

O P E R A T I N G M A N U A L

incl. Declaration of Conformity

tina42e1

**VSC150**

Part Number  
399-005

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Vacuum Switch

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**General Note**

The right of alterations in the design and the technical data is reserved.

The illustrations are not binding.

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# 1 Description

## 1.1 General



These Operating Instructions contain important information on the functions, installation, operation, and maintenance of the Vacuum Switch and the switching amplifier.

Important remarks concerning operational safety and protection are emphasized as follows:

### Warning



Indicates procedures that must be strictly observed to prevent hazards to persons.

### Caution

Indicates procedures that must be strictly observed to prevent damage or destruction.

### Note

Indicates special technical requirements that the user must comply with.

The references to diagrams, e.g. (1/5), consist of the Fig. No. and the Item No. in that order.

Unpack the Vacuum Switch and the switching amplifier

immediately after delivery, even if they are to be put into operation at a later date.

Before doing so, examine the shipping container for any external damage.

Then completely remove the packaging materials.

### Note

The shipping container and packaging materials must be kept in the event of complaints about damage.

Check for completeness (see Section 1.4).

Carefully examine the Vacuum Switch and the switching amplifier visually.

If any damage is discovered, report it immediately to the forwarding agent and insurer. If the damaged part has to be replaced, please get in touch with the orders department.

### 1.1.1 Purpose

The Vacuum Switch VSC150 in connection with the switching amplifier SV is used to produce pressure dependent signals and for the control of valves and pumps.

The Vacuum Switch VSC150 can also be used as a differential pressure switch.

Note the Technical Data given in section 1.2.

## 1.2 Technical Data

### 1.2.1 VSC150 Vacuum Switch

Switching range	0.5 to 2000 mbar
Overload limit	3000 mbar
Response sensitivity	0.1 mbar
Switching hysteresis	0.5 mbar
Temperature coefficient	0.4 % / K of switching value
Ambient temperature, briefly (max. 8 h)	120 °C
continuous	90 °C
Switching voltage	24 V
Switching current	10 mA
Connector	protected plug-(DIN 43 650)
Protection type (DIN 40 050)	IP 65
Vacuum connection	DN 16 KF

Materials in contact with the medium:

Sensing volume	stainless steel 1.4301; 1.4401
	stainless steel 1.4310; 1.3541 FPM
Reference volume	stainless steel 1.4301
	stainless steel 1.4401; 1.3541 glass; gold

Sensing volume, approx. 4<sup>1)</sup> cm<sup>3</sup>

Reference volume, approx. 20 cm<sup>3</sup>

Weight 1.3 kg

#### **VSC150 Vacuum Switch**

Switching pressure adjustable  
between 0.5 and 2000 mbar Part Number 399-005

#### **Differential Pressure Adapter**

Connection DN 16 KF Part Number 399-007

**Pressure switch adjustment** Part Number 399-006

<sup>1)</sup> Including connection port

## 1.2.2 SV Switching Amplifier

Mains supply	110 to 130 VAC 220 to 240 VAC
Mains frequency	50 / 60 Hz
Power consumption	3 VA
Output relay	
Switching voltage, max.	250 V
Switching current, max.	5 A
Switching capacity, max.	500 VA
Response time	30 ms
Release time	7 ms
Control circuit	24 V / 10 mA
Ambient temperature, max.	50 °C
Weight	0.36 kg
SV Switching amplifier	<b>Part Number 399-008</b>

## 1.3 Technical Description

### 1.3.1 Design

The VSC150 is a diaphragm absolute pressure switch. He can also be used as a differential pressure switch.

Within both pressure switches there is a sensing chamber (1/2) and a reference chamber (1/5) separated by a highly sensitive sealed diaphragm made of stainless steel (1/3). A pin (1/6) in the reference chamber (1/5) is led to the outside and insulated (1/7). The ground connected diaphragm acts as the opposite contact.

