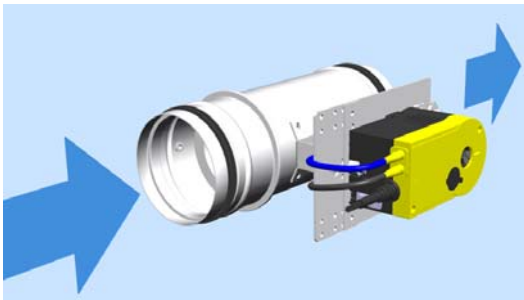


Technical Brochure

LTG Air Distribution

Variable flow rate controllers VRE



Round, made of steel or PPs

Technical brochure · Variable flow rate controllers VRE, round

LTG Comfort Air Technology	
Air-Water Systems	
Air Diffusers	
Air Distribution	

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Notes

Dimensions stated in this brochure are in mm.

Dimensions stated in this brochure are subject to General Tolerances according to DIN ISO 2768-vL.

The actual specifications are available as a word document at your local distributor or at www.LTG.de.

The flow rate controllers VRE, VRF, VREactive and VRFactive are designed to be installed in air-conditioning systems in accordance with DIN 60 Sheets 1+2 and DIN 1946 Sheet 2.

The aforementioned standards, in particular DIN 1946-2 which has been superseded by DIN EN 13779, relate to DIN EN 13779, which in turn refer to the standards DIN EN 12237 and DIN EN 1507. The tightness classes quoted in the standards must be enquired depending on the product design.

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Flow Rate Control Basics – Which Product for which Application?

Plant types

Variable Flow Rate

Units with variable flow rates (VVS) use electronic flow rate controllers providing the room with exactly the required air volume – according to function and energy efficiency.

Constant Flow Rate

Units with constant flow rates (KVS) use flow rate controllers maintaining a constant flow rate mechanically system-powered. Working with no wiring or external power supply, they provide convenient and cost-saving solutions.

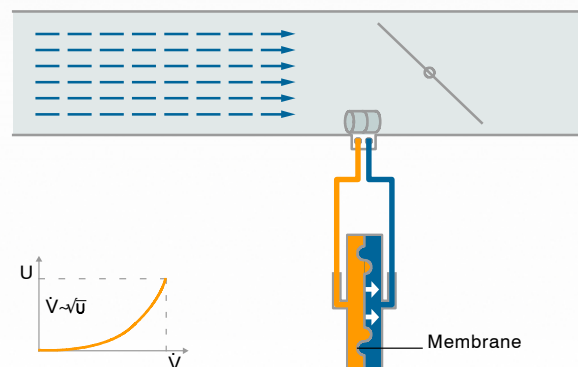
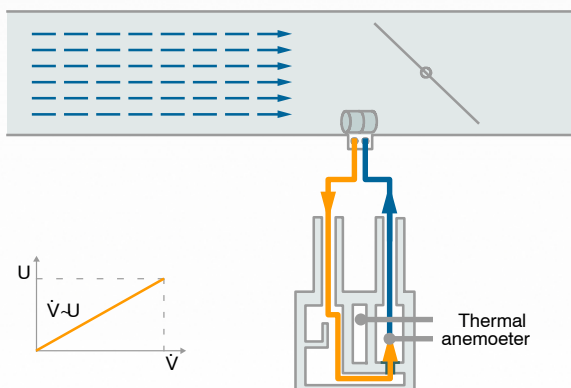
Measuring Methods

Dynamic Differential Pressure Management

Dynamic methods measure part of the air that is guided through the differential pressure transducer. Dynamic differential pressure measuring makes economical sense in plants where no dust and/or chemical pollution of the air is expected, potentially leading to the contamination of sensors (e. g. administration and office buildings, museums, etc.).

Static Differential Pressure Management

Static differential pressure measurement uses a diaphragm pressure transducer. With this method, no air is guided through the sensor, so no dust or chemical pollution by the air is possible and hence, may well be used in such environments.



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Measuring principle VRE

The continual constriction in the cross-section of a measuring orifice with defined aperture ratio creates a static differential pressure (= active pressure) between the inflow and outflow sides during air flow.

With this method the flow rate depends only on the active pressure.

The active pressure is tapped in front of and behind the orifice using a pair of measuring tappings (plus and minus pressure tapping). Since it is not the dynamic pressure in the air flow which is measured, unlike in other active pressure transducers (e.g. measuring cross), the risk of contamination of the measuring holes is lower.

Depending on the make of the attached sensor, the measurement in the sensor can be dynamic or static.

In the dynamic measurement the pressure gradient at the orifice is used to generate in the pressure transducer a low bypass airflow from plus to minus pressure tapping.

The air flow is routed via a thermal anemometer of which the output voltage is proportional to the flow velocity inside the damper housing.

The measurement value is independent of the installation position of the sensor.

Since there is a flow through the sensor, it is unsuitable for air that contains dust or is contaminated by chemicals.

In the static measurement the chambers of the pressure transducer are separated by a diaphragm. The diaphragm is deformed by the pressure difference and leads to a change in the electrical capacitance.

The pressure transducer is calibrated here such that the output signal is proportional to the flow velocity in the damper housing.

With simple diaphragm sensors without position compensation, the measurement value is position-dependent on account of the weight of the diaphragm itself, which is why a zero point calibration might be necessary.

The sensor is suitable for air that contains dust or is contaminated by chemicals, as there is no flow through it.

Control accuracy

Deviations from the set value: $\pm 5\%$ of V_{nenn} (10 m/s)

Installation position

The flow rate controller must be installed with due attention to the airflow direction arrow affixed to the housing and with the damper axis horizontal.

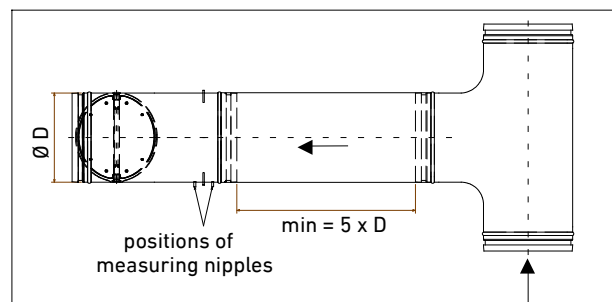
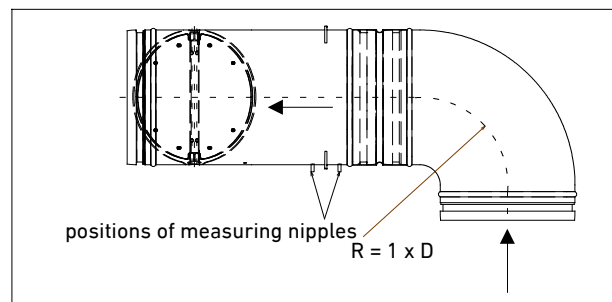
The differential pressure sensor of the attached compact controller, Sauter model ASV115, is position-independent.

In the case of other control components with static differential pressure sensor, the permissible installation position of the sensor can be found in the technical documents valid in each case. If necessary, a zero point adjustment must be conducted.

Required straight inflow distances

A straight, undisturbed inflow distance „min“ in front of the flow rate controller - acc. to the following illustrations - is required. A 90° bend can be connected without a straight inflow section to the flow rate controller. If a branch is connected, a straight inflow section of at least $5 \times D$ is required. Care must be taken with the positions of the measuring nipples to ensure that the specified control accuracy is achieved.

There are, however, no restrictions regarding the outflow side



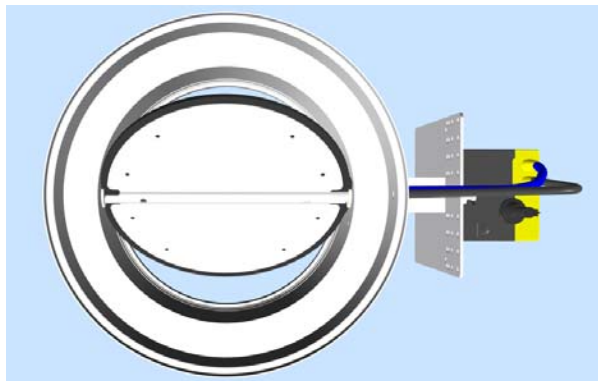
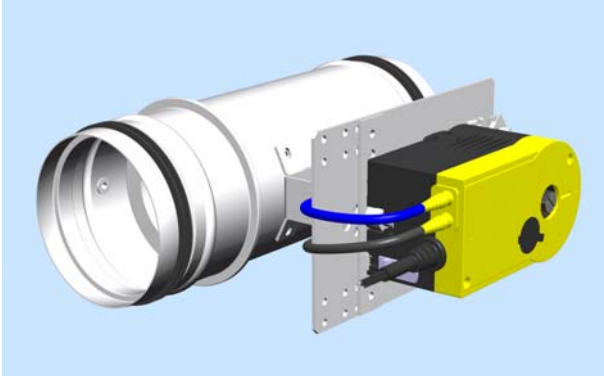
D - Diameter

min - minimum inflow distance for a control accuracy of $\pm 5\%$ of V_{nenn}

If a combination of fittings that is unfavourable with view to the air flow is unavoidable, the minimum distance is several times the given Min.

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Views of unit



Inside view in the direction of air flow

Application

The round flow rate control unit VRE is designed to control an initial pressure-independent constant or variable air flow.

Configuration

VRE units comprise of housing, flow rate measuring element with sensor, damper blade with actuator and controller. The housing is provided with plug-in end pieces with insertion groove for a lip-seal gasket, to fit air ducts according to DIN EN 1506 or EN 13180.

Mode of operation

The flow rate is measured using a measuring orifice as an active pressure transducer and with a differential pressure sensor, the measured differential pressure being the dimension for the flow rate.

The controller compares the actual value measured by the sensor with the setpoint value, and corrects the divergence by altering the damper setting using the actuating drive.

Control and regulation are achieved with external energy, either electric or pneumatic depending on the chosen design.

All components are factory-wired and hose-connected.

The flow rate controllers are rated for air velocities of 1...10 m/s.

Depending on the size, the control component and the set flow rate, the minimum pressure difference is approx. 10...130 Pa.

The damper blade closes air-tight in accordance with DIN EN 1751, complete shut-off is also possible.

To reduce sound emission, the flow rate controller can be optionally retrofitted with an insulating case and/or a silencer.

The mechanism is universally suitable for the attachment of various controller makes and combinations of controllers, sensors and actuators for specific applications too.

The control components also differ here in the measuring principle (dynamic/static), in their actuator function (running time, standby setting) and in their operation (with / without bus mode).

With a static measuring principle of the sensor and a corrosion-resistant design (coated or stainless steel), the flow rate controller is suitable for aggressive media, for example laboratory waste air (resistance verification required).

For rapid and stable control of critical applications, e.g. in laboratory and pharmaceutical applications, controllers with high-speed actuators are available.

If a standby setting function is required, actuators with spring return or SuperCaps are used.

Materials, finishes

- Housing, damper, axle, measuring probes of galvanized steel
- Damper bearings of POM plastic
- Sealings of EPDM

Accessories, special versions

- Insulating case for sound and heat insulation
- Plug-in end pieces with lip-seal gasket on both sides
- Flanges according to DIN 24154 R1 at both ends and counterflanges (loose)
- Pipe ends at both ends with flange and clamping rings with ring seal
- Additional pressure tapping points for parallel active pressure/flow rate measurement
- All metal parts within the air flow are made of V4A
- Housing and orifice with PUR finish RAL 9010 (damper blade, axle, measuring nipple of stainless steel V4A)
- Controller with dynamic differential pressure sensor
- Communication via MP-Bus or LON
- Actuator with spring return
- High-speed actuator
- Flexible sound absorber SDE-A0 made of aluminium
- Rigid sound absorber SDE-S0 made of galvanized sheet steel

Additional accessories and special versions by request.

Connection

Notes and circuit diagrams for regulating the flow rate can be found in the operating and maintenance instructions.

