



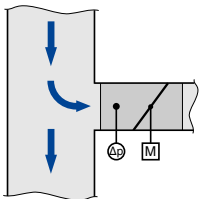
Easy controller



Compact controller



Nozzle for effective pressure measurement



For all upstream conditions



Tested to VDI 6022

# Variable volume flow control VAV terminal units

## LVC



### For low airflow velocities and low duct pressures

Circular VAV terminal units for supply air and extract air systems with variable volume flows, low airflow velocities and low duct pressures

- New measurement principle, optimised for airflow velocities from 0.6 to 6 m/s
- High control accuracy even in case of unfavourable upstream conditions
- Electronic control components for different applications (Easy, Compact)
- Easy to use thanks to innovative control technology
- Casing length of only 310 mm for all nominal sizes
- Any installation orientation
- Closed blade air leakage to EN 1751, up to class 2
- Casing air leakage to EN 1751, class C

Optional equipment and accessories

- Secondary silencer Type CA, CS or CF for the reduction of air-regenerated noise
- Hot water heat exchanger Type WL and electric air heater Type EL for reheating the airflow

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## General information

### Application

- Circular VAV terminal units for use in ventilation and air conditioning systems
- For controlling, restricting, or shutting off supply and extract air flows
- For low airflow velocities and low duct pressures
- Closed-loop volume flow control using an external power supply
- For variable or constant volume flow systems
- Shut-off by means of switching (by others)

### Special features

- Optimised for low airflow velocities from 0.6 to 6 m/s
- High control accuracy even in case of unfavourable upstream conditions
- Any installation orientation
- Volume flow rate control with Easy or Compact controller
- Casing length of only 310 mm
- Effective pressure measurements upstream and downstream of the damper blade
- The relation between damper blade position and differential pressure is stored as a characteristic relationship in the controller

### Nominal sizes

- 125, 160, 200, 250

### Parts and characteristics

- Ready-to-commission unit which consists of mechanical parts and control components.
- Plastic nozzle with integral damper blade to measure the volume flow rate
- Wire clamping bracket
- Double lip seal
- Factory assembled control components complete with wiring and tubing
- Aerodynamic functional testing on a special test rig before shipping of each unit
- Set-up data is given on a label or volume flow rate scale affixed to the unit
- High control accuracy even in case of unfavourable upstream conditions

### Attachments

- EASY controller: Compact unit consisting of controller with potentiometers, effective pressure transducer and actuator
- Compact controller: Compact unit consisting of controller with potentiometers, effective pressure transducer and actuator

### Useful additions

- Circular silencer Type CA, CS or CF

### Construction features

- Circular casing
- Spigot with double lip seal, for circular ducts to EN 1506 or EN 13180
- Position of the damper blade indicated externally at shaft extension

### Easy controller

- Screw terminals for the electrical connection
- Double terminals for looping the supply voltage, i.e. for the simple connection of voltage transmission
- Wire clamping bracket fixed to the casing

### Compact controller

- Cable for the electrical connection

### Materials and surfaces

- Casing made of galvanised sheet steel
- Nozzle, damper blade, and plain bearings made of ABS plastic, UL 94, flame retardant (V-0)
- Damper blade seal made of TPV (plastic)

### Standards and guidelines

Meets the hygiene requirements of

- EN 16798, Part 3
- VDI 6022, Sheet 1
- DIN 1946, Part 4
- For other applicable standards and guidelines refer to the hygiene certificate

### Casing leakage

- EN 1751, Class C

### Closed blade air leakage:

#### Nominal size 125

- EN 1751, Class 2
- Meets the general requirements of DIN 1946, part 4, with regard to the acceptable closed blade air leakage

