Operating instructions

Vacuum/Pressure Switch VSi / VSi-...-D

WWW.SCHMALZ.COM

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Translation of the original operating instructions

Note

The Operating instructions were originally written in German. Store in a safe place for future reference. Subject to technical changes without notice. No responsibility is taken for printing or other types of errors.

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1 Important Information

1.1 Note on Using this Document

J. Schmalz GmbH is generally referred to as Schmalz in this document.

The document contains important notes and information about the different operating phases of the product:

- Transport, storage, start of operations and decommissioning
- Safe operation, required maintenance, rectification of any faults

The document describes the product at the time of delivery by Schmalz and is aimed at:

- Installers who are trained in handling the product and can operate and install it
- Technically trained service personnel performing the maintenance work
- Technically trained persons who work on electrical equipment

1.2 The technical documentation is part of the product

1. For problem-free and safe operation, follow the instructions in the documents.
2. Keep the technical documentation in close proximity to the product. The documentation must be accessible to personnel at all times.
3. Pass on the technical documentation to subsequent users.

⇨ Failure to follow the instructions in these Operating instructions may result in injuries!

⇨ Schmalz is not liable for damage or malfunctions that result from failure to heed these instructions.

If you still have questions after reading the technical documentation, contact Schmalz Service at:
www.schmalz.com/services

1.3 Symbols

This symbol indicates useful and important information.

✓ This symbol represents a prerequisite that must be met before an action is performed.

‣ This symbol represents an action to be performed.

⇨ This symbol represents the result of an action.

Actions that consist of more than one step are numbered:

1. First action to be performed.
2. Second action to be performed.

2 Fundamental Safety Instructions

2.1 Intended use

The vacuum/pressure switches VSi-… / VSi-…-D are used only to measure vacuum and pressure. For further information, see the technical data. Any other use is considered improper by the manufacturer and is deemed as contrary to the designated use.

The product is built in accordance with the latest standards of technology and is delivered in a safe operating condition; however, hazards may arise during use.

The product is intended for industrial and commercial applications.

Intended use includes observing the technical data and the installation and operating instructions in this manual.

2.2 Non-Intended Use

Schmalz accepts no liability for damages caused by the use of the product for purposes other than those described under "Intended Use."

Non-intended use includes the following:

- Use in potentially explosive atmospheres

2.3 Personnel Qualification

Unqualified personnel cannot recognize dangers and are therefore exposed to higher risks!

The operating company must ensure the following points:

- The personnel must be commissioned for the activities described in these operating instructions.
- The staff must be at least 18 years of age and physically and mentally capable.
- The operating staff have been instructed in the operation of the product and have read and understood the operating instructions.
- Work on electrical equipment must be carried out only by qualified electrical specialists.
- Installation, maintenance, and repairs must be carried out only by specialists or by persons who can prove that they have undergone appropriate training.

Applicable for Germany:

A qualified employee is defined as an employee who has received technical training and has the knowledge and experience – including knowledge of applicable regulations – necessary to enable him or her to recognize possible dangers and implement the appropriate safety measures while performing tasks. Qualified employees must observe the relevant industry-specific rules and regulations.

2.4 Warnings in This Document

Warnings warn against hazards that may occur when handling the product. The signal word indicates the level of danger.

Signal word	Meaning
⚠ WARNING	Indicates a medium-risk hazard that could result in death or serious injury if not avoided.
⚠ CAUTION	Indicates a low-risk hazard that could result in minor or moderate injury if not avoided.
NOTE	Indicates a danger that leads to property damage.

2.5 Residual Risks

⚠ WARNING

Serious injuries due to improper mounting!

- Carry out mounting and removal only when the device is in an idle, depressurized state.
- Use only the connectors, mounting holes and attachment materials that have been provided.

⚠ WARNING

Uncontrolled movements of system components or falling objects caused by incorrect activation and switching of the Vacuum/pressure switch while persons are in the plant (safety door opened and actuator circuit switched off)

Serious injury

- Ensure that the components are enabled via the actuator voltage by installing a potential separation between the sensor and actuator voltage.
- Wear the required personal protective equipment (PPE) when working in the danger zone.

⚠ CAUTION

Noise pollution from leakage

Hearing damage

- Correct position.
- Wear ear protectors.

NOTE

Incorrect power supply

Destruction of the integrated electronics

- Operate the product using a power supply unit with protected extra-low voltage (PELV).
- The system must incorporate safe electrical cut-off of the power supply in compliance with EN60204.
- Do not connect or disconnect the connector under tension and/or when voltage is applied.

2.6 Modifications to the Product

Schmalz assumes no liability for consequences of modifications over which it has no control:

1. The product must be operated only in its original condition as delivered.
2. Use only original spare parts from Schmalz.
3. The product must be operated only in perfect condition.

3 Product description

3.1 General Description

The vacuum switch and pressure switch versions belonging to the VSi series are referred to only as the switch below.

The VSi-series switch can be operated in two operating modes.

- Via direct connection to discrete inputs (standard I/O = SIO) or
- Via connection through the communication line (IO-Link class A)

Switching points are indicated using one or two orange LEDs. If the switching point is not active, operational readiness is indicated by a green LED at switching point 1. The LED for switching point 2 remains deactivated.

Additionally, a multitude of information and status reports for the switch can be accessed using wireless communication with NFC (near-field communication).

The parameters can also be set using two buttons on the display version (VSi-…-D). The current system status and the settings are shown on a display.

The fluid connection offers the opportunity to align the switch in a screwed-in position.

3.2 Versions

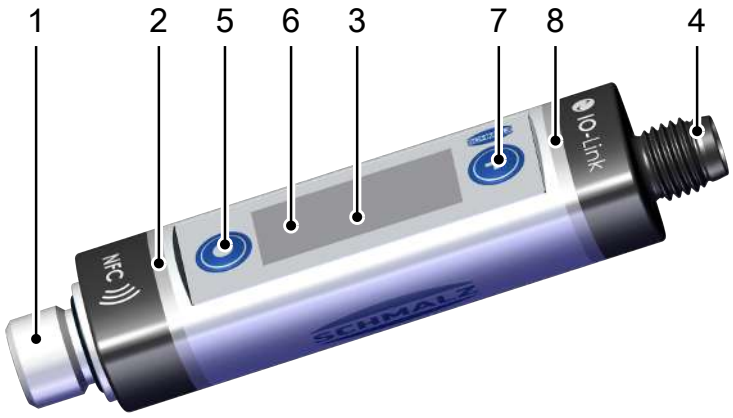
Each switch has a precise item designation (e.g. VSi-V-D-M8-4) that is composed of the following type keys:

Type	Pressure range	Analog output	Display	Electrical connection
VSi	V (-1 to 0 bar)	SA (only available in combination with pressure range V)	D (with integrated display)	M12-4 (1xM12, 4-pin)
	VP8 (-1 to +8 bar)			M8-4 (1xM8, 4-pin)
	P10 (0 to +10 bar)			

3.3 VSi Design (without Display)

1	Fluid connector	3	Position of the NFC antenna
2	Switching point 1 display, ORANGE or operating voltage display, GREEN	4	Electrical connection M12-4 or M8-4

3.4 Design of VSi ... D (with Display)



1	Fluid connector	5	MODE button
2	Switching point 1 display, ORANGE or operating voltage display, GREEN	6	Display
3	Position of the NFC antenna behind the display	7	SET button
4	Electrical connection M12-4 or M8-4	8	Switching point 2 display, ORANGE

4 Technical Data

4.1 General Data

Property	Version V	Version P10	Version VP8
Operating pressure range	-1 to 0 bar	0 to 10 bar	-1 to 8 bar
Overpressure resistance	8 bar	15 bar	12 bar
Solution	1 mbar	11 mbar	Vacuum 2 mbar/pressure 11 mbar
Degree of protection	IP 65 (M8/M12 plugged in)		
Working temperature	0 to 50° C		
Storage temperature	-10 to 60° C		
Permitted humidity	10 to 90% RH (free from condensation)		
Accuracy	± 3% FS [1)]		
Measuring medium	Non-aggressive gases; dry, oil-free air		
Weight	VSi VSi ... D	12 g 16 g	

[1)] The accuracy applies to the entire measuring and temperature range.