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Control

Made by Sauter, model ASV115CF132E (standard)

- Electronic VAV compact controller, supply 24V AC/DC
- Position-independent sensor with static measuring principle, suitable for aggressive media and contaminated air
- Running time of actuator 30...120 s parametrizable
- Torque of actuator 10 Nm, for sizes up to DN 630
- Analog control with 0(2)...10 V
- Control as switch command via two independent digital inputs (override controls CLOSE, OPEN, V_{\min} and V_{\max} with external potential-free switches is possible)
- Feedback of actual value analog with 0...10 V
- Communication via RS485 bus interface (max. 31 controllers)
- Parametrization of set values and inputs/outputs using SAUTER CASE VAV software
- Second control circuit for room pressure or room temperature control by connection of an appropriate sensor

Example for application of a VAV room temperature cascade controller

In combination with an Ni1000 temperature sensor, the VAV compact controller regulates the air change in the room, depending on the temperature control divergence (cooling sequence). The VAV compact controller can also operate a continuous valve actuator of an after-heater / radiator or of an after-cooler. A room temperature setpoint value can be specified from outside or permanently set in the VAV compact controller. All control functions and parameters of the temperature controller can be set using the software tool in the VAV compact controller.

Output or status signals (from VAV compact controller to DDC/BMS)

1. Flow rate actual value via analog output 0...10 V
2. Setting signal for valve actuator via analog output 0...10 V

Input or control signals (from DDC/BMS to VAV compact controller)

1. Room temperature setpoint value (variable control) via analog input: 0...10 V
2. Room temperature actual value via digital input / NI1000
3. Flow rate setpoint value (priority control) via digital input

Application ranges, limits

Valid for Sauter ASV115CF132E controller. With other controller models, divergences are possible.

- Minimum air speed 1 m/s
- Nominal air speed 10 m/s
- Static over-pressure in the air duct based on ambient pressure up to 1000 Pa
- Static under-pressure in the air duct based on ambient pressure 750 Pa max.
- Leakage flow rate via shut damper blade Class 4 acc. to DIN EN 1751 (DN 100 and 125: Class 3)
- Leakage flow rate via casing Class A acc. to DIN EN 1751 (optional Class C)
- Operating temperature range 0 ...+50 °C at <85 % rh, non-condensing
- Suitable for polluted or contaminated air flows (resistance verification required)
- Installation with horizontal damper axle only
- Free suction with upstream air duct or via fitting only

Recommendation for selection

- Air speed up to 7 m/s
- Damper pressure loss up to 500 Pa
- If sound emission via air duct surfaces is critical, all ducts including the controller must be sound insulated up to the sound absorber

Flow rate range, minimum pressure difference

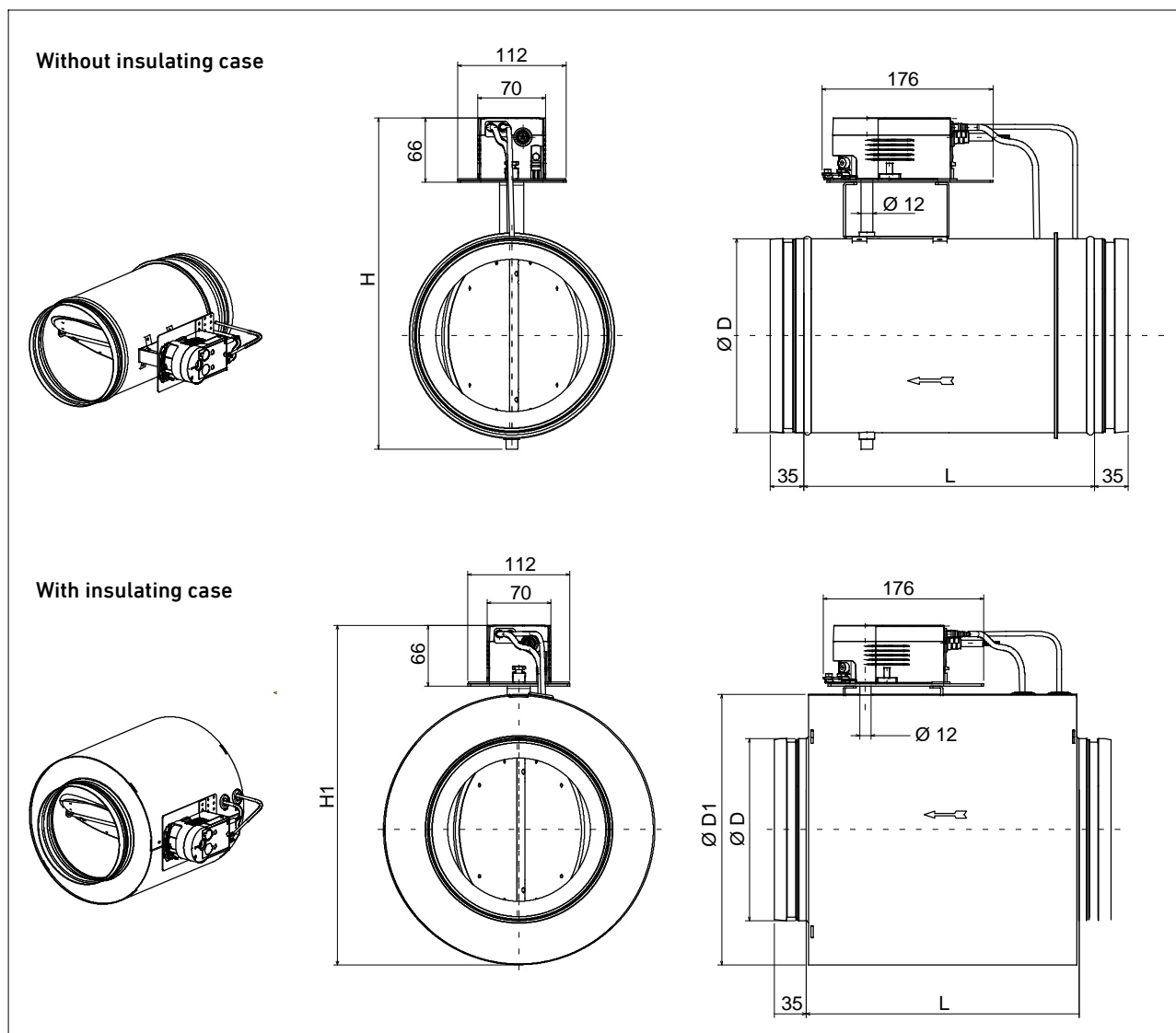
DN [mm]	at 1 m/s		at 2 m/s		at 4 m/s		at 7 m/s		at 10 m/s		
	V_{\min} [m ³ /h]	V [m ³ /h]	Δp_{\min} [Pa]	V [m ³ /h]	Δp_{\min} [Pa]	V [m ³ /h]	Δp_{\min} [Pa]	V_{nenn} [m ³ /h]	Δp_{\min} [Pa]		
100	27	54	10	109	25	190	70	272	130	DN - nominal diameter V - flow rate V_{\min} - min. flow rate = lower limit of control V_{nenn} - nominal flow rate Δp_{\min} - min. pressure loss	
125	43	86		171		300		428			
160	71	141		282		494		706			
200	111	222		443		776		1108			
250	174	348		696		1217		1739			
315	277	554		1108		1939		2770			
400	448	896		1792		3135		4479			
500	701	1402		2805		4908		7012			
630	1115	2230	4460	7806	11 151						

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Dimensions, weight – connection with plug in ends acc. to DIN EN 1506

Valid in conjunction with the Sauter model ASV115CF132E compact controller (standard). With other control components, divergences are possible.

The necessary space for fitting, connection and maintenance work must be kept accessible



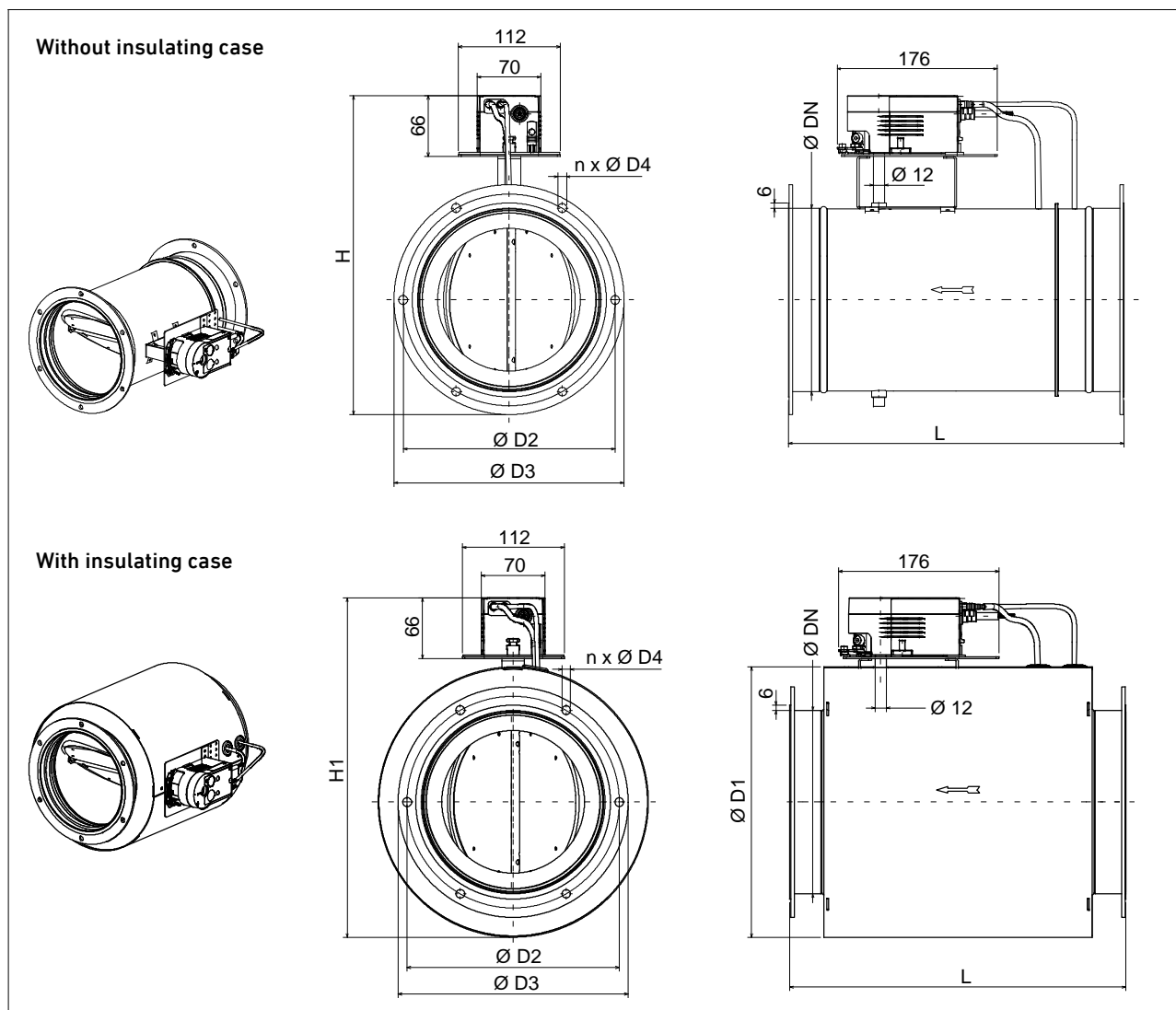
Nominal diameter DN	L [mm]	D [mm]	D1 [mm]	H [mm]	H1 [mm]	Damper angle ca. [°]	Weight [kg]	
							without insulating case	with insulating case
100	195	99	199	242	274	60	2.4	4.2
125	225	124	224	267	295	60	2.7	4.8
160	260	159	259	302	335	60	3.1	5.9
200	300	199	299	342	374	60	3.7	7.4
250	375	249	349	392	424	60	5.0	9.9
315	470	314	414	457	490	60	6.5	13.8
400	555	399	499	542	575	60	9.0	19.3

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Dimensions, weight – connection with flanges acc. to DIN 24154 row 1

Valid in conjunction with the Sauter model ASV115CF132E compact controller (standard). With other control components, divergences are possible.