#### Nominal sizes 160 – 250

- EN 1751, Class 1

### Maintenance

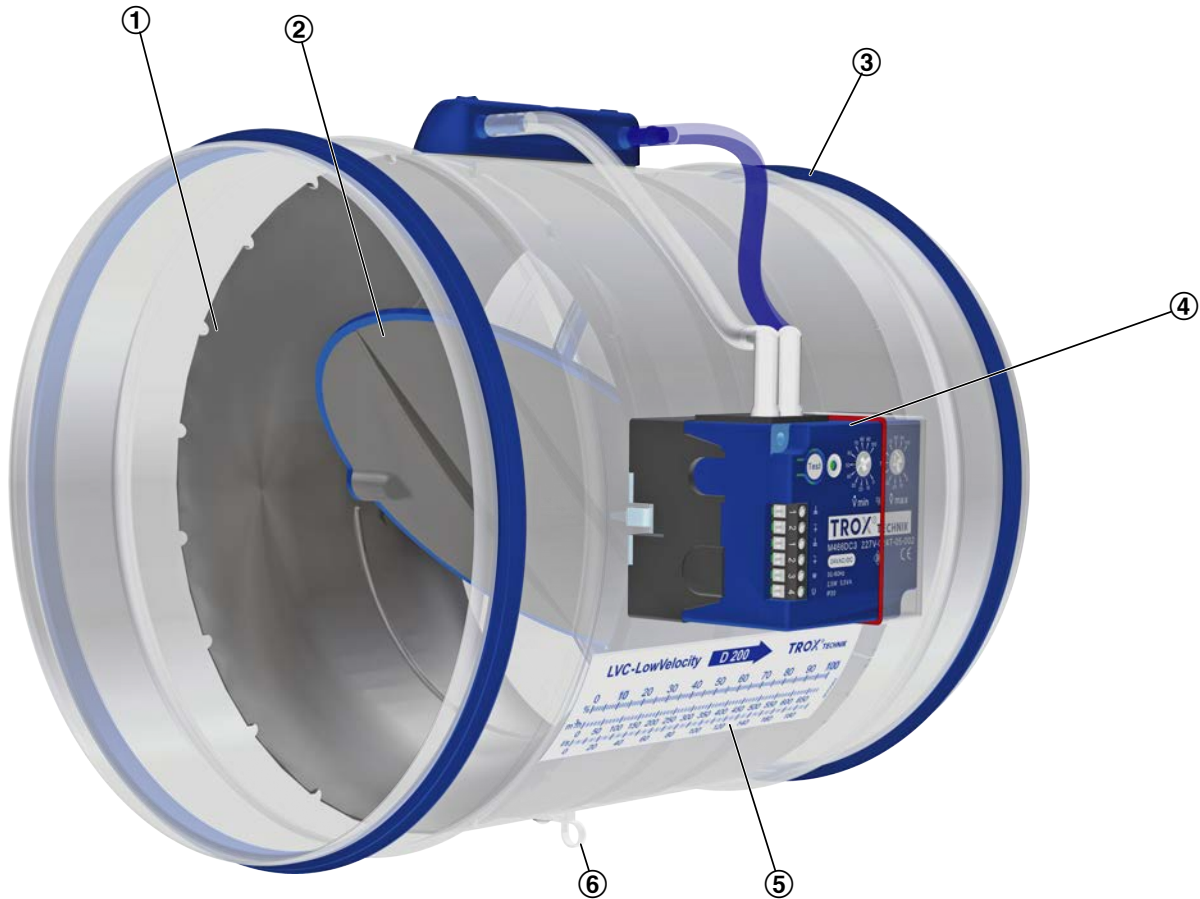
- Maintenance-free as construction and materials are not subject to wear

## Function

A new measurement principle makes it possible to measure low volume flow rates. The pressure is measured by means of a nozzle with pressure taps upstream and downstream of the damper blade. The Easy controller or the Compact controller of the LVC determines the resulting effective pressure and

compares it to the stored characteristic. This measurement principle is characterised by small measuring tolerances, and the upstream conditions do not have to meet any special requirements.

