

# VaryControl® VAV Controller

Type TVR-Easy



# TROX® TECHNİK

Gebrüder Trox GmbH

Heinrich-Trox-Platz  
D-47504 Neukirchen-Vluyn

Telephone +49/28 45/2 02-0  
Telefax +49/28 45/2 02-2 65  
e-mail [trox@trox.de](mailto:trox@trox.de)  
[www.troxtechnik.com](http://www.troxtechnik.com)

# Contents · TVR-Easy

TVR-Easy, Selection of nominal size _____	4
Sound pressure level · Quick Selection _____	5
Air regenerated noise · Sound power level _____	6
Case Radiated Noise · Sound power level _____	7
Volume flow adjustment _____	8
Characteristics · Connection examples _____	9
Functional characteristics · Dimensions _____	10
Nomenclature · Technical data _____	11
Order Details _____	12

**1** Select nominal size

D		
100	35	70
125	55	110
160	90	180
200	145	290
250	222	444
315	370	740
400	604	1200

Set volume flow

**2**

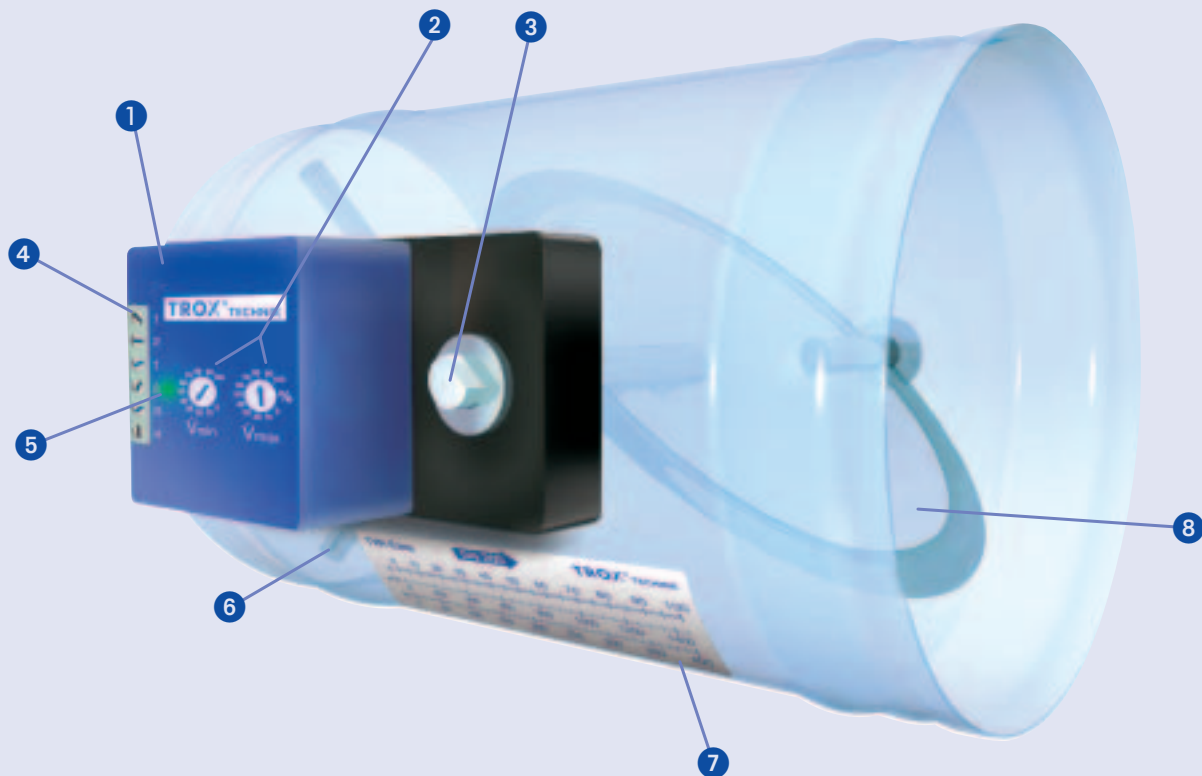
**3** Green light: Ready!

## Trox TVR-Easy – the innovative solution

- **Easy** Selection according to nominal size of the duct system
- **Easy** Volume flow rate adjustment without adjusting actual unit
- **Easy** Functional check by LED light

The proven technology of the compact flow rate controller has been optimized. Valuable on site time saved by simple set up.

TVR-Easy, developed with consultant and customers!