The necessary space for fitting, connection and maintenance work must be kept accessible.



Nomin. diam. DN	L [mm]	D1 [mm]	D2 [mm]	D3 [mm]	D4 [mm]	H [mm]	H1 [mm]	Number n	Damper angle ca. [°]	Weight [kg]	
										without insulating case	with insulating case
100	265	199	132	152	9.5	242	274	4	60	3.1	4.9
125	295	224	157	177	9.5	267	295	4	60	3.5	5.6
160	330	259	192	212	9.5	302	335	6	60	4.1	6.9
200	370	299	233	253	9.5	342	374	6	60	4.9	8.6
250	445	349	283	303	9.5	392	424	6	60	6.5	11.4
315	540	414	352	378	9.5	457	490	8	60	8.7	16.0
400	625	499	438	464	9.5	542	575	8	60	11.7	22.0
500 *	800	599	538	564	9.5	658	675	8	90	17.3	40.2
630 *	800	729	670	704	9.5	793	805	12	90	22.0	49.9

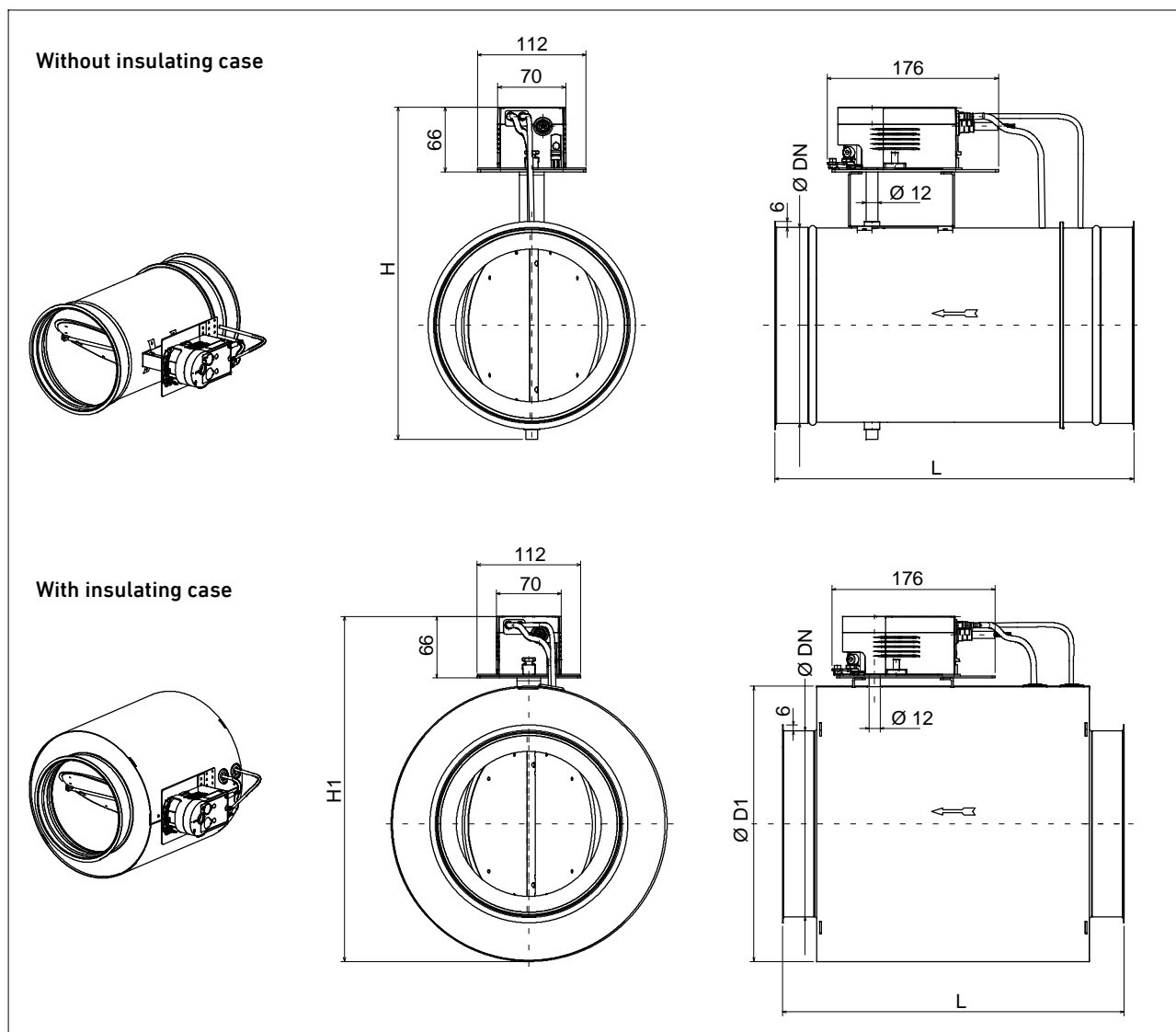
* DN 500 and 630: insulating case can not be retrofitted

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Dimensions, weight – connection with flange for clamping ring connection

Valid in conjunction with the Sauter model ASV115CF132E compact controller (standard). With other control components, divergences are possible.

The necessary space for fitting, connection and maintenance work must be kept accessible.



Nominal diameter DN	L [mm]	D1 [mm]	H [mm]	H1 [mm]	Damper angle ca. [°]	Weight [kg]	
						without insulating case	with insulating case
100	265	199	242	274	60	2.5	4.3
125	295	224	267	295	60	2.8	4.9
160	330	259	302	335	60	3.2	6.0
200	370	299	342	374	60	3.8	7.5
250	445	349	392	424	60	5.1	10.0
315	540	414	457	490	60	6.6	13.9
400	625	499	542	575	60	9.2	19.5

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Airborne sound transmission with $\Delta p_{ges} = 150 \text{ Pa}$

Nominal size	speed [m/s]	Flow rate [m ³ /h]	Without silencer										With silencer type SDE-S0 900 mm long										
			f_m [Hz]								Sum		f_m [Hz]								Sum		
			63	125	250	500	1 K	2 K	4 K	8 K	L_{WA} [dB(A)]	L_{pA} [dB(A)]	63	125	250	500	1 K	2 K	4 K	8 K	L_{WA} [dB(A)]	L_{pA} [dB(A)]	
			L_W [dB/Okt]										L_W [dB/Okt]										
100	1	27	29	28	33	32	31	25	22	25	37	27	25	18	18	<15	<15	<15	<15	<15	<15	<15	<15
	4	108	49	48	47	43	38	33	34	40	46	38	45	38	32	15	<15	<15	<15	<15	<15	27	18
	7	189	53	52	51	47	42	37	38	44	50	42	49	42	36	19	<15	<15	<15	17	31	22	
	10	272	58	57	56	52	47	42	43	49	53	47	51	44	38	21	<15	<15	<15	19	33	24	
125	1	43	31	30	35	34	33	27	24	27	39	29	27	21	21	<15	<15	<15	<15	<15	<15	<15	<15
	4	172	51	50	49	45	40	35	36	42	48	40	47	41	35	18	<15	<15	<15	18	30	21	
	7	299	55	54	53	49	44	39	40	46	52	44	51	45	39	22	<15	<15	<15	22	34	25	
	10	428	58	57	56	52	47	42	43	49	55	47	53	47	41	24	<15	<15	<15	24	36	27	
160	1	71	33	32	37	36	35	29	26	29	41	31	30	27	26	<15	<15	<15	<15	17	21	<15	
	4	284	53	52	51	47	42	37	38	44	50	42	50	47	40	24	<15	<15	<15	32	37	28	
	7	494	57	56	55	51	46	41	42	48	54	46	54	51	44	28	<15	<15	<15	36	40	32	
	10	706	60	59	58	54	49	44	45	51	57	48	56	53	46	30	<15	<15	<15	38	43	32	
200	1	111	35	34	39	38	37	31	28	31	43	33	34	29	29	19	<15	<15	<15	20	24	17	
	4	444	55	54	53	49	44	39	40	46	52	44	54	49	43	30	<15	<15	24	35	40	31	
	7	776	59	58	57	53	48	43	44	50	56	46	58	53	47	34	16	<15	28	39	43	33	
	10	1108	62	61	60	56	51	46	47	53	59	48	60	55	49	36	18	<15	30	41	46	34	
250	1	174	37	36	41	40	39	33	30	33	45	35	35	33	32	23	<15	<15	17	25	28	21	
	4	696	57	56	55	51	46	41	42	48	54	45	55	53	46	34	20	20	29	40	44	34	
	7	1217	61	60	59	55	50	45	46	52	58	46	59	57	50	38	24	24	33	44	47	35	
	10	1739	64	63	62	58	53	48	49	55	61	48	61	59	52	40	26	26	35	46	50	36	
315	1	277	39	38	43	42	41	35	32	35	47	37	38	36	37	27	20	20	24	28	33	25	
	4	1108	59	58	57	53	48	43	44	50	56	45	58	56	51	38	27	28	36	43	48	36	
	7	1939	63	62	61	57	52	47	48	54	60	46	62	60	55	42	31	32	40	47	51	37	
	10	2770	66	65	64	60	55	50	51	57	63	48	65	63	58	45	34	35	43	50	54	39	
400	1	448	41	40	45	44	43	37	34	37	49	39	40	38	40	31	28	29	31	35	39	31	
	4	1792	61	60	59	55	50	45	46	52	58	45	60	58	54	42	35	37	43	50	53	39	
	7	3135	65	64	63	59	54	49	50	56	62	46	64	62	58	46	39	41	47	54	57	41	
	10	4479	68	67	66	62	57	52	53	59	65	48	67	65	61	49	42	44	50	57	59	42	
500	1	701	50	49	54	53	52	46	43	46	57	47	49	47	50	40	41	43	39	44	49	40	
	4	2805	69	68	67	63	58	53	54	60	66	51	68	66	63	50	47	50	50	58	61	46	
	7	4908	71	70	69	65	60	55	56	62	70	50	70	68	65	52	49	52	52	60	63	45	
	10	7012	73	72	71	67	62	57	58	64	72	51	72	70	67	54	51	54	54	62	65	46	
630	1	1115	52	51	56	55	54	48	45	48	59	47	49	48	48	39	48	45	42	45	52	41	
	4	4460	71	70	69	65	60	55	56	62	68	51	68	67	61	49	54	52	53	59	62	45	
	7	7806	73	72	71	67	62	57	58	64	72	50	70	69	63	51	56	54	55	61	64	45	
	10	11151	75	74	73	69	64	59	60	66	74	51	72	71	65	53	58	56	57	63	67	45	

For other pressure differences and flow rates, the sound levels can be ascertained with our design program.

