

Control engineering information VARYCONTROL[®] VAV Units Electronic controller VRP-M

VRP-M

VRP-M The system

VRP-M controller



Differential pressure transducer VFP-... 1)



Actuators 1)



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Air terminal units with controller VRP-M, M466EN6

Code 2)	Air terminal unit	Control function	Diaphragm transducer		Actuator	
			Type	TROX-part No.	Type	TROX-part No.
BP1	TVT 3)	Flow rate			SM24A-V-ST	M466ER0
BP3	TVR · TVJ · TVZ · TVA · TVRK · TVLK	Pressure differential (room or duct pressure)	VFP-300	M546EJ1	NM24A-V-ST	M466EQ9
BPG	TVR · TVZ · TVA · TVRK · TVLK				LMQ24A-SRV-ST	M466EQ2
BR3	TVR · TVJ · TVZ · TVA · TVRK · TVLK	Pressure differential (Room pressure)	VFP-100	M546EJ6	NM24A-V-ST	M466EQ9
BRG	TVR · TVZ · TVA · TVRK · TVLK				LMQ24A-SRV-ST	M466EQ2
BS3	TVR · TVJ · TVZ · TVA · TVRK · TVLK	Pressure differential (Duct pressure)	VFP-600	M546EJ7	NM24A-V-ST	M466EQ9
BSG	TVR · TVZ · TVA · TVRK · TVLK				LMQ24A-SRV-ST	M466EQ2

1) For further information about wiring and operation, see separate manual
2) Control components according to order code
3) Flow rate control only

Control engineering information VARYCONTROL[®] VAV Units Electronic controller VRP-M

VRP-M

Correct application

The electronic controller VRP-M combined with a diaphragm pressure transducer and an actuator are part of air terminal units and provide a control loop for flow rate or differential pressure control. The controller is delivered ready to operate. Control function and parameters are factory set.

The air terminal units are suitable for use in ventilation and air conditioning systems. Particular conditions can restrict the functional capacity and must be taken into account during the design stage:

- Installation should only be carried out by specialists. The normal rules of site working, in particular the health and safety regulations must be complied with.
- For aggressive air, only air terminal units made of plastic materials should be used after extensive tests for suitability.
- Galvanised sheet steel units must not be installed in contaminated environments (e.g. acetic acid).

For the electronic controller VRP-M the following must be noted:

- Use in aircraft is not allowed.
- Safety transformers must be used.
- The user should not exchange or repair any parts of the controller.
- The controller consists of electronic parts therefore must be separated from domestic waste. When disposed of, local and up to date regulations must be complied with.
- For hazardous areas, only use units with explosion proof electrical components.
- If there is a risk of fire due to flammable solids, the electric equipment must be rated IP 4X (see VdS 2033 fire safety guidelines or appropriate regulations).

Dependency of orientation

A diaphragm pressure transducer Type VFP for flow rate measurement is part of the system. It operates based on the static measurement principle and comprises a diaphragm.

The weight of the diaphragm means that the orientation of the transducer affects the measured signal. The transducer is factory fitted and adjusted with the diaphragm in a vertical position. The tube connection points can be on top or bottom also on either side but with the diaphragm still vertical. Other installation orientations must be specified on order.

Materials

Please note that in critical cases, material compatibility testing should be carried out on the air terminal unit and the diaphragm pressure transducer, taking into consideration the harmful substances involved and the concentrations in which they occur.

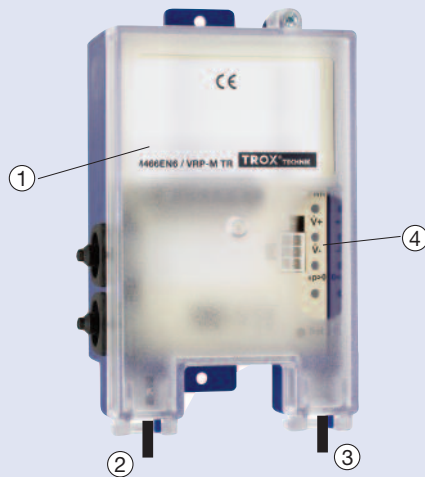
Maintenance

- The mechanical components are maintenance-free
- A yearly adjustment of the zero-point of the transducer is recommended.

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VARYCONTROL[®] VAV Units
Electronic controller VRP-M**

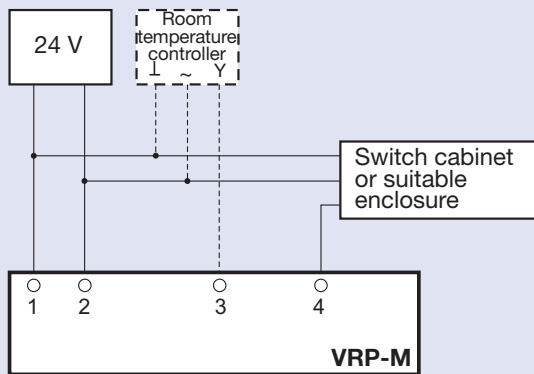
VRP-M

VRP-M



- ① VRP-M TR controller
- ② Connecting cable of transducer
- ③ Connecting cable of actuator
- ④ Indicator lights

Service signal



Area of application

The electronic controller VRP-M combined with a diaphragm pressure transducer, is designed for use in VAV systems for flow rate or differential pressure control. For variable control a control signal e.g. of a room temperature controller is necessary. Control signals can be in the range of 0 to 10 or 2 to 10 VDC. Separate switches can be used for override control. Several controllers may be connected in parallel to one room temperature controller. Supply - extract tracking control is possible.

Static differential pressure measurement

The flow rate is measured by a diaphragm pressure transducer so that the VRP-M is suitable to control extract air contaminated with fluff, sticky particles or containing aggressive media. In this case only air terminal units with powder coated surfaces or made of plastic should be used.

Commissioning connections

It is advisable that the signal line for the adjustment tool ZTH-VAV is linked up in an easily accessible location. This would mean that ceiling panels do not need to be removed for service. Suitable locations include: spare terminals in room temperature controller, wall mounted enclosure or switch cabinet. It is important that the ground/earth (and 24 V) is also available. Therefore, a 3-wire connection is recommended for the commissioning connection.