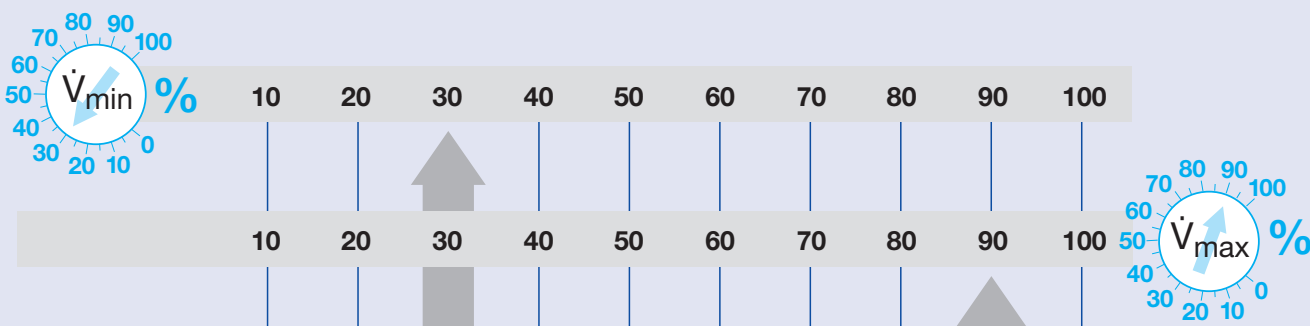


- |                             |                              |
|-----------------------------|------------------------------|
| 1 Trox Compact Controller   | 5 Function control           |
| 2 Potentiometers            | 6 Differential pressure grid |
| 3 Damper position indicator | 7 Volume flow scale          |
| 4 Connection terminals      | 8 Control damper blade       |

# Selection of nominal size

The selection of the nominal sizes takes place according to the volume flow range specified by the consultant.

The accurate adjustment of the volume flows is carried out using a volume flow scale, which is attached on each controller. For the acoustic characteristics in tables on pages 5 and 6, duct air velocity is needed. This can be determined from the following table.



		10	20	30	40	50	60	70	80	90	100
Air velocity $v$ in m/s		1,3	2,6	3,9	5,2	6,5	7,8	9,1	10,4	11,7	13
<b>D</b>											
<b>100</b>	m <sup>3</sup> /h	35	70	105	140	175	210	245	280	315	350
	l/s	10	19	29	39	49	58	68	78	88	97
<b>125</b>	m <sup>3</sup> /h	55	110	165	220	275	330	385	440	495	550
	l/s	15	31	46	61	76	92	107	122	138	153
<b>160</b>	m <sup>3</sup> /h	90	180	270	360	450	540	630	720	810	900
	l/s	25	50	75	100	125	150	175	200	225	250
<b>200</b>	m <sup>3</sup> /h	145	290	435	580	725	870	1015	1160	1305	1450
	l/s	40	81	121	161	201	242	282	322	363	403
<b>250</b>	m <sup>3</sup> /h	222	444	666	888	1110	1332	1554	1776	1998	2220
	l/s	62	123	185	246	308	370	432	493	555	617
<b>315</b>	m <sup>3</sup> /h	370	740	1110	1480	1850	2220	2590	2960	3330	3700
	l/s	103	206	308	411	514	617	719	822	925	1028
<b>400</b>	m <sup>3</sup> /h	604	1207	1811	2414	3018	3621	4225	4828	5432	6035
	l/s	168	335	503	671	838	1006	1174	1341	1509	1676

# Sound pressure level · Quick selection

System attenuation in dB/Oct. according to VDI 2081 (values incorporated into the quick selection table)

$f_m$ in Hz	63	125	250	500	1000	2000	4000	8000
Duct attenuation	0	0	1	2	3	3	3	3
Room attenuation	5	5	5	5	5	5	5	5
End reflection	10	5	2	0	0	0	0	0

Correction for distribution into the duct system

$\dot{V}$ in m <sup>3</sup> /h	500	1000	1500	2000	2500	3000	4000	5000	6000
l/s	139	278	417	556	695	834	1111	1389	1667
dB per octave	0	3	5	6	7	8	9	10	11

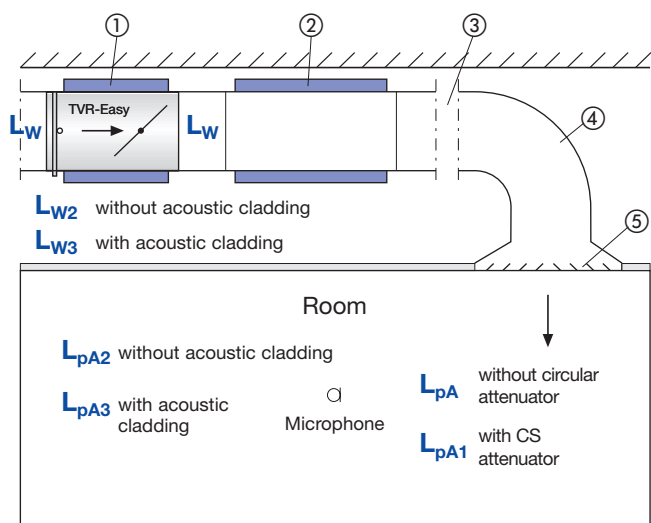
Correction for other pressure differentials (averaged values)