Schematic illustration of the LVC



- ① Plastic nozzle
- ② Damper blade
- ③ Double lip seal
- ④ Easy controller
- ⑤ Volume flow rate scale
- ⑥ Wire clamping bracket

### Technical data

Nominal sizes	125 – 250 mm
Volume flow rate range	9 – 300 l/s or 30 – 1080 m³/h
Volume flow rate control range	Approx. 10 – 100 % of the nominal volume flow rate
Minimum differential pressure	Up to 33 Pa (without circular silencer)
Maximum differential pressure	600 Pa
Operating temperature	10 to 50 °C

### Quick sizing

Quick sizing tables provide a good overview of the minimum differential pressures, the volume flow rate accuracy and the room sound pressure levels that can be expected. Intermediate values may be achieved by interpolation.

The sound power levels for calculating the sound pressure levels were measured in the TROX laboratory according to DIN EN ISO 5135 - see "Basic information and nomenclature".

Precise results and spectral data for all control components can be calculated with our Easy Product Finder design program. The first selection criteria for the nominal size are the actual volume flow rates  $q_{vmin}$  and  $q_{vmax}$ .

#### Volume flow rate ranges and minimum differential pressure values

The minimum differential pressure of VAV terminal units is an important factor in designing the ductwork and in rating the fan including speed control. It must be ensured that for all operating conditions and for all terminal units a sufficient pressure differential is applied to each controller ( $\Delta p_{stat,min}$ ). The measurement points for fan speed control must be selected accordingly. The volume flow rates given for VAV terminal units depend on the nominal size and on the control component (attachment) that is installed.

#### Volume flow rate ranges and minimum differential pressure values

Controller for dynamic measurements

Attachment: Easy, BC0

NS	qv [l/s]	qv [m³/h]	$\Delta p_{stmin}$ [Pa]				$\Delta qv$ [±%]
			①	②	③	④	
125	9	30	1	1	1	1	15
125	31	110	6	6	7	7	9
125	53	190	16	18	19	21	7
125	75	270	33	36	39	41	6
160	13	45	1	1	1	1	16
160	48	173	5	6	6	6	9
160	84	302	15	16	17	18	7
160	119	430	30	32	34	36	6
200	20	70	1	1	1	1	16
200	76	275	5	6	6	6	9
200	133	480	15	16	17	17	7
200	190	685	31	32	33	35	6
250	31	110	1	1	1	1	16
250	120	433	5	6	6	6	9
250	210	757	15	16	16	17	7
250	300	1080	31	32	33	34	6

① Basic unit

② Basic unit with circular silencer CS/CF, insulation thickness 50 mm, length 500 mm

③ Basic unit with circular silencer CS/CF, insulation thickness 50 mm, length 1000 mm

④ Basic unit with circular silencer CS/CF, insulation thickness 50 mm, length 1500 mm

## Quick sizing table for sound pressure level

The quick sizing tables are based on generally accepted attenuation and insulation levels. If the sound pressure level exceeds the required level, a larger air terminal unit and/or a silencer or acoustic cladding is required. For more information on the acoustic data, see basic information and nomenclature.

## Quick sizing table for air-regenerated noise $L_{PA}$

Controller including silencer

NS	qv [l/s]	qv [m³/h]	150 Pa				500 Pa			
			①	②	③	④	①	②	③	④
125	9	30	39	20	< 15	< 15	50	31	22	16
125	31	110	47	32	26	23	58	42	36	31
125	53	190	50	37	32	29	61	47	41	37
125	75	270	52	40	36	32	63	50	45	41
160	13	45	40	27	21	15	52	38	31	25
160	48	173	45	33	27	23	56	43	36	31
160	84	302	47	35	31	27	59	45	39	35
160	119	430	48	37	33	30	60	46	41	38
200	20	70	42	30	24	19	53	41	34	29
200	76	275	46	34	29	25	57	45	38	34
200	133	480	47	36	31	28	59	46	40	36
200	190	685	47	36	32	29	58	46	40	37
250	31	110	43	34	30	26	54	47	42	39
250	120	433	47	39	34	30	59	51	46	42
250	210	757	47	39	34	30	59	51	46	42
250	300	1080	47	39	34	30	59	51	46	42

