

# Vacuum Switch, Differential Pressure Adapter, Switching Amplifier

VSC150, SV



CE

## Product Identification

In all communications with INFICON, please specify the information on the product nameplate. For convenient reference copy that information into the space provided below.

<b>INFICON AG, LI-9496 Balzers</b>	
Model:.....	
PN: .....	
SN: .....	

## Validity

This document applies to products with part numbers

399-005	(VSC150 Vacuum Switch)
399-007	(Differential Pressure Adapter)
399-006	(Pressure switch adjustment)
399-008	(SV Switching amplifier)

The part number (PN) can be taken from the product nameplate.

We reserve the right to make technical changes without prior notice.

All dimensions in mm.

The references to diagrams, e.g. (4/5), consist of the fig. no. and the item no. in that order.

## Description

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.

## Unpacking and Checking

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.

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

Check for completeness.

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.

## Design and Function

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.

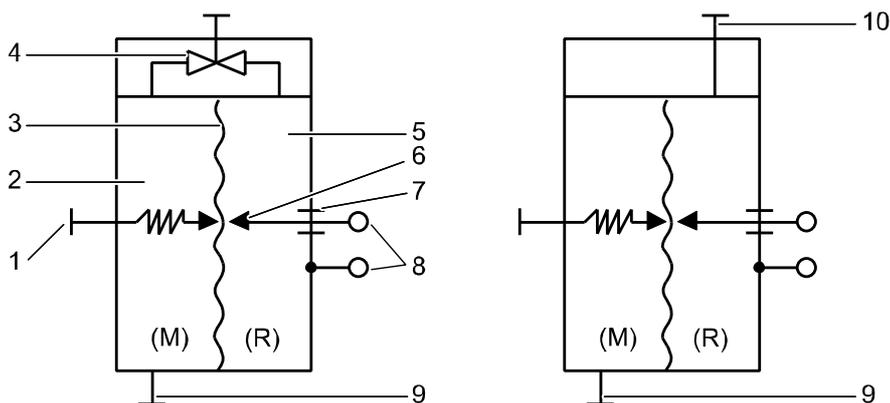
This contact configuration is so designed that the diaphragm contacts the pin when it is unstressed, i. e. with equal pressure in sensing and reference chamber.

## 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.

## 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 | Adjusting screw      | 6  | Contact pin                   |
| 2 | Sensing chamber (M)  | 7  | Current leadthrough           |
| 3 | Diaphragm            | 8  | Electrical connection         |
| 4 | Adjusting valve      | 9  | Vacuum connection flange      |
| 5 | Reference volume (R) | 10 | Differential pressure adapter |

Fig 1 Schematic diagram of the vacuum switches

## Supplied Equipment

- Vacuum Switch VSC150 or Switching Amplifier SV
- Operating Manuals de & en

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For cross-references within this document, the symbol (→  XY) is used.

# 1 Safety

## 1.1 Symbols Used

Symbols for residual risks



Information on preventing any kind of physical injury.



Information on preventing extensive equipment and environmental damage.



Information on correct handling or use. Disregard can lead to malfunctions or minor equipment damage.



Notice

## 1.2 Personnel Qualifications



All work described in this document may only be carried out by persons who have suitable technical training and the necessary experience or who have been instructed by the end-user of the product.

## 1.3 General Safety Instructions

- Adhere to the applicable regulations and take the necessary precautions for the process media used.  
Consider possible reactions with the product materials (→ 6).
- Adhere to the applicable regulations and take the necessary precautions for all work you are going to do and consider the safety instructions in this document.
- Before beginning to work, find out whether any vacuum components are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.

Communicate the safety instructions to all other users.

## 1.4 Liability and Warranty

INFICON assumes no liability and the warranty is rendered null and void if the end-user or third parties

- disregard the information in this document
- use the product in a non-conforming manner
- make any kind of interventions (modifications, alterations etc.) on the product
- use the product with accessories not listed in the corresponding product documentation.

