VAV terminal units
Type TVT

Universal controller

Compact controller

Easy controller

With sealing elements
for low-leakage shut-off

For normal and high volume flow rate ranges and air-tight shut-off

Rectangular VAV terminal units for standard applications regarding the supply air or extract air control in variable air volume systems where low-leakage shut-off is required

- For volume flow rate ranges up to 21,000 m^3/h or 5,800 l/s
- 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
- Suitable for airflow velocities up to 10 m/s
- Closed blade air leakage to EN 1751, class 3
- Casing air leakage to EN 1751, up to class C

Optional equipment and accessories

- Acoustic cladding for the reduction of case-radiated noise
- Secondary silencer Type TX for the reduction of air-regenerated noise
- Hot water heat exchanger of Type WT for reheating the airflow

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Variants

Product examples

VAV terminal unit, variant TVT

VAV terminal unit, variant TVT-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
- Rectangular VARYCONTROL VAV terminal units of Type TVT 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
- TVT: VAV terminal unit
- TVT-D: VAV terminal unit with acoustic cladding
- Units with acoustic cladding and/or secondary silencer Type TX for demanding acoustic requirements
- Acoustic cladding cannot be retrofitted

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

Nominal sizes
- 36 nominal sizes from 200 × 100 to 1000 × 600
- Up to nominal size 800 × 300 including all attachments, larger units only with actuators with higher torque

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

Useful additions
- Secondary silencer Type TX for demanding acoustic requirements
- Heat exchanger Type WT

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 blades
- 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 volume flow rate control accuracy

Construction features
- Rectangular casing
- Flanges on both sides, suitable for duct connection
- Opposed blade action, blades connected by internal gears (enclosed) at both ends
- Damper blades with replaceable seals
- Position of the damper blade indicated externally at shaft extension
- Bearings with ring seals

Materials and surfaces
Galvanised sheet steel construction
- Casing made of galvanised sheet steel
- Shaft and linkage made of galvanised steel
- Damper blades and differential pressure sensor made of aluminium
- Gears made of anti-static plastic (ABS), heat resistant to 50 °C
- Plastic bearings

Powder-coated construction (P1)
- Casing made of galvanised sheet steel, 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)
- With flanges on both ends to make connections to the ducting
- TVT-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
- Closed blade air leakage to EN 1751, class 3
- Meets the general requirements of DIN 1946, part 4, with regard to the acceptable closed blade air leakage
- Casing air leakage to EN 1751, class C (B + H ≤400, class B)

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

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Attachments: VARYCONTROL control components for Type TVT

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				
B11	Volume flow rate	Universal controller TROX/Belimo	Dynamic, integral	Actuator
B1B				Spring return actuator
XC3		Universal controller TROX/Gruner		
Universal controller, static				
BP1	Volume flow rate	Universal controller with MP bus interface TROX/Belimo	Static	Actuator
BPB				Spring return actuator
BPG				Fast-running actuator
BB1		Universal controller TROX/Belimo		Actuator
BBB				Spring return actuator
XD1		Universal controller TROX/Gruner	Static, integral	Actuator
XD3				Spring return actuator
BR1	Differential pressure	Universal controller with MP bus interface TROX/Belimo	Static, integral 100 Pa	Actuator
BRB				Spring return actuator
BS1			Static, integral 600 Pa	Actuator
BSB				Spring return actuator
BSG				Fast-running actuator
BG1		Differential pressure controller TROX/Belimo	Static, integral 100 Pa	Actuator
BGB				Spring return actuator
BH1			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 TVT

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	200 × 100 to 1000 × 600 mm
Volume flow rate range	45 – 6100 l/s or 162 – 21960 m³/h
Volume flow rate control range (unit with dynamic differential pressure measurement)	Approx. 20 to 100 % of the nominal volume flow rate
Minimum differential pressure	5 – 40 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 TVT

① Differential pressure sensor
② Damper blade with seal
③ Gears
④ Control components, e.g. an Easy controller