$\Delta p_g$ in Pa	100	200	400	600	800	1000
dB	-5	0	6	9	11	14

## Quick Selection of sound pressure level in dB(A) with $\Delta p_g = 200$ Pa

D	v	$\Delta p_{g \min}$	$\Delta \dot{V}$	Air regenerated noise					Case radiated noise	
				$L_{pA}$	$L_{pA1}$				$L_{pA2}$	$L_{pA3}$
					without circular attenuator	with attenuator type CS Length in mm				
mm	m/s	Pa	± %		500	1000	1500	2000	without Acoustic cladding	with Acoustic cladding
100	1.3	20	15	35	22	12	10	8	19	15
	5.2	20	8	47	37	29	27	26	31	30
	9.1	35	7	54	45	37	35	34	38	38
	13.0	70	5	57	47	38	35	34	41	39
125	1.3	20	15	37	24	14	10	7	20	13
	5.2	20	7	48	39	33	30	28	31	29
	9.1	55	6	52	44	38	36	34	36	34
	13.0	90	5	55	45	38	35	33	39	34
160	1.3	20	15	42	30	21	16	13	23	15
	5.2	25	8	51	42	37	34	32	33	28
	9.1	40	7	54	46	41	38	36	37	32
	13.0	70	5	56	48	42	40	37	41	36
200	1.3	20	15	44	34	25	22	19	24	12
	5.2	20	7	50	43	38	36	34	32	24
	9.1	35	5	53	47	43	42	39	37	31
	13.0	65	5	56	48	43	42	39	41	34
250	1.3	20	15	42	32	25	23	21	24	13
	5.2	20	7	49	43	37	36	34	32	25
	9.1	25	5	50	44	40	39	38	37	32
	13.0	45	5	54	46	41	40	38	41	35
315	1.3	20	15	47	39	32	28	25	31	15
	5.2	20	7	50	45	39	37	36	40	27
	9.1	20	6	52	47	41	40	39	44	34
	13.0	30	5	55	50	44	43	41	48	39
400	1.3	20	15	48	41	34	30	28	33	16
	5.2	20	7	49	43	38	35	35	41	28
	9.1	25	6	49	44	39	37	37	43	33
	13.0	25	5	52	47	41	40	39	48	38

# Air-regenerated noise, sound power level



- ① Acoustic cladding
- ② CS circular attenuator
- ③ Air distribution to several ceiling diffusers
- ④ Connecting duct
- ⑤ End reflection based on diffuser

All noise levels were measured in the reverberation room. The sound performance data was determined and corrected in accordance with ISO 5135, December 1997.