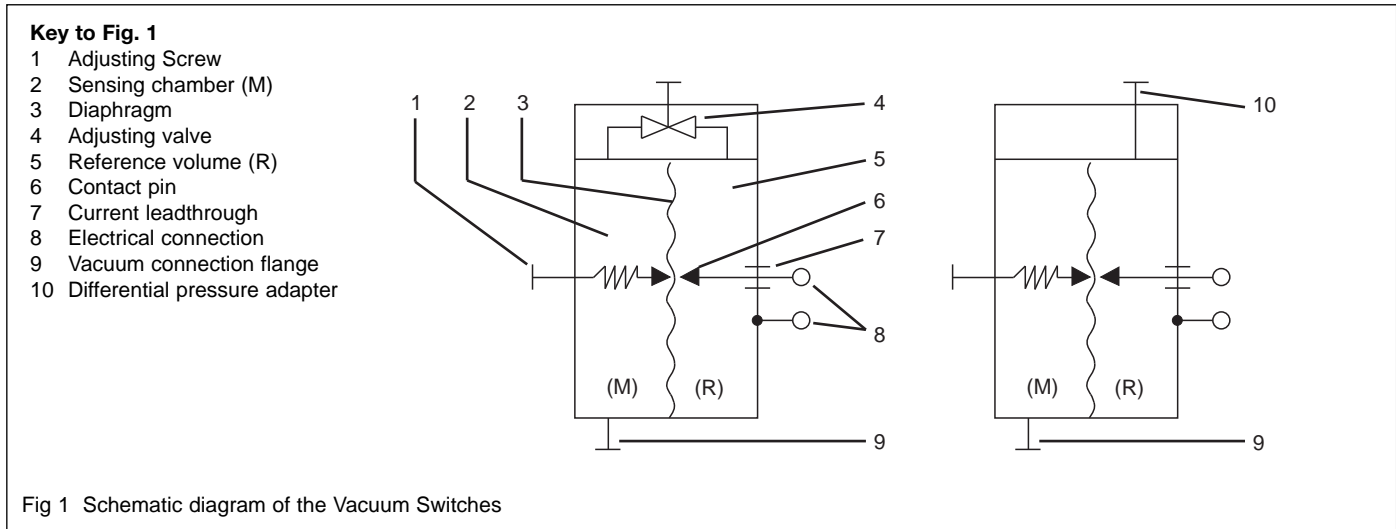
This contact configuration is so designed that the diaphragm contacts the pin when it is unstressed, i. e. with equal pressure in sensing and reference chamber.

### 1.3.2 Vacuum Switch Mode of Operation

For switch-point setting, the adjusting valve (1/4) between sensing chamber (1/2) and reference chamber (1/5) is opened and closed again when the desired switching pressure is attained. If the pressure in the sensing chamber drops below the set reference pressure by more than 0.1 mbar, the contact opens and energizes a heavy-duty relay in the connected SV switching amplifier.

### 1.3.3 Switching Amplifier Mode of Operation

A switching amplifier is required for each Vacuum Switch. The output relay supplied with heavy-duty change-over contact is energized when the pressure drops below the value preset on the Vacuum Switch, i.e. if the contact between diaphragm and contact pin in the reference chamber opens by flexing of the diaphragm. The built-in slide switch (Fig. 5) must be set to the connected type of Vacuum Switch.



## 1.4 Equipment

### 1.4.1 Scope of Delivery

#### Part Number

Vacuum Switch VSC150 or	399-005
Switching amplifier SV	399-008
Operating Instructions	tina42d1 tina42e1

### 1.4.2 Accessories

Clamping ring DN 16 KF, made of plastic \*)

Centering ring DN 16 KF, made of PTFE, with FPM O-ring \*)

#### For pressure systems

(1000 to max. 3000 mbar abs.)