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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 $\Delta p_{st\ min}$		$\Delta\dot{V}$
	l/s	m³/h	Pa		± %
200 × 100	45	162	5	10	14
	85	306	10	25	8
	150	540	20	80	5
	215	774	40	155	5
300 × 100	65	234	5	10	14
	120	432	10	25	8
	210	756	20	70	5
	320	1152	40	155	5
400 × 100	85	306	5	10	14
	170	612	10	25	8
	300	1080	20	80	5
	425	1530	40	155	5
500 × 100	105	378	5	10	14
	200	720	10	25	8
	350	1260	20	70	5
	535	1926	40	155	5
600 × 100	130	468	5	10	14
	260	936	10	25	8
	450	1620	20	75	5
	650	2340	40	155	5
200 × 200	85	306	5	10	14
	160	576	10	25	8
	280	1008	20	75	5
	415	1494	40	155	5
300 × 200	125	450	5	10	14
	240	864	10	25	8
	420	1512	20	75	5
	620	2232	40	155	5
400 × 200	165	594	5	10	14
	330	1188	10	25	8
	580	2088	20	80	5
	825	2970	40	155	5
500 × 200	205	738	5	10	14
	400	1440	10	25	8
	700	2520	20	75	5
	1035	3726	40	155	5
600 × 200	250	900	5	10	14
	500	1800	10	25	8
	870	3132	20	80	5
	1250	4500	40	155	5
700 × 200	290	1044	5	10	14
	560	2016	10	25	8
	980	3528	20	75	5
	1450	5220	40	155	5

Nominal size	$\dot{V}$		① ② $\Delta p_{st\ min}$		$\Delta\dot{V}$
	l/s	m³/h	Pa		± %
800 × 200	330	1188	5	10	14
	660	2376	10	25	8
	1160	4176	20	80	5
	1650	5940	40	155	5
300 × 300	185	666	5	10	14
	360	1296	10	25	8
	630	2268	20	75	5
	920	3312	35	150	5
400 × 300	245	882	5	10	14
	480	1728	10	25	8
	840	3024	20	70	8
	1230	4428	35	150	5
500 × 300	305	1098	5	10	14
	600	2160	10	25	8
	1050	3780	20	70	5
	1535	5526	35	150	5
600 × 300	370	1332	5	10	14
	740	2664	10	25	8
	1290	4644	20	75	5
	1850	6660	35	150	5
700 × 300	430	1548	5	10	14
	840	3024	10	25	8
	1470	5292	20	70	5
	2150	7740	35	150	5
800 × 300	490	1764	5	10	14
	980	3528	10	25	8
	1720	6192	20	75	5
	2450	8820	35	150	5
900 × 300	555	1998	5	10	14
	1080	3888	10	25	8
	1890	6804	20	70	5
	2770	9972	35	150	5
1000 × 300	620	2232	5	10	14
	1240	4464	10	25	8
	2150	7740	20	75	5
	3100	11160	35	150	5
400 × 400	325	1170	5	10	14
	640	2304	10	25	8
	1120	4032	20	75	5
	1630	5868	35	150	5
500 × 400	410	1476	5	10	14
	800	2880	10	25	8
	1400	5040	20	75	5
	2040	7344	35	150	5

① TVT
② TVT with secondary silencer TX

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.

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	$\Delta\dot{V}$
			$\Delta p_{st\ min}$		
	l/s	m^3/h	Pa		± %
600 × 400	490	1764	5	10	14
	980	3528	10	25	8
	1720	6192	20	75	5
	2450	8820	35	150	5
700 × 400	570	2052	5	10	14
	1120	4032	10	25	8
	1960	7056	20	75	5
	2850	10260	35	150	5
800 × 400	650	2340	5	10	14
	1300	4680	10	25	8
	2280	8208	20	75	5
	3250	11700	35	150	5
900 × 400	735	2646	5	10	14
	1440	5184	10	25	8
	2520	9072	20	75	5
	3670	13212	35	150	5
1000 × 400	820	2952	5	10	14
	1640	5904	10	25	8
	2850	10260	20	75	5
	4100	14760	35	150	5
500 × 500	510	1836	5	10	14
	1000	3600	10	25	8
	1750	6300	20	75	5
	2540	9144	40	155	5
600 × 500	610	2196	5	10	14
	1200	4320	10	25	8
	2100	7560	20	75	5
	3050	10980	40	155	5