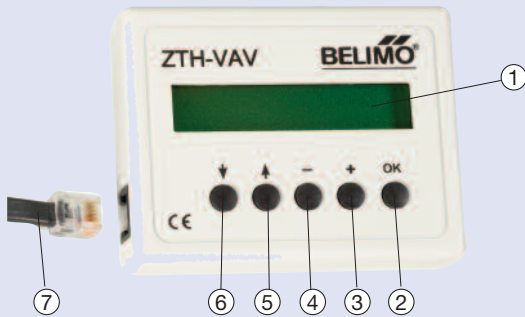
Technical data

Supply voltage	24 VAC ± 20 %, 50/60 Hz or 24 VDC ± 10 %	Override control	Terminal 6, input resistance >300kΩ Terminal 7, contact current <1mA
Power rating transducer VFP included	max. 2.6 VA (for AC voltage) max. 1.1 W (for DC voltage)	IEC protection class	III (Safe voltage)
Control signal	0 to 10 VDC, Ri >100 kΩ	Protection level	min. IP 42
Flow rate actual value signal	0 to 10 VDC, max. 0.5 mA	EMC	CE marking according to 2004/108/EG

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VRP-M

ZTH-VAV



- ① Display
- ② OK key
- ③ Plus key
- ④ Minus key
- ⑤ Arrow key "back"
- ⑥ Arrow key "forward"
- ⑦ Connecting cable

Adjustment tool ZTH-VAV

Actual values can be read and parameters can be changed using the adjustment tool ZTH-VAV.

The adjustment tool is connected directly to the VRP-M or in the switch cabinet.

Start-up window

```
VRP-M
Room XYZ
```

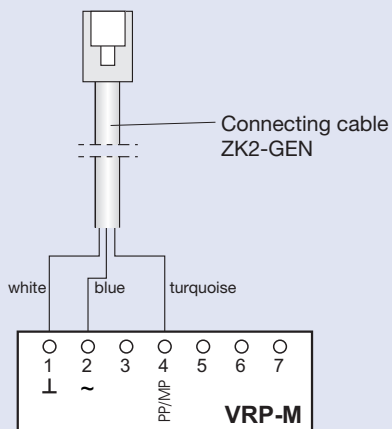
Reading of actual values

Use the arrow keys to change the displays.

Example:

```
Volume      133 m3/h
Position    24 %
```

Connection of ZTH-VAV to VRP-M



Setting of parameters

Select parameter using arrow keys. The actual value is shown.

Use + and - keys to set required value. Save value with OK.

Example:

```
Vmin        300 m3/h
-new        250 m3/h
```

For further information about wiring and operation, see separate manual.

Values and parameters of VRP-M

Display	Actual values			Parameter		Mode ¹⁾
	Flow rate	Pressure	Damper position	min	max	
Flow rate control	\dot{V}_{Act} in m ³ /h	p_{Act} in Pa ²⁾	Y_{Act} in %	\dot{V}_{min}	\dot{V}_{max}	0 – 10 VDC or 2 – VDC
Pressure control	p_{Act} in Pa ²⁾	p_{Act} in Pa		p_{min}	p_{max}	

¹⁾ Can only be changed when "expert mode" is active

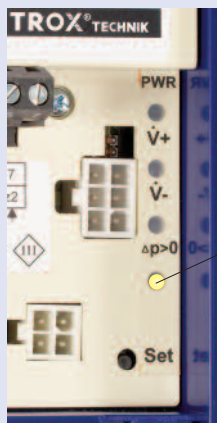
²⁾ Display from delivery date June 2008

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Electronic controller VRP-M**

VRP-M

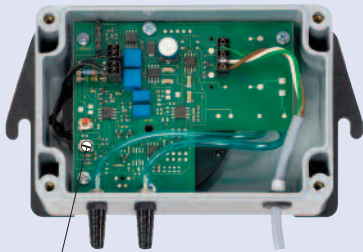
Zero point adjustment

VRP-M



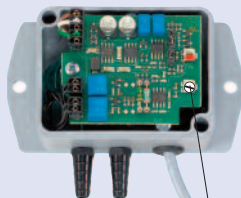
Zero point indicator light

VFP 100



Zero point potentiometer

VFP 300, VFP 600



Zero point potentiometer

Zero point adjustment

With the tubing disconnected if the zero point indicator light is illuminated this means that a value other than zero is being registered and the zero point must therefore be adjusted.

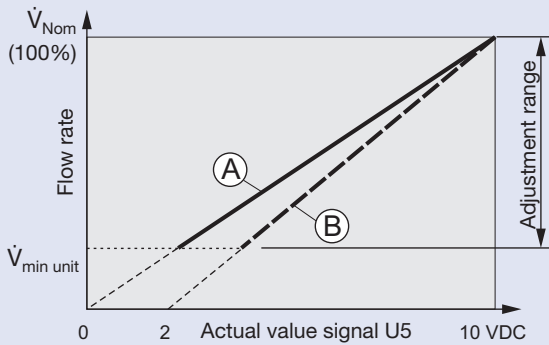
To adjust the zero point proceed as follows:

- Disconnect both (!) measuring tubes from VFP...
- Remove cover from VFP casing
- Turn zero point potentiometer clockwise until indicator light at VRP-M comes on
- Turn zero point potentiometer slowly counterclockwise backwards until indicator light goes off
- Replace cover

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VARYCONTROL[®] VAV Units
VRP-M for flow rate control**

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Characteristic of actual value signal



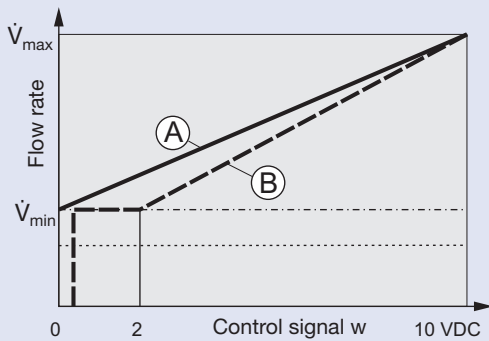
Ⓐ 0 – 10 VDC

$$\dot{V}_{\text{actual}} = \dot{V}_{\text{Nom}} \frac{U5}{10}$$

Ⓑ 2 – 10 VDC

$$\dot{V}_{\text{actual}} = \dot{V}_{\text{Nom}} \frac{U5-2}{8}$$

Characteristics of the control signal



Ⓐ 0 – 10 VDC

$$\dot{V}_{\text{set}} = \frac{w}{10} (\dot{V}_{\text{max}} - \dot{V}_{\text{min}}) + \dot{V}_{\text{min}}$$

Ⓑ 2 – 10 VDC

$$\dot{V}_{\text{set}} = \frac{w-2}{8} (\dot{V}_{\text{max}} - \dot{V}_{\text{min}}) + \dot{V}_{\text{min}}$$

Functional description

The flow rate is measured using the static differential pressure principle. The differential pressure sensor of the air terminal unit allows the measurement of an effective pressure (Δp_w). This causes a diaphragm in the differential pressure transducer to deflect, the movement is detected by induction and converted into a linear pressure/voltage signal. The linearisation of the flow rate is carried out in the VRP-M.

