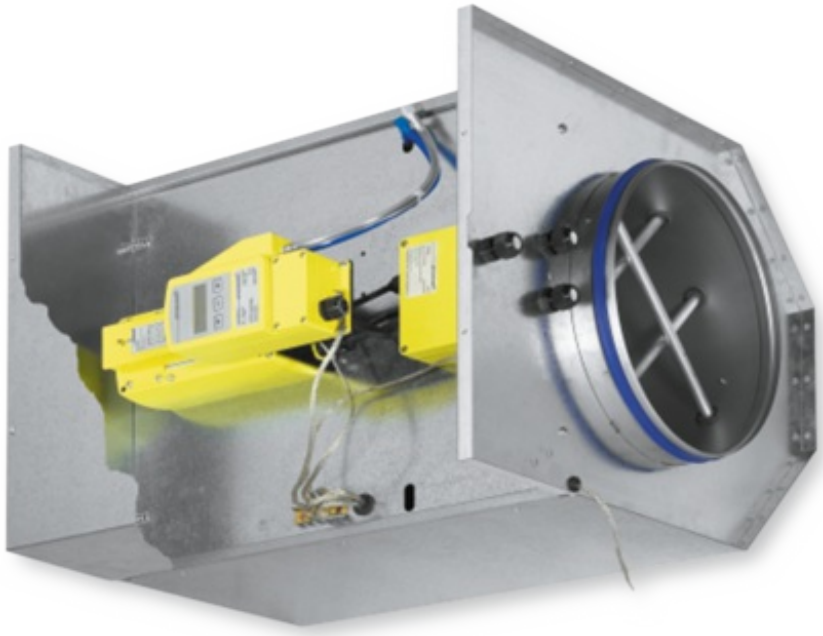
Type TVR-Ex



FOR THE CONTROL OF VARIABLE AIR VOLUME FLOWS IN POTENTIALLY EXPLOSIVE ATMOSPHERES (ATEX)

Circular VAV terminal units for variable air volume systems, approved and certified for potentially explosive atmospheres (ATEX)

- ATEX-compliant construction and parts
- Approved for all gases, mists and vapours in zones 1 and 2, with electronic control additionally for dusts in zones 21 and 22
- Suitable for the control of supply or extract air as well as for differential pressure control
- Electronic or pneumatic control components
- Closed blade air leakage to EN 1751, up to class 4
- Casing air leakage to EN 1751, class C

Optional equipment and accessories

- Spring return actuator
- Auxiliary switch with adjustable switching points for capturing the end positions

APPLICATION

Application

- Circular EXCONTROL VAV terminal units of Type TVR-Ex for the precise supply air or extract air flow control in variable air volume systems
- For use in potentially explosive atmospheres (ATEX)
- Closed-loop volume flow control using an external power supply
- Electronic or pneumatic volume flow control
- Shut-off by means of switching (equipment supplied by others)

Special features

- ATEX mark and certification
- ATEX equipment group II, approved for use in zones 1 and 2; electronic control also for zones 21 and 22
- Volume flow rate can later be measured and adjusted on site; configuration is possible using personal computer software

Classification

Electronic control: Equipment group II

- Zones 1 and 2 (atmosphere: gases): II 2 G c II T5/T6
- Zones 21 and 22 (atmosphere: dusts): II 2 D c II 80 °C

Pneumatic control: Equipment group II

- Zones 1 and 2 (atmosphere: gases): II 2 G c II T5/T6

Nominal sizes

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

DESCRIPTION

Construction

- Galvanised sheet steel
- P1: Inner duct powder-coated, silver grey (RAL 7001)

- A2: Inner duct in stainless steel

Parts and characteristics

- Ready-to-commission unit which consists of mechanical parts and control components.
- Averaging differential pressure sensor for volume flow rate measurement
- Damper blade
- Connection for equipotential bonding
- Cable bushings suitable for use in potentially explosive atmospheres
- ATEX-compliant control components, factory assembled and complete with wiring and tubing
- Aerodynamic functional testing on a special test rig prior to shipping of each unit
- Unit carries test label with relevant data
- High control accuracy (even with upstream bend R = 1D)

Attachments

- Electronic control
- Pneumatic control

Accessories

- Actuator with auxiliary switch for capturing the end positions
- Spring return actuator

Useful additions

- Secondary silencer Type CA for demanding acoustic requirements

Construction features

- Construction and materials comply with the EU directive and guidelines for use in potentially explosive atmospheres (ATEX)
- Spigot with lip seal, for circular connecting ducts to EN 1506 or EN 13180

Materials and surfaces

- Casing and inner duct made of galvanised sheet steel
- Control components made of die cast aluminium (pneumatic control: plastic)
- Plastic bearings
- Damper blade of stainless steel and with TPE seal (thermoplastic elastomer)
- Differential pressure sensor made of aluminium
- P1: Inner duct powder-coated
- A2: Inner duct in stainless steel

Standards and guidelines

- Directive 94/9/EC: Equipment and protective systems intended for use in potentially explosive atmospheres
- Closed blade air leakage to EN 1751, class 4 (nominal sizes 125 and 160, class 3).
- Nominal sizes 125 and 160 meet the general requirements, nominal sizes 200 – 400 meet the increased requirements of DIN 1946, part 4, with regard to the acceptable closed blade air leakage
- Casing air leakage to EN 1751, class C

Maintenance

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

Electronic control

- Zero point correction of the static differential pressure transducer should be carried out once per year (recommendation)

TECHNICAL INFORMATION

Function, Technical data, Quick sizing, Specification text, Order code, Related Products

FUNCTION

Functional description

The VAV terminal unit is fitted with a differential pressure sensor for measuring the volume flow rate.