4.2 Electrical Data

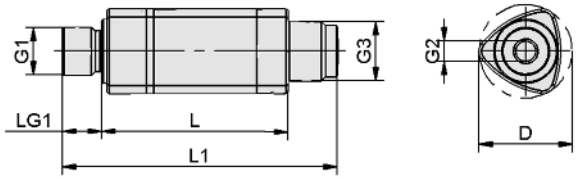
Property	VSi	VSi-...-D
Power consumption (where U = 24 V)	< 35 mA	< 35 mA
Display	—	3-digit, 7-segment display with decimal point
Display resolution	—	Vacuum: 1 mbar Pressure: 10 mbar
Analog output (VSi-V-SA only)	1 to 5 V (corresponds linearly to 0 to -1000 mbar)	—
Analog output load impedance (VSi-V-SA only):	>5k ohms [2)]	—
Supply voltage	10 to 30 V DC (PELV)[1)]	
Current load rating per output	100 mA	
Polarity reversal protection	Yes, all connections	
Overload/short circuit OUT1/OUT2	Automatic switch-off of both outputs	
NFC	NFC Forum Tag type 4	
IO-Link	IO-Link 1.1 Class A Baud rate COM2 (38.4 kBits/s) Minimum cycle time 2.3 ms (also see separate data dictionary)	

[1)] The power supply must correspond to the regulations in accordance with EN60204 (protected extra-low voltage).

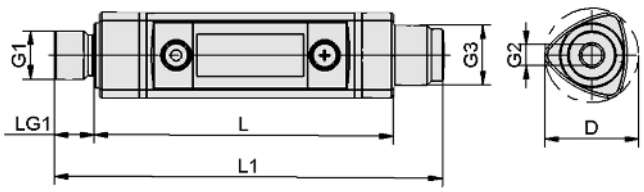
[2)] Do not short-circuit the analog output, this can lead to thermal overheating and damage to the product.

4.3 Mechanical Data

VSi



VSi-...-D



Type	L	L1	G3	G1[1)]	G2 [1)]	LG1	D
VSi ... M8-4	38.0	55.0	M8x1 male thread	G1/8" male thread	M5 female thread	8	19.6
VSi ... M12-4	38.0	56.0	M12x1 male thread				
VSi ... D M8-4	60.5	77.5	M8x1 male thread				
VSi ... D M12-4	60.5	78.5	M12x1 male thread				

[1)] Maximum tightening torque 2.5 Nm

All specifications are in mm.

4.4 Factory Settings

Parameter	VSi-V	VSi-P10	VSi-VP8	VSi-V-SA
Switching point 1				
Switching point mode and logic	Normally open two-point mode (H.no)			
Switching point SP1	750 mbar	5500 mbar	–750 mbar	–750 mbar
Reset point rP1	600 mbar	5000 mbar	–600 mbar	–600 mbar
Window hysteresis Hy1/leakage limit per sec L-1	20 mbar	100 mbar	20 mbar	20 mbar
Switch-on delay dS1, switch-off delay dr1	0 ms			
Transistor function	PNP			
Switching point 2				
Switching point mode and logic	Two-point mode, normally closed (H. no)			Not available
Switching point SP2	550 mbar	5000 mbar	5500 mbar	
Reset point rP2	500 mbar	4500 mbar	5000 mbar	
Window hysteresis Hy2/leakage limit per sec L-2	20 mbar	100 mbar	20 mbar	
Switch-on delay dS2, switch-off delay dr2	0 ms			
Transistor function	PNP			

Display unit	mbar
Eco mode	Off
Display alignment	Standard
IO-Link device locks, extended device locks	0
Menu PIN code, NFC PIN code	000

5 Installation

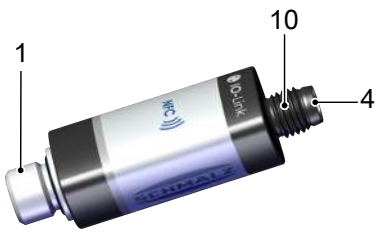
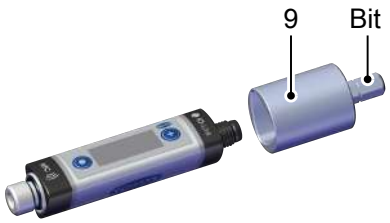
5.1 Mounting

NOTE

Exceeding the specified maximum tightening torques during mounting

Product damage

- Ensure that the specified maximum tightening torques are complied with.

VSi	VSi ... D	
		

Position	Description	Max. tightening torque
1	Fluid connector	2.5 Nm
4	Electrical connection (plug)	See note
10	Electrical connection (union nut)	0.8 Nm
9	Screw-in aid (see accessories)	

5.2 Electrical Connection

5.2.1 Mounting the Connection Cable

⚠ CAUTION

Changing output signals when the product is switched on or plug is connected

Personal injury or damage to property!

- The electrical connection must be performed only by specialists who can evaluate the effects of signal changes on the overall system.

NOTE

Incorrect connection with the IO-Link class B port

Damage to the IO-Link device or peripheral equipment

- When operating the IO-Link class A device on an IO-Link master with a class B port, ensure compliant connection and potential separation.

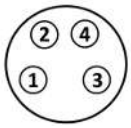
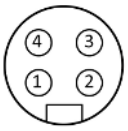
The electrical connection of the switch is established using a 4-pin M-12 or a 4-pin M8 connector (> See ch. 5.1 Mounting, p. 14).

Establish the electrical connection for the sensor as described below:

- ✓ The connection cable with socket is provided by the customer. The maximum cable length is 30 m in SIO operation and 20 m in IO-Link operation.

1. Connect the connection cable with socket at position 4.
2. Hold the socket and **simultaneously** attach the union nut at position 10 with a maximum tightening torque of 0.8 Nm. The plug must not twist or be subjected to any torque load (0 Nm). If the plug is subjected to torque during mounting, the torque must not exceed 0.6 Nm.

5.2.2 Pin Assignment, M8 Connector/M12 Connector

M8 connector	M12 connector	Pin	Symbol	Wire color [1]	Function
		1	U_s	Brown	Supply voltage
		2	OUT2	White	Signal output 2 (SIO) or analog output [2]
		3	GND	Blue	Ground
		4	OUT1	Black	C/Q (IO-Link) and signal output 1 (SIO)

[1] When using a Schmalz connection cable (see “Accessories”)

[2] For version VSi-V-SA

6 IO-Link Commissioning

When operating the switch in IO-Link mode (digital communication), the supply voltage, Gnd (ground) and the C/Q communication cable must be directly connected to the corresponding connections of an IO-Link master with IO-Link class A ports. When doing so, a new port must be used on the master for each switch; a junction of several C/Q cables is not possible with only one IO-Link master port.

The IO-Link master must be connected in the configuration of the automation system in the same way as other fieldbus components. To activate the port for IO-Link communication, a software tool from the respective master manufacturer is usually provided (e.g. Siemens PCT, Beckhoff TwinCAT etc.).

The necessary device description data (IODD) for the switch can be downloaded from our website www.schmalz.com.

The second output OUT2 for the vacuum switch is deactivated in IO-Link operation.

7 Interfaces

7.1 Digital Switching Outputs (SIO)

To operate the standard digital inputs of the automation technology or to directly control the electrical consumers, the switch has two digital outputs.

In the version with an analog output, the functions of switching point 2 or the second digital switching output are unavailable.

In the delivery state, the signal output OUT 1 is assigned the function switching point 1, parts control, and the signal output OUT 2 is assigned the switching point 2, leakage monitoring. They are configured in the EF menu (Extended Functions) via the associated menu items Ou 1 and Ou2.

The electrical status of both of the outputs OUT1 and OUT2 thus corresponds with the logical status of switching points 1 and 2 regardless of the switching point parameters that have been set:

- Switching point mode and switching point logic
- Switching thresholds and hysteresis (function depends on mode set)
- Switch-on and switch-off delay times
- Electrical transistor functions PNP or NPN

The electrical signal outputs are adjustable with regard to the switching behavior on the device. In the EF menu or via IO-Link, a choice can be made between the PNP and NPN signal types for each signal output. The setting is independent of the version.

The vacuum switch is factory set to PNP.

7.2 Analog output

NOTE

The analog output is supplied with voltage.

Damage to the product and/or malfunctions

- Ensure that the analog output is **not** supplied with voltage.

Only the version VSi-V-SA has an analog output.

The integrated sensor measures the vacuum and proportionally outputs an electrical voltage between 1 and 5 V at the analog output (OUT2, PIN 2). 1 V corresponds to a vacuum of 0 mbar.

7.3 IO-Link

The vacuum switch can be operated in IO-Link mode to enable intelligent communication with a controller. The parameters of the vacuum switch can be set remotely using IO-Link mode.

