VAV terminal units
Type TVR

Universal controller

Compact controller

Easy controller

Tested to VDI 6022

For the most diverse applications regarding standard volume flow rate ranges

Circular VAV terminal units for standard applications regarding the supply air or extract air control in variable air volume systems

- Suitable for the control of volume flow rate, room pressure or duct pressure
- Electronic control components for different applications (Easy, Compact, Universal, and LABCONTROL)
- High control accuracy even with upstream bend (R = 1D)
- Suitable for airflow velocities up to 13 m/s
- Closed blade air leakage to EN 1751, up to class 4
- Casing air leakage to EN 1751, class C

Optional equipment and accessories
- Acoustic cladding for the reduction of case-radiated noise
- 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

Variants

Product examples

VAV terminal unit, variant TVR

VAV terminal unit, variant TVR-D

Description

For detailed information on control components see Chapter K5 – 1.3.

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

Application
– Circular VARYCONTROL VAV terminal units of Type TVR for the precise supply air or extract air flow control in variable air volume systems
– Closed-loop volume flow control using an external power supply
– For controlling, restricting, or shutting off the airflow in air conditioning systems
– Shut-off by means of switching (equipment supplied by others)

Variants
– TVR: VAV terminal unit
– TVR-D: VAV terminal unit with acoustic cladding
– TVR-FL: VAV terminal unit with flanges on both ends
– TVR-D-FL: VAV terminal unit with acoustic cladding and flanges on both ends
– Units with acoustic cladding and/or a secondary silencer Type CA, CS or CF for demanding acoustic requirements
– Acoustic cladding cannot be retrofitted

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

Nominal sizes
– 100, 125, 160, 200, 250, 315, 400

Attachments
– Easy controller: Compact unit consisting of controller with potentiometers, differential pressure transducer and actuator
– Compact controller: Compact unit consisting of controller, differential pressure transducer and actuator
– Universal controller: Controller, differential pressure transducer and actuators for special applications
– LABCONTROL: Control components for air management systems

Accessories
– G2: Matching flanges for both ends
– D2: Lip seals on both ends (factory fitted)

Useful additions
– Secondary silencer Type CA, CS or CF for demanding acoustic requirements
– Heat exchanger Type WL
– Electric air heater Type EL

Special characteristics
– Integral differential pressure sensor with 3 mm measuring holes (resistant to dust and pollution)
– Factory set-up or programming and aerodynamic function testing
– Volume flow rate can be measured and subsequently adjusted on site; additional adjustment tool may be necessary

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
– Factory-assembled control components
  complete with wiring and tubing
– Aerodynamic function testing on a special test
  rig prior to 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 with upstream bend R = 1D)

Construction features
– Circular casing
– Spigot suitable for circular ducts
  to EN 1506 or EN 13180
– Spigot with groove for lip seal
– Position of the damper blade indicated
  externally at shaft extension
– TVR-FL: Flanges to EN 12220

Materials and surfaces
Galvanised sheet steel construction
– Casing and damper blade
  made of galvanised sheet steel
– Damper blade seal made of TPE plastic
– Aluminium sensor tubes
– Plastic bearings

Powder-coated construction (P1)
– Casing made of galvanised sheet steel,
  powder-coated
– Damper blade and shaft
  made of stainless steel 1.4301
– 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

Variant with acoustic cladding (-D)
– Acoustic cladding made of galvanised
  sheet steel
– Rubber profile for the insulation
  of structure-borne noise
– Lining is mineral wool

Mineral wool
– To EN 13501, fire rating class A1,
  non-combustible
– RAL quality mark RAL-GZ 388
– Biosoluble and hence hygienically
  safe according to the German TRGS 905
  (Technical Rules for Hazardous Substances)
  and EU directive 97/69/EG

Installation and commissioning
– Any installation orientation
  (except units
  with static differential pressure transducer)
– TVR-D: For constructions
  with acoustic cladding, ducts on the room
  side should have cladding up to the acoustic
  cladding of the controller

Standards and guidelines
– Hygiene conforms to VDI 6022
– Closed blade air leakage to EN 1751, class 4
  (nominal size 100, class 2;
  nominal sizes 125 and 160, class 3)
– Nominal sizes 100, 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

1

Attachments: VARYCONTROL control components for Type TVR

Order code detail	Control function	Controller	Differential pressure transducer	Actuator
Easy controller				
Easy	Volume flow rate	Easy controller TROX	Dynamic, integral	Integral
Compact controller				
BC0	Volume flow rate	Compact controller with MP bus interface TROX/Belimo	Dynamic, integral	Integral
BL0		Compact controller with LonWorks interface TROX/Belimo		
XB0		Compact controller TROX/Gruner		
LN0		Compact controller Siemens		
Universal controller, dynamic				
B13	Volume flow rate	Universal controller TROX/Belimo	Dynamic, integral	Actuator
B1B				Spring return actuator
XC3		Universal controller TROX/Gruner		
Universal controller, static				
BP3	Volume flow rate	Universal controller with MP bus interface TROX/Belimo	Static	Actuator
BPB				Spring return actuator
BPG				Fast-running actuator
BB3		Universal controller TROX/Belimo		Actuator
BBB				Spring return actuator
XD1		Universal controller TROX/Gruner	Static, integral	Actuator
XD3				Spring return actuator
BR3	Differential pressure	Universal controller with MP bus interface TROX/Belimo	Static, integral 100 Pa	Actuator
BRB				Spring return actuator
BRG				Fast-running actuator
BS3			Static, integral 600 Pa	Actuator
BSB				Spring return actuator
BSG				Fast-running actuator
BG3		Differential pressure controller TROX/Belimo	Static, integral 100 Pa	Actuator
BGB				Spring return actuator
BH3			Static, integral 600 Pa	Actuator
BHB				Spring return actuator
XE1		Differential pressure controller TROX/Gruner	Static, integral 100 Pa	Actuator
XE3				Spring return actuator
XF1			Static, integral 600 Pa	Actuator
XF3				Spring return actuator

Attachments: LABCONTROL control components for Type TVR

Order code detail	Control function	Controller	Differential pressure transducer	Actuator
EASYLAB				
ELAB	Room supply air Room extract air Room pressure Single controller	EASYLAB controller TCU3	Static, integral	Fast-running actuator
TCU-LON-II				
TMA	Room supply air Room extract air Room pressure	Electronic controller TCU-LON-II with LonWorks interface	Static, integral	Fast-running actuator
TMB				Fast-running actuator (brushless motor)

Technical data

|	
Nominal sizes	100 – 400 mm
Volume flow rate range	10 – 1680 l/s or 36 – 6048 m³/h
Volume flow rate control range (unit with dynamic differential pressure measurement)	Approx. 10 to 100 % of the nominal volume flow rate
Minimum differential pressure	5 – 90 Pa
Maximum differential pressure	1000 Pa
Operating temperature	10 – 50 °C

1

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; the control functions
can be achieved with an Easy controller,
with a Compact controller, or with individual
components (Universal or LABCONTROL).
For most applications, the setpoint value
comes from a room temperature controller.
The controller compares the actual value
with the setpoint value and alters the control
signal of the actuator if there is a difference
between the two values.