The flow rate range is adjusted depending on the unit size at the factory so that 10 VDC corresponds to the unit nominal flow rate (\dot{V}_{Nom}). The actual flow rate is measured as a 0/2 to 10 VDC signal (U5).

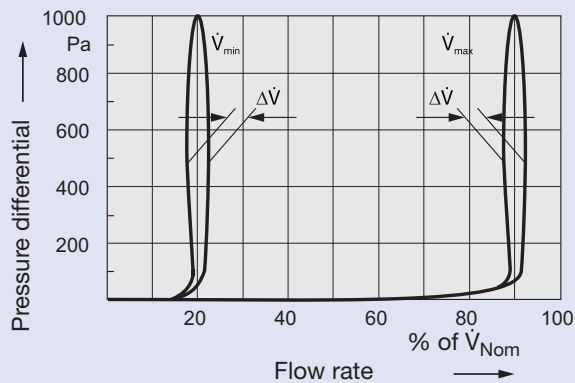
The room temperature controller provides a signal that controls the flow rate setpoint value in the range from \dot{V}_{min} to \dot{V}_{max} .

The VRP-M determines the required flow rate in accordance with the characteristic shown and compares this with the actual value. The damper actuator is controlled based on the deviation. The electronic controllers VRP-M allow for a specific range of actuators, the dynamic behaviour and control voltage of which are matched to the controller and thus a stable flow rate control can be achieved.

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VARYCONTROL® VAV Units
VRP-M for flow rate control**

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Pressure independent control characteristics



$$\dot{V}_{min} \text{ - setpoint value} = \frac{\dot{V}_{min}}{\dot{V}_{Nom}} \cdot 100\%$$

$$\dot{V}_{max} \text{ - setpoint value} = \frac{\dot{V}_{max}}{\dot{V}_{Nom}} \cdot 100\%$$

$$\frac{\dot{V}_{max M}}{\dot{V}_{min M}} = \frac{\dot{V}_{max S}}{\dot{V}_{min S}}$$

$$\dot{V}_{max} \text{ - setpoint value} = \frac{\dot{V}_{max S}}{\dot{V}_{max M}} \cdot \frac{\dot{V}_{Nom M}}{\dot{V}_{Nom S}} \cdot 100\%$$

Flow rate control

The flow rate controller works independently of duct pressure, i.e. pressure fluctuations cause no changes to flow rate. To prevent the flow rate control becoming unstable, a dead band is provided within which the damper does not move. This dead band and the accuracy of the differential pressure sensor lead to a flow rate deviation $\Delta \dot{V}$ as shown in the figure.

If the conditions given in the technical leaflet (e.g. minimum total pressure differential, upstream conditions) are not complied with, greater deviations must be expected.

\dot{V}_{min} -setting

The \dot{V}_{min} -value corresponds to the flow rate which is set with a 0 or 2 VDC control signal or \dot{V}_{min} override control. \dot{V}_{min} may be set between 0 and \dot{V}_{max} . The percentage figures relate to \dot{V}_{Nom} .

At setpoint values lower than the unit \dot{V}_{min} the damper blade closes.

\dot{V}_{max} -setting

The \dot{V}_{max} -value corresponds to the flow rate which is set with a 10 VDC control signal or \dot{V}_{max} override control. The setting range is from 30 to 100 %.

The percentage figures relate to \dot{V}_{Nom} .

Flow rate adjustment on site

If site adjustments to the factory set flow rate values are required, \dot{V}_{min} and/or \dot{V}_{max} can be set to new values using the formulae shown. Use adjustment tool ZTH-VAV or a notebook with VRP-M-Tool for resetting.

Tracking control

The VRP-M only provides a ratio control, i.e. the supply and extract air must be in the same ratio under all operating conditions.

The flow rate ratio is set using the \dot{V}_{max} parameter on the slave controller, according to the formula opposite.

Where the flow rates are the same and the units of equal size, the setting will be 100 %. The setting range is from 30 to 100 %. If \dot{V}_{max} setpoint value > 100 %, the master and slave functions must be reversed. As a rule, the \dot{V}_{min} setpoint value on the slave is set to 0 %.

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VRP-M for flow rate control

BP...

Flow rate ranges									
Nominal size		in l/s				in m³/h			
		\dot{V}_{min}		\dot{V}_{max}		\dot{V}_{min}		\dot{V}_{max}	
		$\dot{V}_{min-unit} 1)$	up to	from	up to \dot{V}_{Nom}	$\dot{V}_{min-unit} 1)$	up to	from	up to \dot{V}_{Nom}
		TVZ · TVA · TVR · TVRK							
100 ²⁾		15	95	30	95	54	342	108	342
125		25	150	45	150	90	540	162	540
160		40	250	75	250	144	900	270	900
200		65	405	120	405	234	1458	432	1458
250		95	615	185	615	342	2214	666	2214
315		155	1025	310	1025	558	3690	1116	3690
400		255	1680	505	1680	918	6048	1818	6048
B x H in mm		TVJ · TVT							
200	100	45	215	65	215	162	774	234	774
300		65	320	95	320	234	1152	342	1152
400		85	425	130	425	306	1530	468	1530
500		105	535	160	535	378	1926	576	1926
600		130	650	95	650	468	2340	702	2340
200	200	85	415	125	415	306	1494	450	1494
300		125	620	185	620	450	2232	666	2232
400		165	825	250	825	594	2970	900	2970
500		205	1035	310	1035	738	3726	1116	3726
600		250	1250	375	1250	900	4500	1350	4500
700		290	1450	435	1450	1044	5220	1566	5220
800		330	1650	495	1650	1188	5940	1782	5940
300	300	185	920	275	920	666	3312	990	3312
400		245	1230	370	1230	882	4428	1332	4428
500		305	1535	460	1535	1098	5526	1656	5526
600		370	1850	555	1850	1332	6660	1998	6660
700		430	2150	645	2150	1548	7740	2322	7740
800		490	2450	735	2450	1764	8820	2646	8820
900		555	2770	830	2770	1998	9972	2988	9972
1000		620	3100	930	3100	2232	11160	3348	11160
400	400	325	1630	490	1630	1170	5868	1764	5868
500		410	2040	610	2040	1476	7344	2196	7344
600		490	2450	735	2450	1764	8820	2646	8820
700		570	2850	855	2850	2052	10260	3078	10260
800		650	3250	975	3250	2340	11700	3510	11700
900		735	3670	1100	3670	2646	13212	3960	13212
1000		820	4100	1230	4100	2952	14760	4428	14760
500	500	510	2540	760	2540	1836	9144	2736	9144
600		610	3050	915	3050	2196	10980	3294	10980
700		710	3550	1065	3550	2556	12780	3834	12780
800		810	4050	1215	4050	2916	14580	4374	14580
900		915	4570	1370	4570	3294	16452	4932	16452
1000		1020	5100	1530	5100	3672	18360	5508	18360
600	600	730	3650	1095	3650	2628	13140	3942	13140
700		850	4250	1275	4250	3060	15300	4590	15300
800		970	4850	1455	4850	3492	17460	5238	17460
900		1100	5500	1650	5500	3960	19800	5940	19800
1000		1220	6100	1830	6100	4392	21960	6588	21960
700	700	990	4950	1485	4950	3564	17820	5346	17820
800		1140	5700	1710	5700	4104	20520	6156	20520
900		1280	6400	1920	6400	4608	23040	6912	23040
1000		1420	7100	2130	7100	5112	25560	7668	25560
800	800	1300	6500	1950	6500	4680	23400	7020	23400
900		1460	7300	2190	7300	5256	26280	7884	26280
1000		1620	8100	2430	8100	5832	29160	8748	29160
900	900	1640	8200	2460	8200	5904	29520	8856	29520
1000		1820	9100	2730	9100	6552	32760	9828	32760
1000	1000	2020	10100	3030	10100	7272	36360	10908	36360