See page 11 for definitions

Sound power level  $L_w$  at octave band centre frequency  $f_m$  in Hz

D mm	v m/s	$\Delta p_g = 100 \text{ Pa}$								$\Delta p_g = 250 \text{ Pa}$								$\Delta p_g = 500 \text{ Pa}$								$\Delta p_g = 1000 \text{ Pa}$							
		63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000
100	1,3	55	41	40	37	28	17	15	10	55	47	46	45	42	36	26	21	54	48	50	49	45	44	43	35	62	53	55	54	49	48	51	49
	5,2	65	62	54	47	40	34	30	24	66	65	62	55	50	44	39	36	68	66	66	60	56	53	48	45	70	67	69	64	60	60	56	54
	9,1	66	66	61	52	47	44	38	32	72	74	71	60	54	49	46	43	73	75	76	66	61	57	52	51	75	75	77	71	66	65	60	57
	13,0	62	61	62	57	52	50	43	37	76	76	76	64	58	55	50	46	77	79	80	70	63	59	55	54	79	79	83	76	69	67	63	61
125	1,3	43	40	40	39	31	20	17	12	53	44	46	46	44	39	29	24	58	48	48	49	47	47	45	37	57	52	54	55	50	52	53	54
	5,2	61	60	53	47	41	36	30	23	65	67	62	56	50	46	42	37	68	68	67	63	58	56	51	48	69	67	71	66	63	64	60	57
	9,1	62	63	57	50	50	44	39	30	72	74	67	59	55	49	49	44	72	76	74	66	61	57	54	52	74	75	78	72	68	66	63	60
	13,0	64	58	58	54	54	48	43	38	73	74	70	62	59	54	53	48	76	79	79	68	63	59	58	56	78	81	84	76	70	67	65	63
160	1,3	46	44	45	45	39	34	22	20	50	48	47	50	47	44	34	27	55	55	52	54	54	52	49	42	59	61	58	58	57	59	55	55
	5,2	63	61	55	48	45	43	34	31	69	68	64	58	55	54	47	42	70	71	69	64	62	63	56	52	71	73	73	70	68	72	65	62
	9,1	65	64	58	52	51	47	40	37	75	74	68	61	58	56	52	47	77	78	75	68	64	64	59	56	78	81	80	76	71	74	68	65
	13,0	65	65	62	57	57	51	46	40	78	77	73	65	62	59	56	51	82	82	79	71	66	66	61	59	82	87	85	78	73	74	70	67
200	1,3	54	47	45	44	38	34	33	21	48	52	48	51	50	48	47	33	54	51	52	54	56	54	54	44	59	56	60	58	62	63	64	57
	5,2	64	62	52	48	48	47	43	40	70	69	61	55	51	52	54	47	73	71	67	63	59	60	63	55	73	72	72	70	67	70	73	64
	9,1	66	71	59	55	54	49	44	35	77	78	65	60	56	56	57	50	79	81	72	66	62	63	65	59	79	83	77	73	68	71	74	66
	13,0	72	70	62	62	60	55	51	45	79	80	71	65	62	61	59	53	83	85	77	70	66	66	67	62	84	89	82	76	71	73	75	69
250	1,3	49	46	41	40	34	27	18	22	49	53	49	52	49	46	39	36	49	54	53	57	58	56	53	45	49	53	57	60	64	65	60	57
	5,2	61	60	51	49	47	51	47	46	67	67	59	56	50	50	54	50	70	71	65	61	57	56	55	58	72	72	70	68	66	66	62	63
	9,1	65	70	59	56	52	49	44	46	73	75	64	61	55	55	57	52	78	79	71	66	61	60	60	60	79	81	76	72	68	68	65	66
	13,0	71	68	62	64	59	56	50	45	77	77	71	66	61	60	59	53	82	82	76	71	64	64	63	63	83	86	80	76	71	71	69	68
315	1,3	48	47	44	42	41	40	27	23	54	53	50	53	54	55	46	37	54	53	53	55	61	63	56	48	57	55	59	58	67	71	64	59
	5,2	64	61	54	51	48	53	50	43	70	68	61	57	53	58	58	50	75	73	67	63	61	66	60	61	76	75	72	70	69	74	68	68
	9,1	71	70	62	58	54	54	52	50	77	76	68	64	58	61	61	56	81	80	74	68	64	68	63	65	84	83	78	73	70	75	71	69
	13,0	75	72	71	65	60	58	53	47	81	78	76	70	62	63	62	59	86	84	80	74	67	70	66	66	89	87	83	77	73	76	73	71
400	1,3	46	46	46	44	44	41	25	24	55	53	51	53	56	56	44	37	56	53	54	57	63	67	57	54	56	57	59	62	70	76	67	64
	5,2	64	61	54	51	51	47	39	41	73	68	61	58	59	62	58	52	74	71	66	63	64	69	63	65	76	75	71	68	72	78	69	69
	9,1	70	69	64	62	54	51	45	46	76	74	67	64	61	62	55	52	81	79	72	68	67	71	65	63	83	82	77	73	74	79	73	72
	13,0	78	69	66	67	60	57	52	51	80	76	74	70	64	64	58	59	85	81	77	73	69	73	66	63	89	85	82	77	75	80	74	72

# Case radiated noise, sound power level

## Example

Given: TVR-Easy, D 200  
 $\dot{V}_{\max} = 1305 \text{ m}^3/\text{h}$  ( $v = 11.7 \text{ m/s}$ )  
 Pressure difference of the controller 250 Pa  
 Specified sound pressure level in room: 40 dB(A)  
 with 5 dB/oct. room attenuation and 4 dB/oct.  
 ceiling attenuation

Required:  $L_{pA2}$  radiated noise in room  
 with  $\dot{V}_{\max} = 1305 \text{ m}^3/\text{h}$

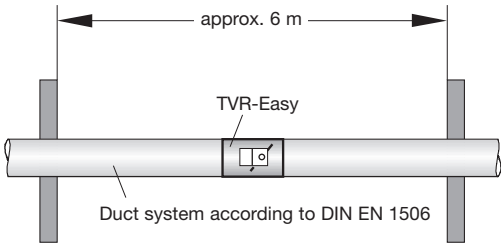
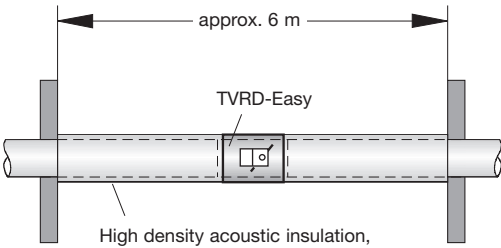
## Calculations

$f_m$	63	125	250	500	1000	2000	4000	8000
$L_W$ (page 6)	79	80	71	65	62	61	59	53
$\Delta L_W$	-13	-18	-18	-20	-20	-18	-16	-13
$L_{W2}$	66	62	53	45	42	43	43	40
Ceiling attenuation	-4	-4	-4	-4	-4	-4	-4	-4
Room attenuation	-5	-5	-5	-5	-5	-5	-5	-5
A-Weighting	-26	-16	-9	-3	0	1	1	-1
corrected level	<b>31</b>	<b>37</b>	<b>35</b>	<b>33</b>	<b>33</b>	<b>35</b>	<b>35</b>	<b>30</b>