- Δp_{ges} - total pressure difference
- f_m - Octave mid-band frequency
- L_W - Sound power level
- L_{WA} - Sound power level, A-weighted
- L_{pA} - Sound pressure level, A-weighted

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Casing sound emission with $\Delta p_{ges} = 150 \text{ Pa}$

Nominal size	Air speed [m/s]	Flow rate [m ³ /h]	Without silencer										With silencer type SDE-SO 900 mm long											
			f_m [Hz]								Sum		f_m [Hz]								Sum			
			63	125	250	500	1 K	2 K	4 K	8 K	L_{WA} [dB(A)]	L_{pA} [dB(A)]	63	125	250	500	1 K	2 K	4 K	8 K	L_{WA} [dB(A)]	L_{pA} [dB(A)]		
			L_W [dB/Okt]										L_W [dB/Okt]											
100	1	27	17	<15	16	15	16	17	<15	15	22	<15	16	<15	16	<15	<15	<15	<15	<15	<15	<15	22	<15
	4	108	37	24	30	26	23	25	23	30	33	24	36	24	30	20	<15	<15	<15	<15	<15	<15	24	15
	7	189	41	28	34	30	27	29	27	34	37	28	40	28	34	24	18	<15	<15	<15	<15	<15	28	19
	10	272	43	30	36	32	29	31	29	36	39	30	43	31	37	27	21	<15	<15	17	30	22	30	22
125	1	43	18	<15	17	16	17	18	<15	16	23	<15	17	<15	17	<15	<15	<15	<15	<15	<15	<15	<15	<15
	4	172	38	25	31	27	24	26	24	31	34	25	37	25	31	21	15	<15	<15	<15	<15	<15	25	16
	7	299	42	29	35	31	28	30	28	35	38	29	41	29	35	25	19	<15	<15	15	29	20	29	20
	10	428	44	31	37	33	30	32	30	37	40	31	44	32	38	28	22	<15	<15	18	31	23	31	23
160	1	71	19	<15	18	17	18	19	<15	19	24	16	18	<15	18	<15	<15	<15	<15	<15	<15	<15	<15	<15
	4	284	39	26	32	28	25	27	25	34	36	27	38	26	32	22	16	<15	<15	<15	<15	<15	26	17
	7	494	43	30	36	32	29	31	29	38	40	31	42	30	36	26	20	<15	<15	16	30	21	30	21
	10	706	45	32	38	34	31	33	31	40	42	33	45	33	39	29	23	<15	<15	19	32	24	32	24
200	1	111	25	15	25	23	21	17	<15	22	26	18	22	<15	23	20	18	<15	<15	<15	<15	<15	22	<15
	4	444	45	35	39	34	28	25	26	37	39	30	42	33	37	31	25	19	<15	16	33	24	33	24
	7	776	49	39	43	38	32	29	30	41	43	34	46	37	41	35	29	23	<15	20	37	28	37	28
	10	1108	51	41	45	40	34	31	32	43	45	36	49	40	44	38	32	26	<15	23	39	31	39	31
250	1	174	26	16	26	24	22	18	15	23	27	19	23	<15	24	21	19	<15	<15	<15	<15	<15	23	<15
	4	696	46	36	40	35	29	26	27	38	40	31	43	34	38	32	26	20	<15	17	34	25	34	25
	7	1217	50	40	44	39	33	30	31	42	44	35	47	38	42	36	30	24	<15	21	38	29	38	29
	10	1739	52	42	46	41	35	32	33	44	46	37	50	41	45	39	33	27	<15	24	40	32	40	32
315	1	277	27	17	27	28	26	23	20	28	32	23	24	15	25	22	20	15	<15	<15	<15	<15	24	15
	4	1108	47	37	41	39	33	31	32	43	44	35	44	35	39	33	27	23	<15	21	35	26	35	26
	7	1939	51	41	45	43	37	35	36	47	48	39	48	39	43	37	31	27	<15	25	39	30	39	30
	10	2770	53	43	47	45	39	37	38	49	51	41	51	42	46	40	34	30	15	28	41	33	41	33
400	1	448	28	18	28	33	31	28	25	33	37	28	25	16	26	23	21	19	<15	<15	<15	<15	26	17
	4	1792	48	38	42	44	38	36	37	48	49	40	45	36	40	34	28	27	<15	23	37	27	37	27
	7	3135	52	42	46	48	42	40	41	52	53	44	49	40	44	38	32	31	16	27	40	31	40	31
	10	4479	54	44	48	50	44	42	43	54	56	46	52	43	47	41	35	34	19	30	43	34	43	34
500	1	701	36	26	36	41	39	36	33	41	45	36	33	24	34	31	29	27	<15	16	34	25	34	25
	4	2805	55	45	49	51	45	43	44	55	56	47	52	43	47	41	35	34	19	30	43	34	43	34
	7	4908	57	47	51	53	47	45	46	57	58	49	54	45	49	43	37	36	21	32	45	36	45	36
	10	7012	59	49	53	55	49	47	48	59	60	51	56	47	51	45	39	38	23	34	47	38	47	38
630	1	1115	37	27	37	42	40	37	34	42	46	37	34	25	35	32	30	28	<15	17	35	26	35	26
	4	4460	56	46	50	52	46	44	45	56	57	48	53	44	48	42	36	35	20	31	44	35	44	35
	7	7806	58	48	52	54	48	46	47	58	59	50	55	46	50	44	38	37	22	33	46	37	46	37
	10	11151	60	50	54	56	50	48	49	60	61	52	57	48	52	46	40	39	24	35	48	39	48	39

Casing sound emission data given in the chart refer to the emitting jacket surface of a duct of galvanized sheet steel, total length 6 m, with the flow rate controller installed. Due to resonance effects given frequency-related sound power level data may vary by +/- 6 dB max.

Δp_{ges} - total pressure difference
 f_m - octave mid-band frequency
 L_W - sound power level
 L_{WA} - sound power level, A-weighted
 L_{pA} - sound pressure level, A-weighted

Technical brochure · Variable flow rate controllers VRE, round Type VRE-./.../S, made of steel

Room sound pressure level calculation from controller sound transmission (excluding flow noise from the air diffusers)

System attenuation according to VDI 2081

f_m	[Hz]	63	125	250	500	1000	2000	4000	8000
Deflection $\Delta L_{W\text{Okt}}$	[dB/Okt]	0	0	1	2	3	3	3	3
Room attenuation $\Delta L_{W\text{Okt}}$	[dB/Okt]	5	5	5	5	5	5	5	5
Outlet reflection $\Delta L_{W\text{Okt}}$	[dB/Okt]	10	5	2	0	0	0	0	0

Branching attenuation for distributing the sound power over multiple rooms, $V_{\text{room}} = 540 \text{ m}^3/\text{h}$

V	[m ³ /h]	540	1080	2160	5400	10800	16200
$\Delta L_{W\text{Okt}} = 10 \times L_g \frac{V}{540 \text{ m}^3/\text{h}}$	[dB/Okt]	0	3	6	10	13	14

Sample calculation sound transmission

Given: VRE 250 with silencer
SDE-SO 900 mm long
 $V_{\text{max}} = 696 \text{ m}^3/\text{h}$, equates to 4 m/s
 $\Delta p_{\text{ges}} = 150 \text{ Pa}$
 $L_{WA} = 44 \text{ dB(A)}$

Required: Room sound pressure level
from controller sound transmission

Solution	f_m	[Hz]	63	125	250	500	1000	2000	4000	8000	Source
Sound power level $L_{W\text{Okt}}$	[dB/Okt]	55	53	46	34	20	20	29	40	page 10	
Deflection $\Delta L_{W\text{Okt}}$	[dB/Okt]	0	0	-1	-2	-3	-3	-3	-3	page 12	
Room attenuation $\Delta L_{W\text{Okt}}$	[dB/Okt]	-5	-5	-5	-5	-5	-5	-5	-5	page 12	
Outlet reflection $\Delta L_{W\text{Okt}}$	[dB/Okt]	-10	-5	-2	0	0	0	0	0	page 12	
Branching attenuation $\Delta L_{W\text{Okt}} = 10 \times L_g \frac{696 \text{ m}^3/\text{h}}{540 \text{ m}^3/\text{h}}$	[dB/Okt]	-1	-1	-1	-1	-1	-1	-1	-1	page 12	
A-weighted $\Delta L_{W\text{Okt}}$	[dB/Okt]	-26	-16	-9	-3	0	1	1	-1		
A-weighted sound pressure level $L_{pA\text{Okt}}$	[dB(A)/Okt]	< 15	26	28	23	11	12	21	30		
A-weighted sum sound pressure level $L_{pA} = 34 \text{ dB(A)}$											

Room sound pressure level calculation from controller radiation

f_m	[Hz]	63	125	250	500	1000	2000	4000	8000
Ceiling attenuation $\Delta L_{W\text{Okt}}$	[dB/Okt]	4	4	4	4	4	4	4	4
Room attenuation $\Delta L_{W\text{Okt}}$	[dB/Okt]	5	5	5	5	5	5	5	5

Sample calculation radiation

Given: VRE 250 without insulating case
 $V_{\text{max}} = 696 \text{ m}^3/\text{h}$, equates to 4 m/s
 $\Delta p_{\text{ges}} = 150 \text{ Pa}$
 $L_{WA} = 40 \text{ dB(A)}$

Required: Room sound pressure level L_{pA}
from controller radiation

Solution	f_m	[Hz]	63	125	250	500	1000	2000	4000	8000	Source
Sound power level $L_{W\text{Okt}}$	[dB/Okt]	46	36	40	35	29	26	27	38	page 11	
Ceiling attenuation $\Delta L_{W\text{Okt}}$	[dB/Okt]	-4	-4	-4	-4	-4	-4	-4	-4	page 12	
Room attenuation $\Delta L_{W\text{Okt}}$	[dB/Okt]	-5	-5	-5	-5	-5	-5	-5	-5	page 12	
A-weighted $\Delta L_{W\text{Okt}}$	[dB/Okt]	-26	-16	-9	-3	0	1	1	-1		
A-weighted sound pressure level $L_{pA\text{Okt}}$	[dB(A)/Okt]	< 15	< 15	22	23	20	18	19	28		
A-weighted sum sound pressure level $L_{pA} = 31 \text{ dB(A)}$											

Technical brochure · Variable flow rate controllers VRE, round Type VRE-./.../S, made of steel

Nomenclature, ordering code

VRE -S 100 / S / D / L / A / C541

(1) (2) (3) (4) (5) (6) (7) (8)

(1) Series	VRE	= Variable flow rate controller, round
(2) Measuring principle		= dynamic
	-S	= static
(3) Size resp. Ø	100	= 100
	125	= 125
	160	= 160
	200	= 200
	250	= 250
	315	= 315
	400	= 400
	500	= 500
(4) Version	S	= Galvanized steel
	E	= Stainless steel V4A
	K	= PUR-coated, RAL 9010
(5) Insulating case	-	= Without insulating case
	D	= With insulating case
(6) Connection	-	= Plug-in end pieces
	L	= Plug-in end pieces with lip-seal gasket
	B	= Bord 6 mm for clamping ring connection
	F	= Flange acc. to DIN 24154 R1
(7) Leak-tightness of housing	A	= Class A acc. to DIN EN 1751
	C	= Class C acc. to DIN EN 1751
(8) Controller type	C541	= Sauter ASV115CF132E (standard, other controller types see last page)

Additional ordering specifications

- V_{\min} [m³/h]
- V_{\max} [m³/h]
- Mode 0...10 V or 2...10 V
- Regulating time: 30...120 s

Please notice: V_{nenn} see page 6

$$V_{\min} \leq V_{\max}$$

$$V_{\max} \leq V_{\text{nenn}}$$

$$V_{\min} \geq 0.064 \times V_{\text{nenn}}$$

In the absence of such specifications the unit will be delivered with the following factory settings:

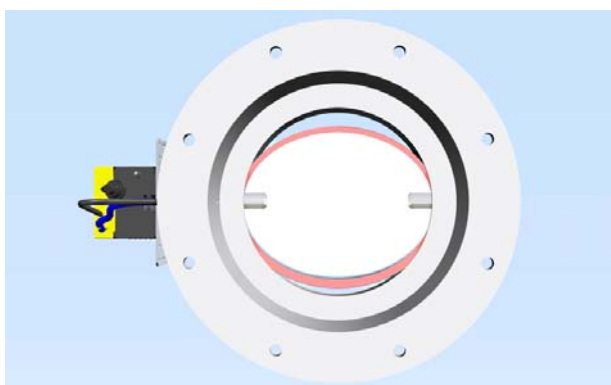
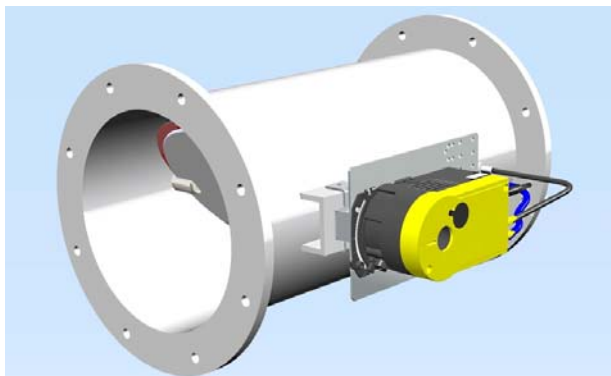
- V_{\min} 0.1 x V_{nenn}
- V_{\max} = V_{nenn}
- Mode 0...10 V
- Regulating time: 30 s

Ordering example

VRE-S 100/S/D/L/A/C541, $V_{\min} = 100 \text{ m}^3/\text{h}$, $V_{\max} = 200 \text{ m}^3/\text{h}$, Mode 2...10 V, regulating time 120 s

Technical brochure · Variable flow rate controllers VRE, round Type VRE-./.../P, made of PPs

Views of unit



Inside view in direction of air flow

Application

The round flow rate controllers VRE made of plastic PPs are designed to control an initial-pressure independent constant or variable flow rate in plants with aggressive media.