Schematic illustration of the TVR

① Differential pressure sensor
② Damper blade
③ Lip seal
④ Control components, e.g. an Easy controller
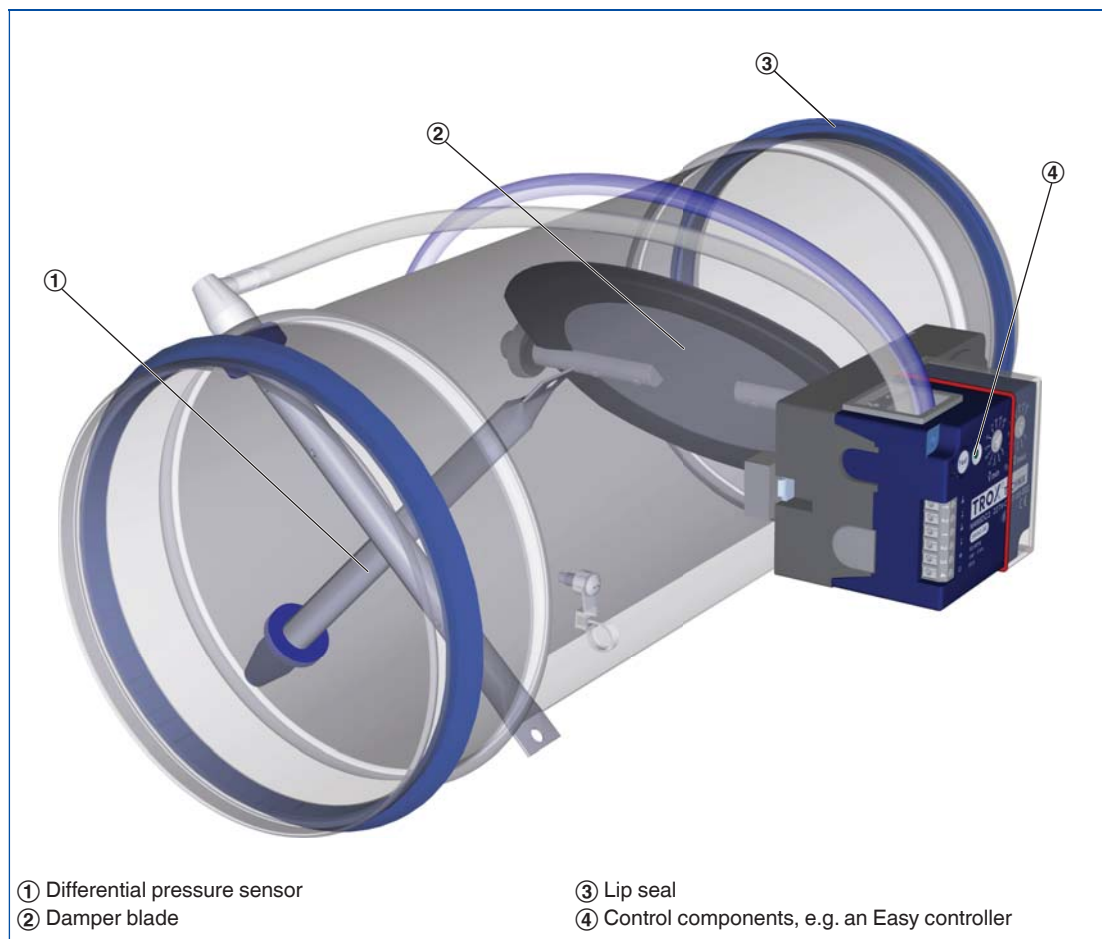
Order code

VARYCONTROL

TVR, TVR/.../Easy

TVR – D – ... –FL / 160 / G2 / B1B / E 0 / 200 – 900 / NO
　　1　　　2　　3　4　　　5　　　　6　　　7　　　8　9　　　　10　　　　11

TVR – D / 200 / D2 / Easy
　　1　　　2　　　5　　　6　　　7

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1 Type
TVR VAV terminal unit

2 Acoustic cladding
　　　　No entry: none
D 　With acoustic cladding

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

4 Flange
　　　　No entry: none
FL 　Both ends (not for TVR-D-P1)

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

6 Accessories
　　　　No entry: none
D2 　Lip seals on both ends
G2 　Matching flanges for both ends

7 Attachments (control component)
　　　　Example
Easy 　Compact controller
BC0 　Compact controller
B13 　Universal controller

8 Operating mode
E 　Single
M 　Master
S 　Slave
F 　Constant value
A 　Differential pressure control – extract air
Z 　Differential pressure control – supply air

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

10 Volume flow rates [m³/h or l/s], differential pressure [Pa]
　　　　$\dot{V}_{min} – \dot{V}_{max}$ for factory setting
　　　　Δp_{min} for factory setting
　　　　(operating modes A, Z)

11 Damper blade position
　　　　Only with spring return actuators
NO 　Power off to open
NC 　Power off to close

Order example

VARYCONTROL

TVR/200/D2/BC0/E0/500–1200 m³/h

Acoustic cladding	Without
Material	Galvanised sheet steel
Flange	Without
Nominal size	200 mm
Accessories	Lip seals on both ends
Attachment	Compact controller
Operating mode	Single
Signal voltage range	0 – 10 V DC
Volume flow rate	500 – 1200 m³/h

TVR with EASYLAB for room control and single operation

TVR – D – ... – FL / 160 / G2 / ELAB / RS / ULZ / LAB / ...

   [1]   [2]   [3]   [4]   [5]   [6]   [7]   [8]   [10]   [11] [12]

TVR – D – ... – FL / 160 / G2 / ELAB / EC – E0 / ULZ / ...

   [1]   [2]   [3]   [4]   [5]   [6]   [7]   [8]   [9]   [10] [12]

[1] Type
TVR   VAV terminal unit

[2] Acoustic cladding
No entry: none
D   With acoustic cladding

[3] Material
No entry: galvanised sheet steel
P1   Powder-coated RAL 7001; silver grey
A2   Stainless steel construction

[4] Flange
No entry: none
FL   Both ends (not for TVR-D-P1)

[5] Nominal size [mm]
D_N

[6] Accessories
No entry: none
D2   Lip seals on both ends
G2   Matching flanges for both ends

[7] Attachments (control component)
ELAB   EASYLAB controller TCU3 with fast-running actuator

[8] Equipment function
Room control
RS   Supply air control (Room Supply)
RE   Extract air control (Room Exhaust)
PC   Differential pressure control

Single operation
SC   Supply air controller
EC   Extract air controller

[9] External volume flow rate setting
Only for single operation
E0   Voltage signal 0 – 10 V DC
E2   Voltage signal 2 – 10 V DC
2P   On-site switch contacts for 2 switching steps
3P   On-site switch contacts for 3 switching steps
F   Volume flow rate constant value

[10] 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 correctionh

[11] Additional functions
Only for room control (equipment function)
Raum management function has been deactivated
LAB   Extract air led system for laboratories
CLR   Supply air led system (clean rooms)
Raum management function is active
LAB-RMF   Extract air led system (LAB)
CLR-RMF   Supply air led system

[12] Operating values [m³/h oder l/s, Pa]
For equipment function 'room control' with additional function RMF
Total room extract air/supply air
$\dot{V}_1$: Standard mode
$\dot{V}_2$: Reduced operation
$\dot{V}_3$: Increased operation
$\dot{V}_4$: Constant room supply air
$\dot{V}_5$: Constant room extract air
$\dot{V}_6$: Supply air/extract air difference
$\Delta p_{setpoint}$: Setpoint pressure (only with differential pressure control)
For single operation (equipment function)
E0, E2: $\dot{V}_{min}$ / $\dot{V}_{max}$
2P: $\dot{V}_1$ / $\dot{V}_2$
3P: $\dot{V}_1$ / $\dot{V}_2$ / $\dot{V}_3$
F: $\dot{V}_1$

Useful additions
Room control panel
BE-LCD-01   40-character display

1

TVR with EASYLAB for fume cupboard control

TVR – D – ... – FL / 160 / G2 / ELAB / FH – VS / ULZS / 200 – 900

|1| |2| |3| |4| |5| |6| |7| |8| |9| |10|

1 Type
TVR   VAV terminal unit

2 Acoustic cladding
No entry: none
D   With acoustic cladding

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

4 Flange
No entry: none
FL   Both ends (not for TVR-D-P1)

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

6 Accessories
No entry: none
D2   Lip seals on both ends
G2   Matching flanges for both ends

7 Attachments (control component)
ELAB   EASYLAB controller TCU3
with fast-running actuator

8 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

9 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)

10 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-** OLED display
BE-LCD-01 40-character display

TVR/200/D2/ELAB/FH-2P/200-700

Acoustic cladding	Without
Nominal size	200 mm
Accessories	Lip seals on both ends
Attachments	EASYLAB controller TCU3 with fast-running actuator
Equipment function	Two switching steps

TVR with TCU-LON-II

TVR – D – ... – FL / 160 / G2 / TMA / RE / 1500 / 750 / 100

|1| |2| |3| |4| |5| |6| |7| |8| |9|

|1| Type
TVR   VAV terminal unit

|2| Acoustic cladding
No entry: none
D   With acoustic cladding

|3| Material
No entry: galvanised sheet steel
P1   Powder-coated (RAL 7001), silver grey
A2   Stainless steel

|4| Flange
No entry: none
FL   Flanges on both ends

|5| Nominal size [mm]
100
125
160
200
250
315
400

|6| Accessories
No entry: none
G2   Matching flanges for both ends
D2   Lip seals on both ends

|7| Attachments (control component)
TMA   TCU-LON-II with fast-running actuator
TMB   TCU-LON-II with fast-running actuator
(brushless motor)

|8| Equipment function
FH   Fume cupboard
RS   Room supply air
RE   Room extract air
PS   Differential pressure control – supply air
(Pressure Supply)
PE   Differential pressure control – extract air
(Pressure Extract)

|9| Operating values [m³/h or l/s, Pa]
Depending on equipment function
FH: $\dot V_{min} - \dot V_{max}$
RS: $\Delta \dot V / \dot V_{constant}$
RE: $\dot V_{Tag} / \dot V_{night} / \dot V_{constant}$
PS: $\Delta \dot V / \dot V_{constant} / \Delta p_{setpoint}$
PE: $\dot V_{day} / \dot V_{night} / \dot V_{constant} / \Delta p_{setpoint}$
The room control volume flow rates
(RS, RE, PS, PE) are related to the total
extract air volume flow rate for the room

Useful additions
Control panel for fume cupboard controller,
for displaying the functions of the control
system according to EN 14175
BE-TCU-LON-II   Control panel

TVR/200/D2/TMB/FH/200–700

Acoustic cladding	Without
Nominal size	200 mm
Accessories	Lip seals on both ends
Attachment	TCU-LON-II with fast-running actuator (brushless motor)
Equipment function	Fume cupboard (Fume Hood)

1

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.