The control components (attachments) include a differential pressure transducer that transforms the differential pressure (effective pressure) into an electric signal, a controller, and an actuator.

For most applications, the setpoint value comes from a room temperature controller which is installed outside of the potentially explosive atmosphere.

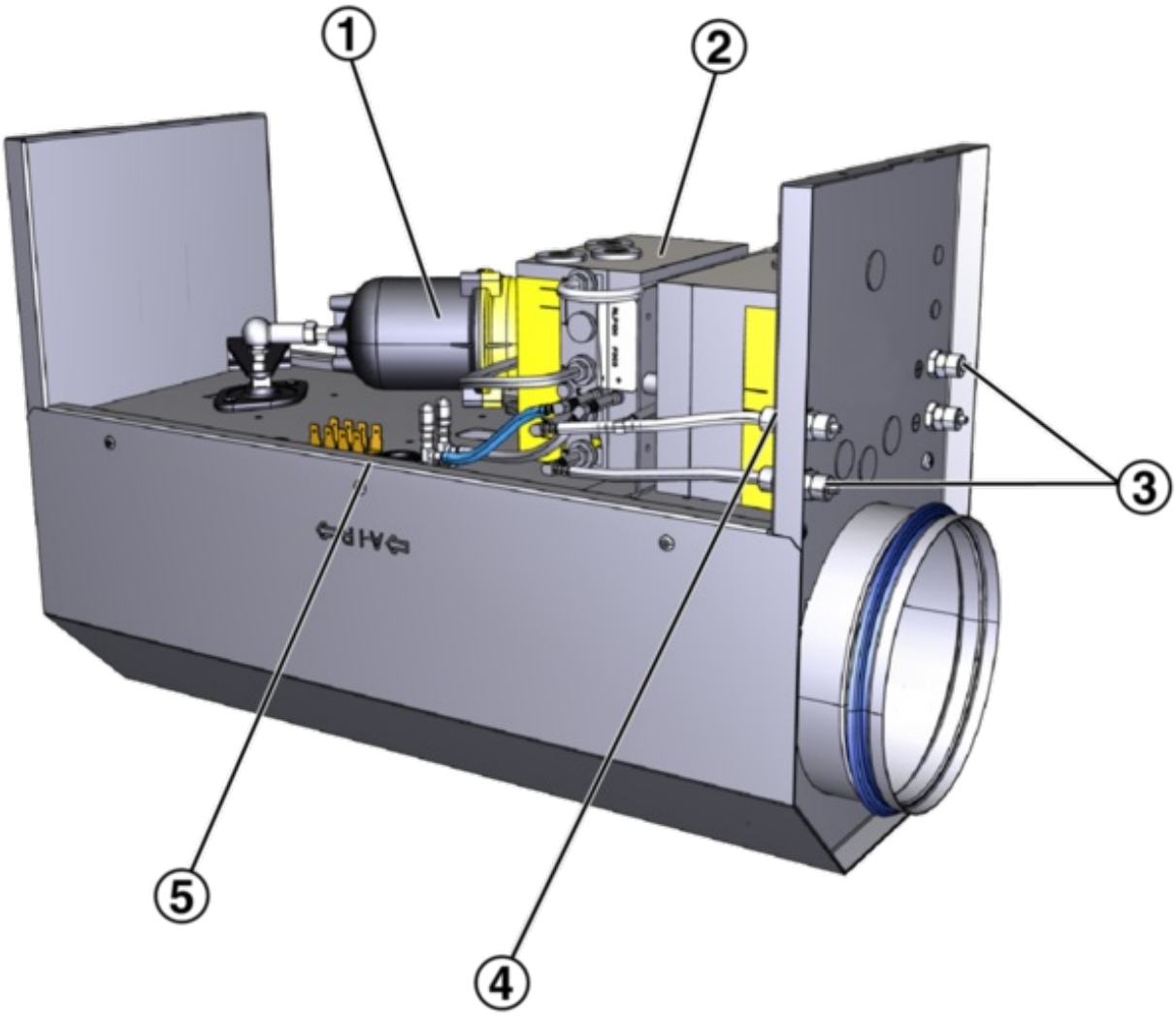
The controller compares the actual value with the setpoint value and alters the control signal of the damper actuator if there is a difference between the two values.

The connections for the supply voltage and for the voltage signals are made in a terminal box that is suitable for use in potentially explosive atmospheres.

Schematic illustration of the TVR-Ex with electronic control

① Auxiliary switch
② Static differential pressure transducer
③ Terminal box
④ Cable bushing
⑤ Equipotential bonding
⑥ Actuator

Schematic illustration of the TVR-Ex with pneumatic control



① Actuator
② Room pressure controller
③ Pneumatic connections
④ Volume flow controller
⑤ Equipotential bonding

TECHNICAL DATA

Volume flow rate ranges

The minimum differential pressure of VAV terminal units is an important factor in designing the ductwork and in rating the fan

including speed control.