The vacuum switch provides many additional functions besides the two switching signals via the IO-Link communication.

- The actual measurement value is provided live using the process data.
- Warnings and error statuses that occur are reported to the master via the IO-Link event mechanism.
- More precise information regarding the system status is retrieved using the acyclical communication channel (known as ISDU parameters).
- Within the framework of the ISDU channel, all settings (e.g. switching point modes and delay times) for the vacuum switch are read or overwritten.

- In addition to the identification data that can be accessed from the control menu such as the part number and serial number, additional information regarding the identity of the ejector can be retrieved. It also provides memory for user-specific information, for example the installation or storage site.

The following diagram shows the alignment of the 2 byte process input data for the switch:

PD in byte no.	**0**								**1**							
Bit no.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Contents	Measured value (14 bit)														SP2	SP1

The bits SP1 and SP2 reflect the logical status of switching points 1 and 2.

The measured value is displayed as 14-bit unsigned vacuum in millibar (vacuum positive):

- VSi V: 14 bit unsigned vacuum in millibar (vacuum positive)
- VSi P10: 14 bit unsigned pressure in millibar (pressure positive)
- VSi VP8: 14-bit signed pressure in millibar (pressure positive, vacuum negative)

A detailed description of all the device parameters can be found in the data dictionary, which can be downloaded together with the IODD as a ZIP archive from www.schmalz.com.

7.4 Replacement of the Device with a Parameterization Server

The IO-Link protocol provides an automated process for transferring data when a device is replaced. For this Data storage mechanism, the IO-Link master mirrors all setting parameters for the device in a separate non-volatile memory. When a device is swapped for a new one of the same type, the setting parameters for the old device are automatically saved in the new device by the master.

✓ The device is operated on a master with IO-Link revision 1.1 or higher.

✓ The Data storage feature in the configuration of the IO-Link port is activated.

▸ Ensure that the new device is restored to the factory settings **before** it is connected to the IO-Link master. If necessary, reset the device to the factory settings.

⇨ The device parameters are automatically mirrored in the master when the device is configured using an IO-Link configuration tool.

Changes to the parameters made by a PLC program using a function module are **not** automatically mirrored in the master.

▸ Manually mirroring data: After changing all required parameters, execute ISDU write access to the System Command parameter (Index 2) using the Force upload of parameter data into the master command (numerical value 0x05) (> See ch. (see Data Dictionary in the appendix)).

Use the Parameterization server function of the IO-Link master to ensure that no data is lost when switching the device.

7.5 NFC Interface

NFC (Near Field Communication) refers to a standard for wireless data transfer between different devices over short distances.

The vacuum switch VSi functions as a passive NFC tag that can be read or written to by a reading device such as a smartphone or tablet with NFC activated. Access to the parameters of the vacuum switch via NFC also works without a connected supply voltage.

There are two options for communicating via NFC:

- Read access only can be obtained via a website viewed in a browser. For this, no additional app is needed. The reading device requires only that NFC and the Internet connection are enabled.
- Another option for communication is the “Schmalz ControlRoom” control and service app. In addition to pure read access, the app allows you to actively write the parameters of the device via NFC.
  The “Schmalz ControlRoom” app is available in the Google Play Store or Apple App Store.

The following instructions should be followed to ensure the optimum data connection between the NFC reading device and the vacuum switch VSi:

- In the VSi version, the antenna is located behind the NFC label on the housing
- In the VSi...D display version, the antenna is located directly behind the display
- The mobile device itself must be aligned as parallel as possible to the front of the switch
- The antenna of the mobile device should be positioned in the center of the antenna of the switch

The reading distance is very short for NFC applications. Determine the position of the NFC antenna in the reading device used. If parameters of the device are modified via NFC, then the power supply must subsequently remain stable for at least three seconds to prevent data loss (error E01).

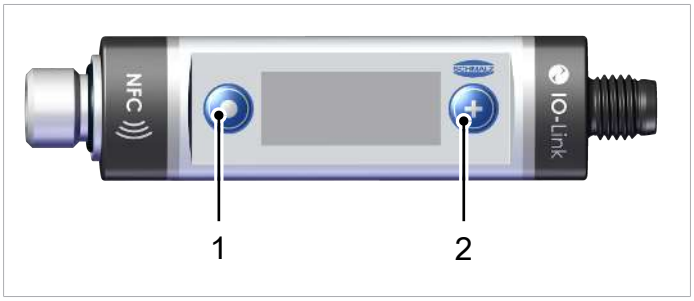
8 Operating Concept

8.1 Manual Operation of the Display Version

The switch is operated using the **MODE** (1) and **SET** (2) buttons.

Settings are configured using software menus. The operating concept is set up according to VDMA 24574-1 and is divided into three menu levels:

- Basic menu
- Menu for additional functions (EF)
- Info menu (INF)



Setting the switch in the basic menu is usually sufficient for standard applications.

The following information can be shown on the display:

- Actual vacuum/pressure measurement value
- Selected menu item
- Settings
- Error messages

After a parameter is set in the operating menu, the power supply of the switch must remain stable for at least 3 seconds. Otherwise, there may be a loss of data and the resulting error E0 1.

8.2 Display of Vacuum and Pressure Values

In the basic operating menu state, the actual measurement value is displayed on the basis of the chosen display unit. All units are available in millibar, kilo pascal, inch-hg and PSi. The information displayed varies depending on the device version and the position of the measurement value in the vacuum and pressure range:

Measurement value	**Version V**				**Version P10**				**Version VP8**			
	mbar	kPa	inHg	psi	mbar	kPa	inHg	psi	mbar	kPa	inHg	psi
10 bar	FFF											
9 bar	FFF				9.00	900	266	131	FFF			
8 bar	FFF				8.00	800	236	116	8.00	800	236	116
6 bar	FFF				6.00	600	177	87	6.00	600	177	87
-800 bar	800	80.0	23.6	11.6	-FF				800	80.0	23.6	11.6
-1000 bar	-FF											

With version V, the vacuum value, i.e. the vacuum compared to the ambient air pressure, is displayed as a positive; in version P10, it is displayed based on the pressure.

In version V8, the pressure is positive and vacuum is negative; however, the positive/negative sign is not displayed. You can determine whether the value is positive or negative using the table due to the presence of a decimal point. The switching threshold SPx/FHx and rPx/FLx in the operating menu is displayed based on the same method.

If an error status is active, it is indicated in the display through a periodic switch with the measurement value. For recognition purposes, a prefix "E" stands for error, followed by the error number.

One exception is error 7 (operating voltage too low): in this case "E07" will be permanently indicated in the display and the switch will delay further user entries until the operating voltage has reached the necessary level again.

8.3 Navigating in the Menu

You can switch from the home screen to the main menu by pressing the **SET BUTTON**.

To scroll through the menu press the **SET BUTTON**.

When you find your desired menu item, select it using the **MODE BUTTON**.

If there is a submenu ("EF" and "INF") this can also be browsed in the same manner using the **SET BUTTON**.

You can exit the menu at any point by pressing the **SET** and **MODE** buttons.

8.4 Editing Parameters

If a menu item has been selected, the current value first appears on the display.

For parameters that can be set, the whole value or lowest number will flash and can be changed by using the **SET BUTTON**. When doing so, the possible settings are run through cyclically.

With version VP8, the values of the switching thresholds SPx/FHx and rPx/FLx can be positive (pressure measurement range) as well as negative (vacuum measurement range). In this case, the desired range for the new value is set at the start of the editing process. The text [PrS] for pressure or [UAc] for vacuum will firstly flash and can be selected accordingly.

For numerical values consisting of 3 numbers, you can use the **MODE BUTTON** to change to the next higher number.

At the end of the editing process, press the **MODE BUTTON** again after the last number. The new value then appears on the display for 2 seconds without flashing.
If the new value is invalid, the display shows a message and the old value is retained:

- [oor] (out of range) means that the new value is generally outside the value range (e.g. SP1 > 8.0 bar in the VP8 version)
- [inc] (inconsistent) means that the value overlaps with the current setting of another parameter, e.g. rP1 > SP1

You can cancel the editing process at any time by pressing the **SET** and **MODE** buttons simultaneously.