Volume flow rate ranges and minimum differential pressure values

Nominal size	$\dot{V}$		①	②	③	④	$\Delta\dot{V}$
			$\Delta p_{st\,min}$				
	l/s	m³/h	Pa				± %
100	10	36	5	5	5	5	15
	40	144	15	15	20	20	8
	65	234	35	40	45	50	7
	95	342	70	85	95	105	5
125	15	54	5	5	5	5	15
	60	216	15	20	20	20	7
	105	378	45	50	55	60	6
	150	540	90	100	110	115	5
160	25	90	5	5	5	5	15
	100	360	15	15	15	15	8
	175	630	35	40	45	45	7
	250	900	70	80	85	95	5
200	40	144	5	5	5	5	15
	160	576	15	15	15	15	7
	280	1008	35	35	40	40	5
	405	1458	65	70	75	80	5
250	60	216	5	5	5	5	15
	250	900	10	10	10	15	7
	430	1548	25	25	30	35	5
	615	2214	45	50	55	65	5
315	100	360	5	5	5	5	15
	410	1476	5	10	10	10	7
	720	2592	15	20	20	20	6
	1030	3708	30	35	40	40	5
400	170	612	5	5	5	5	15
	670	2412	5	5	5	5	7
	1175	4230	15	15	15	15	6
	1680	6048	25	30	30	35	5

① TVR
② TVR with secondary silencer CS/CF, insulation thickness 50 mm, length 500 mm
③ TVR with secondary silencer CS/CF, insulation thickness 50 mm, length 1000 mm
④ TVR with secondary silencer CS/CF, insulation thickness 50 mm, length 1500 mm

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.

1

Air-regenerated noise

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 $\dot{V}_{min}$ and $\dot{V}_{max}$. The quick sizing tables are based on normally accepted attenuation levels. If the sound pressure level exceeds the required level, a larger VAV terminal unit and/or a silencer is required.

Quick sizing: Sound pressure level at differential pressure 150 Pa

Nominal size	$\dot{V}$		Air-regenerated noise				Case-radiated noise	
			①	②	③	④	①	⑤
			L_{PA}	L_{PA1}			L_{PA2}	L_{PA3}
	l/s	m³/h	dB (A)					
100	10	36	32	20	<15	<15	<15	<15
	40	144	45	36	28	26	25	18
	65	234	51	41	33	31	31	24
	95	342	54	42	33	31	36	27
125	15	54	33	22	<15	<15	<15	<15
	60	216	45	36	30	28	25	17
	105	378	49	40	34	32	31	21
	150	540	52	41	34	32	35	24
160	25	90	40	28	20	16	20	<15
	100	360	47	39	34	31	28	19
	175	630	50	42	37	34	32	23
	250	900	53	44	39	36	37	28
200	40	144	40	31	23	20	20	<15
	160	576	47	40	34	33	29	15
	280	1008	50	44	40	38	32	21
	405	1458	54	45	39	38	38	25
250	60	216	37	28	22	20	20	<15
	250	900	47	40	34	33	35	18
	430	1548	48	42	38	37	37	25
	615	2214	52	44	38	37	42	29
315	105	378	42	35	28	25	28	<15
	410	1476	47	42	35	34	39	21
	720	2592	49	44	39	38	42	28
	1030	3708	53	48	42	41	46	35
400	170	612	43	36	30	26	30	<15
	670	2412	44	38	32	30	37	21
	1175	4230	47	42	36	35	41	29
	1680	6048	50	44	38	37	46	33

① TVR
② TVR with secondary silencer CS/CF, insulation thickness 50 mm, length 500 mm
③ TVR with secondary silencer CS/CF, insulation thickness 50 mm, length 1000 mm
④ TVR with secondary silencer CS/CF, insulation thickness 50 mm, length 1500 mm
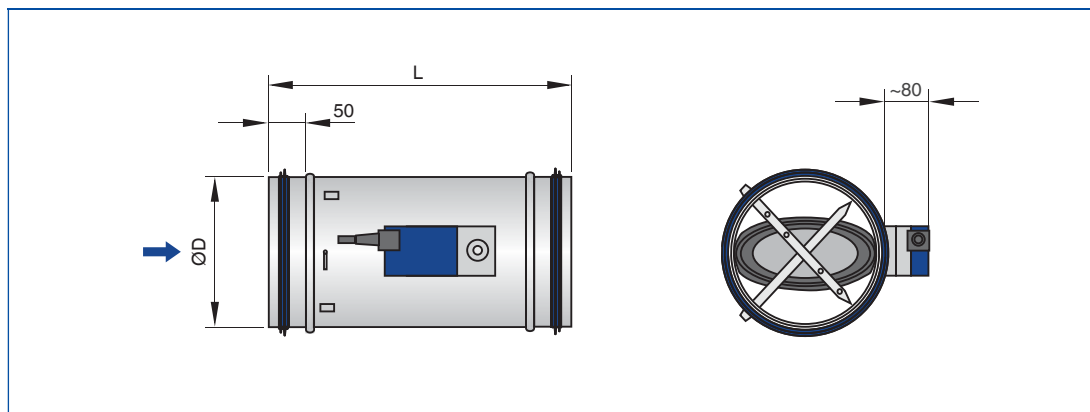
Description

1

VAV terminal unit,
variant TVR

– VAV terminal unit for the control
of variable air volume flow rates
– Spigot to make connections to the ducting

Dimensions

TVR

Dimensions [mm] and weight [kg]

Nominal size	Easy Compact	Universal LABCONTROL	ØD	m
	L			
	mm			kg
100	310	600	99	3.3
125	310	600	124	3.6
160	400	600	159	4.2
200	400	600	199	5.1
250	400	600	249	6.1
315	500	600	314	7.2
400	500	600	399	9.4

Description

VAV terminal unit,
variant TVR-D

– VAV terminal unit with acoustic cladding
for the control of variable air volume flows
– For rooms where the case-radiated noise of the
unit is not sufficiently reduced by a false ceiling
– The circular ducts for the room under
consideration must have adequate acoustic
insulation (provided by others)
on the fan and room ends
– Acoustic cladding cannot be retrofitted

Dimensions

TVR-D
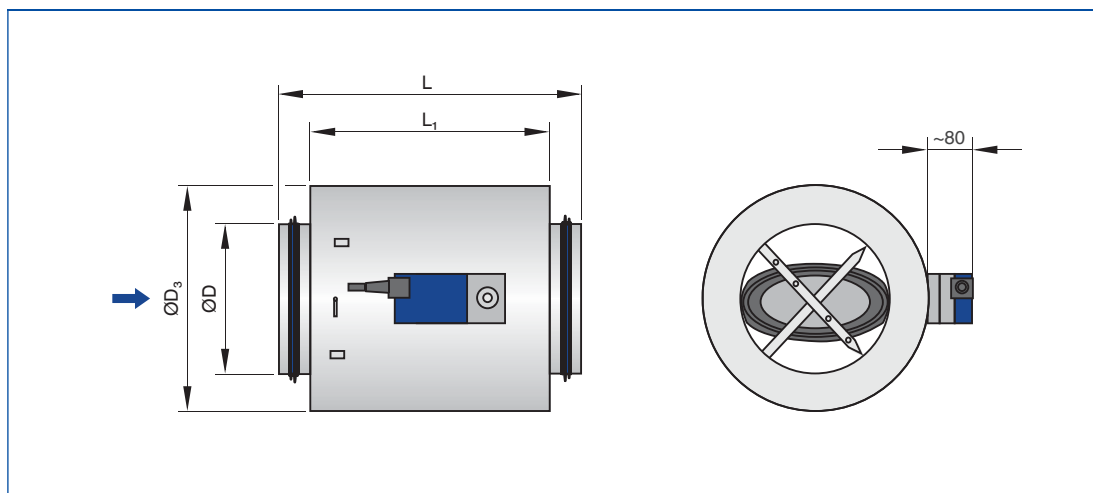
Dimensions [mm] and weight [kg]