Configuration

VRE units comprise of housing, flow rate measuring element with sensor, damper blade with actuator and controller.

The housing is provided with pipe sockets to fit air ducts according to DIN 8077.

Mode of operation

The flow rate is measured using a measuring orifice as an active pressure transducer and with a differential pressure sensor, the measured differential pressure being the dimension for the flow rate.

The controller compares the actual value measured by the sensor with the setpoint value, and corrects the divergence by altering the damper setting using the actuating drive.

Control and regulation are achieved with external energy, either electric or pneumatic depending on the chosen design.

All components are factory-wired and hose-connected.

The flow rate controllers are rated for air velocities of 1...10 m/s.

Depending on the size, the control component and the set flow rate, the minimum pressure difference is approx. 10...130 Pa.

The damper blade closes tight in accordance with DIN EN 1751, so that a complete shut-off is also possible.

To reduce sound emission, the flow rate controller can be optionally retrofitted with an insulating case and/or a silencer.

The mechanism is universally suitable for the attachment of various controller makes and combinations of controllers, sensors and actuators for specific applications too.

The control components also differ here in the measuring principle (dynamic/static), in their actuator function (running time, standby setting) and in their operation (with / without bus mode).

With a static measuring principle of the sensor, the flow rate controller is suitable for aggressive media, for example laboratory waste air (resistance verification required).

For rapid and stable control of critical applications, e.g. in laboratory and pharmaceutical applications, controllers with high-speed actuators are available.

If a standby setting function is required, actuators with spring return or SuperCaps are used.

Materials, finishes

- Housing, damper and measuring probe: polypropylene, hardly inflammable (PPs)
- Damper bearing, damper axle: polypropylene (PP)
- Bearing sealings: Ethylen-Propylen-Dien-Kautschuk (EPDM)
- Damper sealing: polyurethane (PU)

Accessories, special versions

- Insulating case for sound and heat insulation
- Pipe ends on both sides with flanges and mating flanges (loose)
- Pipe ends on both sides with sleeve
- Additional pressure tapping points for parallel active pressure/flow rate measurement
- Controller with dynamic differential pressure sensor
- Communication via MP-Bus, LON, ...
- Actuator with spring return
- Actuator with normal running time
- Pipe silencer SDE-PO of PPs

Additional accessories and special versions on request.

Connection

Notes and circuit diagrams for control components can be found in the operating and maintenance instructions.

Technical brochure · Variable flow rate controllers VRE, round Type VRE-./.../P, made of PPs

Control

Made by Sauter, model ASV115CF152E (standard)

- Electronic VAV compact controller, supply 24 V AC/DC
- Position-independent sensor with static measuring principle, suitable for aggressive media and contaminated air
- Running time of actuator 3...15 s parametrizable
- Torque of actuator 10 Nm, suitable for sizes up to DN 630
- Analog control with 0(2)...10 V
- Control digital via 2 switch inputs: override controls CLOSE, OPEN, V_{min} and V_{max}
- Feedback of actual value analog with 0...10 V
- Communication via RS485 bus interface (max. 31 controllers)
- Parametrization of set values and inputs/outputs using SAUTER CASE VAV software
- Second control circuit for room pressure or room temperature control by connection of an appropriate sensor

Example for application of a VAV room pressure cascade controller

In combination with a static room pressure sensor with symmetrical measuring range, the VAV compact controller independently regulates the specified positive or negative pressure in clean rooms, airlocks, operating areas or laboratories. The room pressure is controlled via the parametrizable room pressure cascade flow rate controller integrated into the VAV compact controller. The room pressure is controlled in accordance with user specifications via the VAV compact controller for waste air or supply air. To achieve the maximum room pressure constancy, the room pressure control is only permissible with flow rate controllers for the supply air and waste air.

A switchover between positive and negative pressure control (septic/aseptic operating mode) can be achieved using a switching contact. All control functions and parameters of the room pressure control circuit can be parametrized using the software tool in the VAV compact controller. The measurement range and the output signal of the connected room pressure sensor can be freely defined.

Flow rate range, minimum pressure difference

DN [mm]	at 1 m/s		at 2 m/s		at 4 m/s		at 7 m/s		at 10 m/s		
	V_{min} [m ³ /h]	V [m ³ /h]	Δp_{min} [Pa]	V [m ³ /h]	Δp_{min} [Pa]	V [m ³ /h]	Δp_{min} [Pa]	V_{nenn} [m ³ /h]	Δp_{min} [Pa]		
110	31	62		122		214		306		DN - nominal diameter V - flow rate V_{min} - minimum flow rate = lower limit of control V_{nenn} - nominal flow rate Δp_{min} - minimum pressure loss	
125	40	80		160		280		400			
160	67	134		268		470		671			
200	106	212		426		745		1064			
250	167	334	10	668	25	1169	70	1670	130		
315	263	526		1052		1841		2630			
400	426	852		1703		2980		4257			
500	662	1324		2649		4636		6623			
630	1052	2104		4208		7365		10 521			

Output or status signals (from VAV compact controller to DDC/BMS)

1. Flow rate actual value via analog output 0...10 V

Input or control signals (from DDC/BMS to VAV compact controller)

1. Flow rate setpoint value (variable control) via analog input 0...10 V
2. Room pressure actual value via analog output 0...10 V
3. Flow rate setpoint value (priority control) via digital input
4. Room pressure setpoint value switchover via digital input

Application ranges and limits

Valid in conjunction with the Sauter model ASV115CF132E compact controller (standard). With other control components, divergences are possible.

- Minimum air speed 1 m/s
- Nominal air speed 10 m/s
- Static over-pressure in the air duct based on ambient pressure up to 1000 Pa
- Static under-pressure in the air duct based on ambient pressure max. 750 Pa
- Leakage flow rate via shut damper blade Class 3 acc. to DIN EN 1751
- Leakage flow rate via casing Class C acc. to DIN EN 1751
- Operating temperature range 0...+55 °C at <85 % rF, non-condensing
- Suitable for polluted or contaminated air flows (resistance verification required)
- Installation with horizontal damper axle only
- Free suction with upstream air duct or via fitting only.

Recommendation for selection

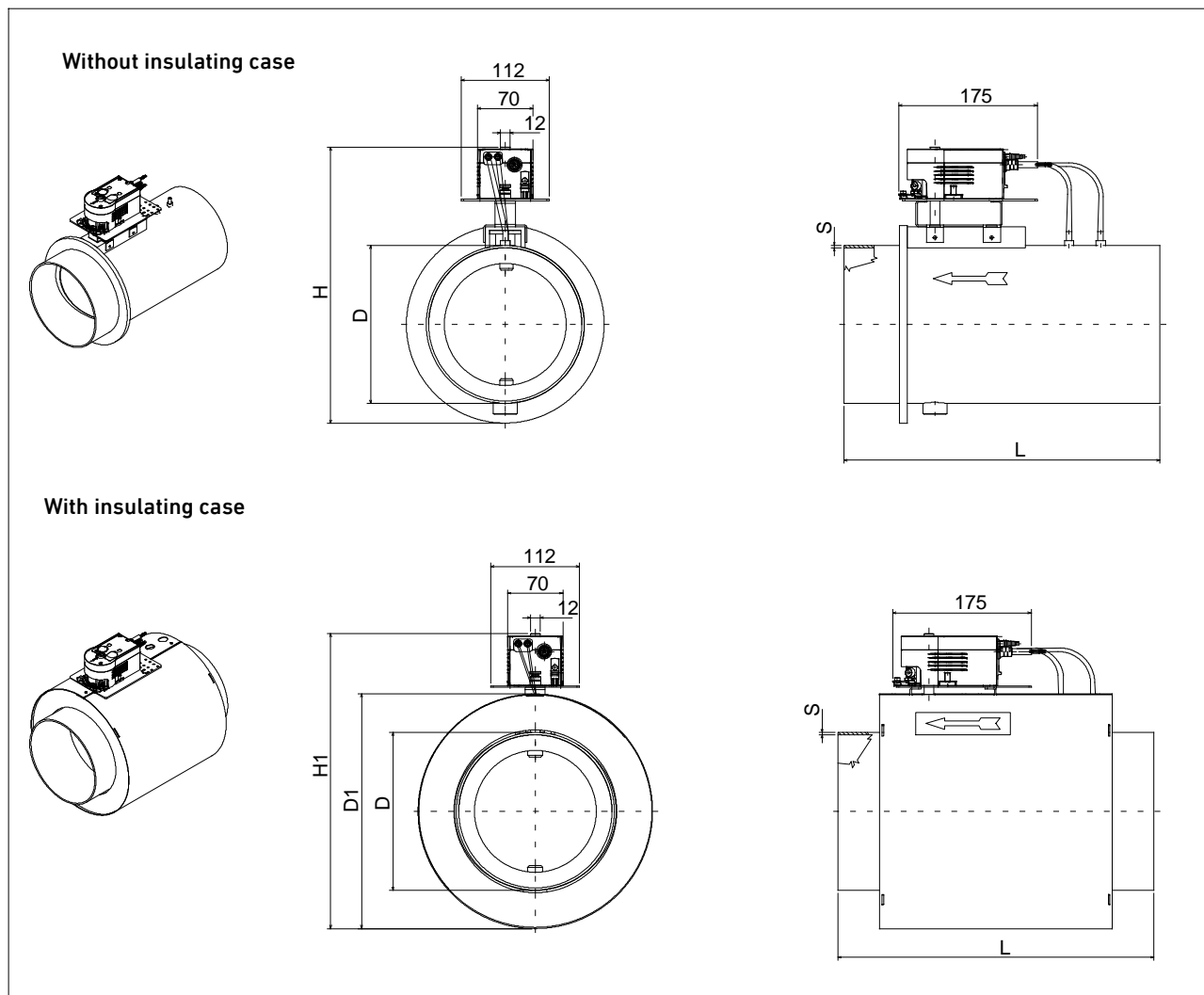
- Air speed up to 7 m/s
- Damper pressure loss up to 500 Pa
- If sound emission via air duct surfaces is critical, all ducts including the controller must be sound insulated up to the sound absorber

Technical brochure · Variable flow rate controllers VRE, round Type VRE-./.../P. made of PPs

Dimensions, weight – connection with pipe sockets

Valid in conjunction with the Sauter model ASV115CF152E compact controller (standard). With other control components, divergences are possible.

The necessary space for fitting, connection and maintenance work must be kept accessible.