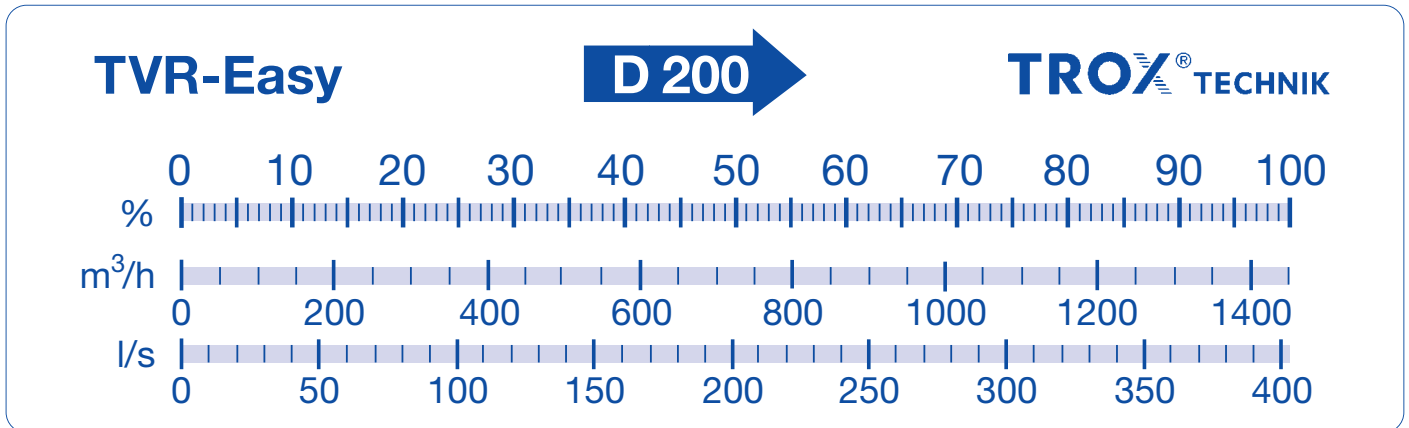
Result:  $L_{pA2}$  approx. 43 dB(A),  
 Acoustic cladding required

New calculation: With  $\Delta L_{W1}$  the result is  $L_{pA3}$  approx. 35 dB(A), specification is met.

## Correction Values for Case-Radiated Noise in dB

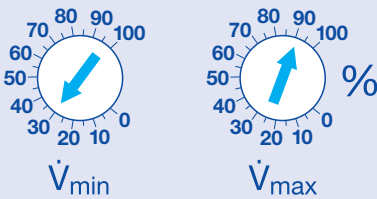
Installation configuration	$\Delta L_W / \Delta L_{W1}$	D mm	$\Delta L_W / \Delta L_{W1}$ in dB, based on $f_m$ in Hz							
			63	125	250	500	1000	2000	4000	8000
TVR-Easy $L_{W2} = L_W - \Delta L_W$ 	$\Delta L_W$	100	9	14	17	16	17	10	11	9
		125	10	15	17	17	17	12	12	10
		160	12	17	17	18	18	16	14	12
		200	13	18	18	20	20	18	16	13
		250	11	16	16	17	16	14	12	11
		315	10	15	16	16	15	13	11	10
		400	10	14	16	16	15	12	10	10
TVRD-Easy (with acoustic cladding) $L_{W3} = L_W - \Delta L_{W1}$ 	$\Delta L_{W1}$	100	11	12	16	21	32	32	37	31
		125	12	15	16	23	32	33	37	32
		160	14	20	17	25	33	38	40	34
		200	15	21	21	31	38	44	43	35
		250	13	19	19	28	35	42	36	31
		315	12	18	20	28	34	41	35	29
		400	12	18	20	28	35	39	33	29

# Volume flow adjustment



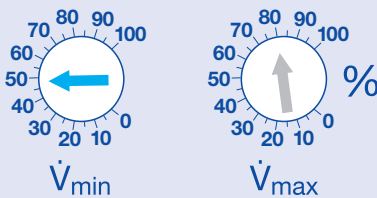
On each TVR Easy, a volume flow rate scale is available in order to determine the settings on site (see example D 200 above).

## Variable volume flow control



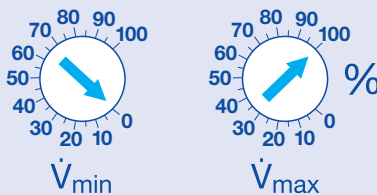
The required volume flow must be adjusted by the customer. If  $\dot{V}_{\min}$  is set higher than  $\dot{V}_{\max}$ , then  $\dot{V}_{\min}$  is provided as a constant volume flow, even if a control signal is transmitted. If  $\dot{V}_{\min}$  is set on 0 %, then control is between shut-off and  $\dot{V}_{\max}$ . If the control signal falls below 0.1 VDC, the control damper closes (leakage flow only).