Sufficient duct pressure must be ensured for all operating conditions and for all control units. 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. The table gives the minimum and maximum values for a VAV terminal unit. Some control components may only have a limited volume flow rate range. This applies in particular to control components with a static differential pressure transducer. For volume flow rate ranges for all control components refer to our Easy Product Finder design programme.

TVR-Ex – ElectronicVolume flow rate ranges and minimum differential pressures

Nominal size	V l/s	V m³/h	① $\Delta p_{st\ min}$ Pa	② $\Delta p_{st\ min}$ Pa	③ $\Delta p_{st\ min}$ Pa	④ $\Delta p_{st\ min}$ Pa	ΔV ± %
125	22	79	5	5	5	5	15
	60	216	15	20	20	20	7
125	105	378	45	50	55	60	6
	150	540	90	100	110	115	5
160	35	126	5	5	5	5	15
	100	360	15	15	15	15	8
160	175	630	35	40	45	45	7
	250	900	70	80	85	95	5
200	60	216	5	5	5	5	15
	160	576	15	15	15	15	7
200	280	1008	35	35	40	40	5
	405	1458	65	70	75	80	5
250	90	324	5	5	5	5	15
	245	882	10	10	10	10	7
250	430	1548	25	25	30	35	5
	615	2214	45	50	55	65	5
315	145	522	5	5	5	5	15
	410	1476	5	10	10	10	7
315	720	2592	15	20	20	20	6
	1030	3708	30	35	40	40	5
400	240	864	5	5	5	5	15
	670	2412	5	5	5	5	7
400	1175	4230	15	15	15	15	6
	1680	6048	25	30	30	35	5

Nominal size	V l/s	V m³/h	① $\Delta p_{st\ min}$ Pa	② $\Delta p_{st\ min}$ Pa	③ $\Delta p_{st\ min}$ Pa	④ $\Delta p_{st\ min}$ Pa	ΔV ± %
125	15	54	5	5	5	5	15
	40	144	10	10	10	10	10
125	70	252	20	25	25	25	7
	100	360	40	45	50	55	5
160	25	90	5	5	5	5	15
	75	270	10	10	10	10	10
160	125	450	20	20	25	25	7
	175	630	35	40	45	45	5
200	40	144	5	5	5	5	15
	125	450	10	10	10	10	10
200	210	756	20	20	25	25	7
	300	1080	40	40	45	45	5
250	60	216	5	5	5	5	15
	200	720	5	10	10	10	10
250	340	1224	15	15	20	20	7
	475	1710	30	30	35	40	5
315	105	378	5	5	5	5	15
	330	1188	5	5	5	5	10
315	555	1998	10	10	15	15	7
	775	2790	20	20	25	25	5
400	170	612	5	5	5	5	15
	545	1962	5	5	5	5	10
400	920	3312	10	10	10	10	7
	1300	4680	15	20	20	20	5

Nominal sizes	125 – 400 mm
Volume flow rate range	15 – 1680 l/s or 54 – 6048 m^3/h
Volume flow rate control range	Approx. 15 to 100% of the nominal volume flow rate
Maximum differential pressure	1000 Pa
Operating temperature	10 – 50 °C

Electronic

Supply voltage (AC)	24 V AC ± 10 %, 50/60 Hz
Supply voltage (DC)	24 V DC ± 10 %
Power rating (AC)	20 VA max.
Power rating (DC)	20 W max.
Setpoint value signal input	0 – 10 V DC, R_a > 100 kΩ
Actual value signal output	0 – 10 V DC, max. 0.5 mA
IEC protection class	III (protective extra-low voltage)
Protection level	IP 42
EC conformity	ATEX to 94/9/EG, EMC to 2004/108/EG, low voltage to 2006/95/EG

Pneumatic

Operating pressure	1.3 bar ± 0.1 bar
Air consumption – volume flow control	50 ln/h
Air consumption – pressure and volume flow cascade	100 ln/h
Control pressure	0.2 – 1.0 bar
Maximum pressure	1.5 bar
Compressed air	Compressed air for instruments, free of oil, water and dust
Protection level	IP 42

QUICK SIZING

Quick sizing tables provide a good overview of the room sound pressure levels that can be expected. Approximate intermediate values can be interpolated. Precise intermediate values and spectral data can be calculated with our Easy Product Finder design programme.

The first selection criteria for the nominal size are the actual volume flow rates V_{min} and V_{max}. The quick sizing tables are based on generally accepted attenuation levels. If the sound pressure level exceeds the required level, a larger air terminal unit and/or a silencer is required.