Example of "Setting a Number Value":

Changing SP1 from 750 mbar to 725 mbar with V version

- ✓ The switch is in its basic state (display mode)

1. Use the **SET** button to select the parameter SP 1.
2. Press the **MODE** button
   ⇨ Choose the menu item; lowest number flashes
3. Press **SET** 5 times
   ⇨ The lowest digit changes to 5
4. Press the **MODE** button
   ⇨ The middle number flashes

5. Press **SET** 7 times
   ⇨ The middle number changes to 2
6. Press the **MODE** button
   ⇨ The highest number flashes
7. Press the **MODE** button

⇨ The new value of 725 mbar for SP 1 is confirmed

After 2 seconds, the system automatically returns to the SP 1 menu parameter.

Example of "Setting a Number Value":

Changing SP1 from -750 mbar to +3.2 bar **with VP8 version**

✓ The switch is in its basic state (display mode)

1. Use the **SET** button to select the parameter SP 1.
2. Press the **MODE** button
   ⇨ Choose the menu item; lowest number flashes
3. Press the **MODE** button
   ⇨ The set operating range flashes as UAc (for vacuum) or PrS (for pressure).
4. Press the **SET** button to set the required PrS operating range and press the **MODE** button to confirm.
   ⇨ Choose the menu item; lowest number flashes
5. Press the **MODE** button
   ⇨ The middle number flashes
6. Press **SET** 2 times
   ⇨ The middle number changes to 2
7. Press the **MODE** button
   ⇨ The highest number flashes
8. Press **SET** 3 times
9. Press the **MODE** button

⇨ The new value of 3.20 bar for SP1 is confirmed

After 2 seconds, the system automatically returns to the SP 1 menu parameter.

Example of "Setting the Mode":

Changing switching point mode 1 from H.no to c.no

✓ The switch is located in the Extended Functions (EF) menu

1. Press the **MODE** button to select the parameter Ou 1
2. Press the **MODE** button
   ⇨ Select the menu item; the current setting or current value flashes (H.no in the example)
3. Press **SET** 4 times
   ⇨ The new setting or value is displayed (c.no here)

4. Press the **MODE** button
⇨ The new mode ⊏⊓⊐ setting is confirmed

After 2 seconds, the system automatically returns to the ⊓⊔ ⊺ menu parameter.

Example of "Triggering a Command":
Reset the erasable counters

✓ The switch is located in the Info menu (INF)
1. Press the **MODE** button to select the parameter ⊢ ⊺
2. Press the **SET** button several times to select the ⌐⊏⊢ parameter (for resetting the erasable counters (Ct1 and Ct2))
3. Press the **MODE** button
   ⇨ The display shows the preselection command execution "No" with ⊓⊐
4. Press the **SET** button
   ⇨ The setting or new value changes to "yes" and ⅄⊑⅀appears on the display
5. Press the **MODE** button
⇨ The command is executed

After 2 seconds, the system automatically returns to the home screen.

Write access from the IO-Link and NFC interfaces has a higher priority than the operating menu, but generally lasts only a few seconds. However, if editing is attempted at the same time using the menu, this will be rejected with the display ⊔⊐⊏.

8.5 Entering a PIN Code

If the menu was write protected with a PIN code, this must be entered first before a parameter can be changed. If there is an attempt to change a value, the message ⊑. ⊺.⊓ appears on the display and changes to the view for entering the 3-digit PIN code after 2 seconds. This is entered number by number like any other numerical value and confirmed with the **MODE** button.

When you enter a valid PIN, the message ⊔⊓⊏ appears and you can then change any number of parameters. You can also exit the menu in the meantime. If no button has been pressed or the switch has not been switched on or off for 1 minute, write protection is activated.

The entry of an invalid PIN is rejected with the message ⊔⊐⊏.

8.6 Leaving the Menu Automatically

The menus automatically close if no buttons are pressed for 1 minute.

If an error state occurs, the display also returns to the home screen so that the error number can be displayed. The menu can be called up and used again afterward.

If parameters are changed using one of the other interfaces, i.e. via the IO-Link or NFC, the menu will also close. The message ⊏⊓⊢ then appears for 2 seconds.

8.7 Main Menu

All settings for standard applications can be accessed and configured using the main menu.

The following table shows an overview of the display codes and parameters in the main menu:

Display code	Parameter	Explanation
SP 1 / FH 1	Switching point 1/upper window point 1	Deactivation value of control function (only active if [ctr] = [on])
rP 1 / FL 1	Reset point 1/lower window point 1	Reset value 1 for the control function
hy 1 / L- 1	Hysteresis switching point 1 (window mode) or leakage limit 1 (CM mode)	
SP2 / FH2	Switching point 2/upper window point 2	Switching value for the “Part Present” check signal
rP2 / FL2	Reset point 2/lower window point 2	Reset value 2 for the “Parts Present” signal
hy2 / L-2	Hysteresis switching point 2 (window mode) or leakage limit 2 (CM mode)	
Submenu: UAc	Vacuum operating range	Version VP8 only: Vacuum operating range in mbar
Submenu: PrS	Pressure operating range	Version VP8 only: Pressure operating range in bar
tcH	Teach-in function	For SP1 and SP2
cAL	Zero-point adjustment (calibration)	Calibrate vacuum sensor, zero point = ambient pressure
EF	Extended functions	Open the “Extended Functions” submenu
INF	Information	Open the “Information” submenu
Inc	Incorrect	The entered value is not within the permissible value range. This is an informational message that appears if incorrect information is entered.

8.8 Extended Functions menu (EF)

An “Extended Functions” menu (EF) is available for applications with special requirements.

The following table shows an overview of the display codes and parameters in the “Extended Functions” menu.

Display code	Parameter	Explanation
Ou 1	Switching function, switching output 1	Define the switching point mode: **H.no / H.nc:** Hysteresis function, normally open / normally closed **F.no / F.nc:** Window function, normally open / normally closed **C.no / C.nc:** Condition monitoring function, normally open / normally closed **d.no / d.nc:** Diagnosis function, normally open / normally closed
Ou2	Switching function, switching output 2	Switching function, switching output 2: (see “Ou1”)
dS 1	Switch-on delay for switching point 1	In ms; this parameter is not displayed in the menu if the switching point is in condition monitoring mode C.no.
dr 1	Switch-off delay for switching point 1	In ms; this parameter is not displayed in the menu if the switching point is in condition monitoring mode C.no.
dS2	Switch-on delay for switching point 2	In ms; this parameter is not displayed in the menu if the switching point is in condition monitoring mode C.no.
dr2	Switch-off delay for switching point 2	In ms; this parameter is not displayed in the menu if the switching point is in condition monitoring mode C.no.
un i	Vacuum unit	Define the displayed vacuum unit **bAr:** Vacuum value in millibar **kPa:** Vacuum value in kilopascal **IHg:** Vacuum value in inch of mercury **PSI:** Vacuum value in pound-force per square inch
Eco	Display in Eco mode	Set the display **off:** Eco mode is deactivated – the display remains on **Lo:** Display dimmed by 50% **on:** ECO mode is activated – the display switches off
d IS	Align the display	**Std:** Standard **Red:** Display rotated by 180°
P In	PIN code	Access rights, specify the PIN code, lock the menus
P-n	Signal type	Transistor functions of both outputs: PnP / nPn
rES	Reset	**No:** The values remain unchanged **YES:** Reset parameter values to factory settings

8.9 Info Menu (INF)

The “Info” (INF) menu is provided for reading out system data such as counters, the software version, part numbers and serial numbers.

The following table shows an overview of the display codes and parameters in the Info menu:

Display code	Parameter	Explanation
HI	Highest measured sensor value	since restart
LO	Lowest measured sensor value	since restart
rHL	Reset maximum and minimum values (HI/LO)	
cc1	Counter 1	Counter, switching ramp SP1 (non-erasable)
cc2	Counter 2	Counter, switching ramp SP2 (non-erasable)
ct1	Counter 1 (erasable)	Counter, switching ramp SP1 (erasable)
ct2	Counter 2 (erasable)	Counter, switching ramp SP2 (erasable)
rct	Reset the erasable counters	Ct1 and Ct2
Soc	Software	Display firmware revision
Art	Part number	Display the part number
Snr	Serial number	Display the serial number Information about the production period

Counter values and serial numbers are 9-digit whole numbers. These numbers are divided into 3 blocks of 3 numbers when shown on the display. One of the decimal points will flash to indicate whether it is referring to the highest, middle or lowest block. The display starts with the 3 highest-value digits and can be scrolled through using the **SET** button.

The part number for the switch is also divided into blocks of digits based on the display and can be scrolled through using the **SET** button. The decimal point indicates your position within the 11-digit part number.

