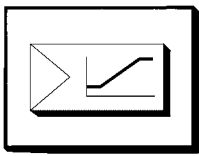
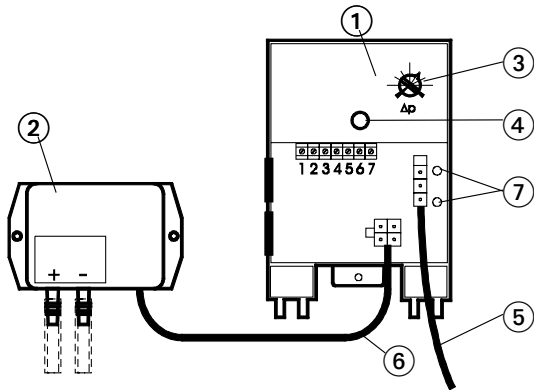


Contents

Subject	Page
Area of Application _____	2
Description of Function _____	2
Differential Pressure Control _____	3
Differential Pressure Adjustment on Site _____	3
Order Code, Examples _____	4
Terminal Connections _____	5
Examples _____	6
Override Control _____	6
Function Test, Commissioning _____	7

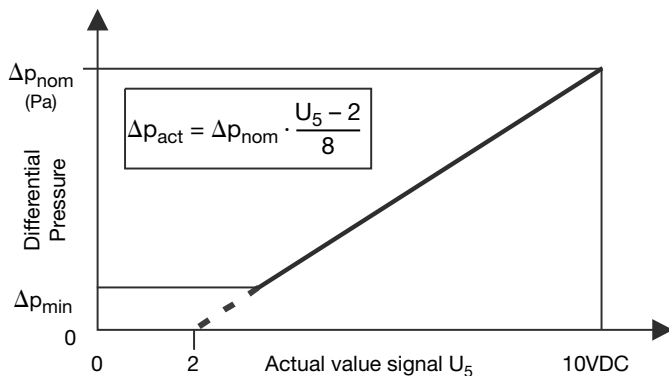


VRP-STP

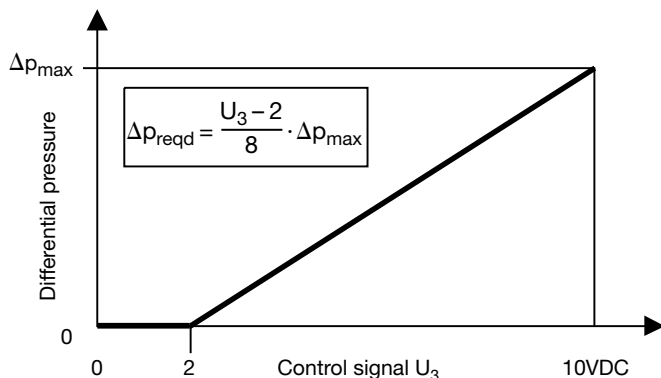


- ① Controller VRP-STP
- ② Transducer VFP 300
- ③ Δp adjustment knob
- ④ Reference value potentiometer
- ⑤ Actuator connection
- ⑥ Transducer connection cable
- ⑦ Offset indicating lights

Characteristic of Actual Value Signal



Characteristic of Differential Pressure Control Variable



Area of Application

The Belimo VRP-STP differential pressure controller combined with a membrane differential pressure transducer VFP 100, is designed for room pressure control of sealed rooms; when combined with a VFP 300 or VFP 600, it is designed for control of duct pressure. No control signal is required if constant differential pressure is to be maintained. The constant differential pressure can be set manually in the range from 30 to 100 % on the adjustment knob. Alternatively, the set value can be pre-set externally by a control signal between 2 to 10 VDC. Override controls can be achieved by external switches. For parallel operation, several controllers can be connected to a common control signal. Supply air/extract duct pressure control sequence available.

Static Measuring Principle

The volume flow is measured using a membrane pressure transducer. Therefore the VRP-STP is suitable for the control of extract air with contaminants and/or which is dust-laden. Terminal units with painted finish or made of plastic should be considered in such situations.

IMPORTANT

In critical cases, a material test should be carried out on the terminal unit and membrane pressure transducer, to prove suitability for chemicals and concentrations concerned.