## 2 Technical Data

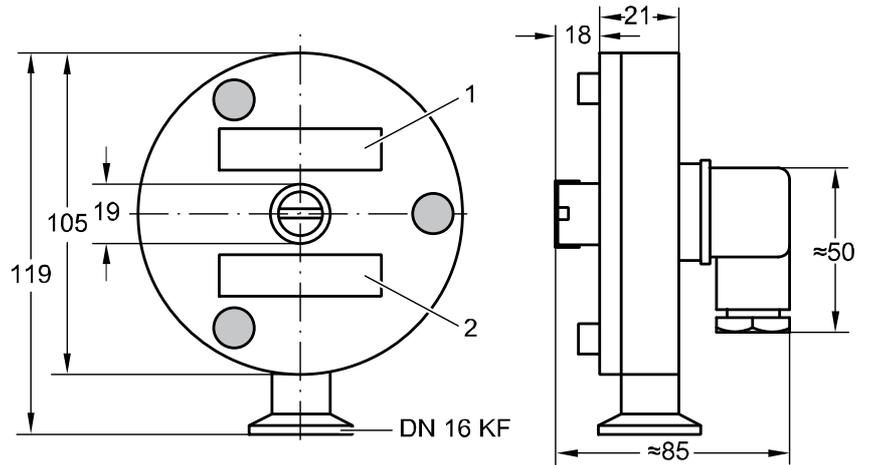
### Vacuum Switch VSC150

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, 1.4310, 1.3541, FPM
Reference volume	stainless steel 1.4301, 1.4401, 1.3541, glass; gold
Sensing volume, approx. including connection port	ca. 4 cm <sup>3</sup>
Reference volume, approx.	ca. 20 cm <sup>3</sup>
Weight	1.3 kg

### Switching Amplifier SV

Mains supply	110 to 130 V 220 to 240 V
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

Dimensions [mm]



Height with differential pressure 133.5 mm  
 1 Name plate  
 2 Label giving the switching threshold

Fig. 2 Dimensional drawing (without differential pressure adapter)

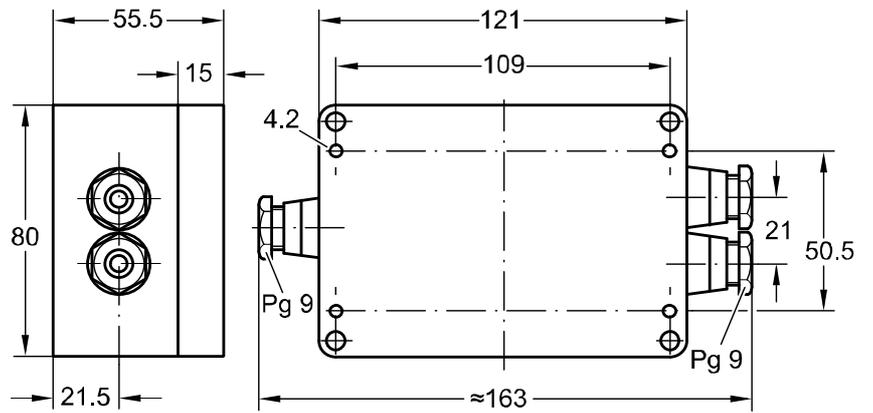


Fig. 3 Switching amplifier SV (dimensional drawing)

