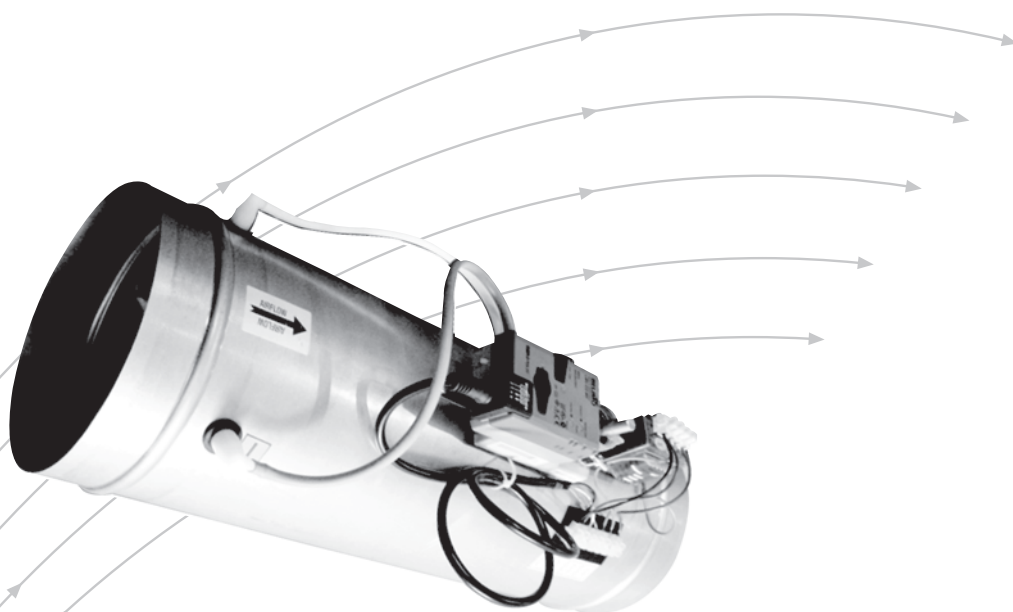


# VARYCONTROL® VAV Controller Units

for variable volume systems  
Type TVR



## TROX® TECHNIK

TROX Malaysia Sdn. Bhd.  
20 Persiaran Bunga Tanjung 1  
Senawang Land Industrial Park  
70400 Seremban  
Negeri Sembilan Darul Khusus  
Malaysia

Telephone + 606-678 8188  
Telefax + 606-678 8288 / 388  
E-mail [enquiry@troxapo.com](mailto:enquiry@troxapo.com)  
[www.troxapo.com](http://www.troxapo.com)

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**Type TVR VAV controller**



**Type TVRD VAV controller**



TROX VARYCONTROL® Types ‘TVR’ and ‘TVRD’ terminal units are suitable for either variable or constant air flow application, to be used in both supply and extract mechanical ventilation systems. It can also be used as a room or duct pressure regulator. These types of terminal units are designed for independent pressure control.

The standard ‘TVR’ unit comes with a circular inlet and discharge spigot connections complete with transformer, volume control damper and multi-point flow sensor grid for better air flow measurement accuracy and reliability. The actuator and control components are fitted to the side of the unit without control enclosure. Each unit will be factory calibrated and tested to the desired flow setting provided that;

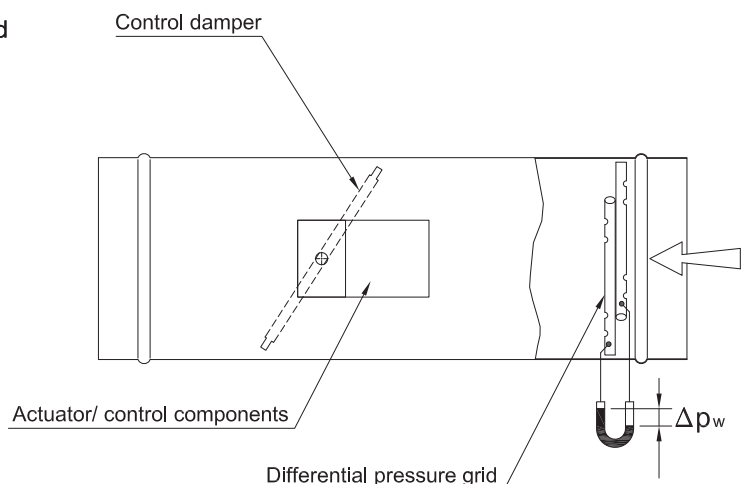
- The actuators and control components are supplied and installed by TROX.
- The design flow rate information is included in the customer’s purchase order.

The ‘TVRD’ unit, which is similar to the ‘TVR’ unit, has an additional acoustic cladding with reduced case radiated noise.