TVR-Ex, electronic, Sound pressure level at differential pressure 150 Pa

Nominal size	V		Air-regenerated noise				Case-radiated noise
			①	②	③	④	①
Nominal size	V		L_{PA}	L_{PA1}			L_{PA2}
	l/s	m³/h	dB(A)				

125	**22**	**79**	36	25	16	<15	16
	60	**216**	45	36	30	28	25
125	**105**	**378**	49	40	34	32	31
	150	**540**	52	41	34	32	35
160	**35**	**126**	41	30	22	19	22
	100	**360**	47	39	34	31	28
160	**175**	**630**	50	42	37	34	32
	250	**900**	53	44	39	36	37
200	**60**	**216**	41	32	24	22	21
	160	**576**	47	40	34	33	29
200	**280**	**1008**	50	44	40	38	32
	405	**1458**	54	45	39	38	38
250	**90**	**324**	38	30	24	22	22
	245	**882**	47	40	34	32	35
250	**430**	**1548**	48	42	38	37	37
	615	**2214**	52	44	38	37	42
315	**145**	**522**	43	36	29	26	29
	410	**1476**	47	42	35	34	39
315	**720**	**2592**	49	44	39	38	42
	1030	**3708**	53	48	42	41	46
400	**240**	**864**	43	36	29	26	31

	670	**2412**	44	38	32	30	37
400	**1175**	**4230**	47	42	36	35	41
	1680	**6048**	50	44	38	37	46

① TVR-Ex

② TVR-Ex with secondary silencer CA, insulation thickness 50 mm, length 500 mm

③ TVR-Ex with secondary silencer CA, insulation thickness 50 mm, length 1000 mm

④ TVR-Ex with secondary silencer CA, insulation thickness 50 mm, length 1500 mm

TVR-Ex, pneumatic, Sound pressure level at differential pressure 150 Pa

Nominal size	V		Air-regenerated noise				Case-radiated noise
			①	②	③	④	①
Nominal size	V		L_{PA}	L_{PA1}			L_{PA2}
	l/s	m³/h	dB(A)				
125	**15**	**54**	33	22	<15	<15	<15
	40	**144**	39	29	22	19	20
125	**70**	**252**	46	37	31	29	26
	100	**360**	49	40	34	32	31
160	**25**	**90**	40	28	20	16	20
	75	**270**	45	35	29	26	25
160	**125**	**450**	49	41	36	33	29
	175	**630**	50	42	37	34	32
200	**40**	**144**	40	31	23	20	20
	125	**450**	46	37	31	30	26

200	**210**	**756**	48	41	36	35	30
	300	**1080**	51	44	40	38	33
250	**60**	**216**	41	32	24	22	21
	200	**720**	44	36	31	29	30
250	**340**	**1224**	47	40	35	34	36
	475	**1710**	49	42	38	37	38
315	**105**	**378**	42	35	28	25	28
	330	**1188**	45	40	33	31	35
315	**555**	**1998**	47	42	36	35	40
	775	**2790**	50	44	39	38	43
400	**170**	**612**	43	36	30	26	30
	545	**1962**	43	37	31	29	35
400	**920**	**3312**	45	40	34	33	39
	1300	**4680**	48	42	37	35	43

① TVR-Ex

② TVR-Ex with secondary silencer CA, insulation thickness 50 mm, length 500 mm

③ TVR-Ex with secondary silencer CA, insulation thickness 50 mm, length 1000 mm

④ TVR-Ex with secondary silencer CA, insulation thickness 50 mm, length 1500 mm

SPECIFICATION TEXT

VAV terminal units for variable and constant air volume systems in potentially explosive atmospheres, suitable for supply or extract air, available in 6 nominal sizes.

High control accuracy (even with upstream bend R = 1D).

Ready-to-commission unit which consists of the mechanical parts, the electronic control components, and parts for equipotential bonding and for use in potentially explosive atmospheres. Each unit contains an averaging differential pressure sensor for volume flow rate measurement and a damper blade.

Factory-assembled control components complete with wiring and tubing.

Differential pressure sensor with 3 mm measuring holes (resistant to dust and pollution)

Spigot with lip seal, for circular connecting ducts to EN 1506 or EN 13180.

Closed blade air leakage to EN 1751, class 4 (nominal sizes 125 and 160, class 3).

Casing air leakage to EN 1751, class C.

Special features

- ATEX mark and certification
- ATEX equipment group II, approved for use in zones 1 and 2; electronic control also for zones 21 and 22
- Volume flow rate can later be measured and adjusted on site; configuration is possible using personal computer software

Materials and surfaces

- Casing and inner duct made of galvanised sheet steel
- Control components made of die cast aluminium (pneumatic control: plastic)
- Plastic bearings
- Damper blade of stainless steel and with TPE seal (thermoplastic elastomer)
- Differential pressure sensor made of aluminium
- P1: Inner duct powder-coated
- A2: Inner duct in stainless steel

Construction

- Galvanised sheet steel
- P1: Inner duct powder-coated, silver grey (RAL 7001)
- A2: Inner duct in stainless steel

Technical data

- Nominal sizes: 125 to 400 mm
- Volume flow rate range: 15 to 1680 l/s or 54 to 6048 m^3/h
- Volume flow rate control range: approx. 15 – 100 % of the nominal volume flow rate
- Maximum differential pressure: 1000 Pa

Attachments

Variable volume flow control with electronic controller to switch a control signal and an actual value signal for integration into the central BMS.