1) $\dot{V}_{min} = 0$ is also possible

2) TVR only

**Control engineering information
VARYCONTROL® VAV Units
VRP-M for flow rate control**

BP...

Flow rate control tolerances 1)

Flow rate as % of \dot{V}_{Nom}	$\Delta\dot{V}$ in \pm %	
	TVZ, TVA, TVR, TVRK	TVJ, TVT
100	5	5
80	5	5
60	7	7
40	7	8
20	9	14
10	20	>14

1) Percentages relative to \dot{V}_{Act}

Order code, Order example

The available options are given in the current price list

TVRK / **250** / **00** / **BP3** / **E0** - 80 - 400 l/s

TVT / **600 x 200** / **00** / **BP1** / **M0** - 300 - 800 l/s

TVR / **200** / **00** / **BPG** / **E0** - 100 - 350 l/s

Control mode	Voltage range
E Single	0 0 to 10 VDC
M Master	
S Slave	2 2 to 10 VDC
F Constant value	

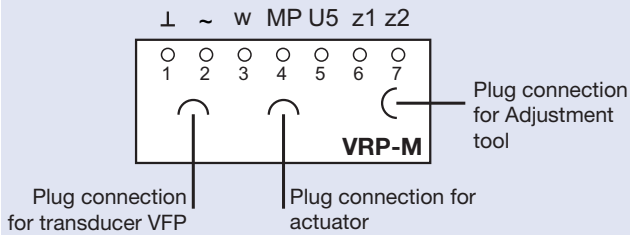
Flow rate parameter

Control mode	Factory settings
E, M	\dot{V}_{min} and \dot{V}_{max} factory set at required values
S	\dot{V}_{min} at 0%, \dot{V}_{max} factory set at flow rate ratio to the master controller
F	\dot{V}_{min} factory set at required value, \dot{V}_{max} at 100%

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Terminal allocation



Nomenclature

- ⊥ Ground/earth
- ~ Supply voltage 24 VAC (24 VDC)
- w Control signal input (0/2 to 10 VDC)
- MP MP bus
- U5 Actual value signal output (0/2 to 10 VDC)
- z1 Override control input 1
- z2 Override control input 2

Wiring

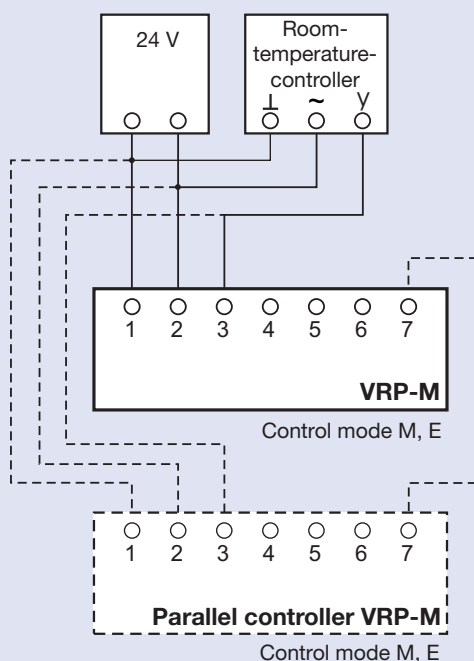
The actuator and flow rate controller are factory wired. The 24 V supply voltage must be wired by the customer. Safety transformers must be used (EN 60742).

If several flow rate controllers are connected to one 24 V network, it is important to ensure that a common neutral or ground wire is used and that this is not connected to any other wiring.

IMPORTANT

The examples illustrated show the most common arrangements for flow rate control. The generally accepted rules of technology must be observed in the overall control system design, selection of other control components and wire sizing.

Room temperature control and parallel control



Room temperature control

A dedicated room temperature controller or a DDC outstation with 0/2 to 10 VDC output is connected with at least two wires (terminals 1 and 3) as shown opposite. If the controllers are on the same mains (24 V) make sure that terminal 1 of the VRP-M is identical to the ground of the control signal.

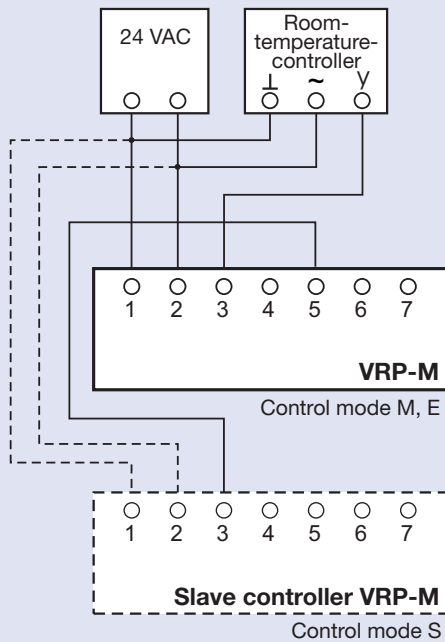
Parallel control

Several flow rate controllers (supply or extract air) are run in parallel by one controller. If the air terminal units are of the same size and the \dot{V}_{min} - and \dot{V}_{max} -values are set the same, all units will control to the same flow rate. If there are different settings, then the controls will maintain a constant percentage between the flow rates.