Air-regenerated noise  $L_{PA}$  [dB(A)] with static differential pressure  $\Delta_{pst}$  of 150 or 500 Pa

- ① Basic unit
- ② Basic unit with circular silencer CS/CF, insulation thickness 50 mm, length 500 mm
- ③ Basic unit with circular silencer CS/CF, insulation thickness 50 mm, length 1000 mm
- ④ Basic unit with circular silencer CS/CF, insulation thickness 50 mm, length 1500 mm

## Quick sizing table for case-radiated noise $L_{PA}$

NS	qv [l/s]	qv [m³/h]	150 Pa	500 Pa
125	9	30	22	34
125	31	110	28	41
125	53	190	31	43
125	75	270	33	45
160	13	45	21	34
160	48	173	29	42
160	84	302	32	45
160	119	430	34	47
200	20	70	22	35
200	76	275	29	43
200	133	480	32	46
200	190	685	34	48
250	31	110	28	40
250	120	433	35	48
250	210	757	38	51
250	300	1080	40	53

Case-radiated noise  $L_{PA}$  [dB(A)] with static differential pressure  $\Delta_{pst}$  of 150 or 500 Pa



Note:  
Information on case-radiated noise for combinations of basic unit and secondary silencer can be found in the Easy Product Finder design program.

## Specification text

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

### Specification text

Circular VAV terminal units for variable air volume systems with low airflow velocities, suitable for supply or extract air, available in four nominal sizes. Measurement and control of low volume flow rates based on a new measurement principle. Plastic nozzle with damper blade for measuring the effective pressure upstream and downstream of the damper blade. The relation between damper blade position and differential pressure is stored as a characteristic relationship in the Easy or Compact controller. This results in high control accuracy even in case of unfavourable upstream conditions. Selection based on nominal size determination. Ready-to-commission unit which consists of the mechanical parts and the electronic control components. Units are equipped with a plastic nozzle with integral damper blade. The averaging effective pressure sensor is resistant to contamination. Spigots with double lip seal, suitable for ducts to EN 1506 or EN 13180. Position of the damper blade indicated externally at shaft extension. Damper blade is factory set to open position which allows ventilation airflow even without control. Closed blade air leakage to EN 1751, class 2 (nominal sizes 160 – 250, class 1). Casing air leakage to EN 1751, class C. Meets the hygiene requirements of EN 16798, Part 3, of VDI 6022, Sheet 1, and of DIN 1946, Part 4.

### Special features

- Optimised for low airflow velocities from 0.6 to 6 m/s
- High control accuracy even in case of unfavourable upstream conditions
- Any installation orientation
- Volume flow rate control with Easy or Compact controller
- Casing length of only 310 mm
- Effective pressure measurements upstream and downstream of the damper blade
- The relation between damper blade position and differential pressure is stored as a characteristic relationship in the controller

### Materials and surfaces

- Casing made of galvanised sheet steel
- Nozzle, damper blade, and plain bearings made of ABS plastic, UL 94, flame retardant (V-0)
- Damper blade seal made of TPV plastic

### Equivalence criteria

- Declaration of hygiene conformity in accordance with VDI 6022, Sheet 1 (01/2018), ÖNORM H 6020 (02/2007) and ÖNORM H 6021 (09/2003)

- Setting the volume flow rates without adjustment device via  $V_{\min}$ - and  $V_{\max}$  potentiometers
- Electrical connections with screw terminals, no additional terminal boxes required
- Aerodynamic functional testing of each volume flow controller on a test rig before shipping (test result on a sticker on the controller)
- No upstream section required
- Acoustic data to ÖNORM EN ISO 5135:1999
- Maximum control deviation of 6 % at  $q_{v\max}$ , without upstream section
- Test

### Connection type

- Spigot with groove for lip seal, suitable for connecting ducts according to EN 1506 or EN 13180.