8.10 Displaying the Basic Settings (Slide Show)

When you press the **MODE** button from the home screen, the following parameters are automatically displayed one after the other on the display (slide show):

- The value of switching point SP1
- The value of reset point rP1
- Operating mode display (SIO or IO link)
- The supply voltage US

The display cycle returns to the vacuum display after a complete cycle or can be canceled at any time by pressing any button.

The product is not a calibrated measuring device. However, the values may be used as a reference and for comparison measurements.

9 Description of Functions

9.1 Overview of Functions

Description	Availability			See section
	Operating menu	IO-Link	NFC	
Switching point setting	✓	✓	✓	(> See ch. 9.4 Switching Points, p. 28)
Switching point mode and logic	✓	✓	✓	(> See ch. 9.4.1 Switching Point Mode and Switching Point Logic, p. 28)
Teach-in	✓	✓	✓	(> See ch. 9.5 Teach-in for Switching Points, p. 32)
Switch-on and switch-off delay	✓	✓	✓	(> See ch. 9.6.1 Switch-on and Switch-off Delay, p. 32)
Transistor function	✓	✓	✓	(> See ch. 9.6.2 Transistor Function, p. 33)
Display unit	✓	✓	✓	(> See ch. 9.7.1 Setting the Vacuum or Pressure Unit, p. 33)
Display alignment	✓	✓	✓	(> See ch. 9.7.2 Display Alignment, p. 33)
Eco mode	✓	✓	✓	(> See ch. 9.7.3 ECO Mode, p. 33)
IO-Link device access locks	✗	✓	✗	(> See ch. 9.8.3 IO-Link Device Access Locks, p. 34)
Extended device access locks	✗	✓	✗	(> See ch. 9.8.4 Extended Device Access Locks, p. 35)
Menu PIN	✓	✓	✓	(> See ch. 9.8.1 PIN Code for Write Protection, p. 34)
NFC PIN	✗	✓	✗	Access Rights: PIN Code for NFC Write Protection [ISDU 91]
Part number	✓	✓	✓	(> See ch. 9.9.1 Device Identity, p. 35)
Software version	✓	✓	✓	(> See ch. 9.9.1 Device Identity, p. 35)
Serial number	✓	✓	✓	(> See ch. 9.9.1 Device Identity, p. 35)
IO-Link identification data	✗	✓	✓	(> See ch. 9.9.1 Device Identity, p. 35)
User-specific identification	✗	✓	✓	(> See ch. 9.9.2 User-Specific Localization, p. 35)
Voltage measurement	✓	✓	✓	(> See ch. 9.3 Monitoring the Operating Voltage, p. 28)
Minimum and maximum values	✓	✓	✓	(> See ch. 9.10.1 Minimum and Maximum Values, p. 36)
Counter	✓	✓	✓	(> See ch. 9.10.2 Counters, p. 36)
Warnings and errors	✓	✓	✓	(> See ch. 10 Help with Malfunctions, p. 38)
System status	✗	✓	✓	(> See ch. 9.10.3 Status Signals, p. 36)
Condition monitoring (CM)	✗	✓	✓	(> See ch. 9.10.4 Leakage Measurement, p. 36)
Reset to factory settings	✓	✓	✓	(> See ch. 9.11.1 Reset to Factory Settings, p. 37)

Description	Availability			See section
Zero point calibration	✓	✓	✓	(> See ch. 9.11.2 Calibrating the Vacuum Sensor, p. 37)
Resetting HI/LO	✓	✓	✓	(> See ch. 9.11.1 Reset to Factory Settings, p. 37)
Reset counters	✓	✓	✓	(> See ch. 9.10.2 Counters, p. 36)

9.2 Measurement of Pressure and/or Vacuum

Depending on the version, the VSi-series switches measure the pressure and/or vacuum relative to the ambient air pressure:

- VSi-V vacuum switch: The vacuum will be indicated as positive pressure difference.
- Pressure switch VSi-P10: The pressure will be indicated as a positive pressure difference.
- VSi-VP8 combined vacuum/pressure switch: Pressure is displayed as positive, vacuum is displayed as negative. The measurement value via IO-Link process data is shown as a signed binary number. The sign is indicated by the position of the decimal point on the display.

“FFF” appears on the display when the pressure is too high. In the case of versions P10 and VP8, an event indicating that the measurement value is outside the valid range is also then sent via IO-Link.

The message “-FF” appears in the display when there is high vacuum and the appropriate IO-Link event will be sent in the case of versions V and VP8.

In the IO-Link operation, these cases ensure that a fixed numerical value outside the normal measurement range is transmitted instead of a measurement value (see “Special Values” in the data dictionary). These numbers should not then be interpreted as measurement values but as an indicator of an overflow.

9.3 Monitoring the Operating Voltage

The switch measures the amount of its operating voltage US with a resolution of 100 mV.

When the valid voltage range is left, corresponding error statuses are triggered. In the undervoltage range, the switch delays all inputs by the user.

The product is not a voltage meter! However, the measured values and the system responses derived from them provide a helpful diagnostics tool for condition monitoring.

9.4 Switching Points

In the following, the switching point number is always denoted by an "x" when information applies equally to both switching points. SPx therefore stands for both SP1 and SP2.

9.4.1 Switching Point Mode and Switching Point Logic

Both switching points are identical in terms of function and can be parameterized independently of one another.

There are 4 different switching point modes to choose from:

- Two-point mode H.no / H.nc
- Window mode F.no / F.nc
- Condition monitoring mode C.no / C.nc
- Diagnostics mode D.no / D.nc

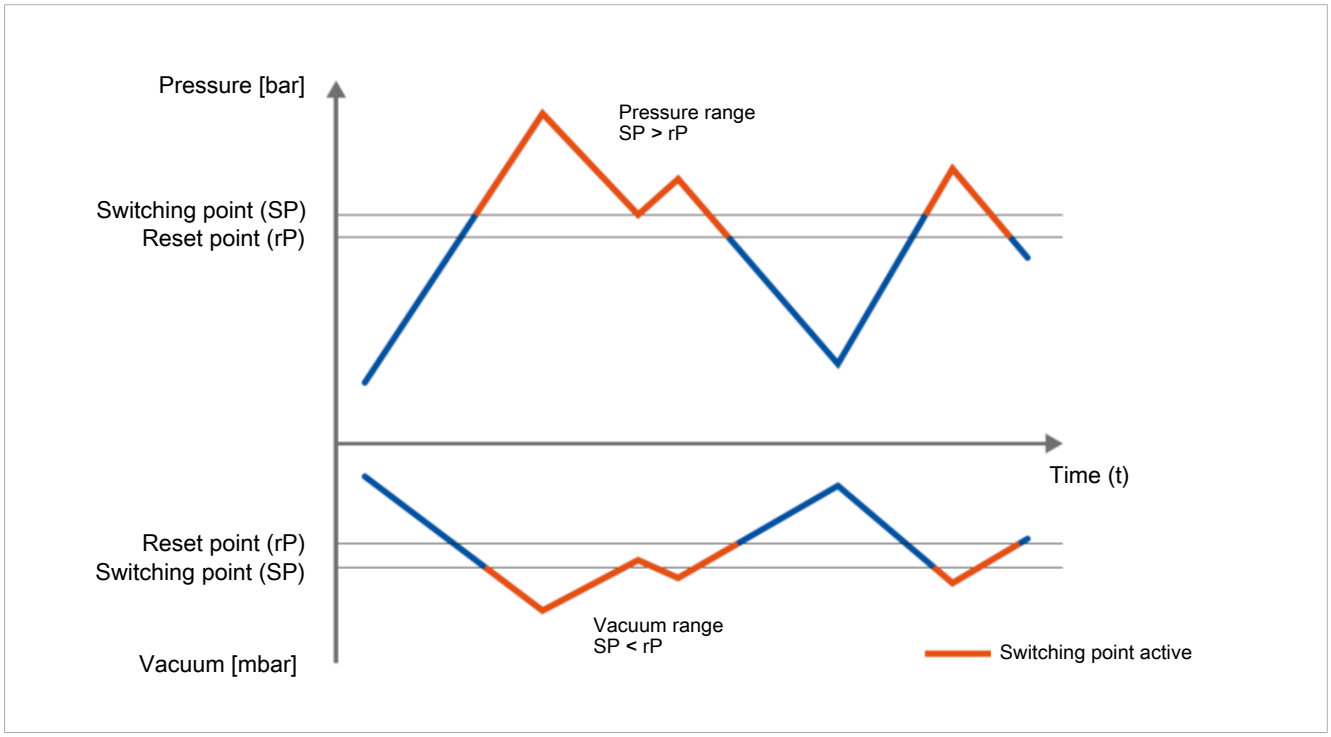
In this case, there is a differentiation between the switching point logic NO (normally open) and NC (normally closed). A change in the switching point logic from NO to NC causes a logical inversion of the electrical switching outputs, the switching point bits in the IO-Link process data and the orange LED display(s) on the switch.