## Constant Volume Flow Control



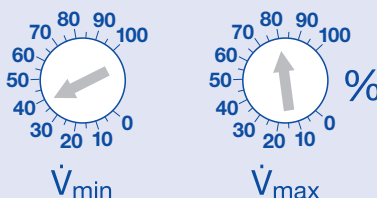
The constant volume flow can be set with the  $\dot{V}_{\min}$ -potentiometer. The position of the  $\dot{V}_{\max}$ -potentiometer is unimportant.

## BMS Activation



If the volume flow is set by the BMS, the potentiometer  $\dot{V}_{\min}$  must be set at 0 % and the potentiometer  $\dot{V}_{\max}$  must be set at 100 %. If the control signal falls below 0.1 VDC, the control damper closes (leakage flow only).

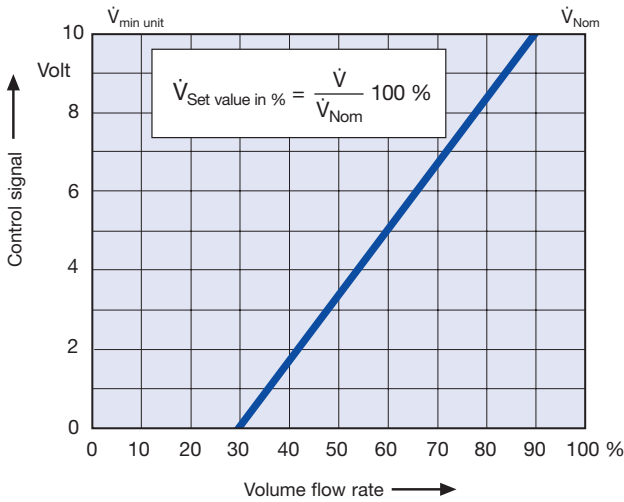
## Factory setting



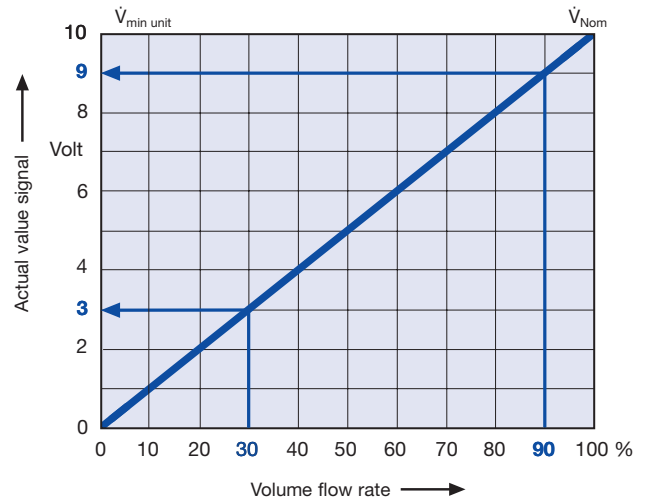
For delivery of the units, the potentiometer  $\dot{V}_{\min}$  and  $\dot{V}_{\max}$  are set at 40 and 80 % respectively.

# Characteristics · Connection examples

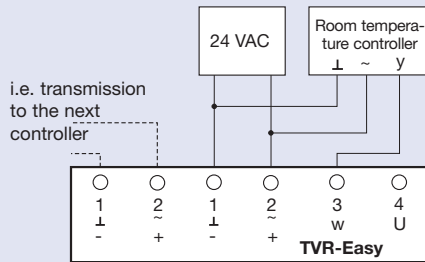
## Characteristics of the control signal



## Characteristic of Actual Value signal

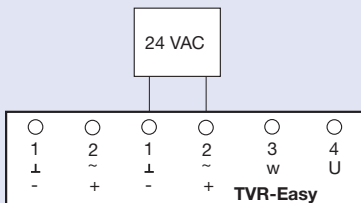


### Variable volume flow control



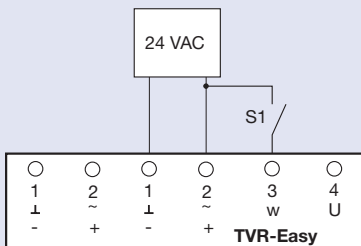
The connection of power supply and of the external room temperature controller must be carried out as shown in the circuit diagram opposite

### Constant Volume Flow Control



As soon as the 24 VAC supply voltage is applied, the controller runs the adjusted  $\dot{V}_{\text{min}}$ -value as a constant volume flow.