## 3 Installation

### 3.1 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.

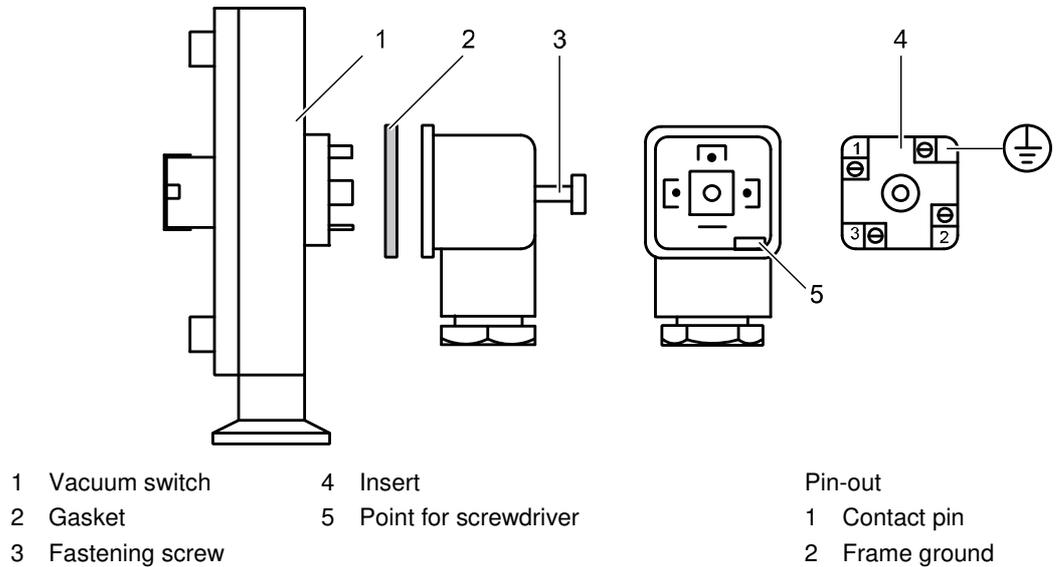


Fig. 4 Vacuum switch (electrical connection)

### 3.2 Electrical Connection

**DANGER**

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.

#### 3.2.1 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).

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).

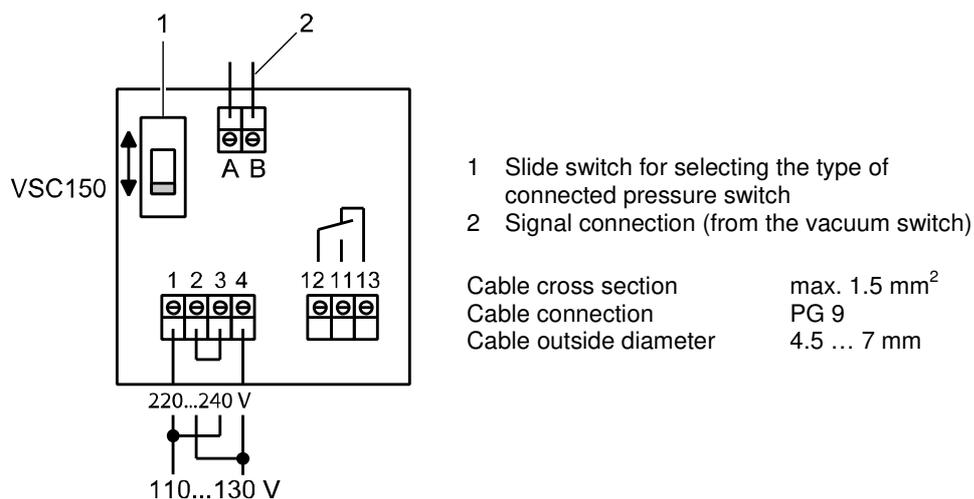


Fig. 5 Connection diagram of the switching amplifier

Reassemble in the reverse order.

### 3.2.2 Switching Amplifier SV

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 is delivered set for 220 V. For mains voltages of 110 V to 130 V 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.

## 4 Operation

### 4.1 Design Versions and Switch Point Setting

#### 4.1.1 Vacuum Switch VSC150

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

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.

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

#### 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 switching amplifier SV 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).