The condition monitoring and diagnostics modes cannot be activated simultaneously for both switching points. That means that when a switching point is already parameterized to C.no, C.nc, D.no or D.nc, the other can only adopt the modes H.no, H.nc, F.no or F.nc.

The version P10 is purely a pressure switch and therefore does not offer condition monitoring mode to monitor the vacuum leakage.

With the version VP8 with combined vacuum/pressure measurement range, the switching points react according to the position of their “upper” switching point SPx/FHx as a pressure switch or vacuum switch. Values are considered “bigger” when they are further from zero and as “smaller” when they are closer to zero.

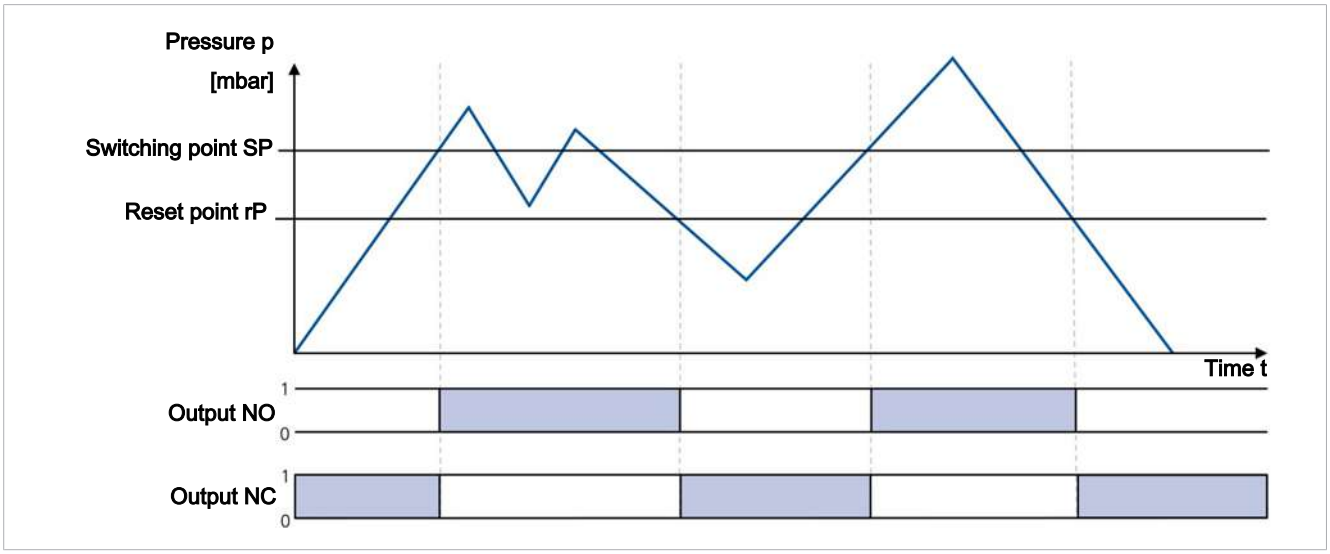
The following diagram shows the switching point behavior using the two-point mode as an example:



9.4.2 Two-Point Mode

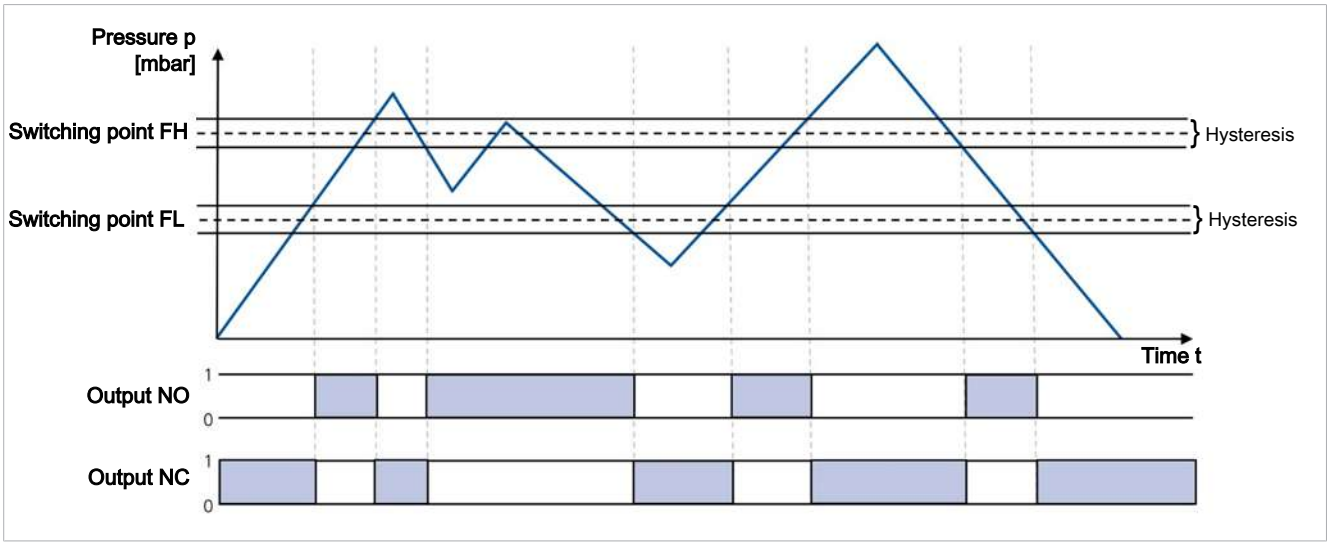
The two-point mode is a threshold switch with hysteresis.

When the measurement value increases, the switching point will be active when the switch-on threshold SPx is reached and remains on until it falls below the reset threshold rPx. The following must always apply for switching thresholds and reset thresholds: |SPx| > |rPx|. The hysteresis is therefore defined by the difference |SPx – rPx|.



9.4.3 Window Mode

In window mode, the switching point is active when the measurement value is between the upper window point FHx and the lower window point FLx. Outside this window, the switching point is inactive. If necessary, a common switching hysteresis Hyx can be set, which symmetrically applies to both window points. For the parameters of the upper window point FHx, lower window point FLx and hysteresis Hyx, the following must always apply: |FHx| > |FLx| + Hyx



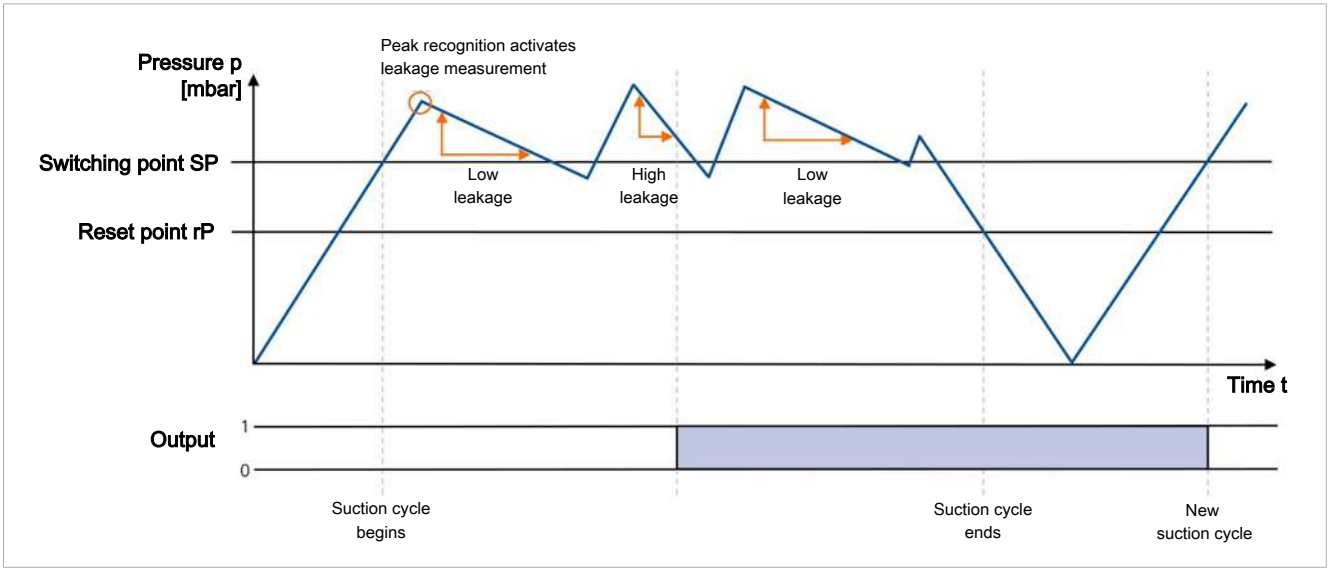
When switching from two-point mode to window mode, the current switching points SPx and rPx are interpreted as window points FHx and FLx. They are the same internal parameters (also see the data dictionary). If the resulting set of parameters are not valid in the new mode (e.g. hysteresis too big in window mode), it is not possible to switch the mode because the difference must be at least 30 mbar.