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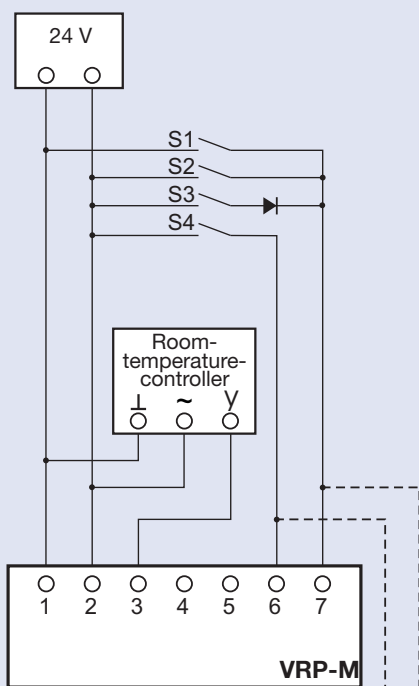
Tracking control



Supply - extract tracking control (Master/Slave)

If the units are controlled in parallel and if the pressure in one duct area is too low there may be an undesirable difference in flow rate between supply and extract air. It is therefore more beneficial to use the actual value signal, usually that of the supply air, as the control signal for the slave flow rate (extract) controller.

Override controls



Override controls

External switches (potential-free contacts) provided by the customer can override the variable flow rate control. These overrides can be applied separately for each controller or centrally as shown in the wiring diagram opposite.

Switch functions

- | | |
|-------------------------|---|
| S1, S2, S3 and S4 open: | \dot{V}_{min} |
| S1 closed: | Damper blade Closed |
| S2 closed: | \dot{V}_{max} |
| S3 closed: | \dot{V}_{mid} *) |
| S4 closed: | Damper blade Open
(Priority to other
override controls) |

*) Not for 24 VDC

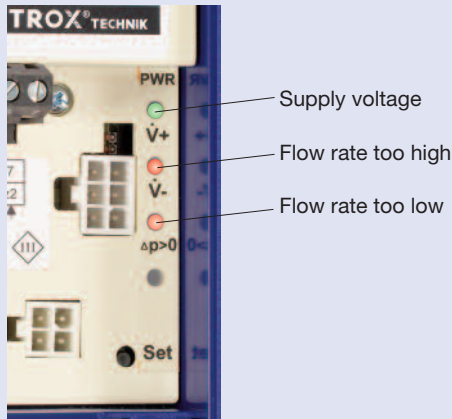
IMPORTANT

When combining several override controls, the switches must be interlocked such that no short-circuits occur.

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VRP-M for flow rate control**

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Functional test



Commissioning

With the indication lights a functional test can easily be carried out.

If the commissioning procedure is to include verification of the flow rate setpoint values \dot{V}_{min} and \dot{V}_{max} , these must be set as described below. The actual value signal U5 is measured in each operating mode and the the flow rate is then calculated.

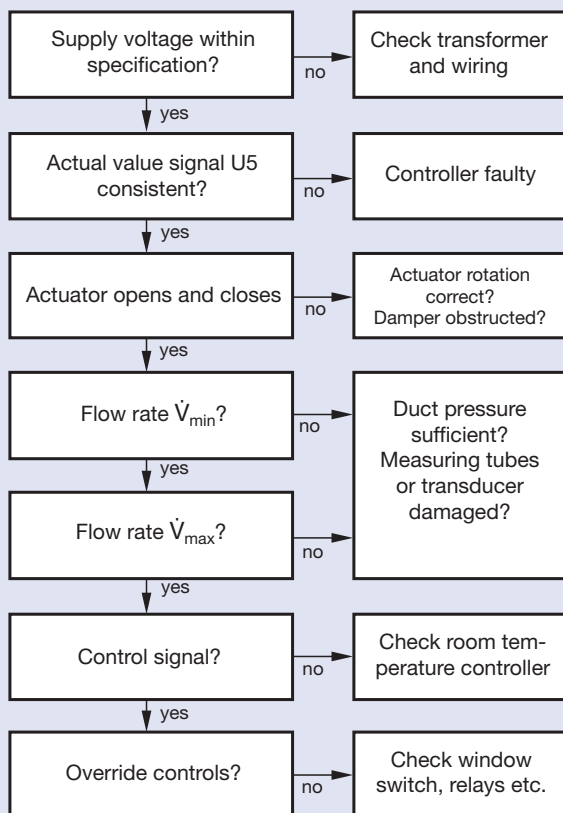
IMPORTANT

Due to excessive vibration during transport or different installation situations re-adjustment of the zero setpoint could be necessary. The procedure is described on page 5 and in the separate VFP manual.

In many cases, incorrect wiring can be the reason for malfunctions. To find faults:

- Disconnect wiring from terminals 3 to 7
- Unplug connection of actuator
- Disengage actuator drive and open damper blade manually, the voltage U5 must increase
- Connect actuator plug, link terminals 1 and 7: the actuator must close
- Change link to 2 to 6, actuator must open
- Remove the link, the controller must control to \dot{V}_{min}
- Calculate flow rate and compare it with the design value
- Link terminals 2 and 7, repeat measurement for \dot{V}_{max} as above
- Remove link. Apply control signal U3. Calculate the set flow rate and compare it with the actual flow rate
- Apply override control (terminals 6/7) and test the required functions in sequence

Fault finding check



Order example spare controller

VRP-M, adjusted for TVZ 125,
60 to 140 l/s, 0 to 10V

Replacement controller

When replacing faulty controllers, calibrated controllers set for the air terminal unit type and size must be used. Uncalibrated controllers can only be used as a temporary solution. When ordering replacement controllers, specify \dot{V}_{min} and \dot{V}_{max} .

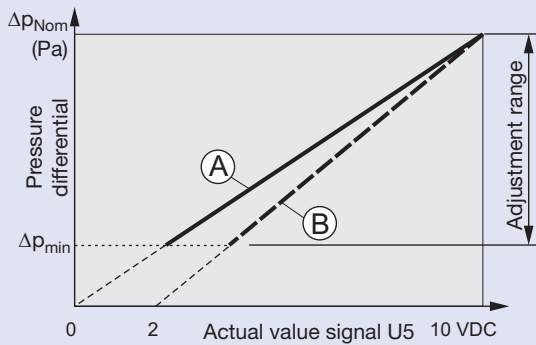
Control engineering information
VARYCONTROL[®] VAV Units
VRP-M for differential pressure control

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BS...

