VMR with control component BTD

Type VMR with control component XTD

Type VMR with control component ELAB TCU3

Tested to VDI 6022

Volume flow rate measurement

VMR

For the measurement of volume flow rates in ducts

Circular volume flow rate measuring device for recording or monitoring the volume flow rate

- Manual volume flow rate measuring
- Permanent volume flow rate measuring
- Recording of measured values for other controllers or for the LABCONTROL air management system
- Effective pressure transducer for the automatic recording of measured values, factory assembled
- With wiring and tubing
- Casing leakage according to EN 15727, Class C

Optional equipment and accessories

- With flanges on both ends
- Lip seal
- Dynamic or static effective pressure transducer

General information

Application
- Circular volume flow rate measuring units for the manual or automatic measuring of volume flow rates
- Simplified commissioning, approval and maintenance
- Suitable for permanent installation because of low differential pressure
- Optional static effective pressure transducer for systems with contaminated air

Special features
- Suitable for permanent installation because of low differential pressure
- High measurement accuracy (even with upstream bend R = 1D)

Nominal sizes
- 100, 125, 160, 200, 250, 315, 400 mm

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

Construction
- Galvanised sheet steel
- P1: Powder-coated, silver grey (RAL 7001)
- A2: Stainless steel

Parts and characteristics
- Ready-to-commission unit which consists of the mechanical parts and optional effective pressure transducers
- Averaging differential pressure sensor for volume flow rate measurement
- Optional effective pressure transducers, factory-assembled and wired
- High measurement accuracy of volume flow rates (even with bend R = 1D).

Attachments
- Dynamic effective pressure transducer (BTD, XTD)
- Static effective pressure transducer (BTS, XTS)
- LABCONTROL: Components for air management systems

Accessories
- G2: Matching flanges for both ends
- D2: Double lip seals on both ends (factory fitted)

Construction features
- Circular casing
- Spigot suitable for circular ducts to EN 1506 or EN 13180
- Spigots with groove for seal
- TVR-FL: Flanges to EN 12220

Materials and surfaces
Galvanised sheet steel construction
- Casing and damper blade made of galvanised sheet steel
- Aluminium sensor tubes

Powder-coated construction (P1)
- Casing made of galvanised sheet steel, powder-coated
- Sensor tubes made of aluminium, powder-coated

Stainless steel construction (A2)
- Casing, damper blade and shaft made of stainless steel 1.4301
- Sensor tubes made of aluminium, powder-coated

Standards and guidelines
Fulfils the hygiene requirements of
- EN 16798, Part 3
- VDI 6022, Sheet 1
- DIN 1946, Part 4
- Further standards, guidelines in accordance with hygiene certificate