Outer centering ring

Clamping ring for ultra-high vacuum disk DN 16 KF

\*) For floating installation

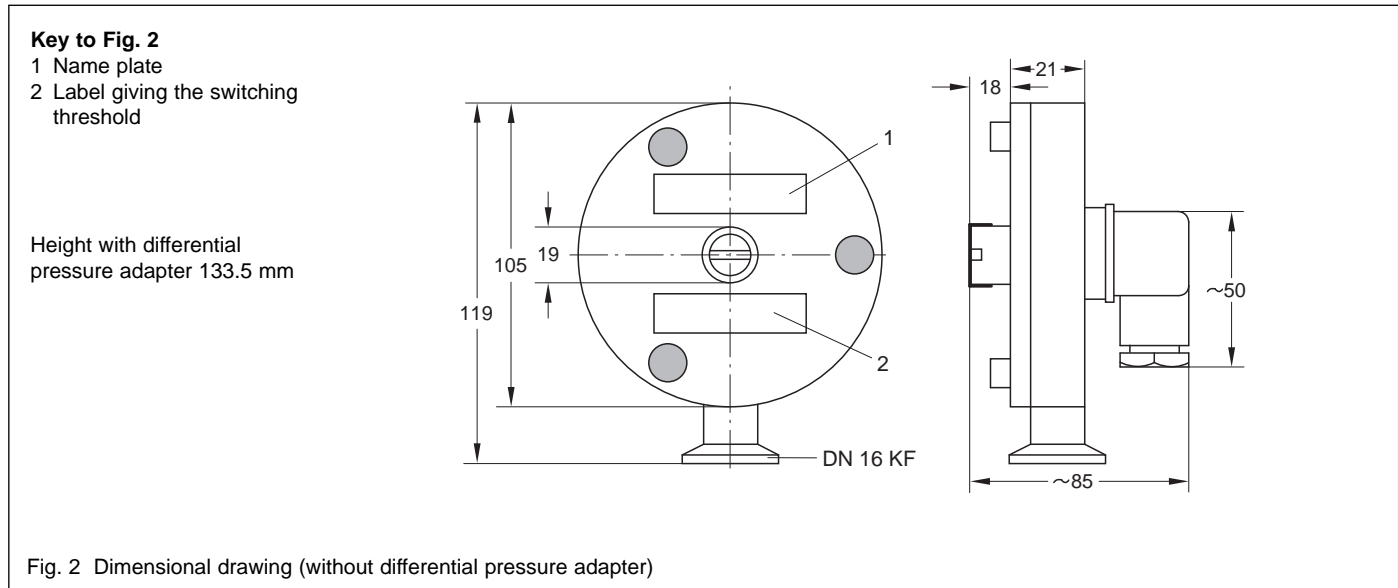


## 2 Operation

### 2.1 Connection to the Vacuum System

The Vacuum Switch is mounted vertically. This ensures that condensate can escape. Flange and gaskets must be free of dust and grease. If the Vacuum Switch is to be

**floated** (electrically) it has to be separated from the vacuum system by an insulating piece (Equipment see Section 1.4.2).



## 2.2 Electrical connection

### Warning



The terminals of the Vacuum Switch must not be connected under any circumstances to the mains voltage.

**DANGER TO LIFE!**

The housing potential may not exceed the levels of protective low voltages referred to ground.

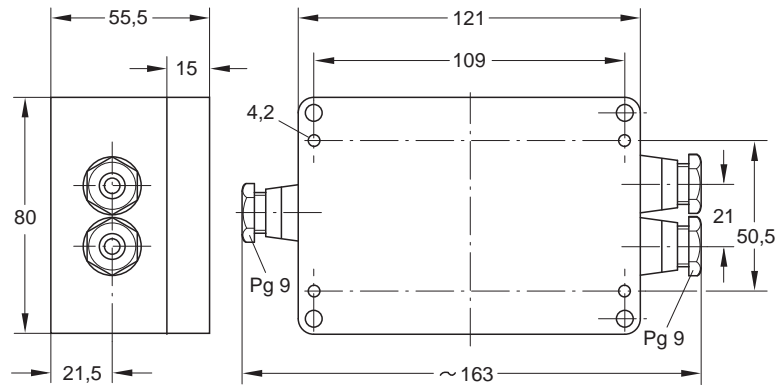


Fig. 3 SV Switching amplifier (dimensional drawing)

## 2.2.1 Connection of the Vacuum Switch

The Vacuum Switch is connected as follows:

- Unscrew fastening screw completely (4/3); lift-off connecting box and gasket (4/2) from the Vacuum Switch.
- Detach insert (4/4) applying a screwdriver at (4/5).

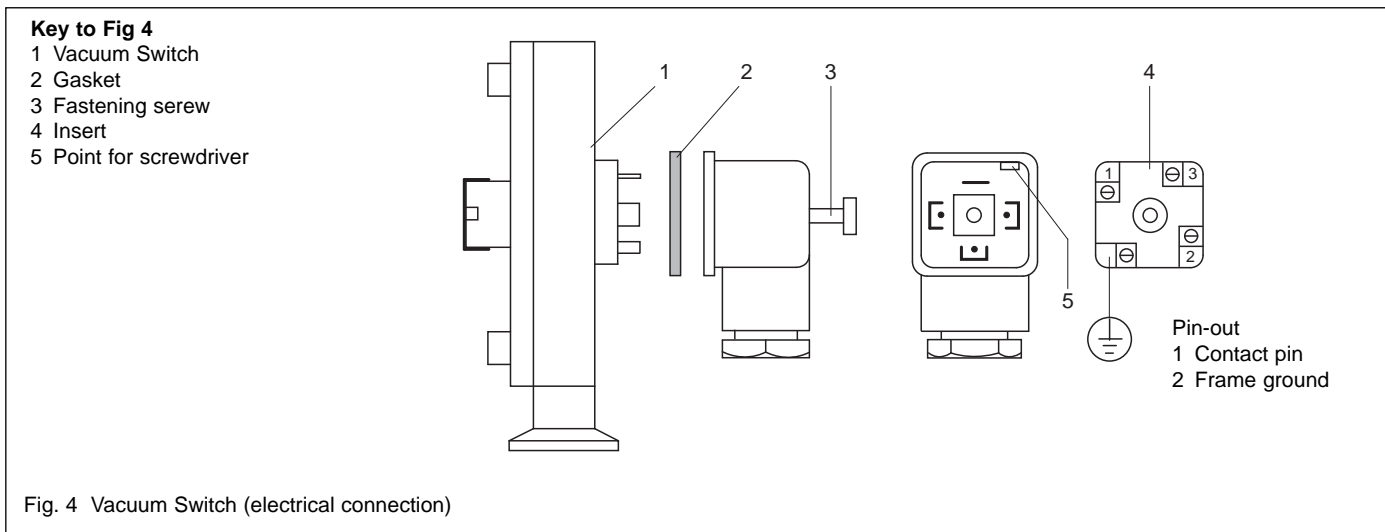
### Note

Socket contact 3 (4/4) and protective ground conductor are not connected!