Nominal size	$\dot{V}$		①	②	$\Delta\dot{V}$
			$\Delta p_{st\ min}$		
	l/s	m^3/h	Pa		± %
700 × 500	710	2556	5	10	14
	1400	5040	10	25	8
	2450	8820	20	75	5
	3550	12780	40	155	5
800 × 500	810	2916	5	10	14
	1600	5760	10	25	8
	2800	10080	20	75	5
	4050	14580	40	155	5
900 × 500	915	3294	5	10	14
	1800	6480	10	25	8
	3150	11340	20	75	5
	4570	16452	40	155	5
1000 × 500	1020	3672	5	10	14
	2000	7200	10	25	8
	3500	12600	20	75	5
	5100	18360	40	155	5
600 × 600	730	2628	5	10	14
	1440	5184	10	25	8
	2520	9072	20	75	5
	3650	13140	40	155	5
800 × 600	970	3492	5	10	14
	1920	6912	10	25	8
	3360	12096	20	75	5
	4850	17460	40	155	5
1000 × 600	1220	4392	5	10	14
	2400	8640	10	25	8
	4200	15120	20	75	5
	6100	21960	40	155	5

① TVT
② TVT with secondary silencer TX

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.

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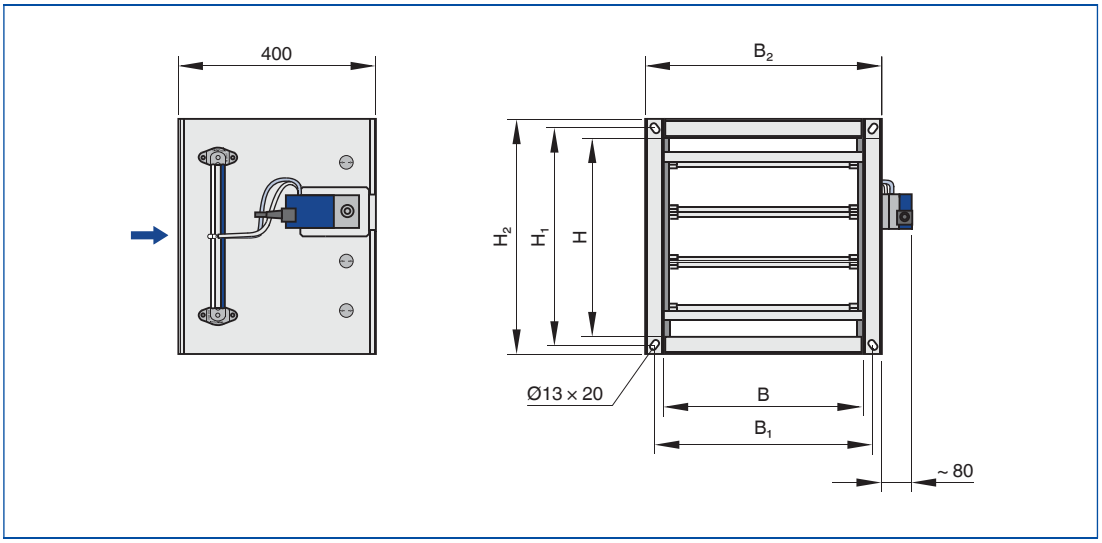
Description

– VAV terminal unit for the control of variable air volume flow rates

VAV terminal unit, variant TVT

Dimensions

TVT



Dimensions [mm] and weight [kg]