- Supply voltage 24 V AC
- Supply voltage for actuator: 230 V AC
- Signal voltages 0 – 10 V DC
- 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. 15 – 100 % of the nominal volume flow rate
- Actuator with adjustable running time, 7.5 – 120 s

Sizing data

- V _____ [m³/h]
- Δp_{st} _____ [Pa]

Air-regenerated noise

- L_{PA} _____ [dB(A)]

Case-radiated noise

- L_{PA} _____ [dB(A)]

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

ORDER CODE

Order example: TVR-Ex/200/S1S/400–1200 m³/h

Material	Galvanised sheet steel
Nominal size	200 mm
Attachments	Electronic controller, internal, pressure transducer and actuator
Volume flow rate	400 – 1200 m³/h

Order example: TVR-Ex/160/PG5/200–500 m³/h/NO

Material	Galvanised sheet steel
Nominal size	160 mm
Attachments	Pneumatic volume flow controller with actuator
Volume flow rate	200 – 500 m³/h
Damper blade position	Pressure off to OPEN

Order example: TVR-Ex/160/TES/SC–E0/T/200–900 m³/h

Material	Galvanised sheet steel
Nominal size	160 mm
Attachments	Electronic controller, external, pressure transducer and actuator with auxiliary switch
Equipment function	Supply air controller
Expansion modules	EM-TRF for 230 V AC
Volume flow rate	200 – 900 m³/h

TVR–Ex – P1 / 125 / S1S / 200 – 400 / NO

1 2 3 4 5 6

1 Type

(control component)

TVR-

Ex VAV terminal unit for use in potentially explosive atmospheres

2 Material

No entry: galvanised sheet steel

P1 Inner duct powder-coated, silver grey (RAL 7001)

A2 Inner duct in stainless steel

3 Nominal size [mm]

[m³/h or l/s, Pa]

125

160

4 Attachments

For example

Electronic control

S1S Integral controller and actuator

Pneumatic control

PG5 Volume flow controller with actuator

PJ5 Pressure and volume flow cascade (±20 Pa)

5 Operating values

Electronic control

$V_{min} – V_{max}$

Pneumatic control

Volume flow rate

$V_{min} – V_{max}$

Pressure and volume flow cascade $V_{min} – V_{max} / \Delta p_{setpoint}$

200

250

315

400

6 Damper blade position

Only for spring return actuators and pneumatic actuators

NO Pressure off/power off to OPEN

NC Power off/Pressure off to close

1 Type

TVR-Ex VAV terminal unit for use in potentially explosive atmospheres

2 Material

No entry: galvanised sheet steel

P1 Inner duct powder-coated, silver grey (RAL 7001)

A2 Inner duct in stainless steel

6 External volume flow rate setting

E0 Voltage signal 0 – 10 V DC

E2 Voltage signal 2 – 10 V DC

2P Switch contacts (provided by others) for 2 switching steps

3P Switch contacts (provided by others) for 3 switching steps

F Volume

flow rate constant value, without signalling

3 Nominal size [mm]

125

160

200

250

315

400

4 Attachments (control component)

For example Electronic control

7 Expansion modules

Power supply

24 V AC

for 230 V AC

USV for 230 V AC, provides uninterruptible power supply (UPS)

Communication interface

for LonWorks FTT-10A

MOD-01 for BACnet MS/TP

BAC-MOD-01 for Modbus RTU

BACnet/IP, Modbus/IP and webserver

with real time clock

8 Operating values [m^3/h or l/s, Pa

Option 1:

No entry:

T EM-TRF

U EM-TRF-

Option 2:

No entry: none

L EM-LON

B EM-BAC-

M EM-

I EM-IP for

R EM-IP

E0, E2:

TES	External	V_{min} / V_{max}	
controller, pressure transducer and actuator			2P: V_1 / V_2
			3P: V_1 / V_2 / V_3

5 Equipment

function			F: V_1
	Single operation		
SC	Supply		
air controller			
EC	Extract		
air controller			

RELATED PRODUCTS

Additional products

Type CA

Variants, Attachments, Dimensions and weight

VARIANTS

Schematic illustration of the TVR-Ex with electronic control

① VAV terminal unit
② Static differential pressure transducer
③ Actuator
④ Terminal box
⑤ Electronic volume flow controller

ATTACHMENTS

TVR-Ex, EXCONTROL Electric control components

Order code detail	Controlled variable	Controller	Differential pressure transducer	Actuator
Internal controller				
S1S	Volume flow rate	Universal controller (use in areas with potentially explosive atmospheres) Schischek	Static, integral	Actuator
S1F	Volume flow rate	Universal controller (use in areas with potentially explosive atmospheres) Schischek	Static, integral	Spring return actuator
S1X	Volume flow rate	Universal controller (use in areas with potentially explosive atmospheres) Schischek	Static, integral	Actuator with auxiliary switches
S1Y	Volume flow rate	Universal controller (use in areas with potentially explosive atmospheres) Schischek	Static, integral	Spring return actuator with auxiliary switch
External controller				
TES	Volume flow rate	Volume flow rate controller TCU3 (use in areas with potentially explosive atmospheres) TROX/Schischek	Static	Actuator
TEF	Volume flow rate	Volume flow rate controller TCU3 (use in areas with potentially explosive atmospheres) TROX/Schischek	Static	Spring return actuator
TEX	Volume flow rate	Volume flow rate controller TCU3 (use in areas with potentially explosive atmospheres) TROX/Schischek	Static	Actuator with auxiliary switches
TEY	Volume flow rate	Volume flow rate controller TCU3 (use in areas with potentially explosive atmospheres) TROX/Schischek	Static	Spring return actuator with auxiliary switch