The full range for this type of VAV terminal unit is able to cover an air flow rate ranging from 10 to 1890 l/s.

Both types of terminal unit have been tested in certified laboratories to ISO 9001 and, in accordance with the following international standards to determine the aerodynamic and acoustics performance as published in this catalogue;

- ISO 5220 on “Aerodynamic testing and rating of constant and variable dual and single duct boxes and single units.”
- ISO 3741 for the “Determination of sound power level on noise control. Precision methods for broad band sources in reverberation room.”



# Construction · Dimensions

## Design Features

### Casing

- Leakage to Class A of DW 144, 1998.

### Volume Flow Control

- Damper blade is fitted with rubber tip seal to provide air tight seal when it is in the fully closed position.
- Multi-point air flow sensor grid is provided to ensure accurate flow measurement even under extreme air inlet conditions (refer to page 4 for more information).
- Typical air flow range is about 10:1, depending on the type of controller to be used.
- Digital VAV Compact Controller will be provided as standard supply. Note: DDC or pneumatic controller can be provided if requested. Delivery lead-time for such controller will be advised.
- Suitable for supply or extract application.
- Recommended operating temperature range is between 10 to 50 °C.

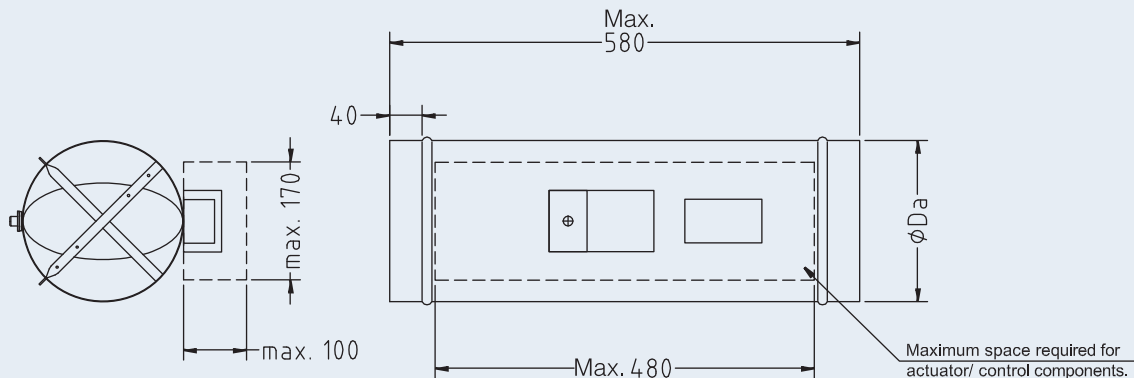
### Pressure Control

- Suitable for duct or room pressure control.
- Positive or negative pressure can be set between 15 and 500 Pa.

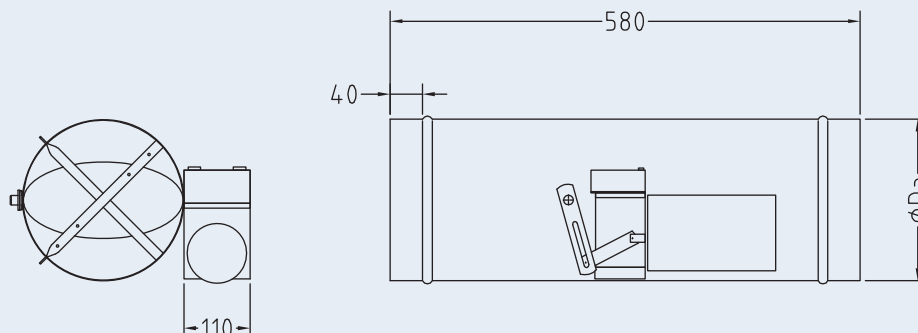
### Acoustic Cladding

- To reduce case radiated noise from the VAV terminal unit.
- Acoustic lining – 50 mm thk fibre glass insulation.
- With external galvanised sheet steel covering.

## TVR, electronic



## TVR, pneumatic



## Materials

- Casing and damper blade are made from galvanised sheet steel.
- Air flow sensor grid is made from aluminium tubes.
- Rubber tip seals and tubing and, plastic component parts are made from UL listed fire retardant material.