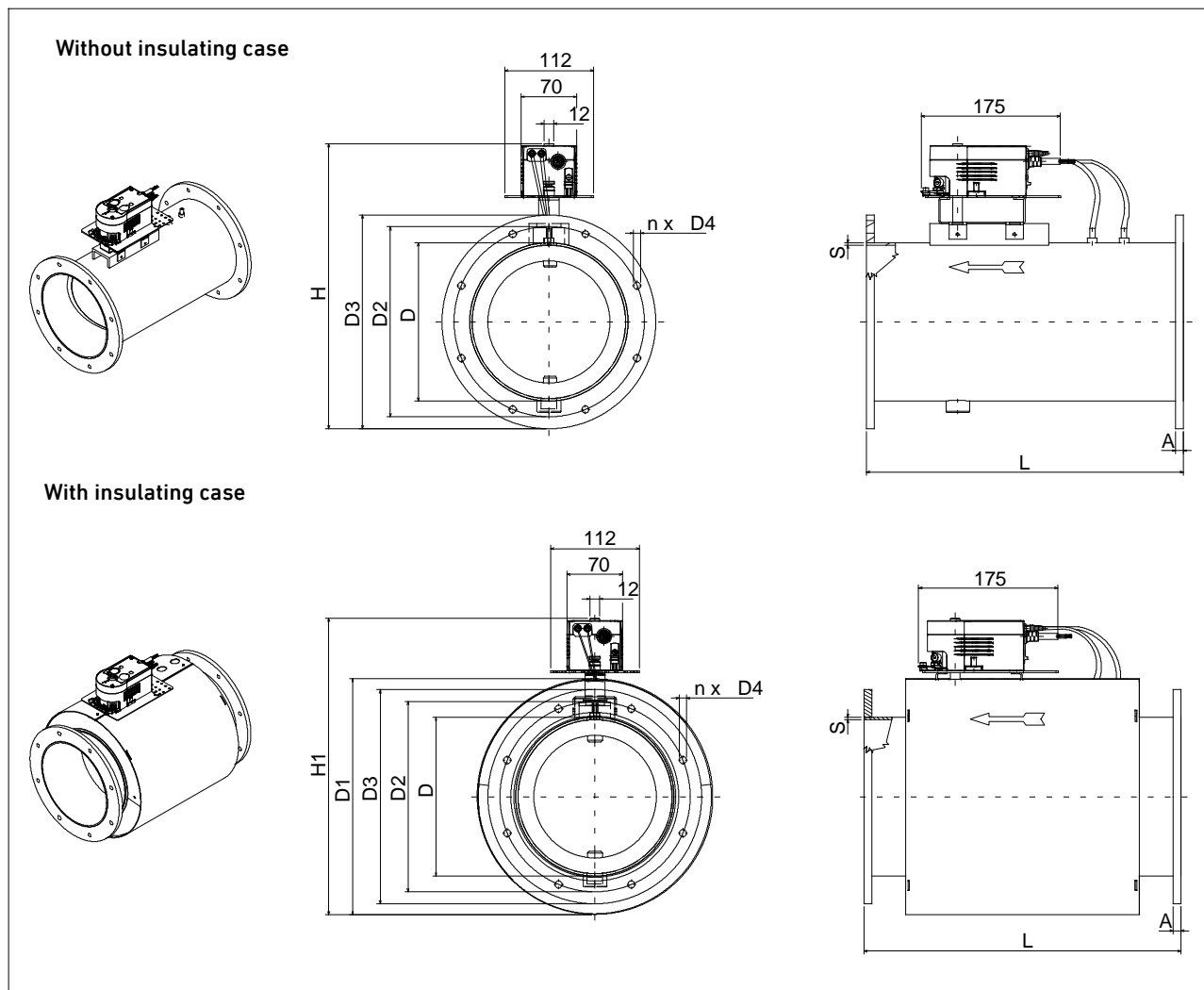
Nominal size Ø D [mm]	L [mm]	Ø D1 [mm]	S [mm]	H [mm]	H1 [mm]	Damper angle ca. [°]	Weight [kg]	
							without insulating case	with insulating case
110	300	198	3	260	274	90	1.2	3.0
125	325	219	3	275	295	90	1.3	3.4
160	360	259	3	310	335	90	1.5	4.3
200	400	298	3	350	374	90	1.7	5.4
250	475	348	3.5	400	424	90	2.4	7.3
315	570	414	5	465	490	90	4.2	11.5
400	655	499	6	550	575	90	6.9	17.2
500	850	599	5	650	675	90	9	31.9
630	1045	729	5	780	805	90	13.5	41.4

Technical brochure · Variable flow rate controllers VRE, round Typ VRE-./.../P. made of PPs

Dimensions, weight – connection with flanges

Valid in conjunction with the Sauter model ASV115CF152E compact controller (standard). With other control components, divergences are possible.

The necessary space for fitting, connection and maintenance work must be kept accessible.



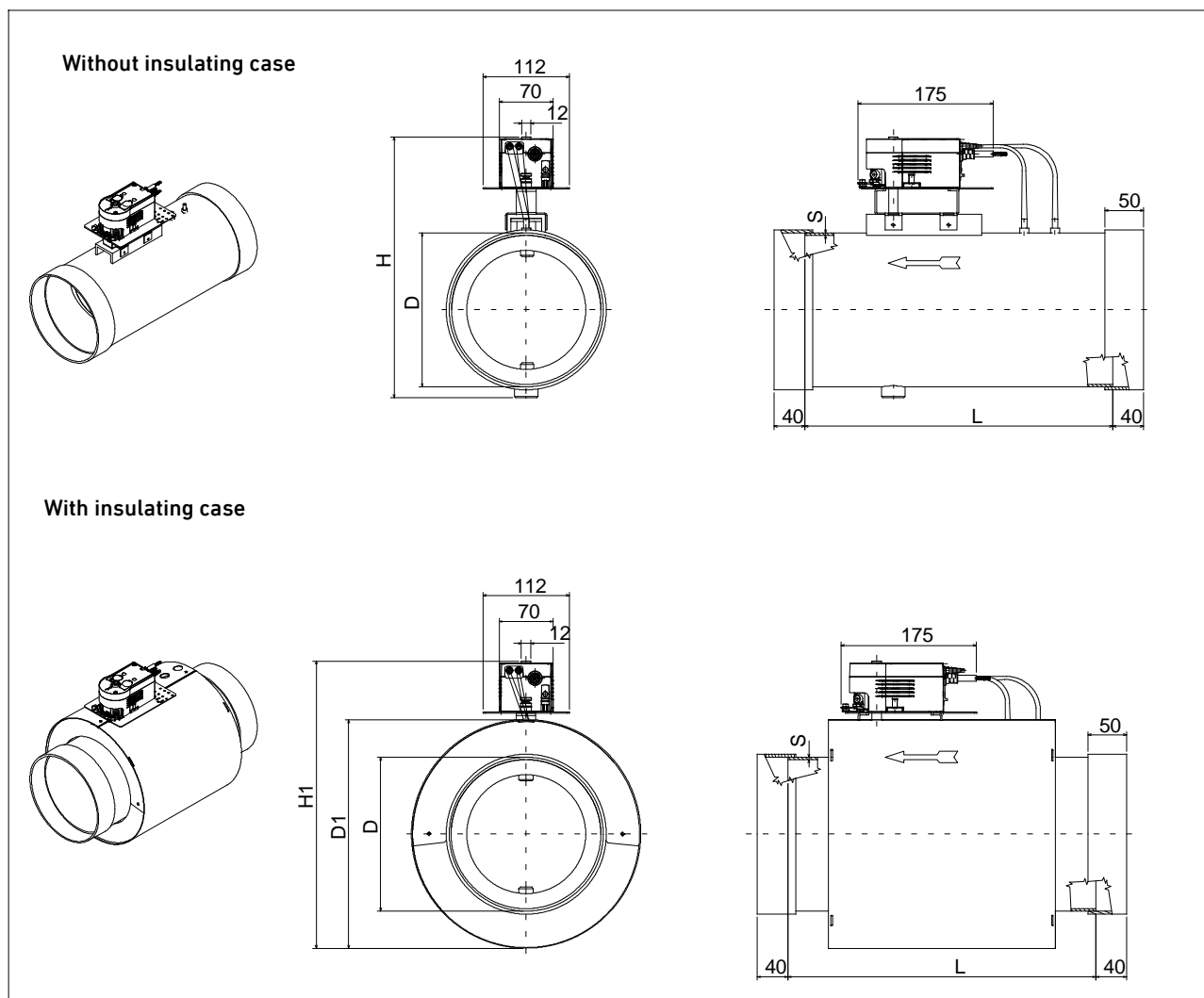
Nominal size Ø D [mm]	L [mm]	Ø D1 [mm]	Ø D2 [mm]	Ø D3 [mm]	Ø D4 [mm]	S [mm]	A [mm]	Number [n]	H [mm]	H1 [mm]	Damper angle ca. [°]	Weight [kg]	
												without insulating case	with insulating case
110	300	198	150	170	10	3	10	4	265	274	90	1.3	3.1
125	325	219	165	185	10	3	10	8	280	295	90	1.4	3.5
160	360	259	200	230	10	3	10	8	320	335	90	1.6	4.4
200	400	298	240	270	10	3	10	8	360	374	90	1.9	5.6
250	475	348	290	320	10	3.5	10	12	410	424	90	2.6	7.5
315	570	414	350	395	10	5	10	12	480	490	90	4.6	11.9
400	655	499	445	480	10	6	10	16	565	575	90	7.3	17.6
500	850	599	545	580	10	5	10	20	665	675	90	10.2	33.1
630	1045	729	700	730	10	5	12	24	795	805	90	15.4	43.3

Technical brochure · Variable flow rate controllers VRE, round Type VRE-./.../P, made of PPs

Dimensions, weight - connection with bushings

Valid in conjunction with the Sauter model ASV115CF152E compact controller (standard). With other control components, divergences are possible.

The necessary space for fitting, connection and maintenance work must be kept accessible.



Nominal size Ø D [mm]	L [mm]	Ø D1 [mm]	S [mm]	H [mm]	H1 [mm]	Damper angle ca. [°]	Weight [kg]	
							without Insulating case	with Insulating case
110	300	198	3	249	274	90	1.3	3.1
125	325	219	3	264	295	90	1.4	3.5
160	360	259	3	299	335	90	1.6	4.4
200	400	298	3	339	374	90	1.9	5.6
250	475	348	3.5	389	424	90	2.6	7.5
315	570	414	5	454	490	90	4.6	11.9
400	655	499	6	539	575	90	7.4	17.7
500	850	599	5	639	675	90	9.5	32.4
630	1045	729	5	769	805	90	14.3	42.2

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Airborne sound transmission with $\Delta p_{ges} = 150 \text{ Pa}$