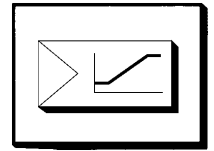
Description of Function

The differential pressure is measured on the static principle. The differential pressure causes a membrane in the pressure transducer to deflect, the movement is detected and converted into a linear pressure-voltage signal. The transducer pressure range is selected and factory-set to the measurement range required such that the differential pressure can be adjusted up or down by the customer. 10 VDC (100 %) always corresponds to the nominal differential pressure (Δp_{nom}). The actual differential pressure is measured as a 2 to 10 VDC signal (U_5). The nominal differential pressure is preset via the Δp adjustment knob. For variable set values, an external 2 to 10 VDC signal controls the differential pressure in the range from 0 to Δp_{max} .

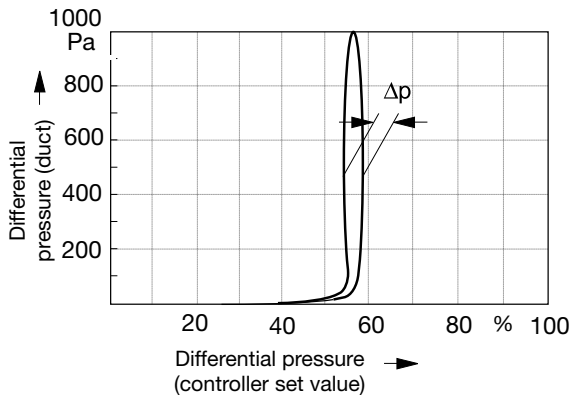
The VRP-STP determines the required pressure in accordance with the characteristic shown and compares this with the actual value. The damper actuator is controlled according to the deviation. The Belimo VRP-STP can only operate with the matched Belimo actuators which are optimized for volume flow control. It is not possible to connect other 3-point or 0 to 10 VDC actuators.

Gravity Dependent

Because of the weight of the membrane the positioning of the VFP affects the measured signal. The VFP is normally calibrated for a vertical position of the membrane, i.e. pressure tube connections above or below horizontal plane. Other installation positions must be specified on order.

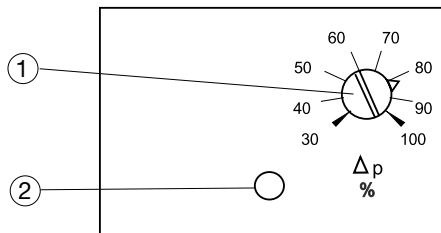


Pressure Independent Control Characteristic



$$\Delta p_{\max} \text{ set value} = \frac{\Delta p_{\max}}{\Delta p_{\text{nom}}} \cdot 100 \%$$

Adjustment Knob



- ① Δp adjustment knob
- ② Reference value potentiometer

IMPORTANT

The reference value potentiometer must not be adjusted.

$$U_5 = \frac{\Delta p_{\max}}{\Delta p_{\text{nom}}} \cdot 8 \text{ V} + 2 \text{ V}$$

Differential Pressure Control

The volume flow controller works independently of the duct pressure, i.e. pressure fluctuations cause no changes to volume flow.

To prevent the volume flow control becoming unstable, a dead zone is allowed within which the damper does not move. This dead zone and the accuracy of site measurements lead to volume flow deviation ΔV shown opposite. If the conditions given in the sales brochure (static minimum pressure differential, inlet flow conditions etc.) are not observed, greater deviations must be expected.

Δp Adjustment

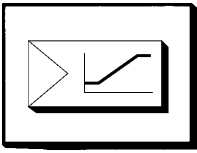
The Δp adjustment knob is used to set the required differential pressure. With variable control, the pressure can be limited to the maximum value Δp_{\max} which is held constant at full control value (10 VDC).

The percentages refer to the nominal differential pressure (Δp_{nom}). The adjustment range is from 30 to 100 %.

Differential Pressure Adjustment on Site

If later adjustment to the differential pressure is required, the potentiometer is set to the new value using the formula specified. The accuracy of the setting can be increased if the actual value signal U_5 is also measured and the following procedure carried out with the system switched on:

- Calculate U_5 voltage for Δp
- If control signal U_5 is present set U_3 to 10 VDC or set wire bridge from terminal 2 to 4
- Adjust Δp potentiometer until voltage U_5 corresponds to the calculated value (wait approx. 2 minutes after adjustment, then read voltage)
- If the VRP-STP is operated with control signal U_3 , remove bridge 2 to 4 again.



Room Pressure Ranges

Differential pressure transducer	$\Delta p_{\min}^{1)}$ Pa	Δp from Pa	to Δp_{nom} Pa
VFP 100	2.5	30	100
	1.5	15	50
	1.5	7.5	25

Duct Pressure Ranges

Differential pressure transducer	$\Delta p_{\min}^{1)}$ Pa	Δp from Pa	to Δp_{nom} Pa
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 \pm %
100	5
80	5
60	7
40	8
30	10
< 30	> 10

1) With a control signal the set value could be lower than 30 % of Δp_{nom} . But pressure differentials < Δp_{\min} are set to 0, resp. could not be controlled stable.