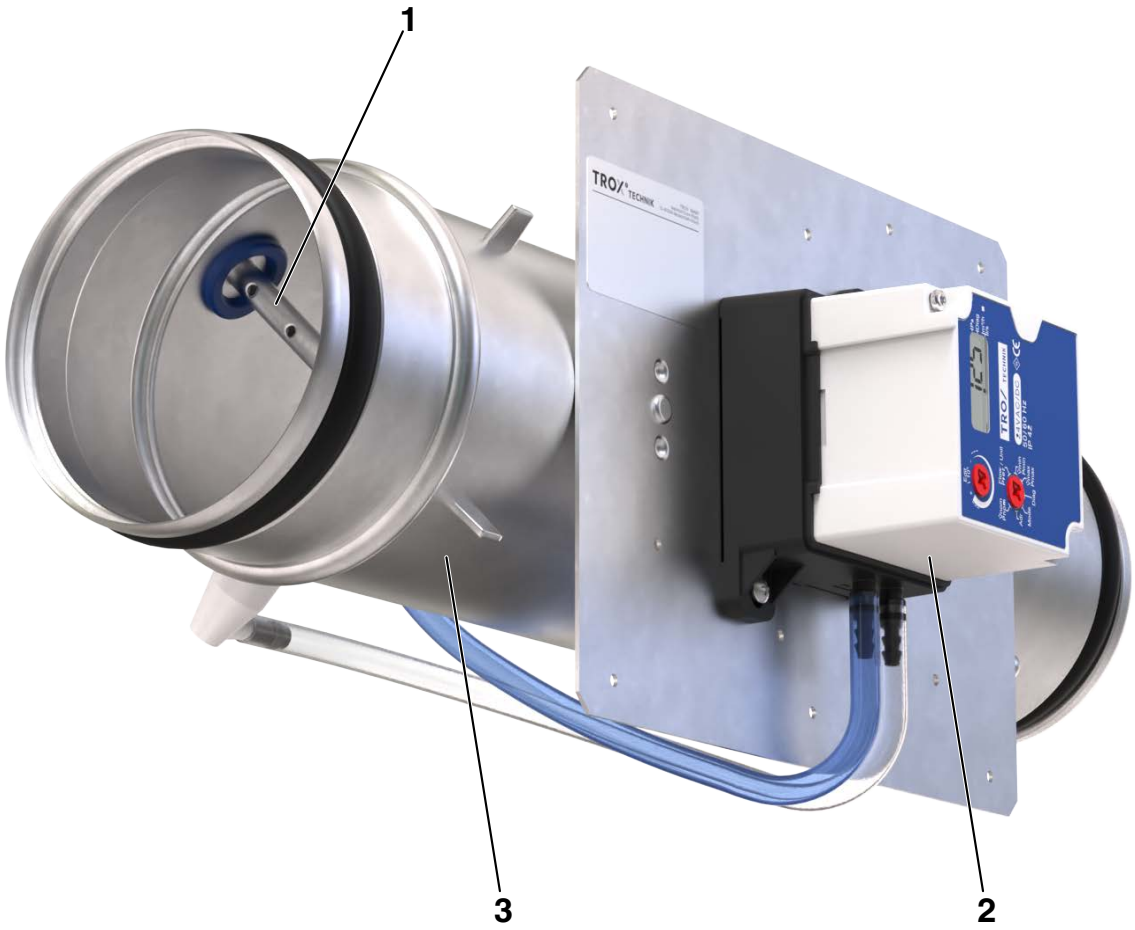
Casing leakage
- EN 1751, Class C

Maintenance
- Maintenance-free as construction and materials are not subject to wear

Function

The volume flow rate measuring unit is fitted with an effective pressure sensor for measuring the volume flow rate. The effective pressure is either measured and evaluated manually, or transformed into an electric signal by a measuring transducer (effective pressure transducer).

VMR with control component XTS



1: Effective pressure sensor
2: Measuring transducer
3: Casing

Technical data

Nominal sizes	100 – 400 mm
Volume flow rate range	34 – 6279 m³/h bzw. 10 – 1744 l/s
Maximum differential pressure	1000 Pa
Effective pressure range	Approx. 2 – 260 Pa *
Measurement accuracy	5 – 16 %
Operating temperature	10 to 50 °C

* 260 Pa of the nominal volume flow rate

Quick sizing

Die Schnellauslegung gibt einen guten Überblick über die Volumenstrommessbereiche, Messgenauigkeiten und die C-Werte der einzelnen Nenngrößen. Berechnung der Volumenströme aus den gemessenen Wirkdrücken bei Ausführung ohne Anbauteile siehe in Abschnitt „Produktdetails“.

Volume flow rate ranges and minimum differential pressure values
Attachment: Without attachment, XTD, BTD

NS	qv [l/s]	qv [m³/h]	C-value [l/s]	C-value [m³/h]	Δqv [±%]
100	10	34	6,1	22,0	16
100	98	354	6,1	22,0	6
125	16	55	10,0	35,9	16
125	160	578	10,0	35,9	6
160	25	88	16,0	57,6	16
160	257	928	16,0	57,6	6
200	40	143	26,1	93,8	16
200	420	1512	26,1	93,8	6
250	60	216	39,5	142,2	16
250	636	2292	39,5	142,2	6
315	100	359	65,6	236,2	16
315	1057	3807	65,6	236,2	6
400	165	591	108,2	389,5	16
400	1744	6279	108,18	389,5	5

Note:

- K values for air density 1.2 kg/m³ at 20 °C

Volume flow rate ranges and minimum differential pressure values
Attachment: XTS, BTS, ELAB