Characteristic of actual value signal



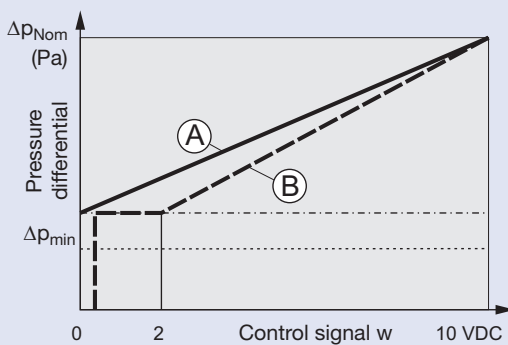
(A) 0 - 10 VDC

$$\Delta p_{\text{actual}} = \Delta p_{\text{Nom}} \frac{U5}{10}$$

(B) 2 - 10 VDC

$$\Delta p_{\text{actual}} = \Delta p_{\text{Nom}} \frac{U5-2}{8}$$

Characteristics of the control signal



(A) 0 - 10 VDC

$$\Delta p_{\text{set}} = \frac{w}{10} (\Delta p_{\text{max}} - \Delta p_{\text{min}}) + \Delta p_{\text{min}}$$

(B) 2 - 10 VDC

$$\Delta p_{\text{set}} = \frac{w-2}{8} (\Delta p_{\text{max}} - \Delta p_{\text{min}}) + \Delta p_{\text{min}}$$

Functional description

The pressure differential is measured using the static differential pressure principle. The difference of static pressures between the duct and the atmosphere (duct pressure control) or one room to a reference room (room pressure control) is measured and controlled.

The pressure differential causes a diaphragm in the differential pressure transducer to deflect, the movement is detected by induction and converted into a linear pressure/voltage signal.

The nominal pressure differential Δp_{Nom} set at the factory is selected such that the customer can adjust the setpoint value up and down. 10 VDC corresponds always to the nominal pressure differential. The actual pressure differential is measured as a 0/2 to 10 VDC signal (U5). The pressure differential setpoint value is set with the Δp_{min} parameter. For variable pressure differential an external adjuster or controller is required with a 0/2 to 10 VDC signal that can be used for the range from

Δp_{min} to Δp_{max} .

The VRP-M determines the required pressure differential in accordance with the characteristic shown and compares this with the actual value. The damper actuator is controlled based on the offset. The electronic controllers VRP-M allows for a specific range of actuators, the dynamic behaviour and control voltage of which are matched to the controller and thus a stable differential pressure control can be achieved.

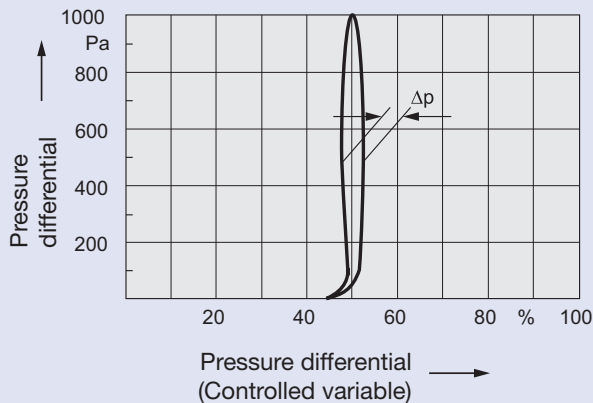
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Pressure independent control characteristics



Differential pressure control

The differential pressure controller works independently of duct pressure, i.e. pressure fluctuations cause no changes to pressure differential. To prevent the differential pressure control becoming unstable, a dead band is provided within which the damper does not move. Pressure deviations and the accuracy of the differential pressure sensor lead to a differential pressure deviation as shown in the figure. If the conditions given in the technical leaflet (e.g. minimum total pressure differential) are not complied with, greater deviations must be expected.

$$\Delta p_{\min} - \text{setpoint value} = \frac{\Delta p_{\min}}{\Delta p_{\text{Nom}}} \cdot 100\%$$

$$\Delta p_{\max} - \text{setpoint value} = \frac{\Delta p_{\max}}{\Delta p_{\text{Nom}}} \cdot 100\%$$

Δ_p-setting

A constant pressure differential is set with the Δ_{p_{min}} parameter. With variable control, the pressure can be limited to the maximum value Δ_{p_{max}} which is held constant at full control value (10 VDC). The percentage figures relate to the nominal pressure differential (Δ_{p_{Nom}}). The setting range is from 30 to 100 %.

Pressure differential adjustment on site

If site adjustments to the factory set differential pressure value is required, Δ_{p_{min}} and/or Δ_{p_{max}} can be set to new values using the formulae shown.

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Room pressure ranges

Diaphragm transducer	Δp_{\min}		
	$\Delta p_{\min}^{1)}$	from	to Δp_{Nom}
VFP 100	2.5	30	100
	1.5	15	50
	1.5	8	25

Duct pressure ranges

Diaphragm transducer	Δp_{\min}		
	$\Delta p_{\min}^{1)}$	from	to Δp_{Nom}
VFP 300	7.5	90	300
	4	30	100
VFP 600	15	180	600
	7.5	90	300

Differential pressure control tolerances

Δp in % of Δp_{Nom}	Control tolerance in $\pm\%$
100	5
80	5
60	7
40	8
30	10
<30	>10

- Using a control signal setpoint values < 30% of Δp_{Nom} can be achieved. Pressure values below Δp_{\min} are set to zero or the control will be unstable.
- The control of negative room pressure differential is also possible using supply air.

Order code, Order example

The available options are given in the current price list

TVT / **600 x 200** / **00** / **BR1** / **Z0** - 15 Pa

TVR / **160** / **00** / **BS3** / **Z0** - - 400 Pa

TVR / **160** / **00** / **BPG** / **A2** - - 250 Pa

Control mode	Voltage range
A Extract air	0 0 to 10 VDC
Z Supply air	2 2 to 10 VDC

Differential pressure parameter

Factory settings

Differential pressure sensor of air terminal unit short-circuited, Δp parameter to pressure differential ordered

Customer supplied fittings

Positive room pressure differential	Room measuring tube to Positive point, reference room to Negative point
Negative room pressure differential ²⁾	Room measuring tube to Negative point, reference room to Positive point
Supply duct pressure	Static pressure of duct to Positive point
Extract duct pressure	Static pressure of duct to Negative point

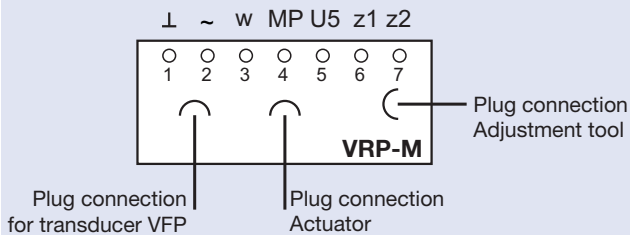
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Terminal allocation



Nomenclature

⊥	Ground/earth
~	Supply voltage: 24 VAC (24 VDC)
w	Control signal input (0/2 to 10 VDC)
MP	MP bus
U5	Actual value signal output (0/2 to 10 VDC)
z1	Override control input 1
z2	Override control input 2

Wiring

The actuator and flow rate controller are factory wired. The 24 V supply voltage must be wired by the customer. Safety transformers must be used (EN 60742).