See Fig. 5 for connection cables.

- Connect socket contact 1 (4/4) to terminal A on the switching amplifier (see fig. 5).
- Connect socket contact 2 (4/4) to terminal B on the switching amplifier (see fig. 5).

Reassemble in the reverse order.

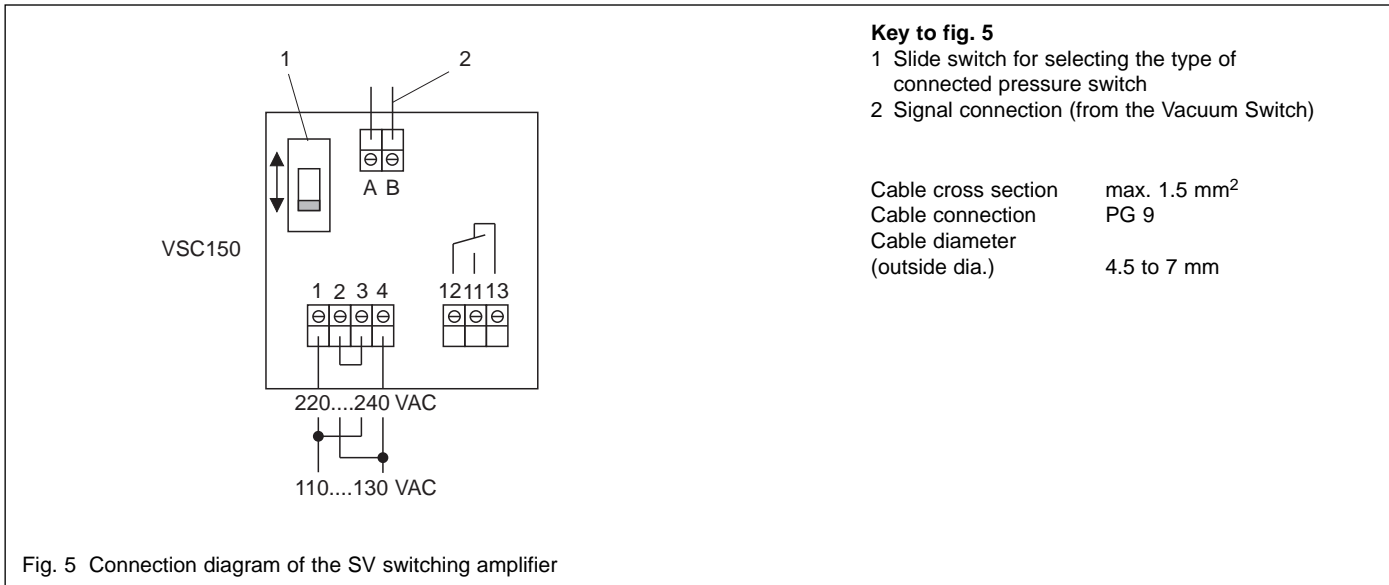


## 2.2.2 SV Switching Amplifier

The diaphragm contact in the Vacuum Switch is **unilaterally connected to ground** and designed for a maximum load of 24 V / 10 mA.

The built-in slide switch (5/1) must be set to the connected type of pressure switch. For electrical installation the switching amplifier SV 110 is delivered set for 220 ... 240 VAC. For mains voltages of 110 ... 130 VAC

change terminal bridge connectors as shown in Fig. 5. **When connecting to the mains the VDE 0100 regulations must be observed.** The connection of the external consumer which is to be switched is shown in Fig. 5.



## 2.3 Design Versions and Switch Point Setting

A suitable vacuum gauge or pressure gauge is required for switch point setting.