NS	qv [l/s]	qv [m³/h]	C-value [l/s]	C-value [m³/h]	Δqv [±%]
100	14	50	6,1	22,0	14
100	98	354	6,1	22,0	6
125	23	81	9,9	35,9	13
125	160	578	9,9	35,9	6
160	36	129	16,0	57,6	14
160	257	928	16,0	57,6	6
200	59	210	26,1	93,8	13
200	420	1512	26,1	93,8	6
250	89	318	39,5	142,2	14
250	636	2292	39,5	142,2	6
315	147	529	65,6	236,2	13
315	1057	3807	65,6	236,2	6
400	242	871	108,2	389,5	13
400	1744	6279	108,2	389,5	5

Note:

- K values for air density 1.2 kg/m³ at 20 °C

Specification text

This specification text describes just one variant of the product and applies to many applications. Texts for variants can be generated with our Easy Product Finder design program.

Specification text

Circular volume flow rate measuring unit for the measurement of volume flow rates in ventilation and air conditioning systems, available in 7 nominal sizes. For manual volume flow rate measurement 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. Differential pressure sensor with 3 mm measuring holes, hence resistant to contamination.

Special features

- Suitable for permanent installation because of low differential pressure
- High measurement accuracy (even with upstream bend R = 1D)

Materials and surfaces

Galvanised sheet steel construction

- Casing made of galvanised sheet steel
- Aluminium sensor tubes

P1: Powder-coated construction (P1)

- Casing made of galvanised sheet steel, surface powder coated, silver (RAL 7001)
- Sensor tubes made of aluminium, powder-coated

A2: Stainless steel construction (A2)

- Casing made of stainless steel 1.4301
- Sensor tubes made of aluminium, powder-coated

Connection

Spigot with groove for lip seal, suitable for ducts to EN 1506 or EN 13180

- FL: Flanges on both ends according to EN 12220

Technical data

- Nominal sizes: 100 to 400 mm
- Volume flow rate range: 34 – 6279 m³/h or 10 – 1744 l/s
- Effective pressure range: approx. 2 – 260 Pa
- Measurement accuracy: 5 – 16 %
- Operating temperature: 10 to 50 °C
- Casing air leakage to EN 1751, Class C

Order code

VMR – P1 – FL / 160 / G2 / BTD / 0
1 2 3 4 5 6 7

1 Type
VMR Circular volume flow rate measuring unit

2 Material
No entry required: Galvanised sheet steel
P1 Powder-coated RAL 7001, silver grey
A2 Stainless steel construction

3 Flange
No entry required: None
FL Flanges on both ends

4 Nominal size [mm]
100, 125, 160, 200, 250, 315, 400

5 Accessories
No entry required: None
D2 Lip seals on both ends
G2 Matching flanges both sides

6 Attachments (effective pressure transducer)
No entry required: None
XTD dynamic effective pressure transducer, analogue, display
BTD dynamic effective pressure transmitter, analogue, and MP-Bus, Modbus RTU, BACnet MS/TP
XTS static effective pressure transducer, analogue, display
BTS static effective pressure transmitter, analogue, and MP-Bus, Modbus RTU, BACnet MS/TP

7 Signal voltage range
Only required if attachment is selected
For the actual value signal
0 0 – 10 V DC
2 2 – 10 V DC

Order example 1: VMR-P1-FL/315/G2/XTS/0

Material	Powder-coated, RAL 7001, silver grey
Duct connection	Flanges on both ends
Nominal size	315 mm
Accessories	Matching flanges on both ends
Attachments (effective pressure transducer)	Static effective pressure transducer with display
Signal voltage range Actual value signal	0 – 10 V DC

Order example 2: VMR/160/BTS/2

Duct connection	Spigot
Nominal size	160 mm
Attachments (effective pressure transducer)	Dynamic effective pressure transducer with bus interface
Signal voltage range Actual value signal	2 – 10 V DC

VMR – P1 – FL / 160 / G2 / ELAB / EC – E0 / UMZ
1 2 3 4 5 6 7 8 9

1 Type
VMR Circular volume flow rate measuring unit

2 Material
No entry: galvanised sheet steel
P1 Powder-coated surface RAL 7001, silver grey (RAL 7001)
A2 Stainless steel construction