### Technical data

- Nominal sizes: 125 to 250 mm
- Volume flow rate range: 9 to 300 l/s or 30 to 1080 m<sup>3</sup>/h
- Volume flow rate control range: approx. 10 – 100 % of the nominal volume flow rate
- Minimum differential pressure: up to 33 Pa (without circular silencer)
- Maximum differential pressure: 600 Pa

### Attachments

Variable volume flow control with electronic Easy controller for applying a reference value and capturing an actual value to be integrated with the central BMS.

- Supply voltage 24 V AC/DC
- Signal voltages 0 – 10 V DC
- Possible override controls with external switches using volt-free contacts: CLOSE, OPEN,  $q_{v\min}$  and  $q_{v\max}$
- Potentiometers with percentage scales to set the volume flow rates  $q_{v\min}$  and  $q_{v\max}$
- The actual value signal relates to the nominal volume flow rate such that commissioning and subsequent adjustment are simplified
- Volume flow rate control range: approx. 10 – 100 % of the nominal volume flow rate
- Clearly visible external indicator light for signalling the functions: Set, not set, and power failure
- Electrical connections with screw terminals
- Double terminals for looping the supply voltage, i.e. for the simple connection of voltage transmission to the next controller



## Order code

Order code for volume flow control (with Easy attachment)

LVC	/	160	/	Easy
1		2		3

<b>1 Type</b>	200
LVC VAV terminal unit	250

**2 Nominal size [mm]**  
125  
160

**3 Attachments (control components)**  
Easy Volume flow controller, dynamic, analogue interface, setting  $q_{vmin}$  and  $q_{vmax}$  with potentiometers

Order example: LVC/160/Easy

Nominal size	160 mm
Attachments (control components)	Easy controller

Order code for volume flow control (with Compact controller attachment)

LVC	/	160	/	BC0	/	V	0	/	80 – 400	[m <sup>3</sup> /h]
1		2		3		4	5		6	

**1 Type**  
LVC VAV terminal unit

F Constant value (one setpoint value)  
V Variable (setpoint value range)

**2 Nominal size [mm]**  
125  
160  
200  
250

**5 Signal voltage range**  
For the actual and setpoint value signals  
0 0 – 10 V DC  
2 2 – 10 V DC

**3 Attachments (control components)**  
BC0 Compact controller

**6 Operating values for factory setting**  
Volume flow rates [m<sup>3</sup>/h or l/s]  
 $q_{vconst}$  (with operating mode F)  
 $q_{vmin} - q_{vmax}$  (with operating mode V)

**4 Operating mode**

Order example: LVC/125/BC0/V2/100–200 m<sup>3</sup>/h

Nominal size	125 mm
Attachments (control components)	Compact controller, dynamic transducer, analogue and MP bus interfaces
Operating mode	Variable
Signal voltage range	2 – 10 V DC
Operating values	$q_{vmin} = 100 \text{ m}^3/\text{h}$ $q_{vmax} = 200 \text{ m}^3/\text{h}$



## Variants

### VAV terminal unit Type LVC



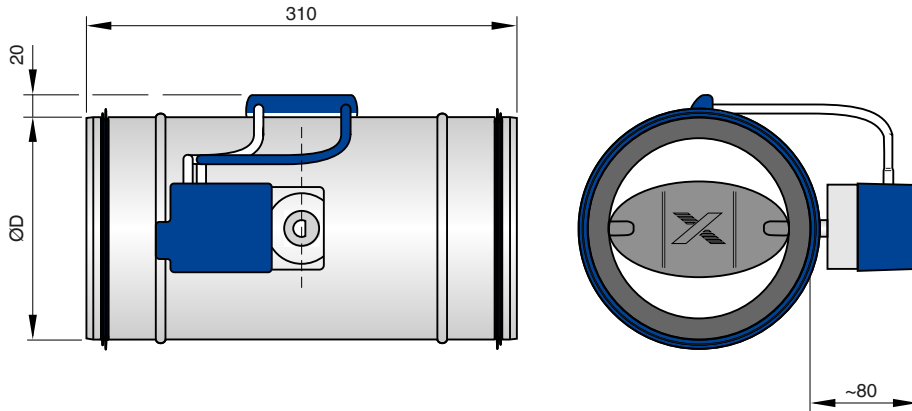
- VAV terminal unit for variable volume flow control
- Spigot with double lip seal