Nominal size	Easy Compact		Universal LABCONTROL		ØD	ØD$_3$	m
	L	L$_1$	L	L$_1$			
	mm						kg
100	310	232	600	517	99	198	7.2
125	310	232	600	517	124	223	8.5
160	400	312	600	517	159	258	11.0
200	400	312	600	517	199	298	13.9
250	400	312	600	517	249	348	15.9
315	500	417	600	517	314	413	18.0
400	500	417	600	517	399	498	22.6

1

Description

– VAV terminal unit for the control
of variable air volume flow rates
– With flanges on both ends to make detachable
connections to the ducting

Dimensions

TVR-FL
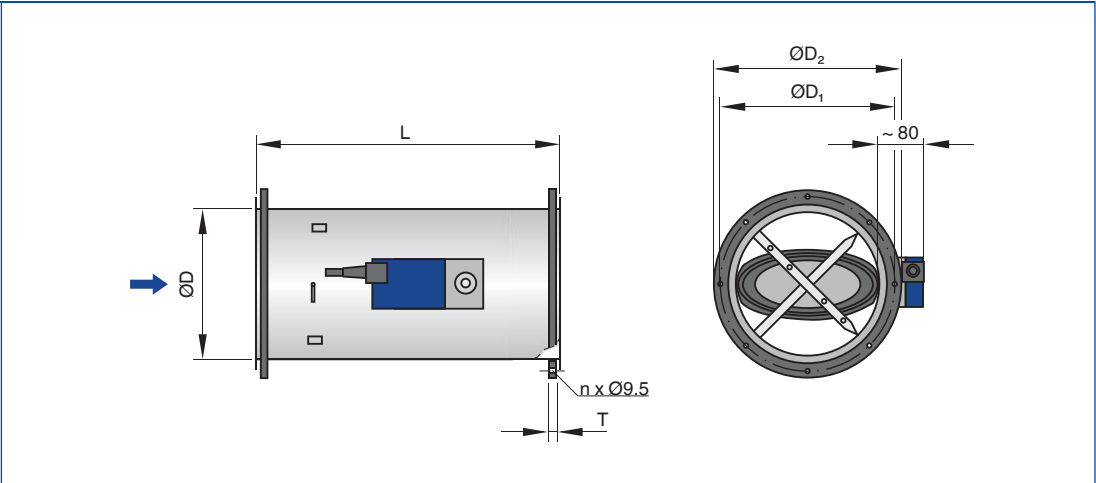
Dimensions [mm] and weight [kg]

Nominal size	Easy Compact	Universal LABCONTROL	ØD	ØD$_1$	ØD$_2$	n	T	m
	L							
	mm						mm	kg
100	290	580	99	132	152	4	4	3.9
125	290	580	124	157	177	4	4	4.2
160	380	580	159	192	212	6	4	5.3
200	380	580	199	233	253	6	4	6.5
250	380	580	249	283	303	6	4	7.8
315	480	580	314	352	378	8	4	10.3
400	480	580	399	438	464	8	4	13.3

Description

– VAV terminal unit with acoustic cladding
for the control of variable air volume flows
– With flanges on both ends to make detachable
connections to the ducting
– For rooms where the case-radiated noise of the
unit is not sufficiently reduced by a false ceiling
– The circular ducts for the room under
consideration must have adequate acoustic
insulation (provided by others)
on the fan and room ends
– Acoustic cladding cannot be retrofitted
– Powder-coated surface (P1)
or stainless steel construction (A2) not possible

Dimensions

TVR-D-FL
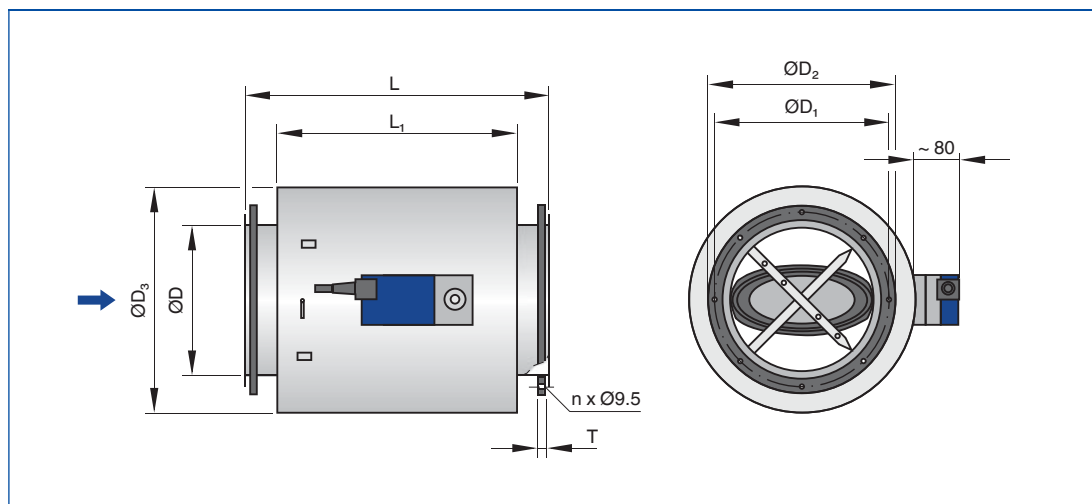
Dimensions [mm] and weight [kg]

Nominal size	Easy Compact		Universal LABCONTROL		ØD	ØD$_1$	ØD$_2$	ØD$_3$	n	T	m
	L	L$_1$	L	L$_1$							
	mm									mm	kg
100	290	232	580	517	99	132	152	198	4	4	7.8
125	290	232	580	517	124	157	177	223	4	4	9.1
160	380	312	580	517	159	192	212	258	6	4	12.1
200	380	312	580	517	199	233	253	298	6	4	14.3
250	380	312	580	517	249	283	303	348	6	4	17.6
315	480	417	580	517	314	352	378	413	8	4	21.2
400	480	417	580	517	399	438	464	498	8	4	26.5

1

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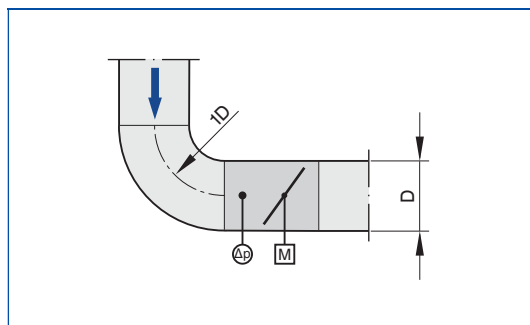
A bend with a centre line curvature radius of at least 1D – without an additional straight duct section upstream of the VAV terminal unit – has only a negligible effect on the volume flow rate accuracy.

Junction
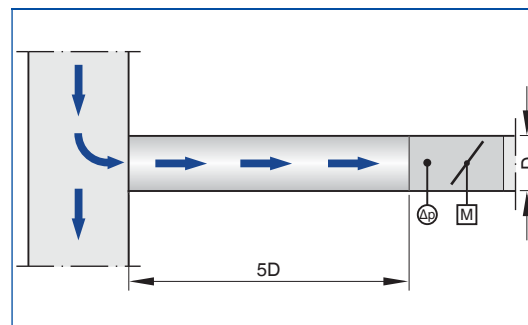
A junction causes strong turbulence. The stated volume flow rate accuracy ΔV̇ can only be achieved with a straight duct section of at least 5D upstream. Shorter upstream sections require a perforated plate in the branch and before the VAV terminal unit. If there is no straight upstream section at all, the control will 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
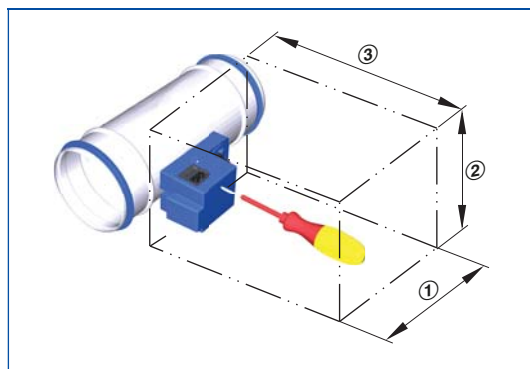
Space required

Attachments	①	②	③
	mm		
VARYCONTROL			
Easy controller	250	200	300
Compact controller	250	200	250
Universal controller, dynamic	520	250	250
LABCONTROL			
EASYLAB	550	350	400
TCU-LON-II	550	250	300

Access to attachments

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

Access to attachments

Space required

Attachments	①	②	③	④	⑤	⑥
	mm					
VARYCONTROL						
Universal controller, static	520	250	250	250	150	250

1

Circular VAV terminal units for variable and constant air volume systems, suitable for supply or extract air, available in seven nominal sizes. High control accuracy (even with upstream bend R = 1D). Ready-to-commission unit which consists of the mechanical parts and the electronic control components. 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 groove for lip seal, suitable for connecting ducts according to EN 1506 or EN 13180. Position of the damper blade indicated externally at shaft extension. Closed blade air leakage to EN 1751, class 4 (nominal size 100, class 2; nominal sizes 125 and 160, class 3). Casing air leakage to EN 1751, class C.