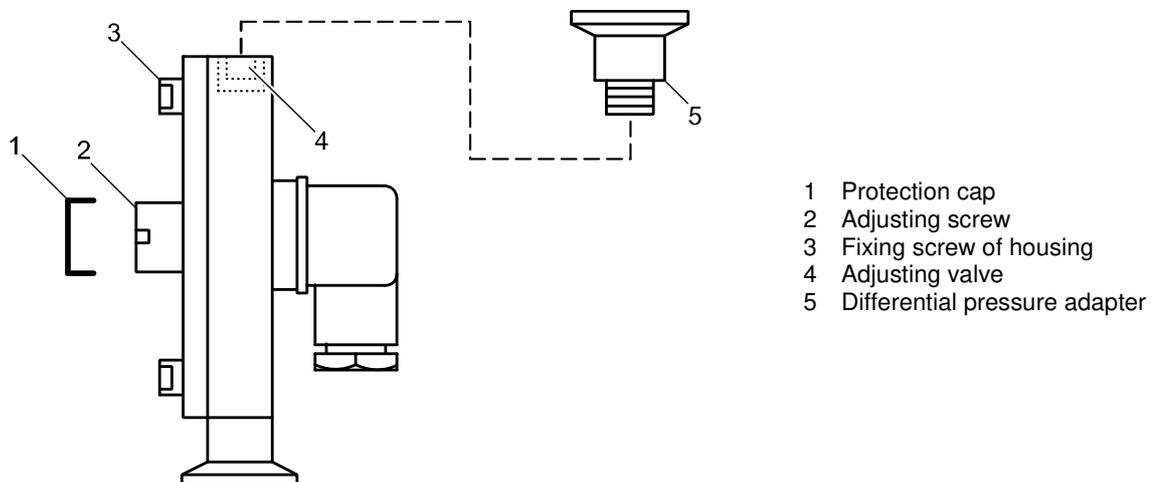


Fig 6 Vacuum switch with differential pressure adapter

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. 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.

## Setting Switching Pressures Lower than 20 mbar

The procedure is basically the same as described above.



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 anti-clockwise 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 above.

Close adjusting valve turning clockwise with the dynamometric key.

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 switching amplifier SV 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..

## 4.2 Differential Pressure Adapter

The differential pressure adapter (6/5) consists of a DN 16 KF flange with male thread and seal-off-fitting. It is screwed onto the VSC150 vacuum switch substituting the adjusting valve (6/4) and enables the vacuum 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 mbar and -20 mbar can be set up.

### 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";  
Connection of reference chamber "R" (1/10).



Only the sensing chamber can be opened for cleaning. The reference chamber cannot be opened and must therefore be protected from contamination.

### Switching Logic

With correct basic adjustment of the switch the following switching logic applies:

$p_R > p_M =$  contact open

Relay in SV energized, contacts 11 and 12 closed.

$p_R \leq p_M =$  contact closed

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

Correction by means of adjusting screw (6/2) see section 3.1.

## 4.3 Typical Applications

### 4.3.1 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 2.3.2.1 applies to the vacuum switch, i.e. the diaphragm must just touch the contact pin (6/2) see section 3.1.

When turned counterclockwise the contact opens. When turned clockwise the contact closes.

### 4.3.2 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 4.3.1, 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 switching amplifier SV. 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.