9.4.4 Condition Monitoring Mode (Leakage Measurement)

The condition monitoring switching point mode is used to monitor the quality of a vacuum suction system. (A requirement for this is that the suction system that is pneumatically connected to the switch has an air saving function or vacuum control in accordance with the two-point principle.) In this case, the vacuum switch can measure the vacuum leakage in millibars per second between two drainage cycles. The switching point is then activated when a leakage exceeds its maximum permissible setting, which can be configured.

The detection of an external suction cycle is carried out using the adjustable limit values SPx and rPx that indicate the limits for picking up and depositing a workpiece. The threshold for the maximum permissible leakage is set using the parameter L-x in millibars per second.

The following diagram shows the case of a typical suction cycle where the system indicates a leakage and the vacuum generator drains many times:



With the VP8 version, the corresponding switching threshold SPx must be in the vacuum range so that condition monitoring mode can be activated.

9.4.5 Diagnostics Mode

Diagnostics mode monitors the internal warnings and error messages of the switch. When any error message (error code in display or ISDU 130) or warning (CM bit in ISDI 146) appears, the switching point is activated.

Diagnostic mode also implements the functionality of condition monitoring mode, provided that the corresponding switching point SPx lies within the vacuum range. That means that in this case the switching point is also activated when the leakage monitoring issues a warning.

With the V and VP8 versions, diagnostics mode also includes the functionality of the condition monitoring mode at the same time, provided that the associated switching point SPx is in the vacuum range. That means that in this case the switching point is also activated when the leakage monitoring issues a warning.

9.5 Teach-in for Switching Points

A teach-in function is available to make it easier to set the limit values. This only affects one switching point at a time and does not change the selected switching point mode or the switching point logic.

- ✓ To cancel a teach-in process, the required switching point must first be selected. This is done via IO-Link, via ISDU 58 or in the menu item "ꓕꓒꓧ" in the basic menu.
- ▸ In the menu, the teach-in starts immediately when the **MODE** button is pressed; if it is done via IO-Link, the appropriate system command has to be written via ISDU 2 first.
- ⇨ For the teach-in in two-point mode, the switch-on threshold SPx is set so that it is 20% below the current measured value. The reset threshold for vacuum values is set 50 mbar below the switch-on threshold, and 300 mbar below it for pressure values. These specifications for the teach-in in the vacuum range of the VP8 version again refer to the absolute value of the measurement value.
  In window mode, the switch-on threshold FHx is set 100 mbar above the current measured value and the switch-off threshold is set 100 mbar below the current vacuum value. When a pressure value is applied, the values are 1 bar above or 1 bar below. The associated hysteresis for window mode is set at 10 mbar for vacuum values and 100 mbar for pressure values.
- ⇨ If the selected switching point (ISDU parameter 58) for the teach-in function is in condition monitoring or diagnostics mode, the values for two-point mode are set.
- ⇨ After a successful teach-in process, an automatic display cycle of the newly set values appears in the display.

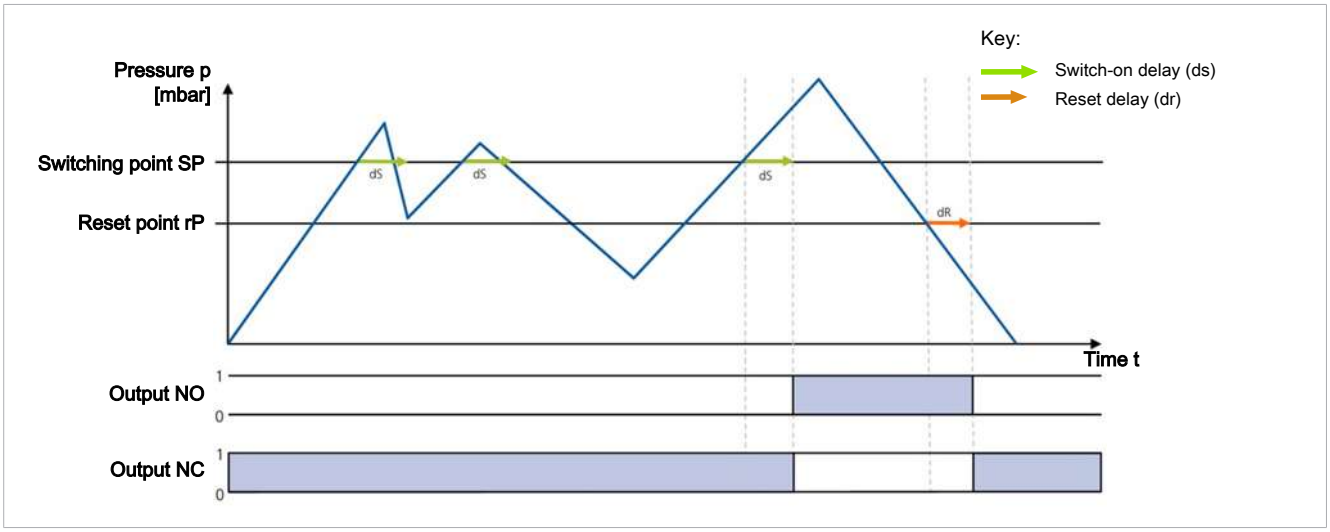
9.6 Additional Switching Point Settings

9.6.1 Switch-on and Switch-off Delay

For each switching point and each associated limit value, a delay time can be set, with the exception of condition monitoring mode. Here, this parameter can only be defined for the switching point SP1. In Condition monitoring mode, the parameters dSx and drx are also not shown on the display.

Due to the switch-on and switch-off delay, short-term fluctuations of the measurement signal can be hidden. In this case, the switch delay dSx is based on a situation in which the measurement value increases (from the absolute value). Accordingly, the reset delay drx is based on a decreasing measurement value.

The following diagram shows the option to set the delay times using two-point mode:



9.6.2 Transistor Function

The electrical characteristic of the switching outputs can be switched between PNP switching (“plus switching” or also “24 V switching”) and NPN switching (“zero switching” or also “GND switching”). Both switching outputs can always be set together, which does not affect the IO-Link operation.

The transistor function is set in the EF menu under the parameter P-n.

9.7 Display Screen

9.7.1 Setting the Vacuum or Pressure Unit

The physical unit that is used to display the measured values, switching points and hystereses on the display can be set using the [unit] menu item in the Extended Functions (EF) menu:

Unit	Explanation
bar	The vacuum level is displayed in mbar. The pressure level is displayed in bar. The setting for this unit is [bAr].
Pascal	The vacuum/pressure values are displayed in kPa. The setting for this unit is [kPA].
Inch of Hg	The vacuum/pressure values are displayed in inHg. The setting for this unit is [inHG].
psi	The vacuum/pressure values are displayed in psi. The setting for this unit is [PSI].

Selection of the unit only affects the display. The units of the parameters that can be accessed via IO-Link and NFC are not affected by this setting. These units are always measured in mbar (see the data dictionary).

9.7.2 Display Alignment

The display alignment can be rotated by 180 degrees using the parameter d IS to adapt to the installation position of the ejector.

When rotated, the decimal point on the far right is no longer displayed and is therefore missing from the display of the counter statuses and serial numbers.

9.7.3 ECO Mode

The product offers the option of switching off or dimming the display to save energy.

ECO mode can be activated and deactivated in the EF menu under the menu item Eco or via the IO-Link.

- ECO mode “on”: The numerical display switches off 1 minute after any button is pressed.
- ECO mode “Lo”: 1 minute after the last button is pressed, the numerical display will reduce to 50% of its normal brightness.

The display is reactivated by pressing any button or by an error message.

If you activate ECO mode using IO-Link, the display will immediately enter energy-saving mode.