Special characteristics
– Integral differential pressure sensor with 3 mm measuring holes (resistant to dust and pollution)
– Factory set-up or programming and aerodynamic function testing
– Volume flow rate can be measured and subsequently adjusted on site; additional adjustment tool may be necessary

Materials and surfaces
Galvanised sheet steel construction
– Casing and damper blade made of galvanised sheet steel
– Damper blade seal made of TPE plastic
– Aluminium sensor tubes
– Plastic bearings

Powder-coated construction (P1)
– Casing made of galvanised sheet steel, powder-coated
– Damper blade and shaft made of stainless steel 1.4301
– 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

Variant with acoustic cladding (-D)
– Acoustic cladding made of galvanised sheet steel
– Rubber profile for the insulation of structure-borne noise
– Lining is mineral wool

Mineral wool
– To EN 13501, fire rating class A1, non-combustible
– RAL quality mark RAL-GZ 388
– Biosoluble and hence hygienically safe according to the German TRGS 905 (Technical Rules for Hazardous Substances) and EU directive 97/69/EG

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

Technical data
– Nominal sizes: 100 to 400 mm
– Volume flow rate range: 10 to 1680 l/s or 36 to 6048 m^3/h
– Volume flow rate control range (unit with dynamic differential pressure measurement): approx. 10 to 100 % of the nominal volume flow rate
– Minimum differential pressure: 5 – 90 Pa
– Maximum differential pressure: 1000 Pa

Attachments
Variable volume flow control with electronic Easy controller to connect an external control signal; actual value signal can be integrated into 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: CLOSED, OPEN, $\dot{V}_{min}$ and $\dot{V}_{max}$
– Potentiometers with percentage scales to set the volume flow rates $\dot{V}_{min}$ and $\dot{V}_{max}$
– 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.

Sizing data
– $\dot{V}$ _____ [m^3/h]
– Δp_{st} _____ [Pa]
– L_{PA} air-regenerated noise _____ [dB(A)]
– L_{PA} Case-radiated noise _____ [dB(A)]

Order options

VARYCONTROL

① Type
TVR   VAV terminal unit

② Acoustic cladding
☐   No entry: none
☐ **D**   With acoustic cladding

③ Material
☐   No entry: galvanised sheet steel
☐ **P1**   Powder-coated (RAL 7001), silver grey
☐ **A2**   Stainless steel

④ Flange
☐   No entry: none
☐ **FL**   Both ends (not for TVR-D-P1)

⑤ Nominal size [mm]
☐ **100**
☐ **125**
☐ **160**
☐ **200**
☐ **250**
☐ **315**
☐ **400**

⑥ Accessories
☐   No entry: none
☐ **D2**   Lip seals on both ends
☐ **G2**   Matching flanges for both ends

⑦ Attachments (control component)
        Example
☐ **Easy**   Compact controller
☐ **BC0**   Compact controller
☐ **B13**   Universal controller

⑧ Operating mode
☐ **E**   Single
☐ **M**   Master
☐ **S**   Slave
☐ **F**   Constant value
☐ **A**   Differential pressure control – extract air
☐ **Z**   Differential pressure control – supply air

⑨ Signal voltage range
        For the actual and setpoint value signals
☐ **0**   0 – 10 V DC
☐ **2**   2 – 10 V DC

⑩ Volume flow rates [m³/h or l/s], differential pressure [Pa]
        $\dot{V}_{min} - \dot{V}_{max}$ for factory setting
        Δp_{min} for factory setting
        (operating modes A, Z)

⑪ Damper blade position
        Only with spring return actuators
☐ **NO**   Power off to open
☐ **NC**   Power off to close

1 Order options

LABCONTROL

EASYLAB

① Type
TVR   VAV terminal unit

② Acoustic cladding
　　　　No entry: none
☐ **D**   With acoustic cladding

③ Material
　　　　No entry: galvanised sheet steel
☐ **P1**   Powder-coated (RAL 7001), silver grey
☐ **A2**   Stainless steel

④ Flange
　　　　No entry: none
☐ **FL**   Both ends (not for TVR-D-P1)

⑤ Nominal size [mm]
　　　　D_N

⑥ Accessories
　　　　No entry: none
☐ **D2**   Lip seals on both ends
☐ **G2**   Matching flanges for both ends

⑦ Attachments (control component)
ELAB   EASYLAB controller TCU3
　　　　with fast-running actuator

⑧ Equipment function
　　　　Room control
☐ **RS**   Supply air control (Room Supply)
☐ **RE**   Extract air control (Room Exhaust)
☐ **PC**   Differential pressure control

　　　　Single operation
☐ **SC**   Supply air controller
☐ **EC**   Extract air controller

⑨ External volume flow rate setting
　　　　Only for single operation
☐ **E0**   Voltage signal 0 – 10 V DC
☐ **E2**   Voltage signal 2 – 10 V DC
☐ **2P**   On-site switch contacts
　　　　for 2 switching steps
☐ **3P**   On-site switch contacts
　　　　for 3 switching steps
☐ **F**   Volume flow rate constant value,
　　　　without signalling

⑩ 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

⑪ Additional functions
　　　　Only for room control
　　　　(equipment function)
　　　　Raum management function
　　　　has been deactivated
☐ **LAB**   Extract air led system (laboratories)
☐ **CLR**   Supply air led system (clean rooms)
　　　　Raum management function is active
☐ **LAB-RMF** Extract air led system (LAB)
☐ **CLR-RMF** Supply air led system (CLR)

⑫ Operating values [m³/h or l/s, Pa]
　　　　For equipment function 'room control'
　　　　with additional function RMF
　　　　Total room extract air/supply air
　　　　$\dot{V}_1$:   Standard mode
　　　　$\dot{V}_2$:   Reduced operation
　　　　$\dot{V}_3$:   Increased operation
　　　　$\dot{V}_4$:   Constant room supply air
　　　　$\dot{V}_5$:   Constant room extract air
　　　　$\dot{V}_6$:   Supply air/extract air difference
　　　　$\Delta p_{setpoint}$:   Setpoint pressure
　　　　(only with differential pressure control)
　　　　For equipment function
　　　　'single operation'
　　　　E0, E2: $\dot{V}_{min} / \dot{V}_{max}$
　　　　2P: $\dot{V}_1 / \dot{V}_2$
　　　　3P: $\dot{V}_1 / \dot{V}_2 / \dot{V}_3$
　　　　F: $\dot{V}_1$

Useful additions
　　　　Room control panel
☐ **BE-LCD-01** 40-character display

Order options

LABCONTROL

EASYLAB

① Type
TVR VAV terminal unit

② Acoustic cladding
No entry: none
☐ **D** With acoustic cladding

③ Material
No entry: galvanised sheet steel
☐ **P1** Powder-coated (RAL 7001), silver grey
☐ **A2** Stainless steel

④ Flange
No entry: none
☐ **FL** Both ends (not for TVR-D-P1)

⑤ Nominal size [mm]
☐ **100**
☐ **125**
☐ **160**
☐ **200**
☐ **250**
☐ **315**
☐ **400**

⑥ Accessories
No entry: none
☐ **D2** Lip seals on both ends
☐ **G2** Matching flanges for both ends

⑦ Attachments (control component)
ELAB EASYLAB controller TCU3
with fast-running actuator

⑧ 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

⑨ 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)

⑩ 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-** OLED display
☐ **BE-LCD-01** 40-character display

1 Order options

LABCONTROL

TCU-LON-II

① Type
TVR   VAV terminal unit

② Acoustic cladding
No entry: none
☐ **D**   With acoustic cladding

③ Material
No entry: galvanised sheet steel
☐ **P1**   Powder-coated (RAL 7001), silver grey
☐ **A2**   Stainless steel

④ Flange
No entry: none
☐ **FL**   Flanges on both ends

⑤ Nominal size [mm]
☐ **100**
☐ **125**
☐ **160**
☐ **200**
☐ **250**
☐ **315**
☐ **400**

⑥ Accessories
No entry: none
☐ **G2**   Matching flanges for both ends
☐ **D2**   Lip seals on both ends