TVR-Ex, EXCONTROL Pneumatic control components

Order code detail	Controlled variable	Controller	Differential pressure transducer	Actuator
Volume flow controllers				
PG5	Volume flow rate	Volume flow controller Sauter	Integral	Actuator
Pressure and volume flow cascade				
PJ5	Room pressure	Room pressure controller ± 20 Pa Volume flow controller Sauter	Integral	Actuator
PL5	Room pressure	Room pressure controller ± 50 Pa Volume flow controller Sauter	Integral	Actuator

DIMENSIONS AND WEIGHT

Nominal size	ØD mm	B_3 mm	H_3 mm	C mm
125	124	372	221	129
160	159	372	221	111
200	199	463	311	182
250	249	463	311	157
315	314	627	461	289
400	399	627	461	246

Nominal size	TVR-Ex/.../TEx m kg	TVR-Ex/.../Pxx m kg
125	17.5	15.5
160	17.5	15.5
200	19.0	17.0
250	19.0	17.0
315	23.0	21.0
400	23.0	21.0

TVR-Ex

INSTALLATION DETAILS

Installation and commissioning

- Connections for equipotential bonding: Suitable cables must be connected by others

Electronic control

- Any installation orientation
- Zero point correction required

Pneumatic control

- Installation orientation must be as shown on the sticker

Upstream conditions

The volume flow rate accuracy ΔV 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.

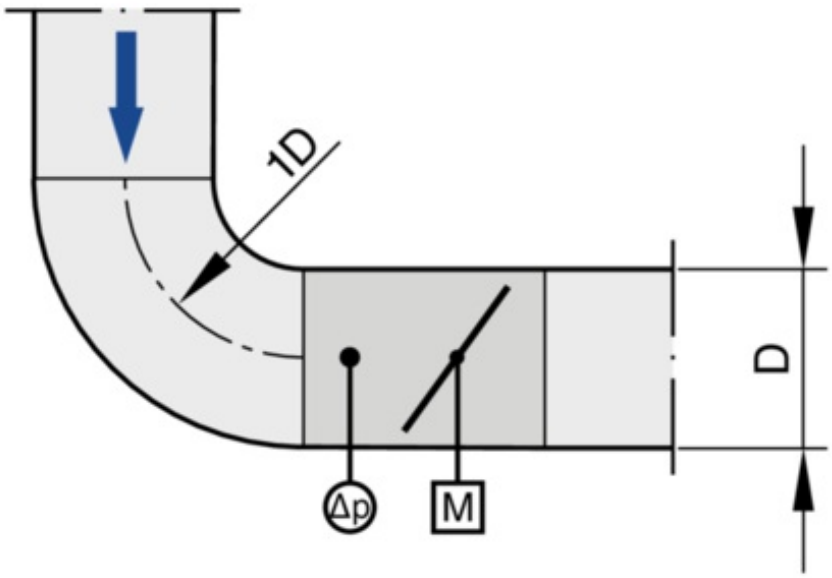
Space required for commissioning and maintenance

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.

Space required

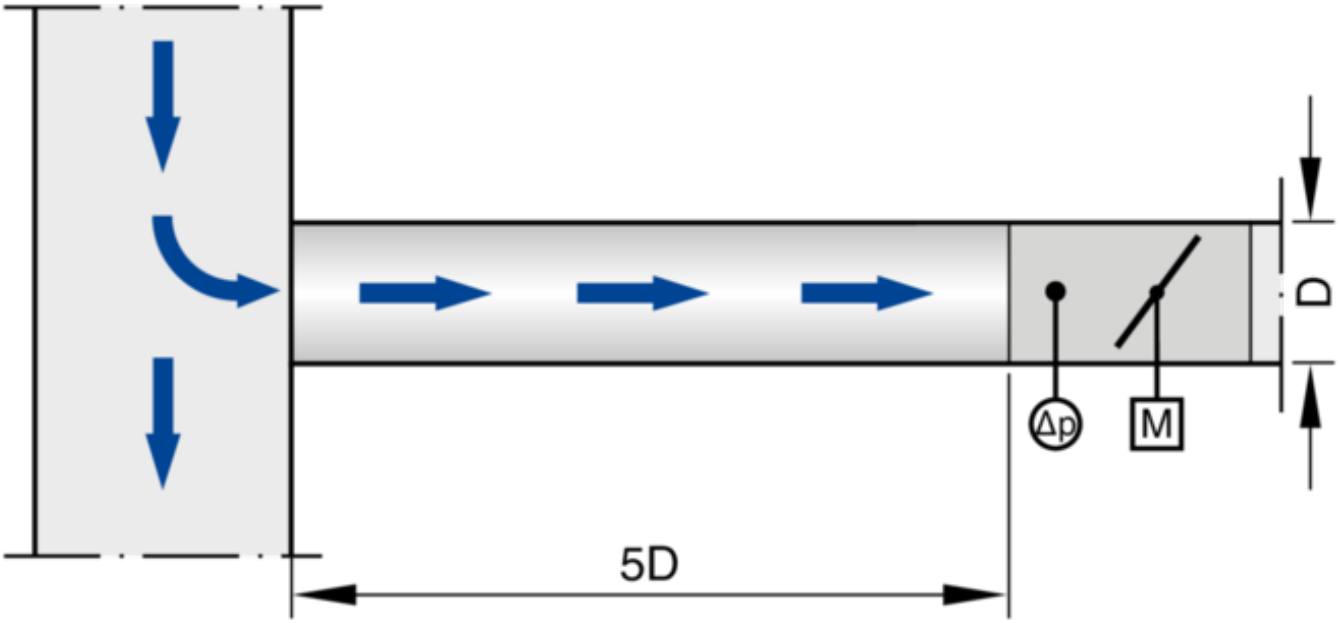
Nominal size	①	②	③
	mm		
125	600	220	300
160	600	220	300
200	600	310	300
250	600	310	300
315	600	460	300
400	600	460	300