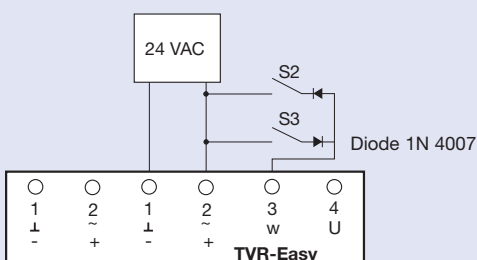
### $\dot{V}_{\text{min}} / \dot{V}_{\text{max}}$ changeover



The switch S1 enables a changeover between the two constant volume flows of  $\dot{V}_{\text{min}}$  and  $\dot{V}_{\text{max}}$

Switch S1 open :  $\dot{V}_{\text{min}}$   
Switch S1 closed :  $\dot{V}_{\text{max}}$

### Override controls OPEN / CLOSED



The override controls to provide OPEN and CLOSED can be achieved using external switches (potential-free contacts).

Switch S2 closed: Damper blade CLOSED  
Switch S3 closed: Damper blade OPEN

All override controls can be combined among themselves and with the different control switch variants. The customer made connections and wiring must comply with the local standards for electrical wiring.

# Functional characteristics · Dimensions

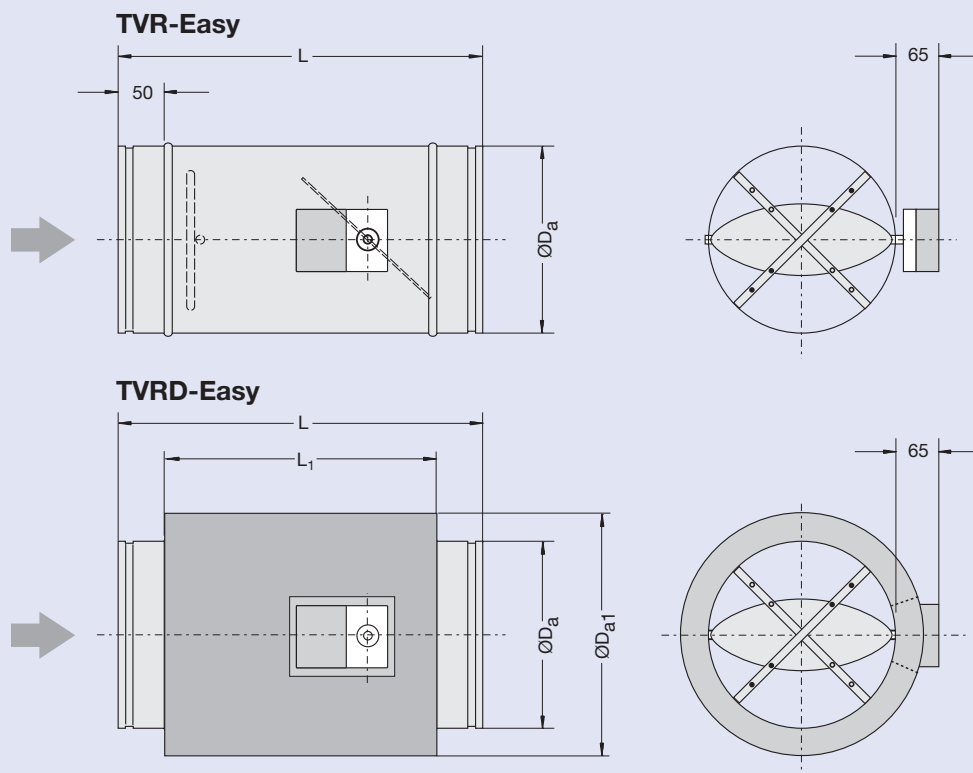
## Functional characteristics

- Electronic control
- Green LED provides functional information:
  - flashes constantly = set
  - blinking = not set
  - off = no supply voltage
- Good control accuracy on the set volume flow rate even if there is an elbow connection with  $R = 1 D$
- Spigot connections on both ends suitable for ducts to DIN EN 1506 or DIN EN 13180 with groove for lip seal
- Casing air leakage flow rate complies with class A, DIN EN 1751
- Differential pressure range 20 to 1000 Pa
- Control damper closed blade leakage complies with DIN EN 1751, class 3 or 4
- For delivery, control damper blade in 45° position
- Operation independent of mounting position
- The control damper mechanism of the VAV controller is maintenance free
- Operating temperature range: from 10°C to 50°C
- Storage temperature from -20°C to +80°C
- Suitable for nont-aggressive air

## General information

Standard filtration in air-conditioning systems allows the use of Trox compact controllers for the supply air without additional dust protection filters. Since a small volume flow is passed through the transmitter in order to monitor the volume flow, however the following must be noted:

- With heavy dust levels in the room, suitable extract air filters must be provided.
- If the air is contaminated with fluff or sticky particles or contains aggressive media, controllers with static differential pressure transducers must be used.



