type of system				
Supply air	●	●	●	●
Extract air	●	●	●	●
Duct connection				
Circular	●		●	●
Rectangular		●		
Volume flow rate range				
Up to [m^3/h]	6048	36360	6048	1854
Up to [l/s]	1680	10100	1680	515
Air quality				
Filtered	●	●	●	●
Office extract air	●	●	●	●
Polluted	○	○	●	●
Contaminated	○	○	●	●
Volume flow rate measurement				
Manually	●	●	●	
Automatically	○	○	○	●
Special areas				
Labs, clean rooms, operating theatres (EASYLAB, TCU-LON II)	●	●	●	●

●	Possible
○	Possible under certain conditions: Robust unit variant and/or specific differential pressure transducer
	Not possible

4

Principal dimensions

ØD [mm]
VAV terminal units made of stainless steel:
Outside diameter of the spigot
VAV terminal units made of plastic:
Inside diameter of the connecting spigot

$ØD_1$ [mm]
Pitch circle diameter of flanges

$ØD_2$ [mm]
Outside diameter of flanges

$ØD_4$ [mm]
Inside diameter of the screw holes of flanges

L [mm]
Length of unit including connecting spigot

L_1 [mm]
Length of casing or acoustic cladding

B [mm]
Duct width

B_1 [mm]
Screw hole pitch of flange (horizontal)

B_2 [mm]
Outside dimension of flange (width)

B_3 [mm]
Width of device

H [mm]
Duct height

H_1 [mm]
Screw hole pitch of flange (vertical)

H_2 [mm]
Outside dimension of flange (height)

H_3 [mm]
Unit height

n [ ]
Number of flange screw holes

T [mm]
Flange thickness

m [kg]
Weight including attachments for the automatic differential pressure measurement

Nomenclature

$\dot{V}_{nom}$ [m^3/h] and [l/s]
Nominal volume flow rate (100 %)

$\dot{V}_{min}$ [m^3/h] and [l/s]
Volume flow rate

$\Delta\dot{V}$ [± %]
Volume flow rate accuracy

K value [m^3/h] and [l/s]
Unit-related constant for air density 1.2 kg/m^3

Δp_w [Pa]
Effective pressure

Δp_{st} [%]
Static differential pressure in relation to the measured effective pressure

Constructions

Galvanised sheet steel
- Casing made of galvanised sheet steel
- Parts in contact with the airflow as described for the product type
- External parts, e.g. mounting brackets or covers, are usually made of galvanised sheet steel

Powder-coated surface (P1)
- Casing made of galvanised sheet steel, powder-coated RAL 7001, silver grey
- Parts in contact with the airflow are powder-coated or made of plastic
- Due to production, some parts that come into contact with the airflow may be stainless steel or aluminium, powder-coated
- External parts, e.g. mounting brackets or covers, are usually made of galvanised sheet steel

Stainless steel (A2)
- Casing made of stainless steel 1.4201
- Parts in contact with the airflow are powder-coated or made of stainless steel
- External parts, e.g. mounting brackets or covers, are usually made of galvanised sheet steel

Sizing with the help of this catalogue

This catalogue provides convenient quick sizing tables for volume flow rate measuring unit, based on aerodynamic data. Volume flow rate ranges are provided for all nominal sizes.

Sizing example

Given data

$\dot{V}_{max}$ = 280 l/s (1010 m³/h)

Quick sizing

VMR/200
C = 25.5 l/s (92 m³/h)
Δp_{st} = 19 %
Δp_w = 121 Pa
Δp_{st} = 23 Pa (121 Pa × 0,19)

Easy Product Finder

The Easy Product Finder allows you to size products using your project-specific data.

You will find the Easy Product Finder on our website.