Bend



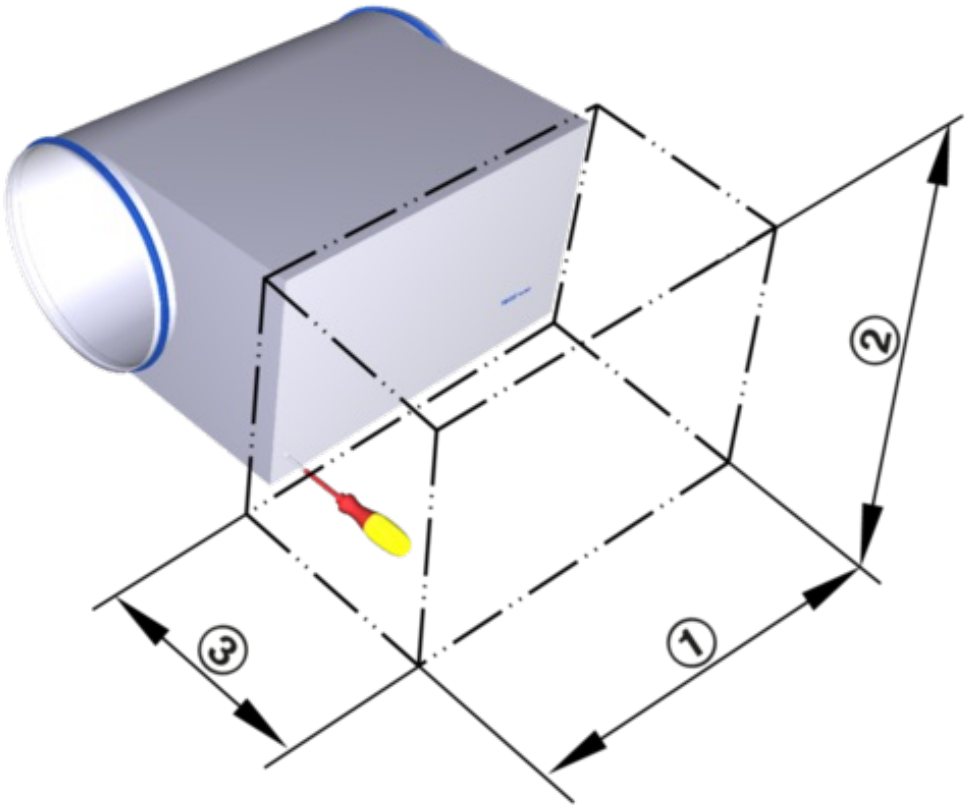
A bend with a centre line curvature radius of at least 1D – without an additional straight duct section upstream of the VAV terminal unit – has only a negligible effect on the volume flow rate accuracy.

Junction



A junction causes strong turbulence. The stated volume flow rate accuracy ΔV 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 VAV terminal unit. If there is no straight upstream section at all, the control will not be stable, even with a perforated plate.

Access to attachments



BASIC INFORMATION AND NOMENCLATURE

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

ØD₄ [mm]

Inside diameter of the screw holes of flanges

L [mm]

Length of unit including connecting spigot

L₁ [mm]

Length of casing or acoustic cladding

B [mm]

Duct width

B₁ [mm]

Screw hole pitch of flange (horizontal)

B₂ [mm]

Outside dimension of flange (width)

B₃ [mm]

Width of device

H [mm]

Duct height

H₁ [mm]

Screw hole pitch of flange (vertical)

H₂ [mm]

Outside dimension of flange (height)

H₃ [mm]

Unit height

n [ ]

Number of flange screw holes

T [mm]

Flange thickness

m [kg]

Unit weight including the minimum required attachments (e.g. Compact controller)

Acoustic data

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

All sound pressure levels are based on 20 µPa.