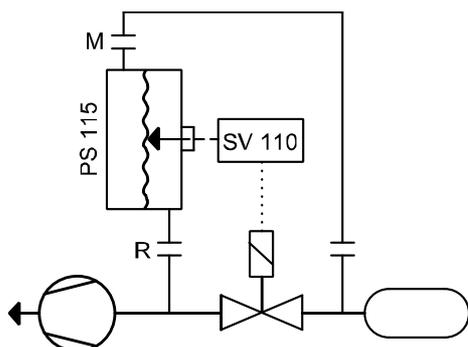


Fig. 7 Differential pressure monitoring of a valve

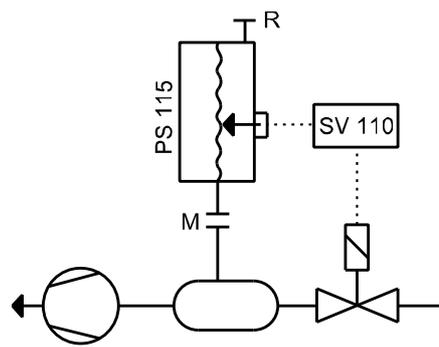


Fig. 8 Automatic venting between -20 mbar and atmospheric pressure

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

### 4.3.4 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.

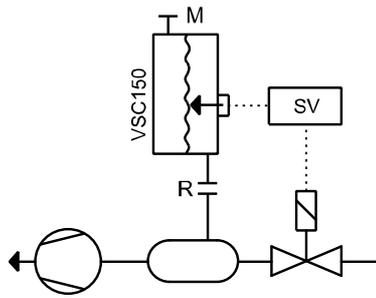


Fig. 9 Automatic venting between atmospheric pressure and +20 mbar

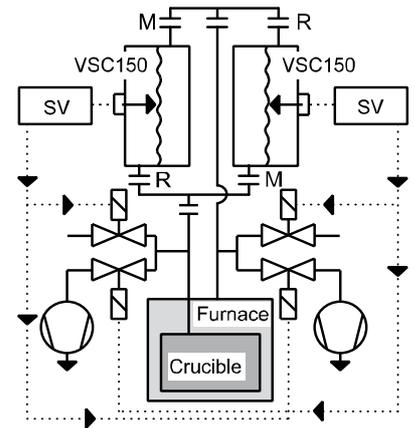


Fig. 10 Differential pressure monitoring, positive and negative going

### 4.3.5 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).

## 5 Maintenance


**DANGER**



**DANGER: contaminated parts**  
Contaminated parts can be detrimental to health and environment. Before you begin to work, find out whether any parts are contaminated. Adhere to the relevant regulations and take the necessary precautions when handling contaminated parts.


**Caution**



**Caution: vacuum component**  
Dirt and damages impair the function of the vacuum component. When handling vacuum components, take appropriate measures to ensure cleanliness and prevent damages.


**Caution**



**Caution: dirt sensitive area**  
Touching the product or parts thereof with bare hands increases the desorption rate. Always wear clean, lint-free gloves and use clean tools when working in this area.

For the vacuum 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 4.2 or 4.3.

### 5.1 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.



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 - see spare parts in section 5.

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 4.1.

## 5.2 Cleaning the reference chamber

Cleaning of the reference chamber is only possible in the vacuum switch VSC150 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.

## 6 Returning the Product

**WARNING**

**WARNING: forwarding contaminated products**

Products returned to INFICON for service or repair should, if possible, be free of harmful substances (e.g. radioactive, toxic, caustic or micro-biological). Otherwise, the type of contamination must be declared.

Adhere to the forwarding regulations of all involved countries and forwarding companies and enclose a completed contamination declaration (form under [www.inficon.com](http://www.inficon.com)).

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.

## 7 Disposal

**DANGER**

**DANGER: 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**

**WARNING: substances detrimental to the environment**

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

## Appendix

### A: Conversion Table

Pressure units  
(vacuum technology)

	mbar	Bar	Pa	hPa	kPa	Torr mm HG
mbar	1	$1 \times 10^{-3}$	100	1	0.1	0.75
Bar	$1 \times 10^3$	1	$1 \times 10^5$	$1 \times 10^3$	100	750
Pa	0.01	$1 \times 10^{-5}$	1	0.01	$1 \times 10^{-3}$	$7.5 \times 10^{-3}$
hPa	1	$1 \times 10^{-3}$	100	1	0.1	0.75
kPa	10	0.01	$1 \times 10^3$	10	1	7.5
Torr mm HG	1.332	$1.332 \times 10^{-3}$	133.32	1.3332	0.1332	1

$$1 \text{ Pa} = 1 \text{ N/m}^2$$

## EU 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 2014/35/EU, the Directive relating to electromagnetic compatibility 2014/30/EU and the Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment 2011/65/EU.

**Products**

Vacuum Switch, Differential Pressure Adapter, Switching Amplifier  
VSC150, SV

**Part numbers**

399-005  
399-008

**Standards**

Harmonized and international/national standards and specifications:

- EN 61000-6-2:2005  
(EMC: generic immunity standard for industrial environments)
- EN 61000-6-3:2007 + A1:2011  
(EMC: generic emission standard for residential, commercial and light-industrial environments)
- EN 61010-1:2010  
(Safety requirements for electrical equipment for measurement, control and laboratory use)
- EN 61326-1:2013; Group 1, Class A  
(EMC requirements for electrical equipment for measurement, control and laboratory use)

**Manufacturer / Signatures**

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16 March 2017

16 March 2017




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Notes

Original: German tina42d1-b (2017-03)



tina42e1-b



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