Dimensions in mm, weights in kg

D	ØD <sub>a</sub>	ØD <sub>a1</sub>	L	L <sub>1</sub>	Weight	
					TVR-Easy	TVRD-Easy
100	99	200	310	232	1,4	2,9
125	124	220	310	232	1,7	3,4
160	159	260	400	317	2,2	4,8
200	199	300	400	317	2,6	5,7
250	249	355	400	317	3,3	7,1
315	314	415	500	417	4,8	10,5
400	399	500	500	417	6,1	13,4

## Trox-Compact Technical Data

Supply voltage:	24 VAC ± 20 %, 50/60 Hz
Power absorption:	max. 3 W
Rating:	max. 5.5 VA
Control signal:	0 to 10 VDC, Ri > 100 kΩ
Volume flow- Actual value signal:	0 to 10 VDC linear, max. 0.5 mA
Measuring Sensor:	2 to 300 Pa
Factory preset:	250 Pa
Running time:	approx. 120 to 300 sec. for 87°
Torque:	min 4 Nm, 6 Nm starting torque
Safety class:	III (Safety K voltage)
Protection level:	IP 20
Ambient temperature:	0° C to +50° C
Storage temperature:	from -20° C to +80° C

## Nomenclature

$f_m$	in Hz:	Octave centre frequency
$L_W$	in dB:	Sound power level (re 1 pW) of air generated noise in duct
$L_{W2}$	in dB:	Sound power level (re 1pW) of case-radiated noise
$L_{W3}$	in dB:	Sound power level (re 1pW) of case-radiated noise with acoustic cladding
$L_{pA}$	in dB(A):	A-weighted sound pressure level (re 20 µPa) of air-regenerated noise in room, including system attenuation (see Table on Page 5)
$L_{pA1}$	in dB(A):	A-weighted sound pressure level (re 20 µPa) of air-regenerated noise in room with CS circular attenuator, including system attenuation (see Table on Page 5)
$L_{pA2}$	in dB(A):	A-weighted sound pressure level (re 20 µPa) of case-radiated noise in room, ceiling attenuation of 4 dB/oct. and room attenuation of 5 dB/oct.
$L_{pA3}$	in dB(A):	A-weighted sound pressure level (re 20 µPa) of case-radiated noise in room with acoustic cladding, ceiling attenuation of 4 dB/oct. and room attenuation of 5 dB/oct.
$\Delta L_W$	in dB:	Correction value for case radiated noise without acoustic cladding
$\Delta L_{W1}$	in dB:	Correction value for case radiated noise with acoustic cladding
$\Delta p_{g \min}$	in Pa:	Minimum total pressure differential
$\Delta p_g$	in Pa:	Total pressure differential
$\dot{V}$	in m <sup>3</sup> /h or l/s:	Volume flow rate
$\dot{V}_{\text{Nenn}}$	in m <sup>3</sup> /h or l/s:	Nominal volume flow rate (100%)
$\dot{V}_{\min \text{ Gerät}}$	in m <sup>3</sup> /h or l/s:	Minimum unit volume flow rate
$\dot{V}_{\max}$	in m <sup>3</sup> /h or l/s:	Maximum volume flow rate set point
$\dot{V}_{\min}$	in m <sup>3</sup> /h or l/s:	Minimum volume flow rate set point
$\Delta \dot{V}$	in ± %:	Volume flow rate tolerance from set point
$v$	in m/s:	Velocity in the duct system
$U$	in Volt:	Actual value signal output (from 0 to 10 VDC)
$w$	in Volt:	Command signal input (from 0 to 10 VDC)
$\perp, -$	:	Ground, neutral
$\sim, +$	:	24 VAC ± 20 %, 50/60 Hz supply voltage

# Order details

## Specification text

### TVR-Easy

Make: Trox. VAV circular controller Type TVR-Easy for variable air volume flow systems, for supply air or extract air, in 7 sizes.

Selection based nominal size determination. Simple setting by the customers of the volume flow with  $\dot{V}_{\min}$ - and  $\dot{V}_{\max}$ -adjustment potentiometers with percentage scales. During the installation of controller, adjustment is possible without supply voltage. Control damper blade delivery is in 45° position in order to allow air passage without additional control functions.

High visibility external control lamps (LED) for signalling the functions:

Set, not set and power failure. Electrical connections are with screw terminal, terminal for looping the 24 VAC supply voltage, i.e. for the connection of simple voltage transmission to the next controller.

Voltage range for control and actual value signal from 0 to 10 VDC, possible override controls with external switches using potential-free contacts: CLOSED, OPEN,  $\dot{V}_{\min}$  /  $\dot{V}_{\max}$  changeover.

Same, linear characteristics for any size. Casing with damper blade closed leakage to DIN EN 1751, Class 3 or 4. Integrated differential pressure sensor with 3 mm measurement holes which are, to a large extent resistant to contamination. Trox Compact electronic volume flow rate controller factory fitted. Position of the control blade visible externally based on shaft extension, casing leakage to Class A, DIN EN 1751, differential pressure range 20 to 1000 Pa.

#### Materials:

Casing and attachments in galvanised sheet steel, sheet steel damper with TPE elastomer seal, aluminium sensor tubes, polyurethane plain bearings.

#### Additionally with:

acoustic cladding made of 50 mm mineral wool with outer sheath of galvanised steel sheet, to reduce case radiated noise.

## Order code