Nominal size	Air speed [m/s]	Flow rate [m ³ /h]	Without silencer										With silencer type SDE-PO 1000 mm long											
			f_m [Hz]								Sum		f_m [Hz]								Sum			
			63	125	250	500	1 K	2 K	4 K	8 K	LWA [dB(A)]	LpA [dB(A)]	63	125	250	500	1 K	2 K	4 K	8 K	LWA [dB(A)]	LpA [dB(A)]		
			L _W [dB/Okt]										L _W [dB/Okt]											
110	1	31	29	28	33	32	31	25	22	25	37	27	21	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
	4	122	50	49	48	44	39	34	35	41	47	39	42	35	21	<15	<15	<15	<15	<15	<15	<15	22	<15
	7	214	54	53	52	48	43	38	39	45	51	43	46	39	25	<15	<15	<15	<15	<15	<15	18	26	16
	10	306	56	55	54	50	45	40	41	47	53	45	48	41	27	16	<15	<15	<15	<15	<15	20	28	18
125	1	40	31	30	35	34	33	27	24	27	39	29	25	20	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
	4	160	51	50	49	45	40	35	36	42	48	40	45	40	28	17	<15	<15	<15	<15	<15	18	27	18
	7	280	55	54	53	49	44	39	40	46	52	44	49	44	32	21	<15	<15	<15	<15	<15	22	31	21
	10	400	57	56	55	51	46	41	42	48	54	46	51	46	34	23	<15	<15	<15	<15	<15	24	33	23
160	1	67	33	32	37	36	35	29	26	29	41	31	27	23	19	<15	<15	<15	<15	<15	<15	16	<15	<15
	4	268	53	52	51	47	42	37	38	44	50	42	47	43	33	24	<15	<15	<15	<15	<15	31	22	22
	7	470	57	56	55	51	46	41	42	48	54	46	51	47	37	28	<15	<15	<15	<15	<15	29	35	26
	10	671	60	59	58	54	49	44	45	51	57	48	53	49	39	30	16	<15	<15	<15	<15	31	38	27
200	1	106	35	34	39	38	37	31	28	31	43	33	30	26	24	18	<15	<15	<15	<15	<15	16	21	<15
	4	426	55	54	53	49	44	39	40	46	52	44	50	46	38	29	17	<15	<15	<15	<15	31	36	27
	7	745	59	58	57	53	48	43	44	50	56	47	54	50	42	33	21	<15	<15	<15	<15	35	40	30
	10	1064	62	61	60	56	51	46	47	53	59	48	56	52	44	35	23	<15	<15	<15	<15	37	42	30
250	1	167	37	36	41	40	39	33	30	33	45	35	32	26	24	20	<15	<15	<15	<15	<15	24	16	16
	4	668	57	56	55	51	46	41	42	48	54	45	52	46	38	31	19	<15	<15	<15	<15	36	39	29
	7	1169	61	60	59	55	50	45	46	52	58	47	56	50	42	35	23	<15	<15	<15	<15	40	42	31
	10	1670	64	63	62	58	53	48	49	55	61	48	58	52	44	37	25	<15	<15	<15	<15	42	45	31
315	1	263	39	38	43	42	41	35	32	35	47	37	36	32	30	24	19	<15	<15	<15	<15	25	29	21
	4	1052	59	58	57	53	48	43	44	50	56	45	56	52	44	35	26	<15	<15	<15	<15	40	43	32
	7	1841	63	62	61	57	52	47	48	54	60	47	60	56	48	39	30	<15	<15	<15	<15	44	47	33
	10	2630	66	65	64	60	55	50	51	57	63	48	62	58	50	41	32	<15	<15	<15	<15	46	50	34
400	1	426	41	40	45	44	43	37	34	37	49	39	37	34	34	28	24	<15	<15	<15	<15	28	33	25
	4	1703	61	60	59	55	50	45	46	52	58	45	57	54	48	39	31	<15	<15	<15	<15	43	47	33
	7	2980	65	64	63	59	54	49	50	56	62	47	61	58	52	43	35	<15	<15	<15	<15	47	50	35
	10	4257	68	67	66	62	57	52	53	59	65	48	64	61	55	46	38	<15	<15	<15	<15	50	53	36
500	1	662	50	49	54	53	52	46	43	46	57	47	46	42	43	38	34	<15	<15	<15	<15	38	43	34
	4	2649	69	68	67	63	58	53	54	60	66	51	65	61	56	48	40	<15	<15	<15	<15	52	55	40
	7	4636	71	70	69	65	60	55	56	62	70	51	67	63	58	50	42	<15	<15	<15	<15	54	57	39
	10	6623	73	72	71	67	62	57	58	64	72	51	69	65	60	52	44	<15	<15	<15	<15	56	59	40
630	1	1052	52	51	56	55	54	48	45	48	59	47	50	48	50	41	40	<15	<15	<15	<15	42	48	37
	4	4208	71	70	69	65	60	55	56	62	68	51	69	67	63	51	46	<15	<15	<15	<15	56	60	43
	7	7365	73	72	71	67	62	57	58	64	72	51	71	69	65	53	48	<15	<15	<15	<15	58	62	42
	10	10 521	75	74	73	69	64	59	60	66	74	51	73	71	67	55	50	<15	<15	<15	<15	60	64	43

For other pressure differences and flow rates, the sound levels can be ascertained with our design program.

- Δp_{ges} - total pressure difference
- f_m - Octave mid-band frequency
- L_W - Sound power level
- L_{WA} - Sound power level, A-weighted
- L_{pA} - Sound pressure level, A-weighted

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Casing sound emission with $\Delta p_{ges} = 150 \text{ Pa}$

Nominal size	Air speed [m/s]	Flow rate [m³]	Without insulation case										With insulating case 50 mm									
			f_m [Hz]								Sum		f_m [Hz]								Sum	
			63	125	250	500	1 K	2 K	4 K	8 K	LWA [dB(A)]	LpA [dB(A)]	63	125	250	500	1 K	2 K	4 K	8 K	LWA [dB(A)]	LpA [dB(A)]
			L _W [dB/Okt]										L _W [dB/Okt]									
110	1	31	23	<15	22	21	22	23	17	21	28	19	22	<15	22	15	<15	<15	<15	<15	18	<15
	4	122	44	31	37	33	30	32	30	37	40	31	43	31	37	27	21	<15	<15	17	31	22
	7	214	47	34	40	36	33	35	33	40	43	34	47	35	41	31	25	15	<15	21	34	26
	10	306	49	36	42	38	35	37	35	42	45	36	49	37	43	33	27	17	16	23	37	28
125	1	40	24	<15	23	22	23	24	18	22	29	20	23	<15	23	16	<15	<15	<15	<15	19	<15
	4	160	44	31	37	33	30	32	30	37	40	31	43	31	37	27	21	<15	<15	17	31	22
	7	280	48	35	41	37	34	36	34	41	44	35	47	35	41	31	25	15	<15	21	35	26
	10	400	50	37	43	39	36	38	36	43	46	37	50	38	44	34	28	18	17	24	37	29
160	1	67	25	<15	24	23	24	25	19	25	30	22	24	<15	24	17	15	<15	<15	<15	20	<15
	4	268	45	32	38	34	31	33	31	40	42	33	44	32	38	28	22	<15	<15	18	32	23
	7	470	49	36	42	38	35	37	35	44	46	37	48	36	42	32	26	16	15	22	36	27
	10	671	51	38	44	40	37	39	37	46	48	39	51	39	45	35	29	19	18	25	39	30
200	1	106	31	21	31	29	27	23	20	28	33	24	28	19	29	26	24	17	<15	<15	28	19
	4	426	51	41	45	40	34	31	32	43	45	36	48	39	43	37	31	25	<15	22	39	30
	7	745	55	45	49	44	38	35	36	47	49	40	52	43	47	41	35	29	<15	26	43	34
	10	1064	57	47	51	46	40	37	38	49	51	42	55	46	50	44	38	32	17	29	45	37
250	1	167	30	20	30	28	26	22	19	27	32	23	27	18	28	25	23	16	<15	<15	27	18
	4	668	51	41	45	40	34	31	32	43	45	36	48	39	43	37	31	25	<15	22	39	30
	7	1169	55	45	49	44	38	35	36	47	49	40	52	43	47	41	35	29	<15	26	43	34
	10	1670	57	47	51	46	40	37	38	49	51	42	54	45	49	43	37	31	16	28	45	36
315	1	263	30	20	30	31	29	26	23	31	35	26	27	18	28	25	23	18	<15	<15	28	18
	4	1052	51	41	45	43	37	35	36	47	48	39	48	39	43	37	31	27	<15	25	39	30
	7	1841	55	45	49	47	41	39	40	51	52	<15	52	43	47	41	35	31	16	29	43	34
	10	2630	57	47	51	49	43	41	42	53	54	45	54	45	49	43	37	33	18	31	45	36
400	1	426	28	18	28	33	31	28	25	33	37	28	25	16	26	23	21	19	<15	<15	26	17
	4	1703	48	38	42	44	38	36	37	48	49	40	45	36	40	34	28	27	<15	23	37	27
	7	2980	52	42	46	48	42	40	41	52	53	44	49	40	44	38	32	31	16	27	40	31
	10	4257	55	45	49	51	45	43	44	55	56	47	52	43	47	41	35	34	19	30	43	34
500	1	662	33	23	33	38	36	33	30	38	42	33	30	21	31	28	26	24	<15	<15	31	22
	4	2649	53	43	47	49	43	41	42	53	54	45	50	41	45	39	33	32	17	28	41	32
	7	4636	54	44	48	50	44	42	43	54	55	46	51	42	46	40	34	33	18	29	43	33
	10	6623	57	47	51	53	47	45	46	57	58	49	54	45	49	43	37	36	21	32	45	36
630	1	1052	32	22	32	37	35	32	29	37	42	32	29	20	30	27	25	23	<15	<15	30	21
	4	4208	52	42	46	48	42	40	41	52	53	44	49	40	44	38	32	31	16	27	40	31
	7	7365	53	43	47	49	43	41	42	53	55	45	50	41	45	39	33	32	17	28	42	32
	10	10521	56	46	50	52	46	44	45	56	57	48	53	44	48	42	36	35	20	31	44	35

Casing sound emission data given in the chart refer to the emitting jacket surface of a duct of galvanized sheet steel, total length 6 m, with the flow rate controller installed. Due to resonance effects given frequency-related sound power level data may vary by +/- 6 dB max.

Δp_{ges} - total pressure difference
 f_m - octave mid-band frequency
 L_W - sound power level
 L_{WA} - sound power level, A-weighted
 L_{pA} - sound pressure level, A-weighted

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Room sound pressure level calculation from controller sound transmission (excluding flow noise from the air diffusers)

System attenuation according to VDI 2081

f_m	[Hz]	63	125	250	500	1000	2000	4000	8000
Deflection $\Delta L_{W Okt}$	[dB/Okt]	0	0	1	2	3	3	3	3
Room attenuation $\Delta L_{W Okt}$	[dB/Okt]	5	5	5	5	5	5	5	5
Outlet reflection $\Delta L_{W Okt}$	[dB/Okt]	10	5	2	0	0	0	0	0

Branching attenuation for distributing the sound power over multiple rooms, $V_{room} = 540 \text{ m}^3/\text{h}$

V	[m ³ /h]	540	1080	2160	5400	10 800
$\Delta L_{W Okt} = 10 \times Lg \frac{V}{540 \text{ m}^3/\text{h}}$	[dB/Okt]	0	3	6	10	13

Sample calculation sound transmission

Given: VRE 250 with silencer SDE-PO 1000 mm long
 $V_{max} = 668 \text{ m}^3/\text{h}$, equates to 4 m/s
 $\Delta p_{ges} = 150 \text{ Pa}$

Required: Room sound pressure level L_{pA} from controller sound transmission

Solution:	f_m	[Hz]	63	125	250	500	1000	2000	4000	8000	Source
	Sound power level $L_{W Okt}$	[dB/Okt]	52	46	38	31	19	21	27	36	page 19
	Deflection $\Delta L_{W Okt}$	[dB/Okt]	0	0	-1	-2	-3	-3	-3	-3	page 21
	Room attenuation $\Delta L_{W Okt}$	[dB/Okt]	-5	-5	-5	-5	-5	-5	-5	-5	page 21
	Outlet reflection $\Delta L_{W Okt}$	[dB/Okt]	-10	-5	-2	0	0	0	0	0	page 21
	Branching attenuation $\Delta L_{W Okt} = 10 \times Lg \frac{668 \text{ m}^3/\text{h}}{540 \text{ m}^3/\text{h}}$	[dB/Okt]	0	0	0	0	0	0	0	0	page 21
	A-weighted $\Delta L_{W Okt}$	[dB/Okt]	-26	-16	-9	-3	0	1	1	-1	
	A-weighted sound pressure level $L_{pA Okt}$	[dB(A)/Okt]	<15	19	20	20	<15	<15	19	26	
A-weighted sum sound pressure level $L_{pA} = 29 \text{ dB(A)}$											

Room sound pressure level calculation from controller radiation

f_m	[Hz]	63	125	250	500	1000	2000	4000	8000
Ceiling attenuation $\Delta L_{W Okt}$	[dB/Okt]	4	4	4	4	4	4	4	4
Room attenuation $\Delta L_{W Okt}$	[dB/Okt]	5	5	5	5	5	5	5	5

Sample calculation radiation

Given: VRE 250 with insulating case
 $V_{max} = 668 \text{ m}^3/\text{h}$, equates to 4 m/s
 $\Delta p_{ges} = 150 \text{ Pa}$