**Table 1:** Dimensions in mm

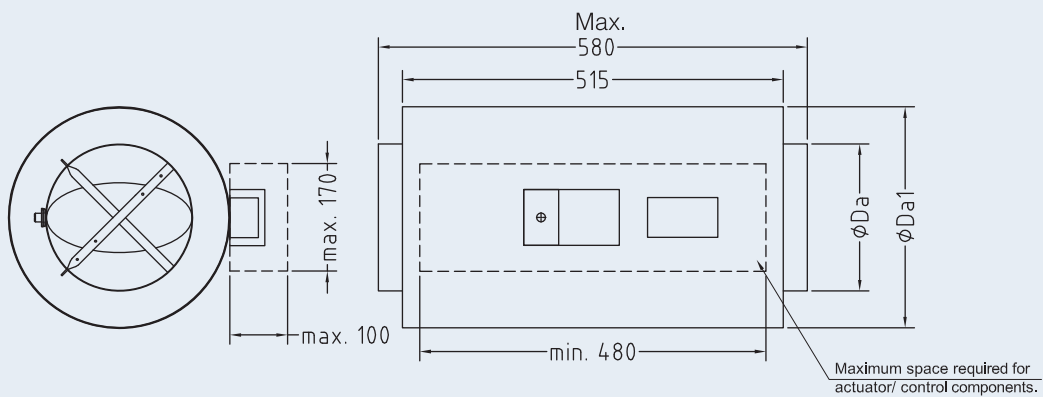
Dia.	SIZE								
	4	5	6	7	8	10	12	14	16
Da	99	124	149	174	199	249	299	349	399
Da1	199	224	249	274	299	349	399	449	499

**Table 2:** Approximate weights in kg

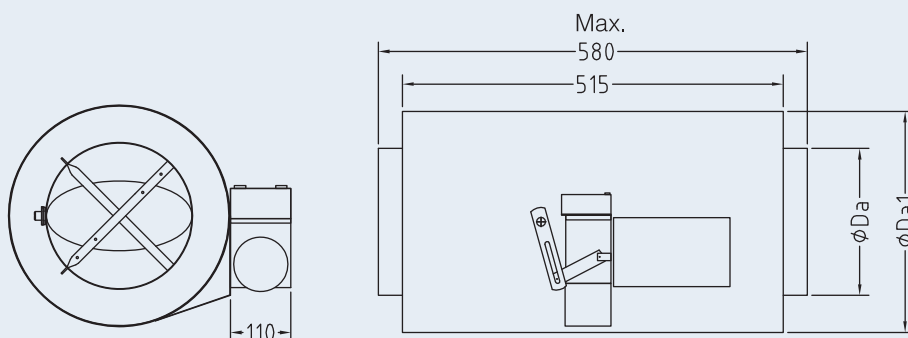
Type	SIZE								
	4	5	6	7	8	10	12	14	16
TVR	2.5	3.0	3.5	4.0	4.5	5.0	6.0	7.0	8.0
TVRD	5.5	6.0	6.5	7.5	8.0	10.5	11.5	13.5	16.0

Allow a dequate access to control components.

## TVRD, electronic



## TVRD, pneumatic



# Contents · Description

Depending on the application, this terminal unit can be used for either one of two basic control options;

- a. Volume Flow Control
- b. Pressure Control

## Volume Flow Control

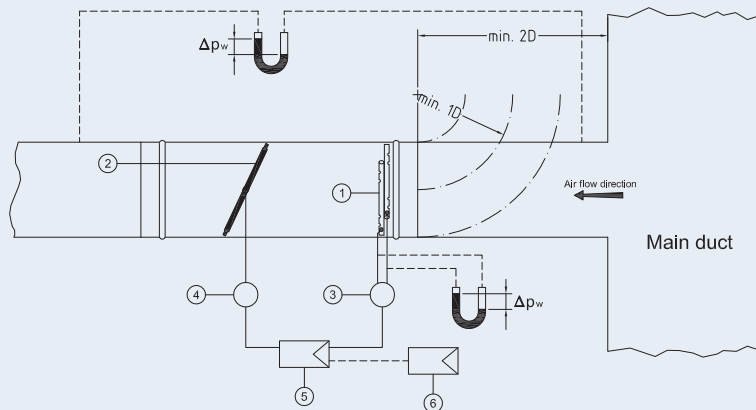
The pressure differential ( $\Delta p_w$ ) measured across the air flow sensor grid will be transmitted to the VAV controller via the transducer as a reference signal. The controller then compares the actual value with the set value. If there is a discrepancy, the damper will adjust its position accordingly to supply the appropriate air flow into the space to maintain the required room temperature.

## Pressure Control

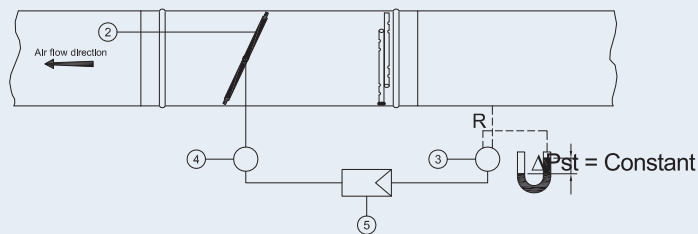
This terminal unit can be used for either duct or room pressure control. The pressure differential pressure between the duct and the surrounding area or, between two rooms is measured and transmitted to the controller as a reference signal.