2) It is possible to control negative room pressure with a supply terminal unit.

Order Code / Examples

The available options are given in the current price list.

TVR / 160 / 00 / BG3 / Z - Δp
15 Pa

TVR / 160 / 00 / BG3 / Z - -15 Pa²⁾

TVR / 160 / 00 / BH3 / A - -250 Pa

Operating mode

- A** Extract air
- Z** Supply air

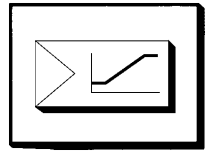
Factory Differential Pressure Setting

TVZ, TVA, TVR, TVRK, TVJ, TVT

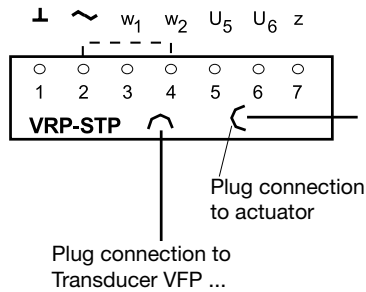
Operating mode	Factory setting
Room pressure control	Differential pressure sensor of terminal unit short-circuited Δp potentiometer to pressure difference ordered
Duct pressure control	Δp potentiometer to pressure difference ordered

Customers Fittings

Operating mode	Measures
Positive room pressure	Room measuring tube to plus reference room measuring
Negative room pressure	Room measuring tube to minus Reference room measuring tube on plus
Supply air duct pressure	Duct measuring tube to plus
Extract air duct pressure	Duct measuring tube to minus



Terminal Connections



Nomenclature

- ⊥ Ground, neutral
- ~ Supply voltage 24 VAC
- w_1 Input voltage for set differential pressure (2 to 10 VDC)
- w_2 Input voltage for set differential pressure (0 to 20 V phasecut)
- U_5 Output voltage for differential pressure (2 to 10 VDC)
- U_6 Actuator signal
- z Input for override control

IMPORTANT

The examples illustrated show the most common arrangements for pressure control. The Belimo specifications must be observed in the overall control system design, selection of the other control components and wire sizing. Details of other circuits are available from Belimo.

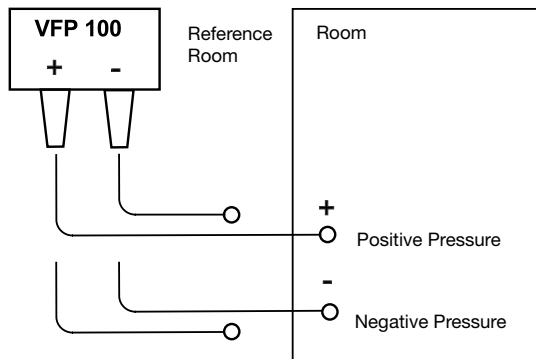
Wiring

Actuator and volume flow controller are factory wired. The 24 VAC voltage supply must be wired up by the customer. Safety transformers must be used (EN 60742). If several volume flow controllers are connected to one 24 VAC network, it is important to ensure that a common neutral or ground wire is used and that this is not connected to other wires.

The control signal for the nominal value emitter has 2 cores connected to the differential pressure controller.

If the measurement and adjustment sites are far apart, remove the made-up plug on the actuator cable and extend the cable. This is easier and more reliable than extending the measurement tube.

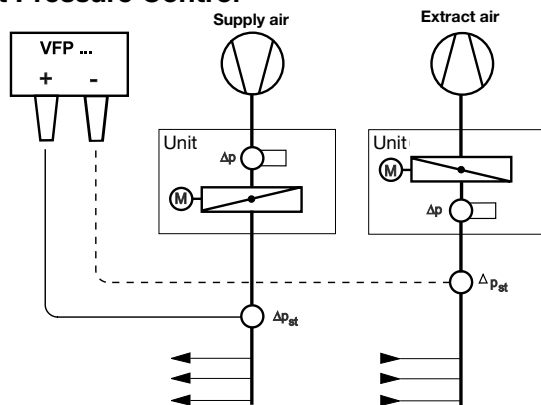
Room Pressure Control



Tube Connections

- Tube dimensions : $d_i = 6$ mm
- Max. Lengths : 10 m
(Plus and Minus total)¹⁾
- Material : Polyurethane¹⁾

Duct Pressure Control



Room Pressure Control

The VFP100 has the tube connections shown for room pressure control. The measurement points in the room and in the reference room must be turbulence-free (no influence by room flow, no dynamic part p_d).