Volume flow rates

V_{nom} [m³/h] and [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 software.
- Reference value for calculating percentages (e.g. V_{max})
- Upper limit of the setting range and maximum volume flow rate setpoint value for the VAV terminal unit

$V_{min\ unit}$ [m³/h] and [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 software
- Lower limit of the setting range and minimum volume flow rate setpoint value for the VAV terminal unit
- Depending on the controller, setpoint values below $V_{min\ unit}$ (if V_{min} equals zero) may result in unstable control or shut-off

V_{max} [m³/h] and [l/s]

Upper limit of the operating range for the VAV terminal unit that can be set by customers

- V_{max} can only be smaller than or equal to V_{nom}
- In case of analogue signalling to volume flow controllers (which are typically used), the set maximum value (V_{max}) is allocated to the setpoint signal maximum (10 V) (see characteristic)

V_{min} [m³/h] and [l/s]

Lower limit of the operating range for the VAV terminal unit that can be set by customers

- V_{min} should be smaller than or equal to V_{max}
- Do not set V_{min} smaller than $V_{min\ unit}$, otherwise the control may become unstable or the damper blade may close
- V_{min} may equal zero
- In case of analogue signalling to volume flow controllers (which are typically used), the set minimum value (V_{min}) is allocated to the setpoint signal minimum (0 or 2 V) (see characteristic)

V [m³/h] and [l/s]

Volume flow rate

ΔV [± %]

Volume flow rate tolerance from setpoint value

ΔV_{warm} [± %]

Volume flow rate tolerance for the warm air flow of dual duct terminal units

Differential pressure

Δp_{st} [Pa]

Static differential pressure

$\Delta p_{st\ min}$ [Pa]

Static differential pressure, minimum

- 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 (sensor tubes, damper mechanism)
- If the 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 duct pressure must be ensured for all operating conditions and for all terminal units, and the measurement point or points for speed control must have been selected accordingly to achieve this

Construction

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

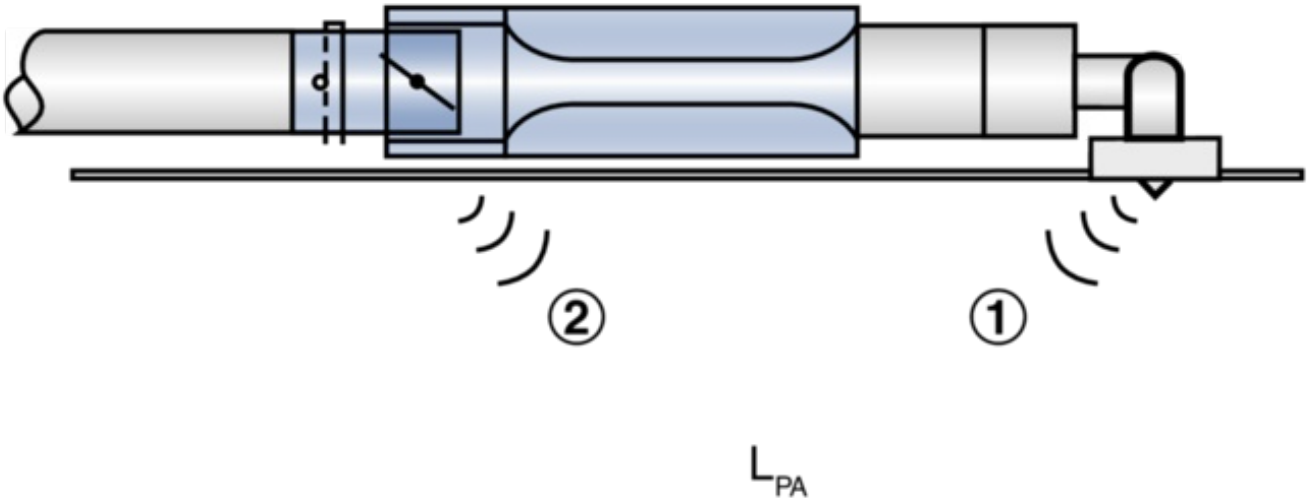
Powder-coated surface (P1)

- 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)

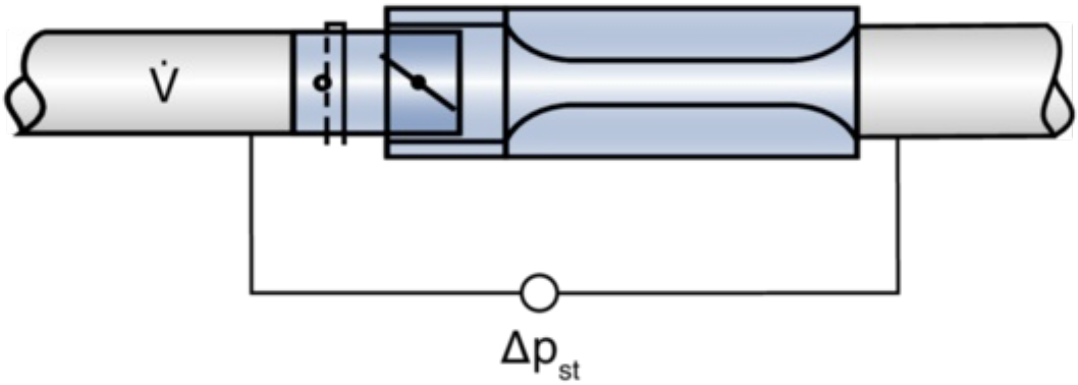
- Casing made of stainless steel 1.4201
- Parts in contact with the airflow are powder-coated or made of stainless steel
- External parts, e.g. mounting brackets or covers, are usually made of galvanised sheet steel

Definition of noise



① Air-regenerated noise
② Case-radiated noise

Static differential pressure



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