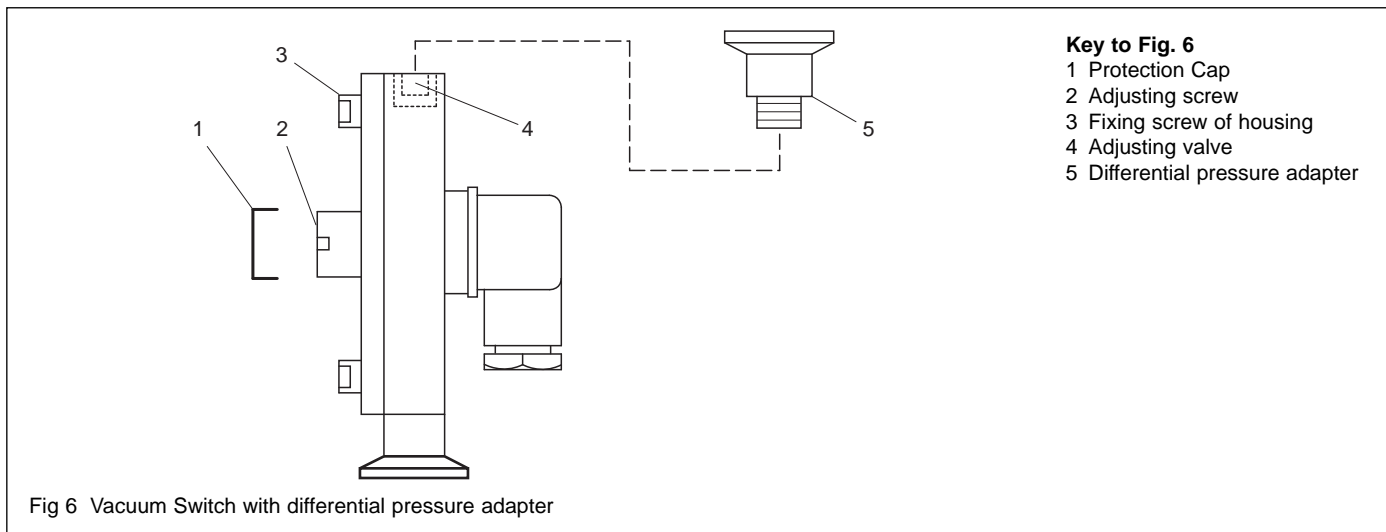
### 2.3.1 VSC150 Vacuum Switch

With adjustable switching pressure in the range from 0.5 to 2000 mbar.

The adjusting valve (1/4) resp. (6/4) is freely accessible and the user may set the switching pressure to any value within the whole range.

#### Note

To avoid switching errors, pressure settings below 20 mbar should only be made under clean conditions and using dry gas.



### 2.3.1.1 Setting Switching Pressures Higher than 20 mbar

Condition: Correct basic adjustment of the Vacuum Switch.

Basic adjustment of the switch in the factory provided that at equal pressure in sensing and reference chamber the contact is just closed.

The diaphragm (1/3) touches the contact pin (1/6) in the reference chamber (1/5).

Check this basic adjustment.

Open adjusting valve (1/4) resp. (6/4) using an Allan key (size across flats 5 mm) by 2 anticlockwise turns.

The relay contact via terminals 11 and 12 in the connected SV switching amplifier must now be open (Fig. 5).

If not, remove protective cap (6/1) and turn adjusting screw (6/2) carefully clockwise till the relay is de-energized and the above-mentioned contact is open.

Then replace protective cap (6/1).

Now set desired **switch point** as follows:

- At first produce desired pressure in the system.
- Then close adjusting valve (6/4) turning clockwise with the dynamometric key.

#### Note

The amount of torque for the adjustment valve is  $M_d = 3.5$  to  $4$  Nm.

- If the pressure in the sensing chamber drops by  $0.1$  mbar the contact between diaphragm and contact pin opens by flexing of the diaphragm and the relay in the connected switching amplifier is energized.
- The switch contact on terminals 11 and 12 (see Fig. 5) is closed.

### 2.3.1.2 Setting Switching Pressures Lower than 20 mbar

The procedure is basically the same as described in 2.3.1.1.

#### Caution

However, to avoid contamination of the reference chamber it is essential to use only extremely dry and clean gas. Otherwise there is a risk that gas (vapor) desorption from the chamber walls will change the pressure in the reference chamber.

The system must be pumped down to a pressure less than  $1 \cdot 10^{-4}$  mbar.

Open adjusting valve (6/4) using an Allan key (size across flats 5 mm) by 2 anticlockwise turns.

Bake out the Vacuum Switch using strip heaters for at least 5 to 6 hours at approx.  $120$  °C, while pump down continues uninterrupted.

Then admit **dry protective gas** to the Vacuum Switch up to a pressure of 20 mbar, check basic adjustment of the Vacuum Switch as described in 2.3.1.1.

Close adjusting valve turning clockwise with the dynamometric key.

### Note

The amount of torque for the adjustment valve is  
 $M_d = 3.5$  to  $4$  Nm.

Now produce desired pressure - between 0.5 and 20 mbar.

Remove protective cap (6/1) and turn adjusting screw (6/2) carefully clockwise till the relay of the connected SV switching amplifier is de-energized.

The contact via terminal 11 and 12 must now be open (Fig. 5).

Then replace protective cap (6/1).

Later correction or change of the switch point between 0.5 and 20 mbar can be made anytime without readjustment of the reference pressure of 20 mbar. Such a change of the switch point is made exclusively by means of the adjusting screw (6/2). **The adjusting valve (6/4) remains closed.**

To reduce the switching pressure turn adjusting screw (6/2) clockwise.

To increase the switching pressure turn adjusting screw (6/2) counterclockwise.