If several flow rate controllers are connected to one 24 V network, it is important to ensure that a common neutral or ground wire is used and that this is not connected to any other wiring.

If the measurement and adjustment sites are far apart, cut connecting cable of actuator in two and extend it. This is easier and more reliable than extending the tubing.

Tubing

Tube dimensions:	di = 6,5 mm
maximum length:	10 m (Total of both positive and negative tubing *)
Material:	Polyurethane *)

*) Recommended

Variable differential pressure control

A dedicated setpoint adjuster or a DDC outstation with 0/2 to 10 VDC output is connected with at least two wires (terminals 1 and 3) as shown opposite. If the controllers are on the same mains (24 V) make sure that terminal 1 of the VRP-M is identical to the ground of the control signal.

Parallel control

Several differential pressure controllers are controlled in parallel from one setpoint adjuster. Thus the setpoint values for several rooms or ducts can be altered simultaneously.

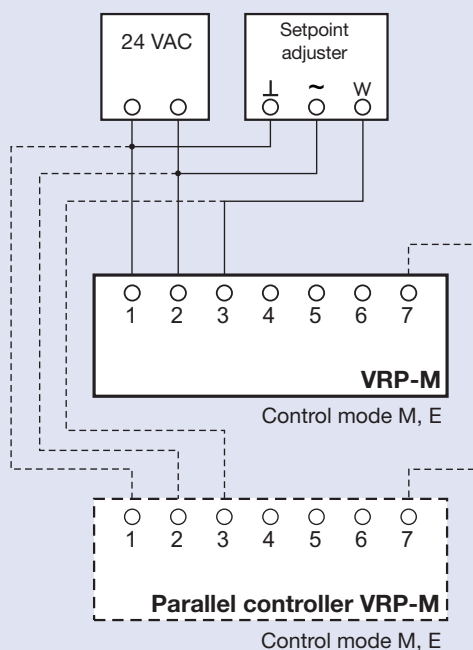
Examples of application:

Day/Night changeover or modulating control.

IMPORTANT

The examples illustrated show the most common arrangements for differential pressure control. The generally accepted rules of technology must be observed in the overall control system design, selection of other control components and wire sizing.

Differential pressure control and parallel control



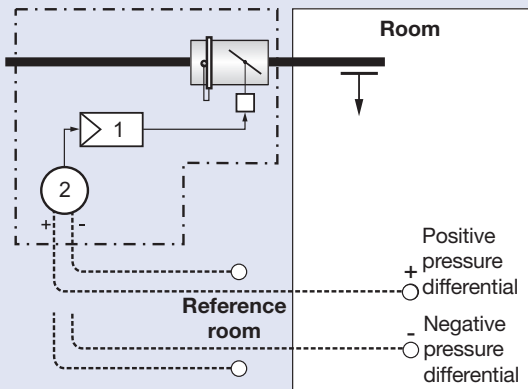
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Room pressure control, Example: supply air



Room pressure control

The connection of tubing to VFP 100 for room pressure control is shown opposite. The measurement points in the room and in the reference room must be turbulence-free (not influenced by air flow).

Note:

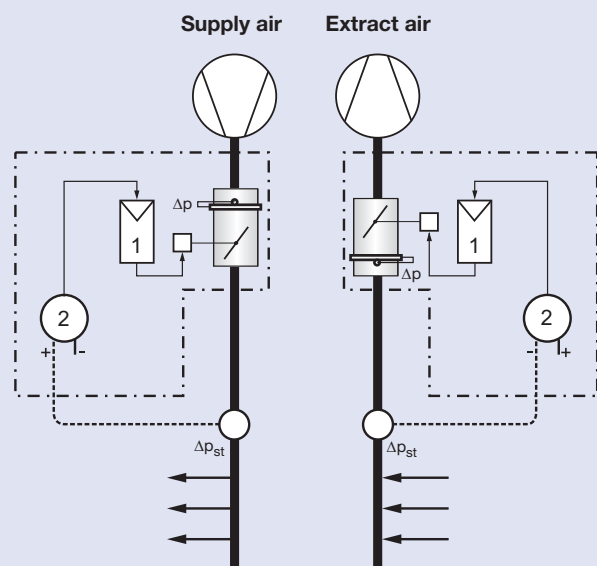
If groups of rooms with different setpoint values are arranged in sequence, all VFP 100 transducers should work with a common reference pressure, e.g. atmospheric pressure.

IMPORTANT

With room pressure control and override control "CLOSED" the override control is reversed and override control "OPEN" must be wired to close damper for combinations of:

- Supply air – negative room pressure differential
- Extract air – positive room pressure differential

Duct pressure control



Duct pressure control

The tubing for supply and extract air are different as shown on the sketch opposite. The pressure connection not used must remain open or connected to the reference pressure with a tube.