3 Flange
No entry required: None
FL Flanges on both ends

4 Nominal size [mm]
100
125
160
200
250
315
400

5 Accessories
No entry required: None
D2 Lip seals on both ends
G2 Matching flanges both sides

6 Attachments (effective pressure transducer)
ELAB EASYLAB TCU3

7 Equipment function
SC Supply air recording
EC Extract air recording

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

9 Expansion modules
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 required: None
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 web server
R EM-IP with real time clock

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

Order example 1: VMR-P1-FL/200/ELAB/EC/E2/TZ

Material	Powder-coated, RAL 7001, silver grey
Nominal size	200 mm
Attachments	EASYLAB TCU3
Equipment function	Extract air controller
external volume flow rate setting	Voltage signal 2 – 10 V DC
Expansion module	With expansion module EM-TRF, transformer for 230 V AC supply with expansion module EM-AUTOZERO, solenoid valve for automatic zero point correction

Variants

Volume flow rate measuring unit VMR

- Spigot

Volume flow rate measuring unit VMR-FL

- With flanges on both ends to make detachable connections to the ducting

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Material

Standard construction

Order code detail	Part	Material
–	Effective pressure sensor	Aluminium tube
	Casing	Galvanised sheet steel

Powder-coated construction

Order code detail	Part	Material
P1	Effective pressure sensor	Aluminium - powder coated, RAL 7001, silver grey
	Casing	Galvanised sheet steel - powder coated, RAL 7001, silver grey

Stainless steel construction

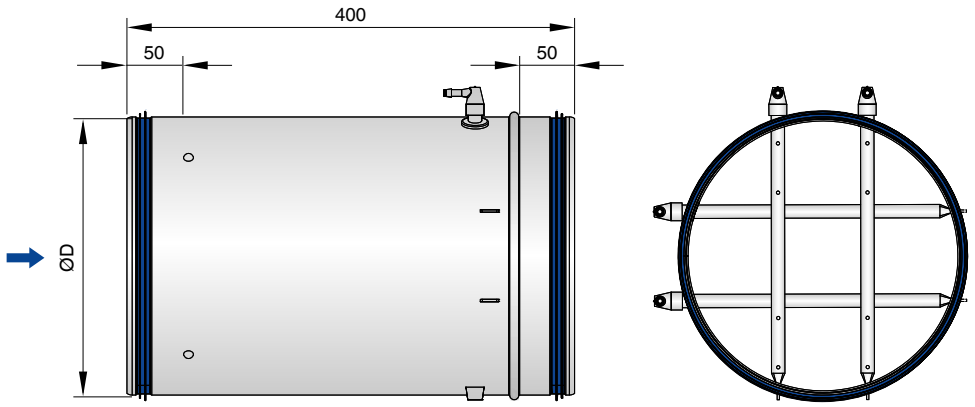
Order code detail	Part	Material
A2	Effective pressure sensor	Aluminium - powder coated, RAL 7001, silver grey
	Casing	Stainless steel, material no. 1.4301

Option double lip seal

Order code detail	Part	Material
D2	Double lip seal	Rubber, EPDM

Dimensions and weight

VMR

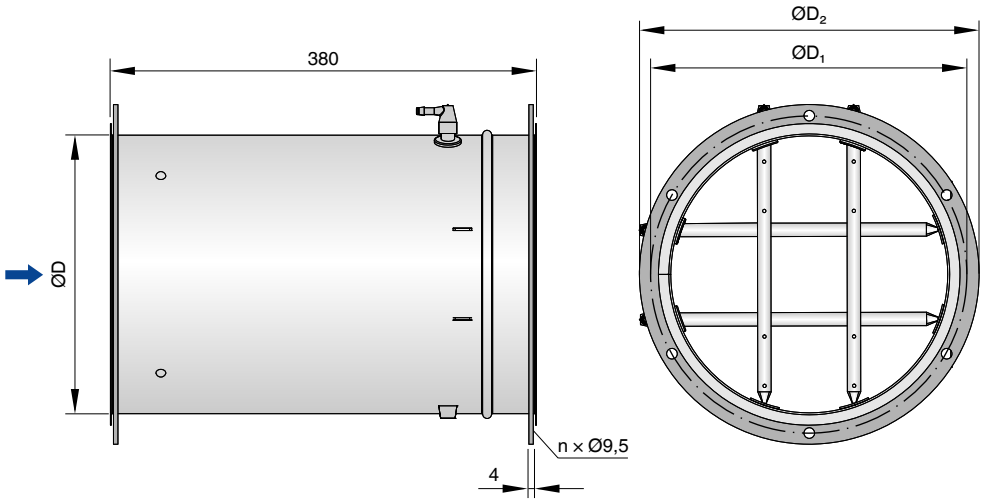


Dimensions/weights for VMR (standard)