Nominal size	B	H	B_1	B_2	H_1	H_2	m
	mm						kg
200 × 100	200	100	234	276	134	176	6
300 × 100	300	100	334	376	134	176	7
400 × 100	400	100	434	476	134	176	8
500 × 100	500	100	534	576	134	176	9
600 × 100	600	100	634	676	134	176	10
200 × 200	200	200	234	276	234	276	9
300 × 200	300	200	334	376	234	276	10
400 × 200	400	200	434	476	234	276	11
500 × 200	500	200	534	576	234	276	12
600 × 200	600	200	634	676	234	276	13
700 × 200	700	200	734	776	234	276	14
800 × 200	800	200	834	876	234	276	15
300 × 300	300	300	334	376	334	376	10
400 × 300	400	300	434	476	334	376	11
500 × 300	500	300	534	576	334	376	12
600 × 300	600	300	634	676	334	376	13
700 × 300	700	300	734	776	334	376	15
800 × 300	800	300	834	876	334	376	16
900 × 300	900	300	934	976	334	376	18
1000 × 300	1000	300	1034	1076	334	376	19

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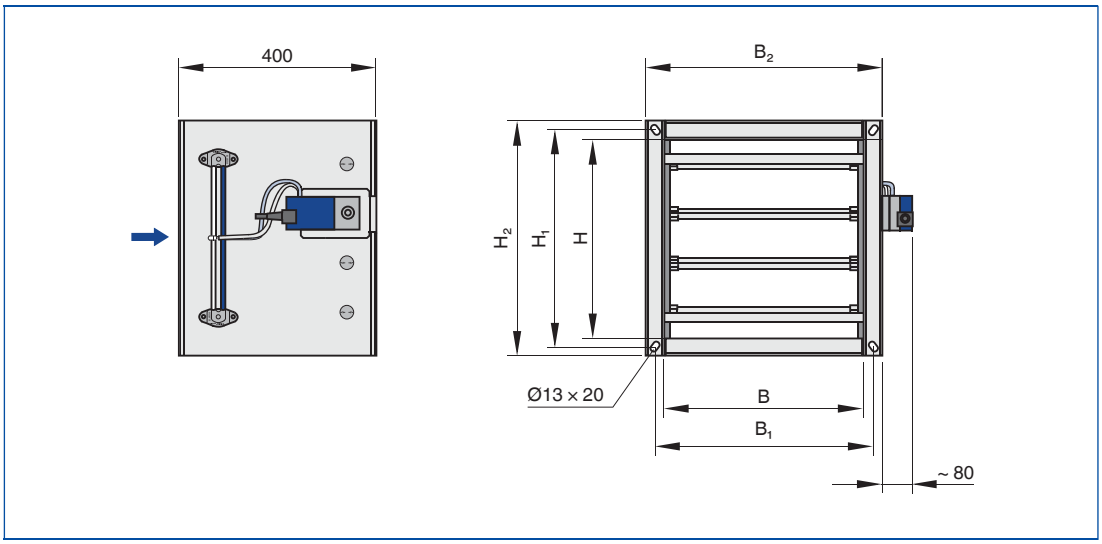
Dimensions

TVT



Dimensions [mm] and weight [kg]

Nominal size	B	H	B_1	B_2	H_1	H_2	m
	mm						kg
400 × 400	400	400	434	476	434	476	14
500 × 400	500	400	534	576	434	476	15
600 × 400	600	400	634	676	434	476	16
700 × 400	700	400	734	776	434	476	17
800 × 400	800	400	834	876	434	476	18
900 × 400	900	400	934	976	434	476	21
1000 × 400	1000	400	1034	1076	434	476	20
500 × 500	500	500	534	576	534	576	19
600 × 500	600	500	634	676	534	576	20
700 × 500	700	500	734	776	534	576	22
800 × 500	800	500	834	876	534	576	23
900 × 500	900	500	934	976	534	576	25
1000 × 500	1000	500	1034	1076	534	576	26
600 × 600	600	600	634	676	634	676	19
800 × 600	800	600	834	876	634	676	23
1000 × 600	1000	600	1034	1076	634	676	27