1. Differential pressure sensor
  2. Control damper
  3. Transducer
  4. Damper actuator
  5. Volume flow controller
  6. Room temperature controller
- Wiring or piping by others

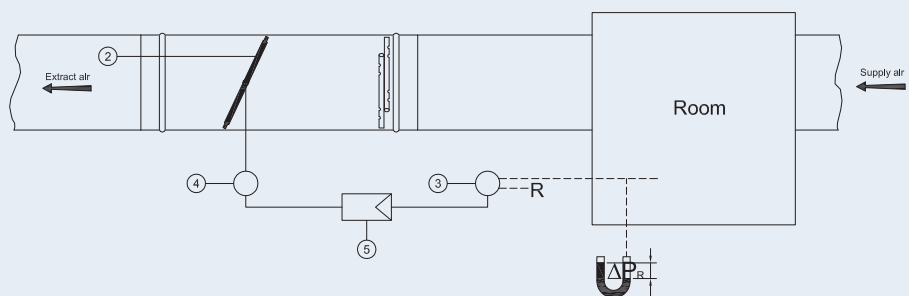
### Volume Flow Control



### Duct Pressure Control



### Room Pressure Control



# Nomenclature · Aerodynamic Data

## Nomenclature

<b>f<sub>m</sub></b>	Octave band frequency (Hz).	<b>Δp<sub>st</sub></b>	Static pressure differential (Pa).
<b>L<sub>w</sub></b>	Air regenerated noise in sound power level measured in a reverberation chamber (re 1 pW).	<b>Δp<sub>w</sub></b>	Pressure differential measurement at the air flow sensor grid (Pa).
<b>L<sub>w1</sub></b>	Case radiated noise in sound power level measured in a reverberation chamber (re 1 pW).	<b>V</b>	Air flow rate (in l/s or CFM).
<b>L<sub>p</sub></b>	Air regenerated noise in sound pressure level including 8 dB room attenuation in dB(A).	<b>ΔV</b>	Deviation from air flow setting (± %).
<b>L<sub>p1</sub></b>	Case radiated noise in sound pressure level including 8 dB room attenuation in dB(A).=	<b>ΔL<sub>1-3</sub></b>	Correction value for case radiated noise.
<b>NC</b>	Noise Criteria for air regenerated noise including 8 dB room attenuation.	<b>ΔL<sub>A1-A3</sub></b>	Correction value. for A-weighted case radiated noise
<b>NC<sub>1</sub></b>	Noise Criteria for case radiated noise including 8 dB room attenuation.	<b>ΔP<sub>g</sub></b>	Total differential Pressure (Pa)
		<b>ΔP<sub>g min.</sub></b>	Minimum total pressure differential (Pa)
		<b>R</b>	Reference pressure, e.g. Atmosphere (Pa)
		<b>ΔP<sub>R</sub></b>	Room pressure differential (Pa)

**Table 3:** Volume flow range with static pressure transducer<sup>1)2)</sup>

Size	ΔP <sub>g min</sub> Pa	V̇		Δ V̇ ± %
		l/s	CFM	
4	20	20	42	10
	20	45	95	7
	40	70	148	5
	70	100	212	5
5	20	35	74	10
	20	80	170	7
	70	125	265	5
	100	165	350	5
6	20	45	95	10
	20	100	212	7
	40	155	328	5
	80	215	456	5
7	20	60	127	10
	20	140	297	7
	40	220	466	5
	70	300	636	5
8	20	75	159	10
	20	175	371	7
	30	275	583	5
	60	380	805	5
10	20	130	275	10
	20	300	636	7
	30	470	996	5
	45	640	1356	5
12	20	200	424	10
	20	450	954	7
	20	700	1483	5
	30	1000	2119	5
14	20	300	636	10
	20	700	1483	7
	20	1100	2331	5
	30	1500	3178	5
16	20	380	805	10
	20	880	1865	7
	20	1380	2924	5
	30	1890	4005	5

1) Actual range depends on controls manufacturer selected  
2) Static pressure transducer; diaphragm type