Note:

If groups of rooms with different set points of differential pressure are arranged in sequence, all transducers VFP100 should work with a common reference pressure, e.g. atmospheric pressure.

Duct Pressure Control

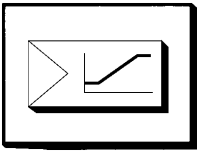
The tube connections for supply and extraction air differ as shown on the sketch. The pressure connection not used must remain open or connected to the reference pressure via a tube.

IMPORTANT

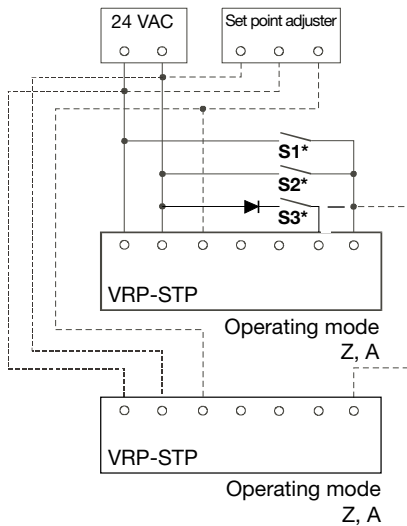
For VAV terminal boxes for room pressure control and required "shut off":

The options "supply air/room negative pressure" and "extract air/room positive pressure" needs a wiring on site for "damper open", so that the damper will be closed (see page 6).

1) Recommendation



Parallel Differential Pressure Control with Override Control



* Switch S2 only in combination with control signal w_1 or w_2

Override Controls

Potential-free switch contacts provided by the customer can override the variable volume flow control. This forced control can be applied separately for each controller (see overleaf for examples) or centrally as in the circuit diagram shown for one building section.

Shut off

Closing switch S1 (e.g. by window contact) causes the damper to close. This override control provides shut off for unit types TVZ/TVA/TVR while maintaining the permitted leakage air volume flow to DIN 1946 Part 4.

S1 open : control mode

S1 closed: shut off

S3 closed: Override Control OPEN

Δp_{\max} Override Control

The variable differential pressure control is interrupted by closing the switch. Control of the maximum differential pressure takes priority.

S2 open : variable control mode

S2 closed: constant pressure Δp_{\max}

NOTE

With a combination of several override controls, the switches must be interlocked such that no short-circuits occur. One switch can control several volume flow controllers if there is a common ground and the control signal is wired in parallel. The circuits apply even if room temperature controller with 0 to 20 V phase cut signal is used.

Parallel Control

Several differential pressure controllers can be operated in parallel by one set point adjuster from one nominal value emitter. Thus the nominal values for several rooms or ducts can be altered simultaneously.

Example application:

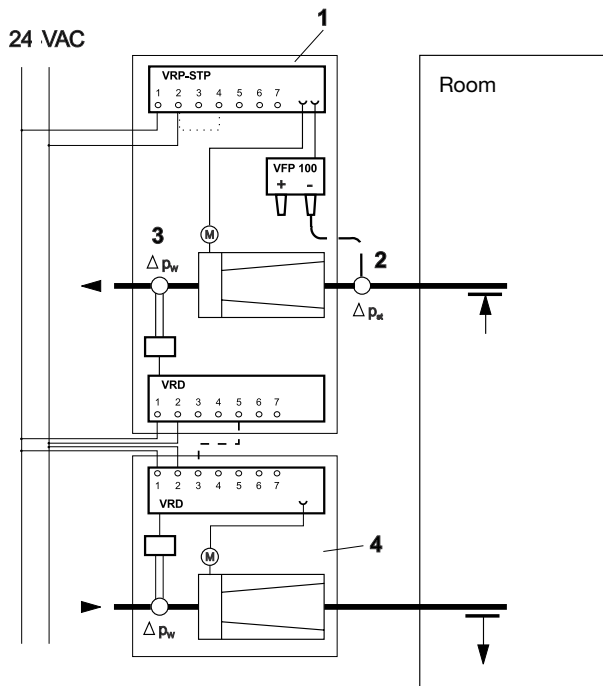
Day/night switching or sliding operation. For example several room or duct pressures can be controlled following the same percentage values.