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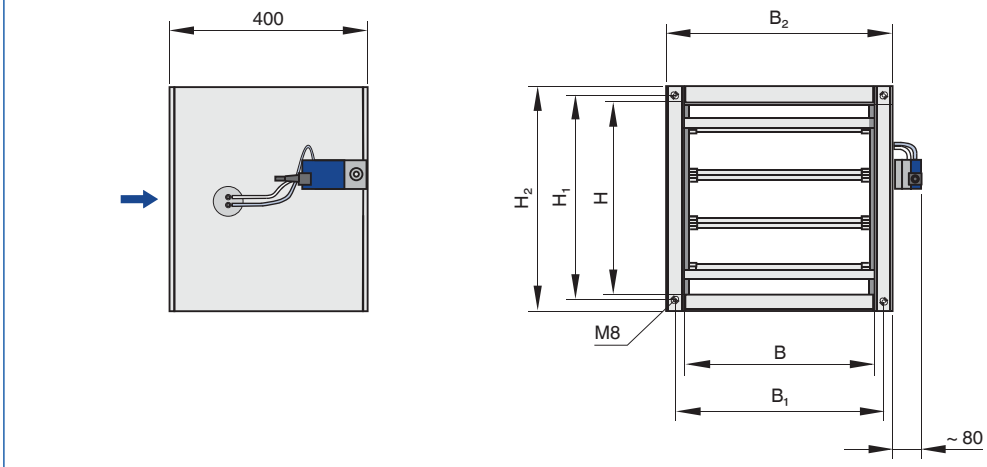
Description

VAV terminal unit, variant TVT-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 rectangular 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

TVT-D



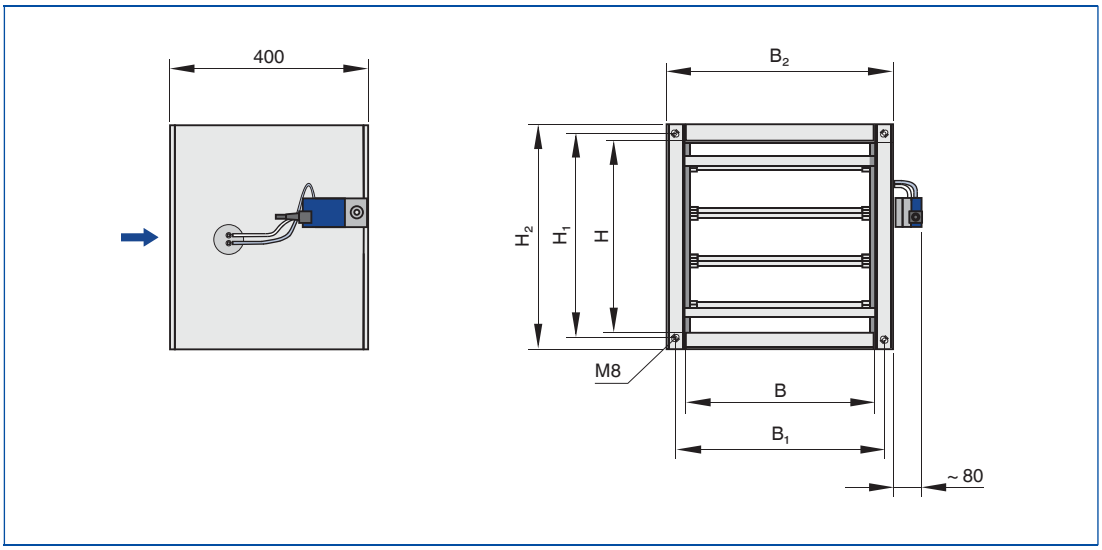
Dimensions [mm] and weight [kg]

Nominal size	B	H	B_1	B_2	H_1	H_2	m
	mm						kg
200 × 100	200	100	234	280	134	180	9
300 × 100	300	100	334	380	134	180	11
400 × 100	400	100	434	480	134	180	12
500 × 100	500	100	534	580	134	180	14
600 × 100	600	100	634	680	134	180	15
200 × 200	200	200	234	280	234	280	14
300 × 200	300	200	334	380	234	280	15
400 × 200	400	200	434	480	234	280	17
500 × 200	500	200	534	580	234	280	18
600 × 200	600	200	634	680	234	280	20
700 × 200	700	200	734	780	234	280	21
800 × 200	800	200	834	880	234	280	23
300 × 300	300	300	334	380	334	380	15
400 × 300	400	300	434	480	334	380	17
500 × 300	500	300	534	580	334	380	18
600 × 300	600	300	634	680	334	380	20
700 × 300	700	300	734	780	334	380	22
800 × 300	800	300	834	880	334	380	24
900 × 300	900	300	934	980	334	380	26
1000 × 300	1000	300	1034	1080	334	380	29