### Materials, standard construction

Order code detail	Part	Material
-	Casing	Galvanised sheet steel
	Effective pressure sensor	Plastic nozzle, ABS, UL 94, flame retardant
	Damper blade	Plastic, ABS, UL 94, flame retardant
	Damper blade seal	Plastic, TPV
	Shaft	Stainless steel, material no. 1.4305
	Plain bearings	Plastic, ABS, UL 94, flame retardant
	Double lip seal	Rubber, EPDM
	Anti-rotation lock	EPDM

## Dimensions and weight

VAV terminal unit without acoustic cladding (LVC)



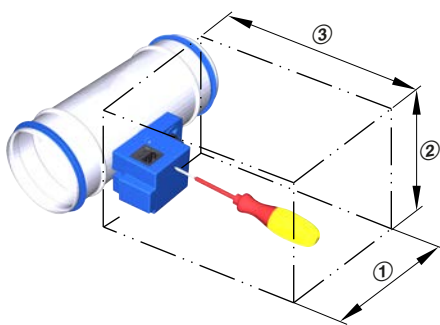
Dimensions/weight for LVC

NS	ØD	kg
125	124	1.5
160	159	1.9
200	199	2.1
250	249	2.7

### Space required 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



Schematic illustration of required installation space

### Product example



Attachment: Easy, BC0



Space required for attachments

Attachment	①	②	③
VARYCONTROL			
Easy controller: Easy	370	200	300
Compact controller: BC0	370	200	200

## Product details

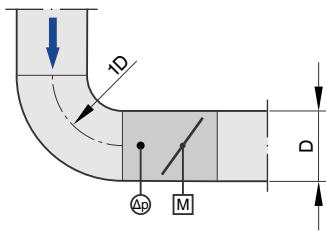
### Installation and commissioning

- Any installation orientation
- Selection based on nominal size determination
- Damper blade is factory set to open position which allows ventilation airflow even without control
- Can be installed at a junction

### Upstream conditions

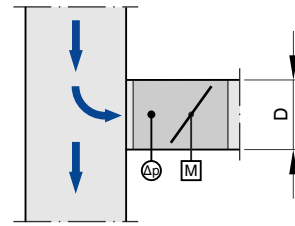
The volume flow rate accuracy  $\Delta_{qv}$  applies to a straight upstream section of the duct. Bends, junctions or a narrowing or widening of the duct cause turbulence that may affect measurement. Duct connections, e.g. branches off the main duct, must comply with EN 1505.

#### Bend



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

#### Junction



The stated volume flow rate accuracy  $\Delta_{qv}$  will be achieved even when the VAV terminal unit is installed in a branch just off the main duct.

VARYCONTROL control components

Attachment	Controlled variable	Interface	Effective pressure transducer	Actuator	Manufacturer
Easy controller, dynamic					
Easy	qv	0 – 10 V	integral	slow-running integral	①
Compact controller, dynamic					
BC0	-	0 – 10 V or 2 – 10 V or MP bus interface	integral	slow-running integral	②

qv Volume flow rate

① TROX, ② TROX/Belimo

## 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

$\varnothing D$  [mm]

Basic units made of sheet steel: Outer diameter of the spigot;  
basic units made of plastic: Inside diameter of the spigot

$\varnothing D_1$  [mm]

Pitch circle diameter of flanges

$\varnothing D_2$  [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 including the minimum required attachments (control component)

$NS$  [mm]

Nominal size

$f_m$  [Hz]

Octave band centre frequency

$L_{PA}$  [dB(A)]

A-weighted sound pressure level of air-regenerated noise of the VAV terminal unit, system attenuation taken into account

$L_{PA1}$  [dB(A)]

A-weighted sound pressure level of air-regenerated noise of the VAV terminal unit with secondary silencer, system attenuation taken into account

$L_{PA2}$  [dB(A)]

A-weighted sound pressure level of case-regenerated noise of the VAV terminal unit, system attenuation taken into account

$L_{PA3}$  [dB(A)]

A-weighted sound pressure level of case-regenerated noise of the VAV terminal unit with acoustic cladding, system attenuation taken into account

Note on acoustic data: All sound pressure levels are based on a reference value of 20  $\mu$ Pa.