## 2.4 Differential Pressure Adapter

The differential pressure adapter (6/5) consists of an DN 16 KF flange with threaded tubulation and seal-off-fitting. It is screwed onto the VSC150 Vacuum Switch substituting the adjusting valve (6/4) and enables the pressure switch to be used as a differential pressure switch or a pressure balance indicator. Its operating range is up to 2000 mbar. Differential pressures ( $\Delta p = p_R - p_M$ ) between + 5 and -20 mbar can be set up.

### 2.4.1 Connecting the Differential Pressure Adapter to the Vacuum Switch

- Unscrew the adjusting valve (6/4) turning counterclockwise using Allan key (5 mm).
- Screw in differential pressure adapter (6/5).

#### **Do not force!**

- The connection ports of sensing chamber (1/2) and reference chamber (1/5) are now separated.

(1/9) Connection of sensing chamber „M“;

(1/10) Connection of reference chamber „R“.

**Caution** Only the sensing chamber can be opened for cleaning. The reference chamber can not be opened and must therefore be protected from contaminaton.

### 2.4.2 Switching Logic

With correct basic adjustment of the switch (see section 2.3.1.1) the following switching logic applies:

$p_R > p_M$  = contact open

Relay in SV switching amplifier energized, contacts 11 and 12 closed.

$p_R \leq p_M$  = contact closed

Relay in SV switching amplifier de-energized, contacts 11 and 12 open.

Correction by means of adjusting screw (6/2) see section 2.3.1.1.

## 2.5 Typical Applications

### 2.5.1 Protection of a Gate Valve which must only be Operated when Pressure on both Sides Becomes Equal

Assembly as shown in the diagram, Fig. 7.

Connect port (1/10) of the Vacuum Switch always to that side where higher pressure is to be expected.

Loop the control circuit of the gate valve via the break contact, terminals 12 and 13 (see Fig. 5), of the switching amplifier relay. The basic adjustment as described in Section 2.3.1.1 applies to the Vacuum Switch, i.e. the diaphragm must just touch the contact pin (6/2) see section 2.3.1.1.

When turned counterclockwise the contact opens.

When turned clockwise the contact closes.



### 2.5.2 In a Vacuum System it must be Prevented that in Case of Failure Gas Flows into the Vacuum Chamber

Assembly as shown in the diagram, Fig. 7.

Also in this case, as in 2.5.1, the contact setting of the Vacuum Switch should correspond to the basic adjustment. Control the electrically operated valve (normally closed) via the break-contact, terminals 12 and 13 (see Fig. 5), of the SV switching amplifier. In case of power failure this valve closes. When the power returns the valve is not opened before the pressure in the sensing volume and the reference volume of the Vacuum Switch has become equal.

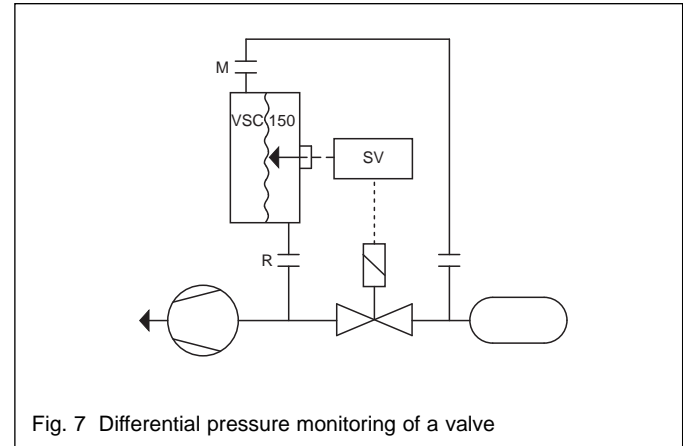


Fig. 7 Differential pressure monitoring of a valve

### 2.5.3 Automatic Venting of a Vacuum Chamber

End of venting at a minimum pressure of 20 mbar below atmospheric pressure, max. at atmospheric pressure.

Assembly as in Fig. 8.

The venting valve (normally closed) is controlled via the make-contact of the switching amplifier relay, terminals 11 and 12 (see Fig. 5). For venting up to atmospheric pressure the basic adjustment of the Vacuum Switch contact applies. If venting should end before, the switching pressure can be continuously lowered by 20 mbar