- 1 Differential pressure controller VRP-M
- 2 Diaphragm pressure transducer VFP

- · - · - Air terminal unit

- - - - - Tubing by others

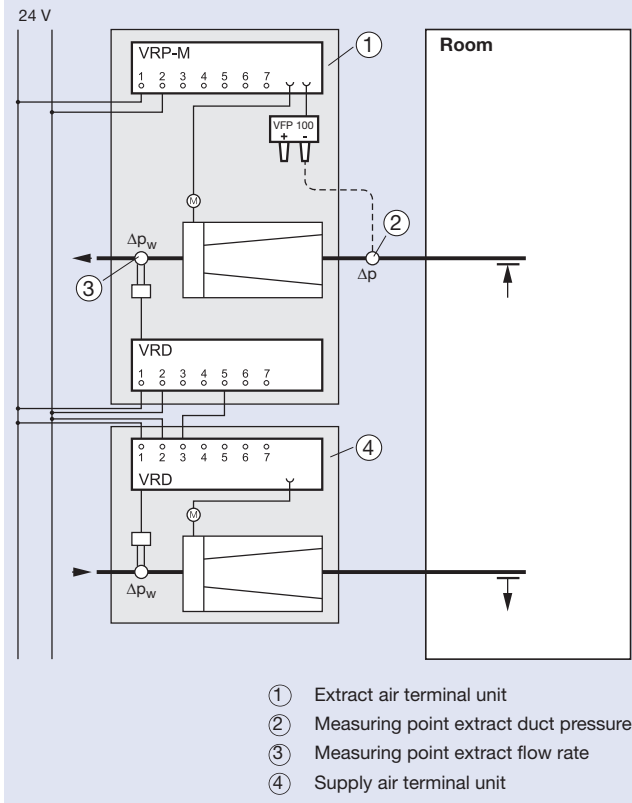
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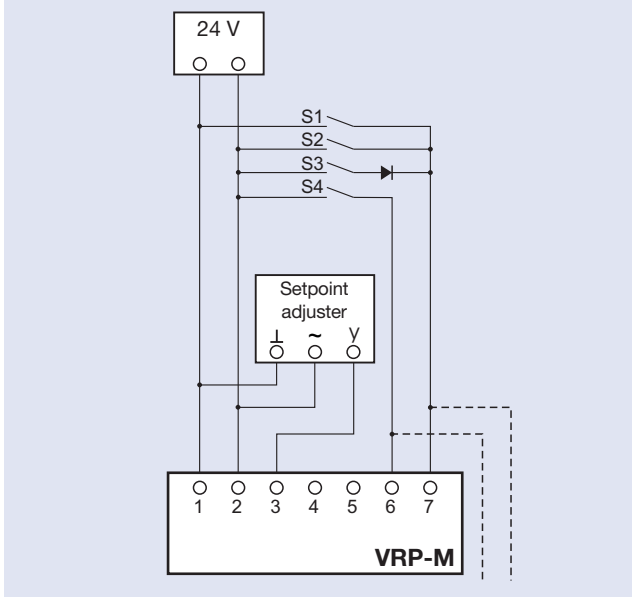
Combination of duct pressure control with flow rate control



Extract air duct pressure and supply air tracking control

The VRP-M controls the pressure in the extract air duct on the room side (low pressure) as it acts directly on the damper of the air terminal unit. The controller VRD of the air terminal unit is used to measure the extract flow rate. The actual value output signal U5 of the extract VRD is used to control the flow rate controller VRD of the supply air rates. This ensures that the supply and extract flow rates are always identical or maintain the required ratio between each other.

Override controls



Override controls

External switches (potential-free contacts) provided by the customer can override the differential pressure control. This override can be applied separately for each controller or centrally as shown in the wiring diagram opposite.

Switch functions

S1, S2, S3 and S4 open:	Δp_{min}
S1 closed:	Damper blade Closed
S2 closed:	Δp_{max}
S3 closed:	actuator stops *)
S4 closed:	Damper blade Open (Priority to other override controls)

*) Not for 24 VDC

IMPORTANT

When combining several override controls, the switches must be interlocked such that no short-circuit occur.

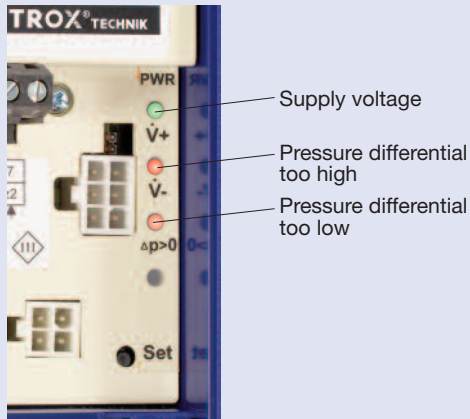
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Functional test



Commissioning

With the indication lights a functional test can easily be carried out.
 If the commissioning procedure is to include verification of the differential pressure setpoints Δp_{min} and Δp_{max} , these must be set as described below. The actual value signal U5 is measured in each operating mode and the the pressure differential is then calculated.

IMPORTANT

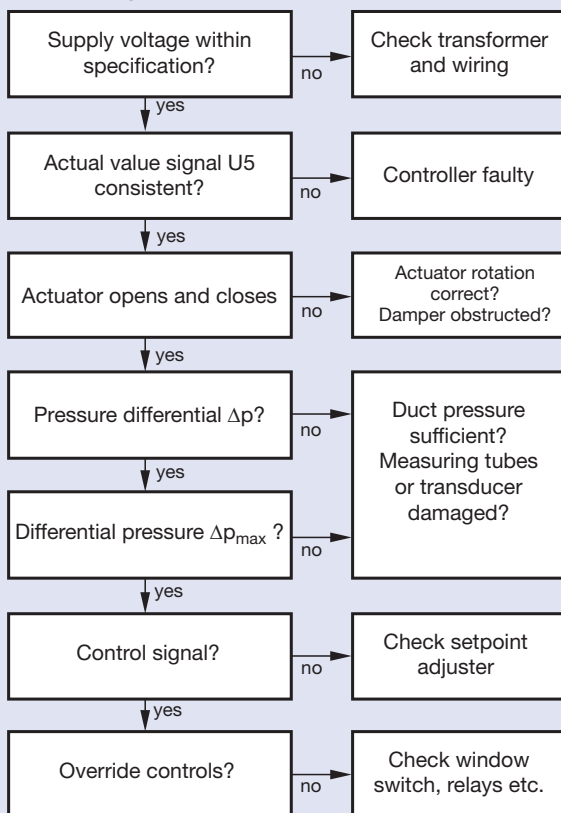
Due to excessive vibration during transport or different installation situations re-adjustment of the zero setpoint could be necessary. The procedure is described on page 5 and in the separate VFP manual.

In many cases, incorrect wiring can be the reason for malfunctions. To find faults:

- Disconnect wiring from terminals 3 to 7
- Unplug connection of actuator
- Disengage actuator drive and open damper blade manually, the voltage U5 must increase *)
- Connect actuator plug, link terminals 1 and 7: the actuator must close *)
- Change link to 2 to 6, actuator must open *)
- Remove the link, The controller must control to Δp_{min}
- Calculate pressure differential rate and compare it with the design value
- Link terminals 2 and 7, repeat measurement for Δp_{max} as above
- Remove link. Apply control signal U3. Calculate pressure differential and compare it with the design value
- Apply override control (terminals 6/7) and test the required functions in sequence

*) Supply air – negative pressure differential and extract air – positive pressure differential operate in the reverse mode

Fault finding check



Order example spare controller

VRP-M, adjusted for TVR 125,
 Duct pressure supply air 250 Pa, for VFP 600

Replacement controller

When replacing faulty controllers, calibrated controllers set for the air terminal unit type and size must be used. Uncalibrated controllers can only be used as a temporary solution. When ordering replacement controllers, specify Δp_{min} and Δp_{max} .