1

Dimensions

TVT-D



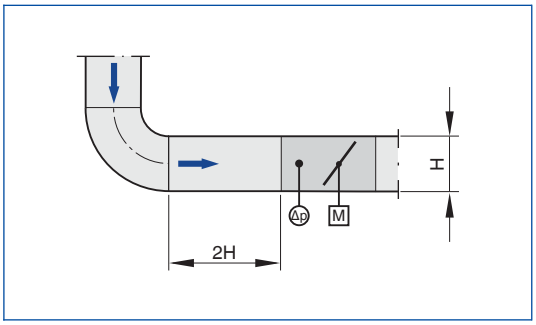
Dimensions [mm] and weight [kg]

Nominal size	B	H	B_1	B_2	H_1	H_2	m
	mm						kg
400 × 400	400	400	434	480	434	480	21
500 × 400	500	400	534	580	434	480	23
600 × 400	600	400	634	680	434	480	24
700 × 400	700	400	734	780	434	480	26
800 × 400	800	400	834	880	434	480	27
900 × 400	900	400	934	980	434	480	29
1000 × 400	1000	400	1034	1080	434	480	32
500 × 500	500	500	534	580	534	580	28
600 × 500	600	500	634	680	534	580	30
700 × 500	700	500	734	780	534	580	32
800 × 500	800	500	834	880	534	580	35
900 × 500	900	500	934	980	534	580	37
1000 × 500	1000	500	1034	1080	534	580	39
600 × 600	600	600	634	680	634	680	29
800 × 600	800	600	834	880	634	680	35
1000 × 600	1000	600	1034	1080	634	680	41

Upstream conditions

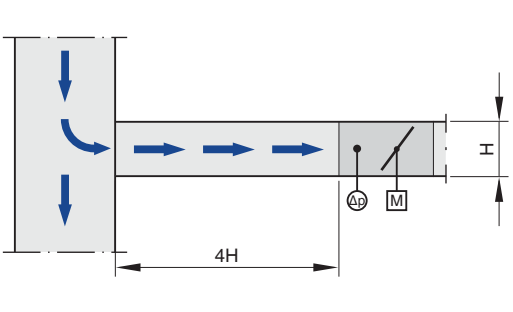
The volume flow rate accuracy ΔV̇ applies to a straight upstream section of the duct. Bends, junctions or a narrowing or widening of the duct cause turbulence that may affect measurement. Duct connections, e.g. branches off the main duct, must comply with EN 1505. Some installation situations require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

Bend, vertical



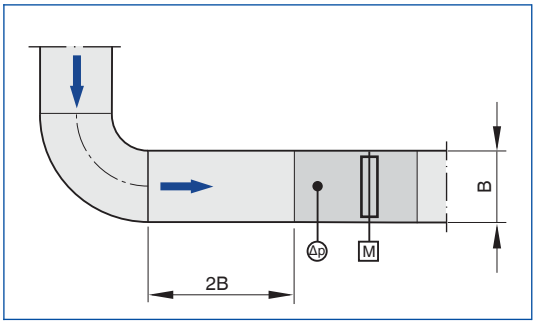
A bend – with a straight duct section of at least 2H upstream of the VAV terminal unit – has only a negligible effect on the volume flow rate accuracy.