NS	ØD	kg
100	99	0.8
125	124	1
160	159	1.2
200	199	1.6
250	249	1.9
315	314	2.4
400	399	3.1

Note:
Weight value only for VMR without attachment.
Note possible additional weights due to optional effective pressure transducers (BTD, XTD, BTS, XTS, ELAB attachments) depending on the construction.

VMR-FL



Dimensions/weights for VMR-FL

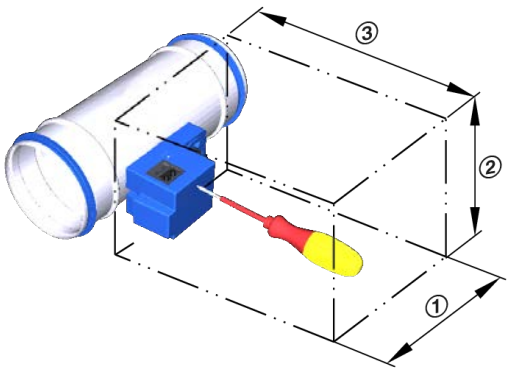
NS	∅D	∅D₁	∅D₂	D	n	kg
100	99	132	152	4	4	1.2
125	124	157	177	4	4	1.5
160	159	192	212	4	6	2.1
200	199	233	253	4	6	2.7
250	249	283	303	4	6	3.3
315	314	352	378	4	8	4.5
400	399	438	464	4	8	5.7

Note:
Weight value only for VMR-FL without attachment.
Note possible additional weights due to optional effective pressure transducers (BTD, XTD, BTS, XTS, ELAB attachments) depending on the construction. Note: Tolerances for dimensions L: ±5 mm

Space required for commissioning and maintenance

Keep sufficient space free in the area of the attachments for commissioning and maintenance. It may be necessary to provide sufficiently sized inspection access openings.
The selected product illustrations do not contain information on possible installation situations. Some attachments require a certain installation orientation; this is specified on the product's installation orientation label.

Access to attachments



Schematic illustration of required installation space

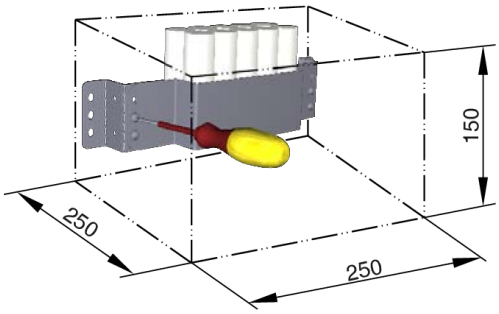
Assembly overview of attachments

XTD/XTS, BTD/BTS, ELAB

Space required

Attachment	①	②	③
Effective pressure transducer: XTD, XTS	250	200	250
Effective pressure transducer: BTD, BTS	520	250	250
Effective pressure transducer: ELAB	550	350	400

Accessibility to the battery pack



Schematic illustration of required installation space

Note: Additional space for fixing and accessing the battery pack (optional accessory for TROX UNIVERSAL or LABCONTROL EASYLAB control component).

Product details

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

Required

- VMR/160
- Δ_{pw} = 100 Pa (manometer reading of effective pressure)
- Volume flow rate q_v in m³/h

Device data

- K value from table: K = 58 m³/h (16.11 l/s)

Volume flow rate calculation for air density 1.2 kg/m³

$$q_v = C \times \sqrt{\Delta p_w}$$

Volume flow rate calculation for other air densities

$$q_v = \sqrt{\frac{1{,}2}{\rho}} \times C \times \sqrt{\Delta p_w}$$

Calculation procedure

$$q_v = 58\ m^3/h \times \sqrt{100}$$

$$q_v = 580\ m^3/h$$

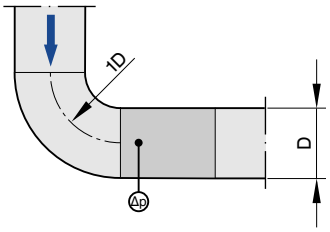
Installation and commissioning

- The installation orientation of ELAB must be as shown on the sticker
- Installation orientation of XTD/XTS and BTD/BTS attachments not critical