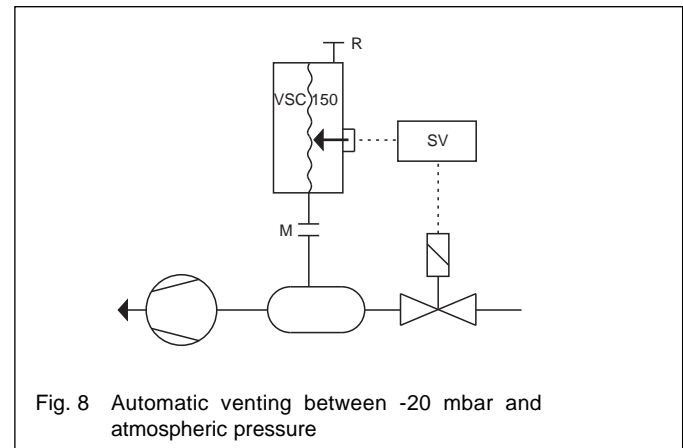


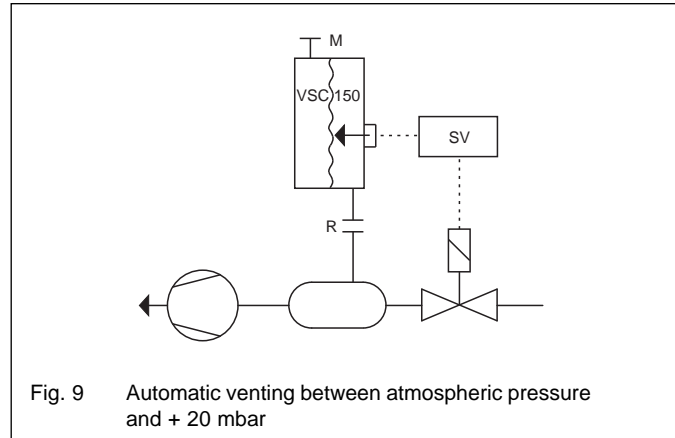
Fig. 8 Automatic venting between -20 mbar and atmospheric pressure

max. turning the adjusting screw (6/2) clockwise.

### 2.5.4 Automatic Venting of a Vacuum Chamber to a Slight Overpressure

Assembly as in Fig. 9.

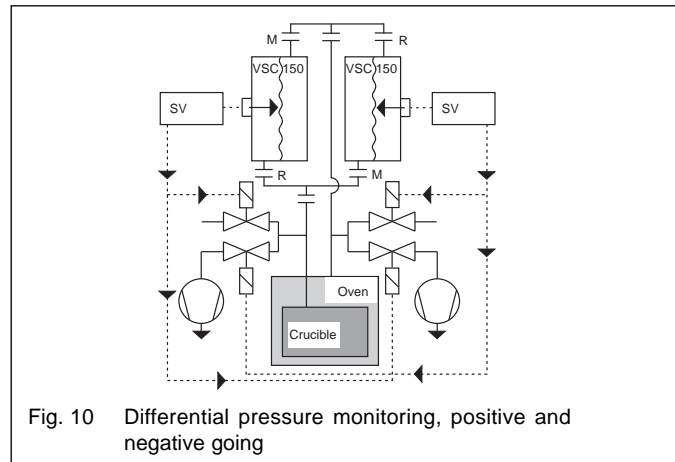
Loop the control circuit of the venting valve via the break contact of the switching amplifier relay, terminals 12 and 13 (see Fig. 5). The switching pressure can be raised by 20 mbar max. above atmospheric pressure by turning the adjusting screw (6/2) clockwise.



### 2.5.5 Differential Pressure Monitoring, Positive and Negative Going

In an annealing plant with „holding vacuum“ pump down and venting of the annealing pot and the vacuum furnace must be regulated so that the differential pressures in both directions will not exceed 10 mbar (Assembly as shown in Fig. 10).

Starting from the basic adjustment set the two Vacuum Switches by turning the adjusting screw (6/2) clockwise so that at a pressure of 10 mbar in the reference chamber against the pressure in the sensing chamber the switch contact opens by flexing of the diaphragm. Control venting valves and pump valves each via the break



contact, terminals 12 and 13, of the two SV switching amplifiers.

As soon as during pump down or venting the differential pressure between annealing pot and vacuum furnace in either direction exceeds 10 mbar, the respective pump valve or venting valve is closed. The valves open again as soon as the differential pressure has dropped below the set switching pressure. Switching pressures can be varied between 0.5 and 20 mbar by means of the adjusting screw (6/2).

## 3 Maintenance

For the pressure switches maintenance work is normally not necessary. Slight contamination of the sensing chamber does not affect the switching performance and accuracy. If for one reason or other cleaning should become necessary, observe Sections 3.1 or 3.2.

### 3.1 Cleaning the Sensing Chamber

- Remove protection cap (6/1).
- Unscrew adjusting screw (6/2) by turning counterclockwise and extract the complete setting mechanism (ball and compression spring).
- Unscrew the three housing screws (6/3) and open the sensing chamber.

#### Caution

Do not exert pressure on the diaphragm. Do not use any mechanical cleaning means like emery paper, steel wool or steel brushes. Cleanse with solvents - petroleum ether, benzine or alcohol - and dry. Replace gasket, if necessary.