⑦ Attachments (control component)
☐ **TMA**   TCU-LON-II with fast-running actuator
☐ **TMB**   TCU-LON-II with fast-running actuator (brushless motor)

⑧ Equipment function
☐ **FH**   Fume cupboard
☐ **RS**   Room supply air
☐ **RE**   Room extract air
☐ **PS**   Differential pressure control – supply air (Pressure Supply)
☐ **PE**   Differential pressure control – extract air (Pressure Extract)

⑨ Operating values [m³/h or l/s, Pa]
Depending on equipment function
FH: $\dot{V}_{min} - \dot{V}_{max}$
RS: $\Delta\dot{V} / \dot{V}_{constant}$
RE: $\dot{V}_{Tag} / \dot{V}_{night} / \dot{V}_{constant}$
PS: $\Delta\dot{V} / \dot{V}_{constant} / \Delta p_{setpoint}$
PE: $\dot{V}_{day} / \dot{V}_{night} / \dot{V}_{constant} / \Delta p_{setpoint}$
The room control volume flow rates (RS, RE, PS, PE) are related to the total extract air volume flow rate for the room

Useful additions
Control panel for fume cupboard controller, for displaying the functions of the control system according to EN 14175
☐ **BE-TCU-LON-II** Control panel

Variable volume flow control – VARYCONTROL

Basic information and nomenclature

- Product selection
- Principal dimensions
- Nomenclature
- Construction
- Correction values for system attenuation
- Measurements
- Sizing and sizing example
- Function
- Operating modes

Variable volume flow control – VARYCONTROL
Basic information and nomenclature

1

Product selection

		Type										
	LVC	TVR	TVJ	TVT	TZ-Silenzio	TA-Silenzio	TVZ	TVA	TVM	TVRK	TVLK	TVR-Ex
Type of system												
Supply air	●	●	●	●	●		●			●		●
Extract air	●	●	●	●		●		●		●	●	●
Dual duct (supply air)									●			
Duct connection, fan end												
Circular	●	●					●	●	●	●	●	●
Rectangular			●	●	●	●						
Volume flow rate range												
Up to [m³/h]	1080	6050	36360	36360	3025	3025	6050	6050	6050	6050	1295	6050
Up to [l/s]	300	1680	10100	10100	840	840	1680	1680	1680	1680	360	1680
Air quality												
Filtered	●	●	●	●	●	●	●		●	●	●	●
Office extract air	●	●	●	●		●		●		●	●	●
Polluted		○	○	○		○		○		●	●	○
Contaminated										●	●	
Control function												
Variable	●	●	●	●	●	●	●	●	●	●	●	●
Constant	●	●	●	●	●	●	●	●	●	●	●	●
Min/Max	●	●	●	●	●	●	●	●	●	●	●	●
Pressure control		○	○	○	○	○	○	○		○		○
Master/Slave	●	●	●	●	●	●	●	●	Master	●	●	●
Shut-off mode												
Leakage			●									
Low leakage	●	●		●	●	●	●	●	●	●	●	●
Acoustic requirements												
High < 40 dB(A)			○	○	●	●	●	●	○			
Low < 50 dB (A)	●	●	●	●	●	●	●	●	●	●	●	●
Other functions												
Volume flow rate measurement	●	●	●	●	●	●	●	●	●	●	●	●
Special areas												
Areas with explosive atmospheres												●
Labs, clean rooms, operating theatres (EASYLAB, TCU-LON II)		●	●	●			●	●		●	●	

●	Possible
○	Possible under certain conditions: Robust unit variant and/or specific control component (attachment) or useful additional product
	Not possible

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

Nomenclature

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.

Definition of noise

① Air-regenerated noise
② Case-radiated noise

1
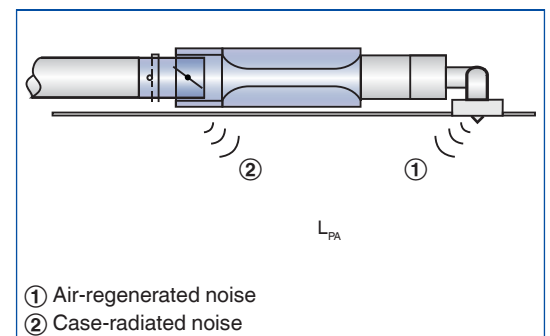
Volume flow rates

$\dot{V}_{nom}$ [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. $\dot{V}_{max}$)
– Upper limit of the setting range
  and maximum volume flow rate setpoint
  value for the VAV terminal unit

$\dot{V}_{min\,unit}$ [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 $\dot{V}_{min\,unit}$
  (if $\dot{V}_{min}$ equals zero) may result
  in unstable control or shut-off

$\dot{V}_{max}$ [m³/h] and [l/s]
Upper limit of the operating range
for the VAV terminal unit that can be
set by customers
– $\dot{V}_{max}$ can only be smaller than or equal to $\dot{V}_{nom}$
– In case of analog signalling to volume flow
  controllers (which are typically used),
  the set maximum value ($\dot{V}_{max}$) is allocated
  to the setpoint signal maximum (10 V)
  (see characteristic)

$\dot{V}_{min}$ [m³/h] and [l/s]
Lower limit of the operating range for the VAV
terminal unit that can be set by customers
– $\dot{V}_{min}$ should be smaller than or equal to $\dot{V}_{max}$
– Do not set $\dot{V}_{min}$ smaller than $\dot{V}_{min\,unit}$,
  otherwise the control may become unstable
  or the damper blade may close
– $\dot{V}_{min}$ may equal zero
– In case of analog signalling to volume flow
  controllers (which are typically used),
  the set minimum value ($\dot{V}_{min}$) is allocated
  to the setpoint signal minimum (0 or 2 V)
  (see characteristic)

$\dot{V}$ [m³/h] and [l/s]
Volume flow rate

$\Delta\dot{V}$ [± %]
Volume flow rate tolerance from setpoint value

$\Delta\dot{V}_{warm}$ [± %]
Volume flow rate tolerance
for the warm air flow of dual duct terminal units

Characteristic of the setpoint value signal

① 0 – 10 V DC
② 2 – 10 V DC
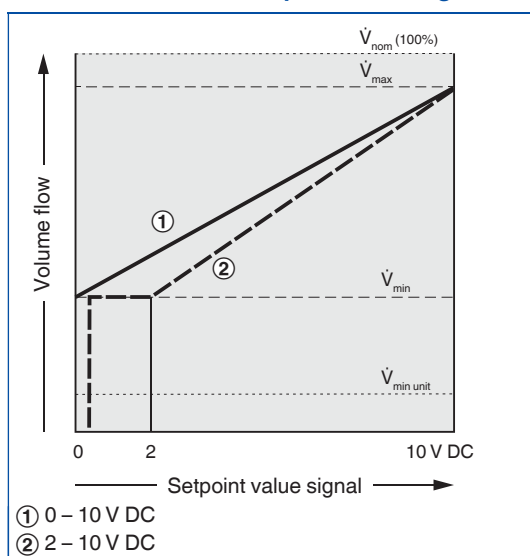
Characteristic of the actual value signal

① 0 – 10 V DC
② 2 – 10 V DC
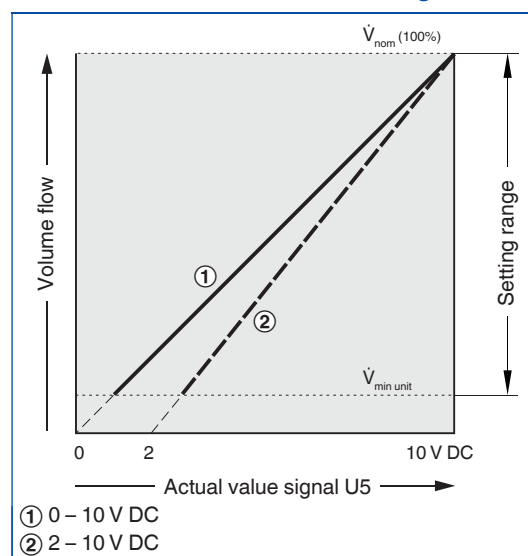
Differential pressure

Δp$_{st}$ [Pa]
Static differential pressure

Δp$_{st\ min}$ [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

Static differential pressure
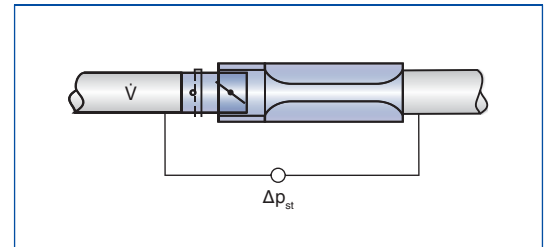
Constructions

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

1

The quick sizing tables show the sound pressure levels that can be expected in a room both for the air-regenerated noise and for the case-radiated noise. The sound pressure level in a room results from the sound power level of the products – for a given volume flow rate and differential pressure – and the attenuation and insulation on site. Generally accepted attenuation and insulation values have been taken into account.
The distribution of air across the ductwork, changes of direction, end reflection, and room attenuation all affect the sound pressure level of the air-regenerated noise. Ceiling insulation and room attenuation influence the sound pressure level of the case-radiated noise.