Required: Room sound pressure level L_{pA} from controller radiation

Solution:	f_m	[Hz]	63	125	250	500	1000	2000	4000	8000	Source
	Sound power level $L_{W Okt}$	[dB/Okt]	48	39	43	37	31	25	15	22	page 20
	Ceiling attenuation $\Delta L_{W Okt}$	[dB/Okt]	-4	-4	-4	-4	-4	-4	-4	-4	page 21
	Room attenuation $\Delta L_{W Okt}$	[dB/Okt]	-5	-5	-5	-5	-5	-5	-5	-5	page 21
	A-weighted $\Delta L_{W Okt}$	[dB/Okt]	-26	-16	-9	-3	0	1	1	-1	
	A-weighted sound pressure level $L_{pA Okt}$	[dB(A)/Okt]	<15	<15	25	25	22	17	<15	<15	
A-weighted sum sound pressure level $L_{pA} = 30 \text{ dB(A)}$											

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Nomenclature, ordering code

VRE -S 110 / P / D / - / C540

(1) (2) (3) (4) (5) (6) (7)

- | | | |
|--------------------------------|-------------|---|
| (1) Series | VRE | = Variable flow rate controller, round |
| (2) Measuring principle | | = dynamic |
| | -S | = static |
| (3) Size resp. Ø | 110 | = 110 |
| | 125 | = 125 |
| | 160 | = 160 |
| | 200 | = 200 |
| | 250 | = 250 |
| | 315 | = 315 |
| | 400 | = 400 |
| | 500 | = 500 |
| | 630 | = 630 |
| (4) Version | P | = Plastic PPs |
| (5) Insulating case | - | = Without insulating case |
| | D | = With insulating case |
| (6) Connection | - | = |
| | F | = Flange |
| | M | = Bushing |
| (8) Controller type | C540 | = Sauter ASV115CF152E (standard,
other controller types see last page) |

Additional order specifications

- V_{\min} [m³/h]
- V_{\max} [m³/h]
- Mode 0...10 V or 2...10 V
- Regulating time: 3...15 s

Please notice: V_{nenn} see page 15
 $V_{\min} \leq V_{\max}$
 $V_{\max} \leq V_{\text{nenn}}$
 $V_{\min} \geq 0,064 \times V_{\text{nenn}}$

In the absence of such specifications the unit will be delivered with the following factory settings

- V_{\min} $0,1 \times V_{\text{nenn}}$
- V_{\max} = V_{nenn}
- Mode $0...10 \text{ V}$
- Regulating time: 3 s

Ordering example

VRE-S 110/P/D/-/C540, $V_{\min} = 100 \text{ m}^3/\text{h}$, $V_{\max} = 200 \text{ m}^3/\text{h}$, Mode 2...10 V, regulating time 15 s

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Controller makes

Electric/pneumatic	Controller make/type	Controller		Sensor			Actuator			Controller type	Sensor type	Actuator type	
		Analogue control	Digital control (Bus)	Measuring principle		Pressure range [Pa]	Torque [Nm]	Runn. time motor/spring for 90° [s]	Spring return				
				dynamic	static								
electric	Belimo												
	B780	x	MP	x		0...450	5	150		LMV-D3-MP	inclusive	inclusive	
	B610	x	MP	x		0...450	10	150		NMV-D3-MP	inclusive	inclusive	
	B823	x		x		2...300	5	150		VRD3	inclusive	LM 24A-V	
	B804	x		x		2...300	10	150		VRD3	inclusive	NM 24A-V	
	B807 / B808 *	x		x		2...300	4	75/20	x	VRD3	inclusive	LF 24-V	
	B819 / B820 *	x		x		2...300	20	150/20	x	VRD3	inclusive	SF 24A-V	
	B803	x			x	0...300	5	150		VRP-BS	VFP300	LM 24A-V	
	B531	x			x	0...300	10	150		VRP-BS	VFP300	NM 24A-V	
	B534 / B535 *	x			x	0...300	4	75/20	x	VRP-BS	VFP300	LF 24-V	
	B536 / B537 *	x			x	0...300	20	150/20	x	VRP-BS	VFP300	SF 24A-V	
	B815	x	MP		x	0...300	10	150		VRP-M-VAV	VFP300	NM24A-V-ST	
	B818	x	MP		x	0...300	20	150/20	x	VRP-M-VAV	VFP300	SF 24A-V-ST	
	B809	x	MP		x	0...300	4	3		VRP-M-VAV	VFP300	LMQ24A-SRV-ST	
	B814	x	MP		x	0...300	8	4		VRP-M-VAV	VFP300	NMQ24A-SRV-ST	
	B800		LON	x		0...450	5	150		LMV-D3LON	inclusive	inclusive	
	B801		LON	x		0...450	10	150		NMV-D3LON	inclusive	inclusive	
	Siemens												
	L540	x		x		0...300	5	150		GDB 181.1E/LT	inclusive	inclusive	
	L560	x		x		0...300	10	150		GLB 181.1E/3	inclusive	inclusive	
	Gruner												
	G610	x	PP	x		0...300	10	150		227V-024-10	inclusive	inclusive	
	G780	x	PP	x		0...300	5	100		227V-024-05	inclusive	inclusive	
	G750	x	PP	x		0...300	5	20		227SV-024-05	inclusive	inclusive	
	G801	x	PP	x		0...300	5	120		GUAC-D3	inclusive	227-024-05-V	
	G521	x	PP	x		0...300	8	120		GUAC-D3	inclusive	227-024-08-V	
	G805	x	PP	x		0...300	8	4		GUAC-D3	inclusive	227CS-024-08-V	
	G544 / G545 *	x	PP	x		0...300	15	150/15	x	GUAC-D3	inclusive	238-024-015-V	
	G802	x	PP		x	0...300	5	120		GUAC-S3	inclusive	227-024-05-V	
	G531	x	PP		x	0...300	8	120		GUAC-S3	inclusive	227-024-08-V	
	G803	x	PP		x	0...300	5	35		GUAC-S3	inclusive	227CS-024-05-V	
	G581	x	PP		x	0...300	8	4		GUAC-S3	inclusive	227CS-024-08-V	
G554 / G555 *	x	PP		x	0...300	15	150/15	x	GUAC-S3	inclusive	238-024-015-V		
Sauter													
C540	x	SLC		x	1...300	10	3...15		ASV115CF152E	inclusive	inclusive		
C541	x	SLC		x	1...300	10	30...120		ASV115CF132E	inclusive	inclusive		
pneumatic													
Sauter													
P521 / P522 *				x	10...250			x	RLP10 F001	inclusive	SMA1 **		
P523 / P524 *				x	10...250			x	RLP10 F001	inclusive	SMD		
P551 / P552 *				x	6,4...160			x	RLP100 F003	inclusive	SMA1 **		
P553 / P554 *				x	6,4...160			x	RLP100 F003	inclusive	SMD		

* ... / ... = dead closed / dead open or pressureless closed / pressureless open

*** air motors LTG model SMA1 up to max. DN 315

Technical brochure · Variable flow rate controllers VRE, round

Controller makes









Electric/pneumatic	Controller Make/ type	Additional order specifications				Operating range for Vmin...Vmax	Control action actuator
		Adjustment limits					
		Vmin [m ³ /h]		Vmax [m ³ /h]			
		minimal	maximal	minimal	maximal		
electric	Belimo						
	B780	0	Vmax	20 % of Vnom	Vnom	0...10 or 2...10 V	
	B610	0	Vmax	20 % of Vnom	Vnom	0...10 or 2...10 V	
	B818	0	Vmax	30 % of Vnom	Vnom	0...10 or 2...10 V	
	B804	0	Vmax	30 % of Vnom	Vnom	0...10 or 2...10 V	
	B807/ 808*	0	Vmax	30 % of Vnom	Vnom	0...10 or 2...10 V	Dead open or closed
	B819 / B820*	0	Vmax	30 % of Vnom	Vnom	0...10 or 2...10 V	Dead open or closed
	B803	0	80 % of Vmax	30 % of Vnom	Vnom	2...10 V	
	B531	0	80 % of Vmax	30 % of Vnom	Vnom	2...10 V	
	B534 / B535*	0	80 % of Vmax	30 % of Vnom	Vnom	2...10 V	Dead open or closed
	B536 / B537*	0	80 % of Vmax	30 % of Vnom	Vnom	2...10 V	Dead open or closed
	B815	0	Vmax	30 % of Vnom	Vnom	0...10 or 2...10 V	
	B818	0	Vmax	30 % of Vnom	Vnom	0...10 or 2...10 V	
	B809	0	Vmax	30 % of Vnom	Vnom	0...10 or 2...10 V	
	B814	0	Vmax	30 % of Vnom	Vnom	0...10 or 2...10 V	
	B800	0	Vmax	20 % of Vnom	Vnom	0...10 or 2...10 V	
	B801	0	Vmax	20 % of Vnom	Vnom	0...10 or 2...10 V	
	Siemens						
	L540	-20 % of Vnom	Vmax	20 % of Vnom	120 % of Vnom	0...10 or 2...10 V	
	L560	-20 % of Vnom	Vmax	20 % of Vnom	120 % of Vnom	0...10 or 2...10 V	
Gruner							
G610	0	Vmax	0	Vnom	0...10 or 2...10 V		
G780	0	Vmax	0	Vnom	0...10 or 2...10 V		
G750	0	Vmax	0	Vnom	0...10 or 2...10 V		
G801	0	Vmax	0	Vnom	0...10 or 2...10 V		
G521	0	Vmax	0	Vnom	0...10 or 2...10 V		
G805	0	Vmax	0	Vnom	0...10 or 2...10 V		
G544 /G545*	0	Vmax	0	Vnom	0...10 or 2...10 V	Dead open or closed	
G802	0	Vmax	0	Vnom	0...10 or 2...10 V		
G531	0	Vmax	0	Vnom	0...10 or 2...10 V		
G803	0	Vmax	0	Vnom	0...10 or 2...10 V		
G581	0	Vmax	0	Vnom	0...10 or 2...10 V		
G554 / G555*	0	Vmax	0	Vnom	0...10 or 2...10 V	Dead open or closed	
Sauter							
C540	6,4 % of Vnom	Vmax	6,4 % of Vnom	Vnom	0...10 or 2...10 V		
C541	6,4 % of Vnom	Vmax	6,4 % of Vnom	Vnom	0...10 or 2...10 V		
Sauter		vm					
P521 / P522*	20 % of Vnom	Vmax	20 % of Vnom	Vnom	0,2...1,0 bar	Pressureless open or closed	
P523 / P524*	20 % of Vnom	Vmax	20 % of Vnom	Vnom	0,2...1,0 bar		
P551 / P552*	16 % of Vnom	Vmax	16 % of Vnom	Vnom	0,2...1,0 bar		
P553 / P554*	16 % of Vnom	Vmax	16 % of Vnom	Vnom	0,2...1,0 bar		

* ... / ... = dead closed / dead open or pressureless closed / pressureless open

Product Overview

LTG Air Diffusion

Flow Rate Controllers





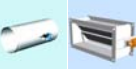
		Round		Square		
Variable		VRE _{active}	LTG Map Control System ActiveControl. Highest precision, short installation length		VRF _{active}	LTG Map Control System ActiveControl. Highest precision, short installation length
		VRD _{active}			VRF	
		VRE				VRX
		VRD			To combine with customized drives; also available in PPS	
Constant		VRW	Without external power supply, pollution-insensitive			
		VRZ				

All variable flow rate controllers are available with dynamic or static measuring principle

Pressure Controllers

Round		Square			
	DRE	To balance extreme pressure level differences		DRF	To balance extreme pressure level differences

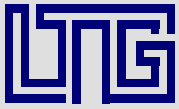
Special Products

	SDE/SDF	Inline, cross-talk, and splitter silencers
	VRC+NE	Variable flow rate controller with silencer and reheating register
	VRW-A	Constant control and shut-off unit
	KLB	Ultra-tight shut-off damper (airtight acc. to DIN EN 1751: Class 4)
	ARE/ARF	Airtight shut-off damper (airtight acc. to DIN EN 1751: Class 4)

Engineering Services



LTG Engineering Services Comfort Air Technology



**AIR TECH
SYSTEMS**

Comfort Air Technology

Air-Water Systems
Air Diffusers
Air Distribution

Process Air Technology

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Filtration technology
Humidification Technology

Engineering Services

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Simulation / Analysis
R&D / Start-up

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