### Note

- Reassemble the setting mechanism in the order compression spring, ball and adjusting screw.
- When screwing in the adjusting screw grease the O-ring **slightly** with Lithelen.

Reassemble Vacuum Switch. Set adjusting screw (6/2) as described in section 2.3.

## 3.2 Cleaning the reference chamber

Cleaning of the reference chamber is only possible in the VSC150 Vacuum Switch if the latter is used as a differential pressure switch. The reference chamber cannot be opened but can only be cleansed with solvents.

Proceed as follows:

- Unscrew the differential pressure adapter (6/5) and inject solvent by means of a syringe. Let solvent act for a while, shake and pour out.
- Repeat this procedure several times (if necessary). Then screw in differential pressure adapter again, **tightening uniformly!**
- Dry the reference chamber by evacuating with a vacuum pump.
- Readjustment of the basic setting is only necessary if the measurement chamber has been opened.

## 3.3 Service at INFICON

### Warning



Contaminated products (e.g. radioactive, toxic, caustic or microbiological hazard) can be detrimental to health and environment.

Products returned to Inficon should preferably be free of harmful substances. Adhere to the forwarding regulations of all involved countries and forwarding companies and enclose a duly completed declaration of contamination (see Annex).

Products that are not clearly declared as „free of harmful substances“ are decontaminated at the expense of the customer.

Products not accompanied by a duly completed declaration of contamination are returned to the sender at his own expense.

## 4 Disposal

### Warning

Contaminated parts



Contaminated parts can be detrimental to health and environment.

Before beginning to work, find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

### Warning

Substance detrimental to the environment



Products or parts thereof (mechanical and electric components, operating fluids etc.) can be detrimental to the environment.

Dispose of such substance in accordance with the relevant local regulations.

### Separating the components

After disassembling the product, separate its components according to the following criteria:

#### Contaminated components

Contaminated components (radioactive, toxic, caustic or biological hazard etc.) must be decontaminated in accordance with the relevant national regulations, separated according to their materials, and disposed of.

#### Other components

Such components must be separated according to their materials and recycled.



## EEC Declaration of Conformity

We, INFICON, hereby declare that the equipment mentioned below complies with the provisions of the Directive relating to electrical equipment designed for use within certain voltage limits 73/23/EEC and the Directive relating to electromagnetic compatibility 89/336/EEC.

**Product:**

Vacuum Switch VSC150

**Part Number**

399-005

**Standards**

Harmonized and international / national standards and specifications:

- EN 61000-6-2
- EN 61000-6-3
- EN 61010
- VDE 0411 Teil 1
- VDE 0839 Teil 81-2
- VDE 0839 Teil 82-2

Balzers, 18 March 2005




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Reto Süssli, Product Marketing Manager

Balzers, 18 March 2005




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Dr. Georg Sele, Technical Support Manager  
Quality Representative

# Declaration of Contamination

The service, repair, and/or disposal of vacuum equipment and components will only be carried out if a correctly completed declaration has been submitted. Non-completion will result in delay.  
 This declaration may only be completed (in block letters) and signed by authorized and qualified staff.

**1 Description of product**

Type \_\_\_\_\_  
 Part number \_\_\_\_\_  
 Serial number \_\_\_\_\_

**2 Reason for return**

\_\_\_\_\_

**3 Operating fluid(s) used (Must be drained before shipping.)**

\_\_\_\_\_

**4 Used in copper process**

no     yes

Seal product in plastic bag and mark it with a corresponding label.

**5 Process related contamination of product:**

toxic	no <input type="checkbox"/>	yes <input type="checkbox"/>
caustic	no <input type="checkbox"/>	yes <input type="checkbox"/>
biological hazard	no <input type="checkbox"/>	yes <input type="checkbox"/>
explosive	no <input type="checkbox"/>	yes <input type="checkbox"/>
radioactive	no <input type="checkbox"/>	yes <input type="checkbox"/>
other harmful substances	no <input type="checkbox"/>	yes <input type="checkbox"/>

1) or not containing any amount of hazardous residues that exceed the permissible exposure limits

2) Products thus contaminated will not be accepted without written evidence of decontamination.

**6 Harmful substances, gases and/or by-products**

Please list all substances, gases, and by-products which the product may have come into contact with:

Trade/product name	Chemical name (or symbol)	Precautions associated with substance	Action if human contact

**7 Legally binding declaration:**

We hereby declare that the information on this form is complete and accurate and that we will assume any further costs that may arise. The contaminated product will be dispatched in accordance with the applicable regulations.

Organization/company \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_

Email \_\_\_\_\_

Name \_\_\_\_\_

Post code, place \_\_\_\_\_

Fax \_\_\_\_\_

Date and legally binding signature \_\_\_\_\_

Company stamp \_\_\_\_\_

This form can be downloaded from our website.

Copies: Original for addressee - 1 copy for accompanying documents - 1 copy for file of sender



INFICON Ltd.

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