Upstream conditions

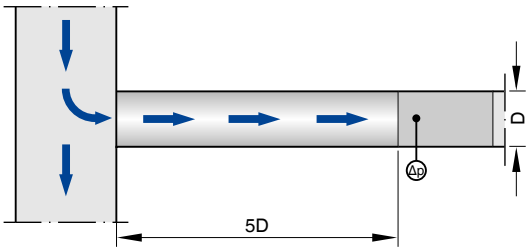
The volume flow rate accuracy Δ_{qv} applies for a straight upstream flow. Bends, junctions or a narrowing or widening of the duct cause turbulence that may affect measurement. Duct connections, e.g. branches off the main duct, must comply with EN 1505. Some installation situations require straight duct 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 turbulences. The stated volume flow rate accuracy Δq_v can only be achieved with a straight duct section of at least 5D upstream.

Installation component

Attachment	Interface	Effective pressure transducer	Manufacturer
Effective pressure transducer, dynamic			
XTD	0 – 10 V or 2 – 10 V	integral	①
BTD	0 - 10 V or 2 - 10 V or MP bus or Modbus RTU or BACnet MS/TP	integral	②
Effective pressure transducer, static			
XTS	0 – 10 V or 2 – 10 V	integral	①
BTS	0 - 10 V or 2 - 10 V or MP bus or Modbus RTU or BACnet MS/TP	integral	②
ELAB	TROX plug and play communication system and 0 - 10 V or 2 - 10 V or with optional accessories: Modbus, BACnet, web server	integral	③

① TROX/Gruner, ② TROX/Belimo, ③ TROX

Nomenclature

Dimensions of rectangular units

B [mm]
Duct width

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

B_2 [mm]
Overall dimension of flange (width)

H [mm]
Duct height

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

H_2 [mm]
Overall dimension of flange (height)

Dimensions of circular units

ØD [mm]
Basic units made of sheet steel: Outer diameter of the spigot; basic units made of plastic: Inside diameter of the spigot

$ØD_1$ [mm]
Pitch circle diameter of flanges

$ØD_2$ [mm]
Outer diameter of flanges

L [mm]
Length of unit including connecting spigot

L_1 [mm]
Length of casing or acoustic cladding

n [ ]
Number of flange screw holes

T [mm]
Flange thickness

General information

m [kg]
Unit weight without any attachments

NS [mm]
Nominal size

q_{vNom} [m³/h]; [l/s]
Nominal volume flow rate (100 %): The value depends on product type and nominal size. Values are published on the internet and in technical leaflets and stored in the Easy Product Finder design program.

Note on acoustic data: All sound pressure levels are based on a reference value of 20 µPa.

q_v [m³/h]; [l/s]
Volume flow rate

Δ_{qv} [%]
Volume flow rate accuracy

Δ_{pw}
Quantity measured with the sensor (in this case the differential pressure). Basis for the calculation of the actual volume flow rate or for the conversion into an electrical signal (linear to the volume flow rate) by an effective pressure transducer.

Lengths
All lengths are given in millimetres [mm] unless stated otherwise.

Volume flow rate measuring unit
Consists of a basic unit and an optional effective pressure transducer.

Basic unit
Unit for recording volume flow rates without an attached measuring transducer. The main components include the casing with sensor(s) to measure the effective pressure and the connection points for effective pressure tubes. In contrast to a volume flow controller, there is no damper blade. Distinguishing features of the basic unit: unit shape (geometry), materials and types of connection. The basic unit can either be prepared for manual measurement with a mobile differential pressure measuring unit or be fitted with an electric attachment for converting the effective pressure into an electrical (effective pressure transducer).

Effective pressure transducer
Electronic device mounted on the basic unit for measuring volume flow rates. The electronic device essentially consists of an effective pressure transducer. Important distinguishing features: Transducer for dynamic pressure measurements that is suitable for clean air or transducer for static pressure measurements that is suitable for contaminated air and interface(s) (analogue interface and digital bus interface).