Extract Air Duct Pressure Control and Supply Air Slave Control

The VRP-STP controls the pressure in the extract air duct on the low pressure side as it acts directly on the damper of the terminal unit. The controller VRD of the terminal unit is used to measure the extract air volume flow.

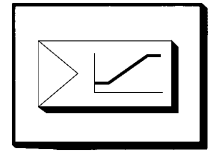
The actual value output signal U_5 for the extract air VRD is used to control the VRD on the supply air terminal unit. This ensures that the supply and extract air volume flows are always identical or stand in the required ratio to each other.

Combination of Duct-Pressure and Volume Flow Control

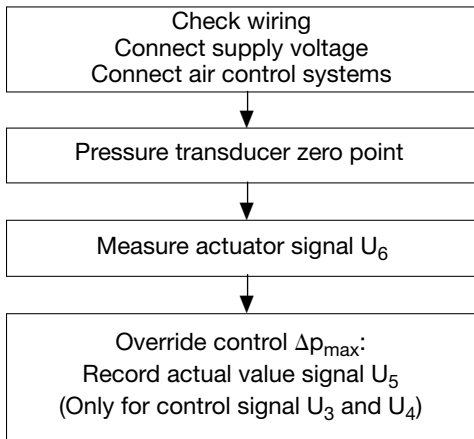


Nomenclature

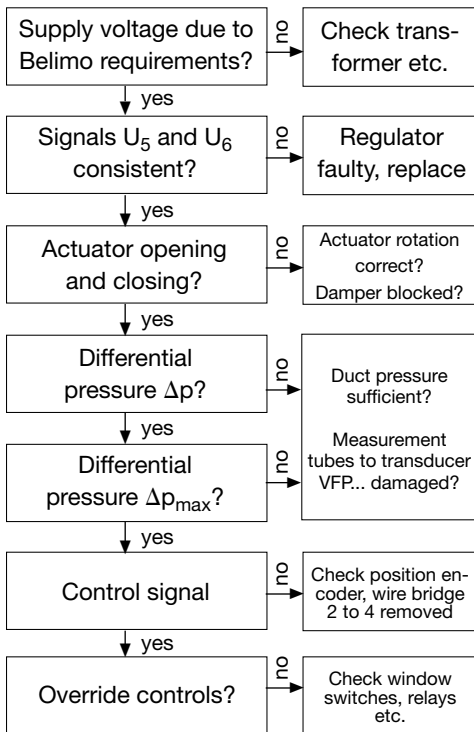
- 1 Terminal unit, extract air
- 2 Measuring point for extract air duct pressure
- 3 Measuring point for extract air volume flow
- 4 Terminal unit, supply air



Function Test



Fault Finding Check



Order Example for Replacement Controller

Belimo VRP-STP and VFP300, preset for TVR 125, and supply air duct pressure 250 Pa
Belimo VRP-STP and VFP100, preset for TVR 125, and negative room pressure, extract air, 20 Pa
Belimo VFP300

Commissioning

A function test for commissioning can be carried out by measuring the actuator signal U_6 (terminal 6 to 1). If U_6 is between 5.8 and 6.2 VDC, the required differential pressure is controlled.

If the maximum differential pressure Δp_{max} should be shown for variable control, proceed as described below. Measure the actual value signal U_5 (having first checked U_6) and then determine the differential pressure from the formula on page 2.

NOTE

Severe vibration during transport or other installation situations can necessitate subsequent adjustment of the zero point setting. The procedure is described in the product information for VFP..

In many cases, incorrect wiring can be the cause of the faults. Therefore a careful check should be carried out to ensure that all connections are secure. Wires in terminals 3 to 7 should be disconnected and the actuator connection plug removed before the following checks are made except link 2 to 4.

If the actuator drive is disengaged and the damper opened manually, the voltage U_5 must increase and the voltage U_6 deviate from 6 VDC.

Connect the actuator plug, link terminals 1 and 7: The actuator must close.

Change link to terminals 2 and 7: The actuator must open.

Wire bridge from 2 to 7: the actuator must open¹⁾.

Remove the link. The controller must control \dot{V}_{min} . If U_6 is approx. 6 volts, measure U_5 , calculate the volume flow and compare it with the design value.

If a control signal U_3 or U_4 is used, link terminal 2 and 7 and repeat the measurement for Δp_{max} as before.

Remove the link from 2 to 4. Apply control signal U_3 . Calculate the set differential pressure and compare with the actual differential pressure.

Apply override control (terminal 7) and test the desired functions in sequence.

Replacement Controller

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

1) The direction can be reversed for room pressure control.