**Table 4:** Volume flow range with dynamic pressure transducer<sup>1)3)</sup>

Size	ΔP <sub>g min</sub> Pa	V̇		Δ V̇ ± %
		l/s	CFM	
4	20	10	21	20
	20	30	64	7
	30	60	127	5
	70	100	212	5
5	20	20	42	20
	20	60	127	7
	60	110	233	5
	100	165	350	5
6	20	25	53	20
	20	90	191	7
	40	150	318	5
	80	215	456	5
7	20	30	64	20
	20	120	254	7
	40	210	445	5
	70	300	636	5
8	20	40	85	20
	20	150	318	7
	30	260	551	5
	60	380	805	5
10	20	65	138	20
	20	255	540	7
	25	445	943	5
	45	640	1356	5
12	20	100	212	20
	20	400	848	7
	20	700	1483	5
	30	1000	2119	5
14	20	150	318	20
	20	600	1271	7
	20	1050	2225	5
	30	1500	3178	5
16	20	190	403	20
	20	760	1610	7
	20	1330	2818	5
	30	1890	4005	5

3) Dynamic pressure transducer; flow through type

# Air Regenerated Noise

## Selection Example

### Data given by customer

1. V min – 60 l/s; V max – 110 l/s.
2. Design Inlet Static pressure – 200 Pa.
3. The specified sound pressure level in room is 55 dB (A) with 8 dB room attenuation.

### Selection

From Table 5, TVR Size 5 with V max of 110 l/s at 200 Pa static pressure, the regenerated noise at the discharge side of the terminal unit is expected to be at 52 dB (A). This will meet the customer's requirements as stated above.

**Table 5:** Regenerated noise on discharge side

Size	V̇		Δ P <sub>g</sub> = 100 Pa														Δ P <sub>g</sub> = 200 Pa														Δ P <sub>g</sub> = 500 Pa														Δ P <sub>g</sub> = 1000 Pa													
			L <sub>w</sub> in dB/Oct.														L <sub>w</sub> in dB/Oct.														L <sub>w</sub> in dB/Oct.														L <sub>w</sub> in dB/Oct.													
			f <sub>m</sub> in Hz														f <sub>m</sub> in Hz														f <sub>m</sub> in Hz														f <sub>m</sub> in Hz													
			63	125	250	500	1000	2000	4000	8000	L <sub>p</sub> in dB(A)	NC	63	125	250	500	1000	2000	4000	8000	L <sub>p</sub> in dB(A)	NC	63	125	250	500	1000	2000	4000	8000	L <sub>p</sub> in dB(A)	NC	63	125	250	500	1000	2000	4000	8000	L <sub>p</sub> in dB(A)	NC																
I/s	CFM																																																									
4	10	21	32	32	31	28	22	<15	<15	<15	21	<15	30	32	35	33	28	21	<15	16	26	19	31	32	39	41	43	44	42	34	41	36	37	36	41	42	42	44	47	47	44	42																
	39	64	36	46	43	42	36	30	25	21	34	28	41	49	49	47	43	37	32	25	40	34	44	49	53	53	51	48	44	40	48	42	45	49	55	56	54	51	50	49	51	45																
	60	127	40	53	52	52	49	45	37	32	46	40	47	58	60	57	53	49	44	38	51	45	52	62	67	64	59	55	50	48	57	52	54	61	69	69	63	61	56	55	62	58																
	100	212	47	52	57	60	59	55	49	42	55	50	50	59	63	64	62	58	53	48	58	53	56	71	73	71	68	64	59	57	65	60	62	70	76	76	72	68	63	60	69	65																
5	20	42	32	35	39	43	35	23	<15	18	33	29	35	35	41	49	48	36	26	26	43	39	37	36	43	54	58	51	43	37	52	49	46	36	45	53	49	56	50	44	51	49																
	60	127	44	52	49	47	41	33	27	30	39	34	47	55	53	52	49	40	36	35	45	40	48	56	58	58	60	55	48	44	55	51	50	53	58	61	64	66	59	53	62	58																
	110	233	50	54	57	55	49	42	38	36	47	42	53	61	62	59	55	47	43	42	52	47	56	65	67	64	61	56	51	49	58	52	55	62	67	66	66	67	61	56	64	59																
	165	350	61	58	62	63	60	56	54	50	57	51	62	62	67	67	61	56	52	48	59	56	61	70	72	69	65	59	55	52	63	58	59	66	72	70	67	67	62	57	66	59																
6	25	53	34	35	37	41	34	23	15	20	32	28	35	35	40	48	46	36	28	28	41	37	36	33	40	51	56	50	43	37	50	47	45	35	43	52	56	56	51	45	53	49																
	90	191	47	51	49	48	43	34	29	29	40	35	50	54	54	53	50	42	38	36	46	41	50	55	57	58	58	55	49	46	54	49	52	53	58	61	63	66	59	54	61	58																
	150	318	52	55	55	54	49	42	38	36	46	41	55	60	60	59	55	47	44	41	52	47	57	64	66	63	61	56	52	49	58	52	56	62	66	65	66	66	61	57	63	58																
	215	456	58	58	60	60	56	51	48	45	53	48	60	63	65	64	59	53	49	46	57	53	62	69	70	67	64	59	55	53	61	56	62	67	71	70	68	68	63	60	66	60																
7	30	64	35	35	37	40	33	24	18	22	31	26	37	33	39	45	44	37	30	30	39	35	37	33	40	48	53	52	44	39	49	44	45	36	43	51	55	58	53	48	54	50																
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8	40	85	42	36	36	39	34	29	25	25	31	25	41	35	38	44	42	39	34	33	38	32	38	32	39	47	53	53	47	43	49	45	46	35	43	50	55	62	55	50	57	54																
	150	318	51	52	49	46	39	36	33	32	39	33	54	55	54	53	47	44	40	40	46	41	58	59	59	59	58	55	51	49	55	49	59	57	60	62	62	64	60	57	61	57																
	260	551	56	57	56	54	47	42	39	38	46	41	60	62	62	59	53	47	44	45	52	47	66	70	68	66	61	57	54	54	59	54	69	70	71	69	67	67	63	61	65	59																
	380	805	60	59	60	61	55	49	47	44	53	49	65	65	67	64	58	53	49	48	57	53	70	72	72	71	64	60	57	56	63	60	73	75	77	74	70	69	65	64	68	63																
10	65	138	40	41	40	39	34	31	27	27	32	25	44	40	41	44	43	39	36	35	39	33	44	39	45	50	53	54	48	45	50	46	49	40	48	53	57	62	56	52	57	54																
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12	100	212	38	43	41	39	34	31	29	28	33	25	40	44	43	43	42	40	38	38	39	33	48	48	50	52	55	53	51	51	52	46	51	47	54	55	59	61	60	58	59	54																
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	700	1483	59	57	57	56	48	44	39	34	48	44	66	65	63	62	56	51	47	46	54	50	72	73	70	67	63	60	56	55	61	55	76	77	75	71	69	69	64	63	68	62																
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14	150	318	38	44	42	40	34	32	30	28	33	26	42	44	44	43	42	40	38	38	39	33	49	50	51	52	55	52	50	50	51	46	53	49	55	55	59	61	59	57	58	53																
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	1050	2225	61	59	61	61	52	47	42	37	52	49	67	66	65	64	57	52	48	46	56	52	74	74	72	69	65	61	57	56	63	58	78	78	77	73	71	70	65	64	69	63																
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16	190	403	37	44	43	40	34	32	30	28	34	27	42	43	44	42	41	39	38	37	39	32	49	50	50	51	54	51	49	49	50	45	53	50	54	55	59	60	57	56	57	53																
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	1890	4005	67	62	68	69	57	52	48	43	60	58	72	69	70	71	62	57	53	50	62	61	78	77	78	75	69	65	61	59	68	64	82	83	83	79	75	73	69	68	74	70																