Reducing the sound pressure level of the air-regenerated noise

① VAV terminal unit
② Distribution in the ducting
③ Change of direction
④ End reflection
⑤ Ceiling insulation
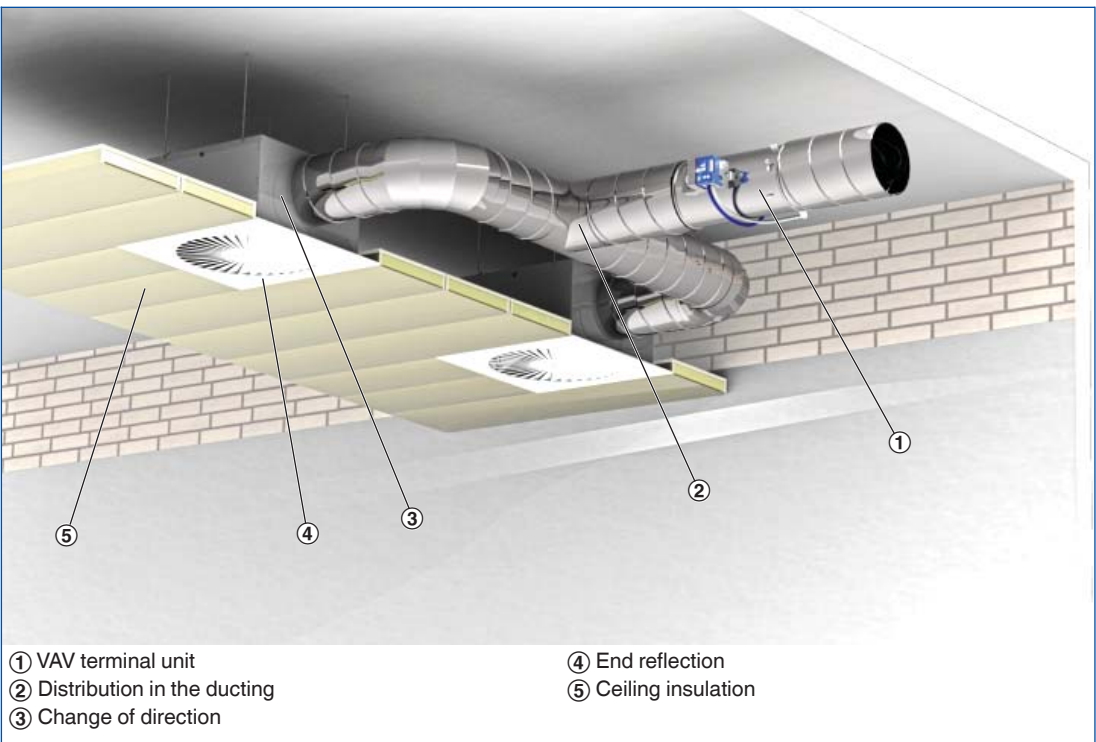
Correction values for acoustic quick sizing

The correction values for the distribution in the ducting are based on the number of diffusers assigned to any one air terminal unit.
If there is just one diffuser (assumption: 140 l/s or 500 m³/h), no correction is necessary.

Octave correction for the distribution in the ducting, used to calculate the air-regenerated noise

V̇ in [m³/h]	500	1000	1500	2000	2500	3000	4000	5000
[l/s]	140	280	420	550	700	840	1100	1400
[dB]	0	3	5	6	7	8	9	10

One change of direction, e.g. at the horizontal connection of the diffuser plenum box, has been taken into consideration for the system attenuation values. Vertical connection of the plenum box does not result in a system attenuation. Additional bends result in lower sound pressure levels.

System attenuation per octave to VDI 2081 for the calculation of the air-regenerated noise

Centre frequency [Hz]	63	125	250	500	1000	2000	4000	8000
				ΔL				
				dB				
Change of direction	0	0	1	2	3	3	3	3
Mündungsreflexion	10	5	2	0	0	0	0	0
Room attenuation	5	5	5	5	5	5	5	5

The calculation is based on the end reflection for nominal size 250

Octave correction for the calculation of case-radiated noise

| Centre frequency [Hz]	63	125	250	500	1000	2000	4000	8000
				ΔL				
				dB				
Ceiling insulation	4	4	4	4	4	4	4	4
Room attenuation	5	5	5	5	5	5	5	5

Measurements

The acoustic data for the air-regenerated noise and case-radiated noise are determined according to EN ISO 5135. All measurements are carried out in a reverberation chamber to EN ISO 3741.

Measuring the air-regenerated noise

④   ⑤   ②   ⑤

①
②
$\dot{V}$ Δp_{st}

③ L_P

① Reverberation chamber
② VAV terminal unit
③ Microphone

④ Fan
⑤ Sound attenuator
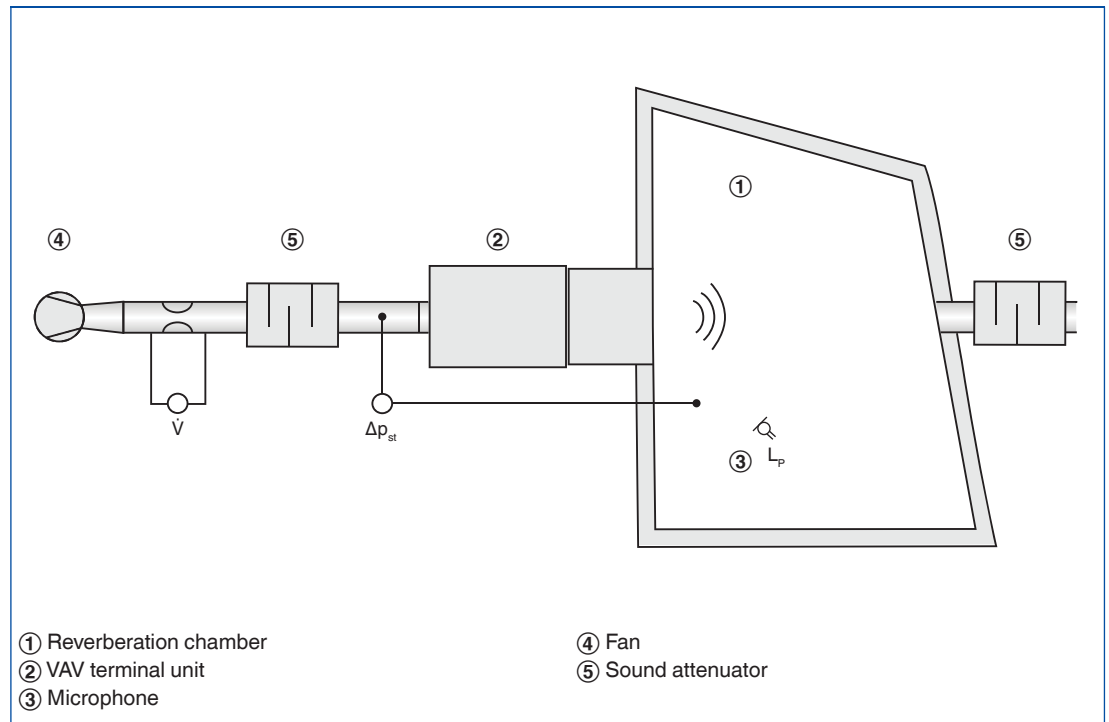
The sound pressure levels for air-regenerated noise L_{PA} given by us result from measurements in a reverberation chamber. The sound pressure L_P is measured for the entire frequency range. The evaluation of the measurements, including system attenuation and A-weighting, results in the sound pressure level L_{PA}.