Junction, vertical



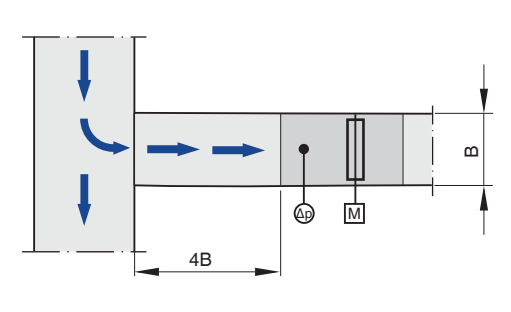
A junction causes strong turbulence. The stated volume flow rate accuracy ΔV̇ can only be achieved with a straight duct section of at least 4H upstream. Shorter upstream sections require a perforated plate in the branch and before the VAV terminal unit. If there is no straight upstream section at all, the control will not be stable, even with a perforated plate.

Bend, horizontal



A bend – with a straight duct section of at least 2B upstream of the VAV terminal unit – has only a negligible effect on the volume flow rate accuracy.

Junction, horizontal

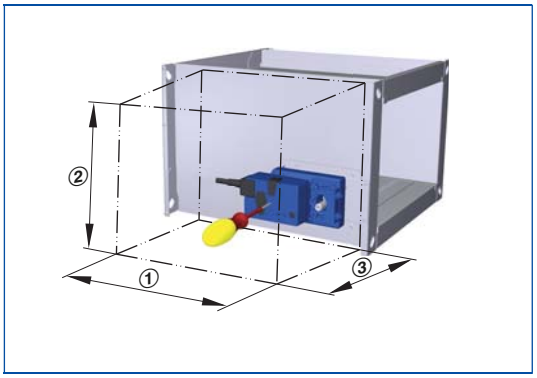


A junction causes strong turbulence. The stated volume flow rate accuracy ΔV̇ can only be achieved with a straight duct section of at least 4B upstream. Shorter upstream sections require a perforated plate in the branch and before the VAV terminal unit. If there is no straight upstream section at all, the control will not be stable, even with a perforated plate.

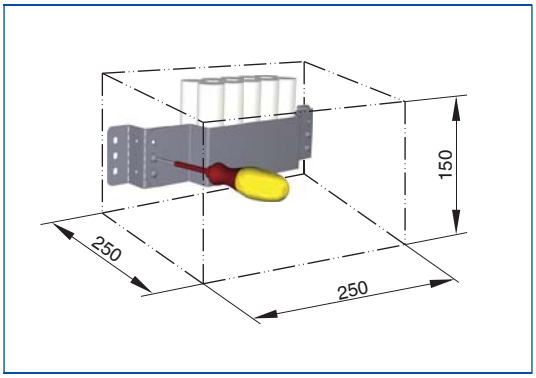
1 Space requirement for commissioning and maintenance

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



Access to attachments



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

Space required

Attachments	①	②	③
	mm		
VARYCONTROL			
Easy controller	400	H	300
Compact controller	400	H	300
Universal controller	500	H	300
LABCONTROL			
EASYLAB	500	H	400
TCU-LON-II	500	H	300

H: Unit height

Standard text

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

Rectangular VAV terminal units for variable and constant air volume systems, suitable for supply or extract air, available in 36 nominal sizes. High volume flow rate control accuracy. 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 damper blades. Factory assembled control components complete with wiring and tubing. Differential pressure sensor with 3 mm measuring holes (resistant to dust and pollution) Both ends suitable for the connection of ducts. Position of the damper blades indicated externally at the shaft extension. Closed blade air leakage to EN 1751, class 3. Casing air leakage to EN 1751, class C (B + H ≤400, class B)

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 made of galvanised sheet steel
- Shaft and linkage made of galvanised steel
- Damper blades and differential pressure sensor made of aluminium
- Gears made of anti-static plastic (ABS), heat resistant to 50 °C
- Plastic bearings

Powder-coated construction (P1)
- Casing made of galvanised sheet steel, 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)

Technical data

- Nominal sizes: 200 × 100 to 1000 × 600 mm
- Volume flow rate range: 45 to 6100 l/s or 162 to 21960 m^3/h
- Volume flow rate control range (unit with dynamic differential pressure measurement): approx. 20 to 100 % of the nominal volume flow rate
- Minimum differential pressure: 5 – 40 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. 20 – 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)]