# Case Radiated Noise

## Selection Example

Data given by customer:

1. V min – 25 l/s; V max – 90 l/s.
2. Design Inlet Static pressure – 500 Pa.
3. The specified sound pressure level in room is 27 dB (A) with 10 dB/Oct. room attenuation. and 4dB/Oct. ceiling sound reduction.

## Selection :

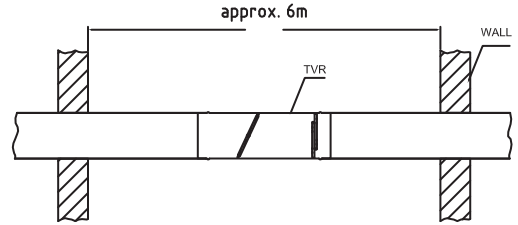
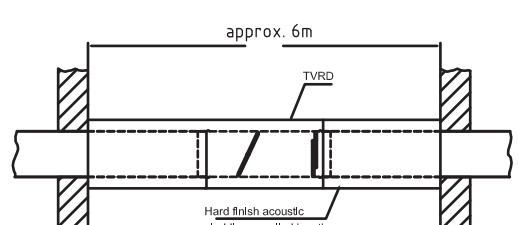
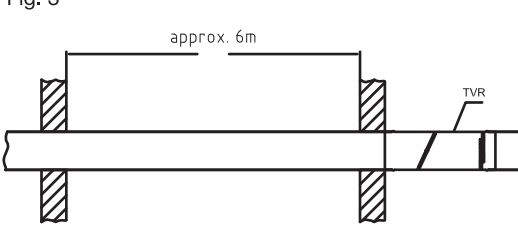
From Table 5, TVR Unit Size 6 will be able to handle V max of 90 l/s at 500 Pa static pressure. To calculate case radiated sound pressure (SPL) from this unit for both TVR and TVRD, use the figures from Table 6 below.