$q_{vNom}$  [ $m^3/h$ ]; [l/s]

Nominal flow rate (100 %): The value depends on product type, nominal size and control component (attachment). Values are published on the internet and in technical leaflets and stored in the Easy Product Finder design program. Reference value for calculating percentages (e.g.  $q_{vmax}$ ). Upper limit of the setting range and maximum volume flow rate setpoint value for the VAV terminal unit.

$q_{vmin Unit}$  [ $m^3/h$ ]; [l/s]

Technically possible minimum volume flow rate: The value depends on product type, nominal size and control component (attachment). Values are stored in the Easy Product Finder design program. Lower limit of the setting range and minimum volume flow rate setpoint value for the VAV terminal unit.

Setpoint values below  $q_{vmin unit}$  (if  $q_{vmin}$  equals zero) may result in unstable control or shut-off.

$q_{vmax}$  [ $m^3/h$ ]; [l/s]

Upper limit of the operating range for the VAV terminal unit that can be set by customers:  $q_{vmax}$  can be set to less than or equal to  $q_{vNom}$ . In case of analogue signalling to volume flow controllers (which are typically used), the set maximum value ( $q_{vmax}$ ) is allocated to the maximum setpoint signal (10 V) (see characteristic).

$q_{vmin}$  [ $m^3/h$ ]; [l/s]

Lower limit of the operating range for the VAV terminal unit that can be set by customers:  $q_{vmin}$  should be set to less than or equal to  $q_{vmax}$ . Do not set  $q_{vmin}$  to less than  $q_{vmin unit}$  as the control may become unstable or the damper blade may close.  $q_{vmin}$  may equal zero. In case of analogue signalling to volume flow controllers (which are typically used), the set minimum value ( $q_{vmin}$ ) is allocated to the minimum setpoint signal (0 or 2 V) (see characteristic).

$q_v$  [ $m^3/h$ ]; [l/s]

Volume flow rate

$\Delta_{qv}$  [%]

Volume flow rate accuracy in relation to the setpoint (tolerance)

**$\Delta_{pst}$  [Pa]**

Static differential pressure

 **$\Delta_{pst\ min}$  [Pa]**

Static minimum differential pressure: The static minimum differential pressure is equal to the pressure loss of the VAV terminal unit when the damper blade is open, caused by flow resistance (damper blade). If the differential pressure on the VAV terminal unit is too low, the setpoint volume flow rate may not be achieved, not even when the damper blade is open. Important factor in designing the ductwork and in rating the fan including speed control. Sufficient static differential pressure must be ensured for all operating conditions and for all controllers, and the measurement point or points for speed control must have been selected accordingly to achieve this.

**Lengths**

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

**Basic unit**

Unit for controlling a volume flow without an attached control component. The main components include the casing with sensor(s) to measure the effective pressure and the damper

blade to restrict the volume flow. The basic unit is also referred to as a VAV terminal unit. Important distinguishing features: Geometry or unit shape, material and types of connection, acoustic characteristics (e.g. acoustic cladding or integral sound attenuator), volume flow rate range.

**Control component**

Electronic unit(s) mounted on the basic unit to control the volume flow rate or the duct pressure or the room pressure by adjusting the damper blade position. The electronic unit consists basically of a controller with effective pressure transducer (integral or external) and an integral actuator (Easy and Compact controllers) or external actuator (Universal or LABCONTROL controllers). Important distinguishing features: Transducer: dynamic transducer for clean air or static transducer for contaminated air. Actuator: slow-running actuator as standard, spring return actuator for safe position, or fast-running actuator. Interface: analogue interface or digital bus interface for the capturing of signals and data.

**VAV terminal unit**

Consists of a basic unit with an attached control component.