Measuring the case-radiated noise

④   ⑤

①
②
$\dot{V}$ Δp_{st}

③ L_P

① Reverberation chamber
② VAV terminal unit
③ Microphone

④ Fan
⑤ Sound attenuator
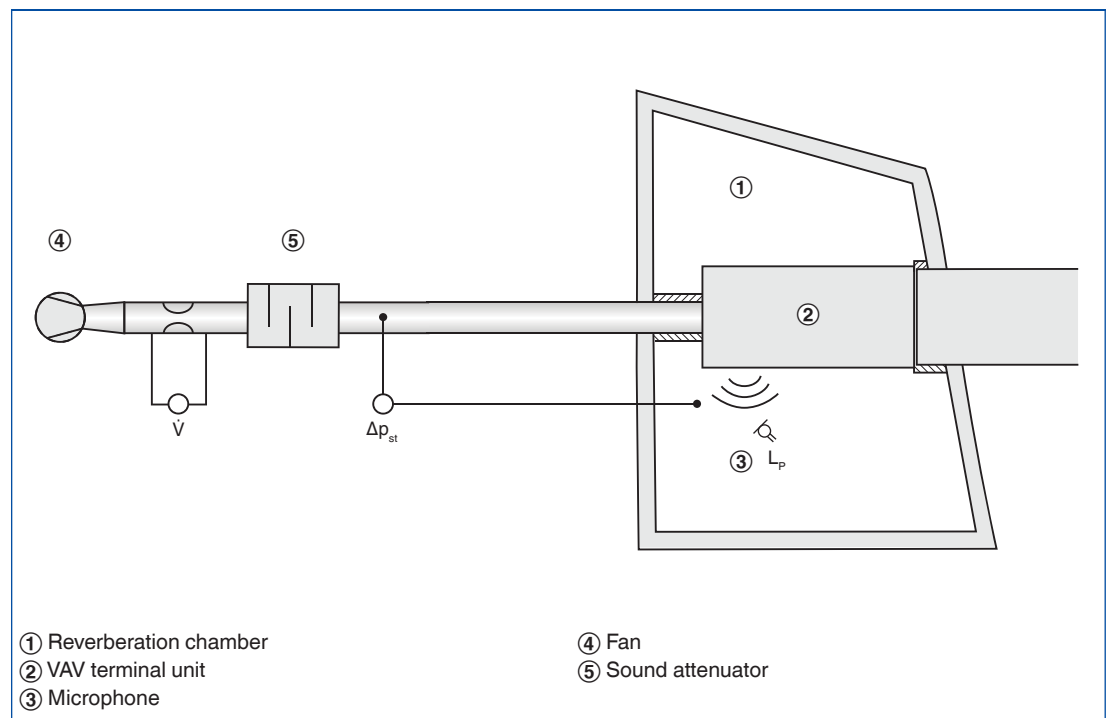
The sound pressure levels for case-radiated noise L_{PA2} given by us result from measurements in a reverberation chamber. The sound pressure L_P is measured for the entire frequency range. The evaluation of the measurements, including system attenuation and A-weighting, results in the sound pressure level L_{PA2}.

**Sizing with
the help of this catalogue**

This catalogue provides convenient quick sizing tables for VAV terminal units. The sound pressure levels for air-regenerated noise and for case-radiated noise are provided for all nominal sizes. In addition, generally accepted attenuation and insulation values have been taken into account. Sizing data for other volume flow rates and differential pressures can be determined quickly and precisely using the Easy Product Finder design programme.

Sizing example

Given data
$\dot{V}_{max}$ = 280 l/s (1010 m³/h)
Δp_{st} = 150 Pa
Required sound pressure
level in the room 30 dB(A)

Quick sizing
TVZ-D/200
Air-regenerated noise L_{PA} = 23 dB(A)
Case-radiated noise L_{PA3} = 24 dB(A)

Sound pressure level in the room = 27 dB(A)
(logarithmic addition since the terminal unit
is installed in the suspended ceiling of the room)

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.

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Function

Volume flow control

The volume flow rate is controlled in a closed loop. The controller receives from the transducer the actual value that results from the effective pressure. For most applications, the setpoint value comes from a room temperature controller. The controller compares the actual value with the setpoint value and alters the command signal of the actuator if there is a difference between the two values.

Correction of duct pressure changes

The controller detects and corrects changes of the duct pressure that may occur, for example, due to volume flow rate changes from other units. Pressure changes will therefore not affect the room temperature.

Variable volume flow

If the input signal is changed, the controller adjusts the volume flow rate to the new setpoint. The variable volume flow rate range is limited, i.e. there is a minimum value and a maximum value. This control strategy can be overridden, e.g. by shutting off the duct.
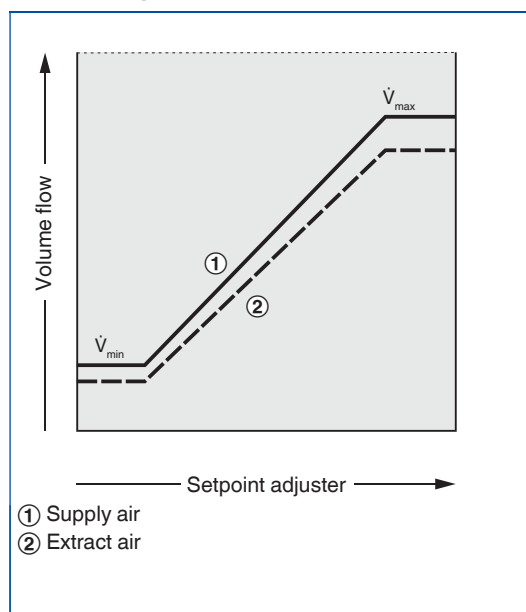
Supply/extract air tracking control

In individual rooms and closed-off office areas, where the balance between supply and extract air flow rate has to be maintained. Otherwise, annoying whistling noises can occur at door gaps, and the doors can be difficult to open. For this reason, the extract air should also have variable control in a VAV system. The supply air actual value (for dual duct terminal units the actual value signal of the warm air controller) is signalled to the extract air controller (slave controller) as setpoint signal. As a consequence, the extract air always follows the supply air.
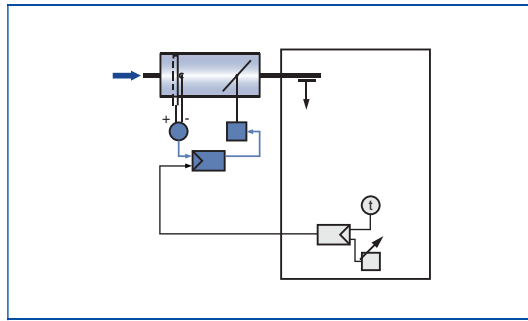
Control loop
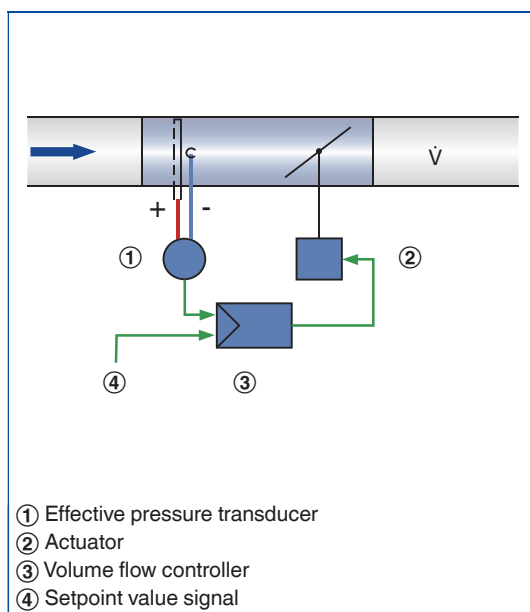
① Effective pressure transducer
② Actuator
③ Volume flow controller
④ Setpoint value signal

Control diagram

① Supply air
② Extract air

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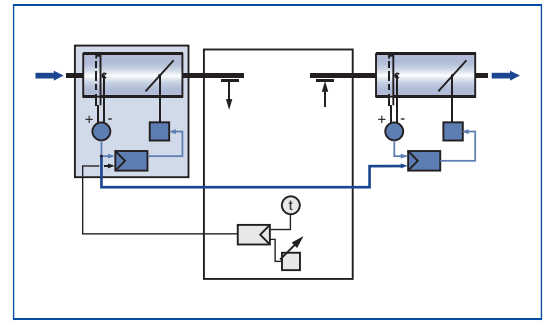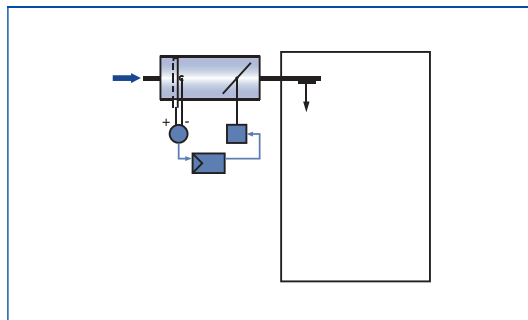**Operating modes**

Single operation

Slave operation (master)

Constant value

Slave operation (slave)