The calculated case radiated SPL from TVR and TVRD units are 32 dB(A) and 23 dB(A) respectively. This is calculated by adding the corrected levels in logarithmically in the table below. Based on the calculated case radiated SPL, only TVRD/ 6 is able to meet the requirement.

Calculation of corrected level for TVRD in dB per Octave.

f <sub>m</sub>	63	125	250	500	1000	2000	4000	8000
L <sub>w</sub>	50	55	57	58	58	55	49	46
ΔL <sub>1</sub>	13	19	15	21	31	34	37	33
Ceiling noise reduction	4	4	4	4	4	4	4	4
Room attenuation	10	10	10	10	10	10	10	10
	23	22	28	23	13	7	-2	-1
A-weighting	-26	-16	-9	-3	0	1	1	-1
Corrected level	-3	6	19	20	13	8	-1	-2

Table 6

L <sub>w1</sub> = L <sub>w</sub> - ΔL <sub>1 to 3</sub> L <sub>p1</sub> = L <sub>p</sub> - ΔL <sub>A1 to A3</sub>	ΔL <sub>1 to 3</sub>	Size	ΔL <sub>1 to 3</sub> in dB/Oct.							ΔL <sub>A1 to A3</sub> in dB	
			f <sub>m</sub> in Hz								
			63	125	250	500	1000	2000	4000		8000
Fig. 1 	ΔL <sub>1</sub>	4	9	14	17	16	17	10	11	9	14
		5	10	15	17	17	17	12	12	10	15
		6	11	16	17	18	18	14	13	11	16
		7	12	17	17	18	18	16	14	12	17
		8	13	18	18	20	20	18	16	13	19
		10	11	16	16	17	16	14	12	11	15
		12	10	15	16	16	15	13	11	10	14
		14	10	15	16	16	15	12	10	10	14
		16	10	14	16	16	15	12	10	10	14
Fig. 2 	ΔL <sub>2</sub>	4	11	12	16	21	32	32	37	31	>25
		5	12	15	16	23	32	33	37	32	
		6	13	19	15	21	31	34	37	33	
		7	14	20	17	25	33	38	40	34	
		8	15	21	21	31	38	44	43	35	
		10	13	19	19	28	35	42	36	31	
		12	12	18	20	28	34	41	35	29	
		14	12	18	20	28	34	40	34	29	
		16	12	18	20	28	35	39	33	29	
Fig. 3 	ΔL <sub>3</sub>	4	9	11	18	19	15	9	9	9	14
		5	10	12	19	19	15	10	10	10	15
		6	11	13	19	20	16	11	11	11	16
		7	12	14	19	20	16	13	12	12	16
		8	13	15	20	21	18	15	14	13	18
		10	11	13	18	19	14	11	11	11	15
		12	10	12	18	18	13	11	10	10	14
		14	10	11	18	18	13	10	10	10	14
		16	10	11	18	18	13	10	10	10	14



# Accessories - *For temperature control only*

Description	Optional Accessories Included			Product code (Cooling only)		
	Actuator	Controller	Temp. sensor			
Bare box only.	None	None	None	0	00	0
Complete with compact stand-alone VAV controller <ul style="list-style-type: none"> <li>excluding temperature sensor</li> </ul>	Yes	Yes	None	X	10	0
<ul style="list-style-type: none"> <li>basic wall mounted temperature sensor. <b>(Standard supply)</b>.</li> </ul>	Yes	Yes	Yes	T	10	1
Complete with compact LONwork VAV controller; <ul style="list-style-type: none"> <li>excluding temperature sensor.</li> </ul>	Yes	Yes	None	X	2X	0
<ul style="list-style-type: none"> <li>with basic wall mounted temperature controller.</li> </ul>	Yes	Yes	Yes	X	2X	1
Complete with compact VAV BACNet controller; <ul style="list-style-type: none"> <li>excluding temperature controller.</li> </ul>	Yes	Yes	None	X	3X	0
<ul style="list-style-type: none"> <li>with basic wall mounted temperature controller.</li> </ul>	Yes	Yes	Yes	X	3X	1

## **Note:**

Typical recommended operating condition for the VAV controllers is between 10 to 50 °C. The standard compact VAV controller as supplied by TROX is not suitable for heating control (i.e., cooling only). Special controller will have to be selected for heating and cooling application. Special consideration should be given if the VAV controllers are expected to interface with the Building Automation System (BAS), to ensure that they are compatible. Step-down transformer (i.e., 240 to 24 V ac) can be provided as optional extra.

To ensure that the room temperature controller will operate effectively, it should be mounted where:

- There is good air circulation.
- At 1.5m above finished floor level.
- In the occupied area where the controller is supposed to maintain the required thermal comfort, rather than in an obscure area such as the ceiling void above the occupied area for example.

The sensors should not be mounted;

1. Directly under sunlight.
2. Above any heat source such as light fixtures or TV.
3. Near cooling units or supply air outlets.
4. Near any heat generating motor, lighting ballast or other inductive load.

**The installer should comply with manufacturer's recommendations on the installation requirements for the room temperature controller.**

# Order Details

## General specification:

This VAV terminal unit is suitable for variable air flow supply or extract application, with flow rate ranging from 10 to 1890 l/s depending on the unit size selected. As a standard supply, an electronic compact standalone VAV controller suitable for cooling application can be provided with the VAV terminal unit. If VAV controllers are supplied with the VAV terminal units, each VAV unit will be factory calibrated and tested to customer's specified design flow rates.

If required, TROX is able to supply either LONMark or BACNet compliant controllers. Delivery lead-time for such controllers will be advised subject to availability.

The case leakage rating for this type of VAV terminal unit will comply with Class A of DW 144, 1998. Typical static differential pressure for the terminal unit ranges from 20 to 1500 Pa with a volume flow range ratio of 10:1 depending on the type of controller used.

All rubber and plastic component parts fitted to this VAV terminal units are UL listed fire retardant material for safety purpose.

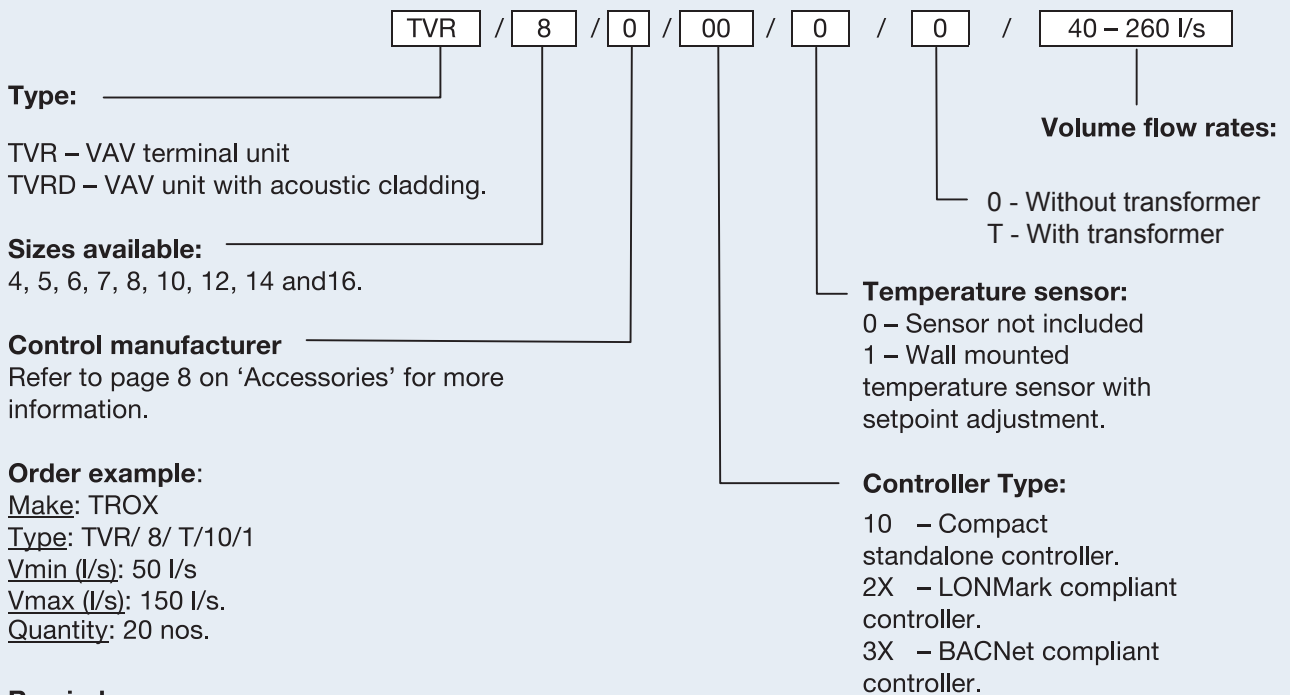
Controls enclosure can be supplied as optional extra.

This terminal unit can also be used for duct or room pressure control application. Please contact TROX for more information.

## Installation:

It is recommended that a minimum of **two diameter (2D) length** of straight metal ducting should be provided before the inlet spigot of the VAV unit to minimise turbulent air flow. Otherwise, this could severely affect the accuracy of the air flow measurement.

## Order Code



## Reminder:

Customers are advised to clearly state the design minimum (V min) and maximum (V max) flow rates in their purchase order for each item for factory calibration and testing purposes. This is to avoid unnecessary delay in order processing, if the information given is incomplete.