9.8 Access Rights

9.8.1 PIN Code for Write Protection

A PIN can be used to prevent the parameters from being changed via the user menu.

The current settings are still displayed. The PIN is set to 000 on delivery, meaning access to the parameters is not locked. A valid PIN between 001 and 999 must be entered to activate write protection. If write protection is activated with a customer-specific PIN, the desired parameters can be changed within one minute after the correct code is entered. If no changes are made within one minute, write protection is automatically reactivated. The PIN must be reset to 000 to permanently deactivate the lock.

Enter the PIN using the Pin parameter in the configuration menu.

When the PIN is activated, [Loc] flashes on the display for write access.

A PIN is recommended because carrying out parameterization while the device is in operation can change the status of signal inputs and outputs.

9.8.2 NFC PIN Code

Parameterization via NFC can be protected against unintentional access by means of a PIN code.

The PIN code can be set with the ControlRoom app under Device settings > PIN code for NFC or via the IO-Link parameter “PIN code NFC” 0x005B.

When delivered, the PIN code is **000** and a lock is therefore not active.

The NFC PIN code can be changed only using this parameter.

When a PIN code is set between 001 and 999, the valid PIN must be entered for every subsequent write process using a mobile NFC device so that the device accepts the changes.

For more detailed information, see the data dictionary attached.

9.8.3 IO-Link Device Access Locks

In IO-Link mode, the “Device access locks” default parameter is available to prevent changes to parameter values using the user menu or IO-Link. You can also prevent the use of the Data storage mechanism described in IO-Link Standard V1.1.

Bit	Meaning
0	Parameter write access locked (Parameters cannot be changed via IO-Link)
1	Data storage locked (Data storage mechanism is not triggered)
2	Local parametrization locked (Parameters cannot be changed via the user menu)

Coding for the device access locks

A menu lock using the Device access locks parameter has a higher priority than the menu PIN. In other words, this lock cannot be bypassed by entering a PIN and remains in SIO mode.

It can only be canceled using IO-Link, not on the device itself.

9.8.4 Extended Device Access Locks

In the extended device access locks parameter, you have the option of completely preventing NFC access or limiting it to read-only function:

Bit	Meaning
0	NFC write locked (parameters cannot be changed via NFC)
1	NFC disabled (NFC tag is completely disabled)

The NFC lock using the extended device access locks parameter has a higher priority than the NFC PIN. That means that this lock also cannot be bypassed by entering a PIN.

9.9 Device Identification

9.9.1 Device Identity

The IO-Link protocol provides a range of identification data for compliant devices that can be used to uniquely identify a particular device. The switches in the VSi series also include additional identification parameters.

All of these parameters are ASCII character strings that adapt their length to the relevant content.

The following can be queried:

- Manufacturer's name and website
- Product series and exact type designation
- Part number and development status
- Serial number and date code
- Version status of the hardware and firmware

All character strings are available via IO-Link.

All character strings are available via IO-Link and NFC; only part numbers, serial numbers and the firmware revision can be retrieved from the menu.

9.9.2 User-Specific Localization

The following parameters are available for each vacuum switch when saving user-specific information:

- Identification of the installation location
- Identification of the storage location
- Equipment labeling from the circuit diagram
- Installation date
- Geo-location
- Web link to the relevant IODD

The parameters are ASCII character strings with the maximum length given in the data dictionary. They can also be used for other purposes if necessary.

The **NFC web link** parameter is a special feature (link to IoT server). This parameter must include a valid web address beginning with http:// or https:// and is automatically used as a web address for NFC read access operations.

As a result, read access operations from smart phones or tablets are rerouted e.g. to an address in the company's own intranet or a local server.

9.10 System Monitoring and Diagnostics

9.10.1 Minimum and Maximum Values

The maximum and minimum pressure/vacuum and operating voltage values that were measured since the last switch-on are logged by the switch and can be queried.

The maximum and minimum values can be reset via IO-Link or NFC during operation using the appropriate system commands.

For pressure/vacuum (HI/LO), this can also be done in the operating menu under the EF menu and the rHL parameter.

9.10.2 Counters

The vacuum switch has two non-erasable counters cc 1 and cc2 as well as two erasable counters ct 1 and ct2 in the INF menu.

These counters count the positive switching ramps of the switching points 1 and 2:

Designation	Display code or parameter	Description
Counter 1	cc 1	Counter for positive switching ramps SP1 (non-erasable)
Counter 2	cc2	Counter for positive switching ramps SP2 (non-erasable)
Counter 3	ct 1	Counter for positive switching ramps SP1 (erasable)
Counter 4	ct2	Counter for positive switching ramps SP2 (erasable)

The average switching frequency of the air saving function can be determined using the difference between counters 1 and 2.

The erasable counters ct1 and ct2 can be reset to 0 during operation via IO-Link by using the appropriate system commands.

In the operating menu, this is possible via the INF menu and the parameter rct.

The storage of the non-erasable counter readings only occurs every 500 steps. That means that when the operating voltage is switched off, up to 499 steps of the counter are lost.

9.10.3 Status Signals

The current status of the product, i.e. whether errors or warnings are active, can be queried in various ways:

- Using the standard “Device status,” “Detailed device status” and “Error count” IO-Link parameters
- Using the "Active error code" and "Condition monitoring" parameters
- Using the “Extended device status,” which transmits the entire display of the device status with classification of the severity level of errors and warnings

9.10.4 Leakage Measurement

The current measured leakage in millibars per second can be read out via the ISDU 160.

This is done regardless of whether one of the switching points of the switch is set to condition monitoring mode.

9.11 System Commands

9.11.1 Reset to Factory Settings

⚠ WARNING

By activating/deactivating the product, output signals lead to an action in the production process!

Personal injury

- Avoid possible danger zone.
- Remain vigilant.

All the setting parameters for the product are reset to factory settings using this function.

The function for resetting factory settings does not affect the following elements:

- The counter readings
- The zero-point adjustment of the sensor
- The IO-Link parameter “Application specific tag”

The function is executed using the [rES] menu item in the Extended Functions menu or via IO-Link.

The factory settings for the product can be found in the chapter (> See ch. 4.4 Factory Settings, p. 13).

9.11.2 Calibrating the Vacuum Sensor

Since the production conditions for the integrated vacuum sensor can vary, we recommend calibrating the sensor once it is installed. To calibrate the vacuum sensor, the system’s vacuum circuit must be open to the atmosphere.

The function for zero-point adjustment of the sensor is performed in the main menu under the parameter cAL or via IO-Link.

A zero offset is only possible in the range of ±3 percent of the end value of the measuring range.

When the permissible limit is exceeded by ±3%, error code E03 appears on the display.

10 Help with Malfunctions

Fault	Cause	Measure
Master or peripheral power supply disturbed	Connection to IO-Link master with IO-Link class-B port	▸ Connection to IO-Link class A port
No output signal	Incorrect electrical connection	▸ Check electrical connection and pin assignment
	Transistor function (PNP/NPN) not appropriate for the application	▸ Adjust the transistor function (PNP/NPN) to the device's electrics
	Switching logic inverted	▸ Adjust the NO/NC switching point logic
No IO-Link communication	Incorrect electrical connection	▸ Check electrical connection and pin assignment
	Master not correctly configured	▸ Check configuration of the master to see whether the port is set to IO-Link
	IODD connection does not work	▸ Check for the appropriate IODD
No NFC communication	No NFC connection between switch and reader (e.g. cell phone)	▸ Hold the reader very close to the intended position on the switch
	NFC function on reader (e.g. cell phone) not activated	▸ Activate NFC function on reader (e.g. cell phone)
	NFC function is deactivated via IO-Link	▸ Activate NFC function on reader
	Write operation canceled	▸ Hold the reader at the intended position on the product for longer
No parameters can be changed using the NFC function	The PIN for NFC write protection is activated via IO-Link	▸ Enable the NFC write permissions via IO-Link.
No display on the screen	ECO mode activated	▸ Press any button or deactivate ECO mode
	Incorrect electrical connection	▸ Check electrical connection and pin assignment
Display shows error code	See the “Error codes” table	▸ See the “Error codes” table in the chapter (> See ch. 11 List of Error Numbers, p. 39)
IO-Link warning message “Leakage too high” although handling cycle is working optimally	Limit value L-x (permissible leakage per second) set too low	▸ Determine typical leakage values in a good handling cycle and set as limit value
	Limit values SPx and rPx for leakage measurement set too low	▸ Set limit values in such a way that there is a clear differentiation between the neutral and suction system states
IO-Link warning message “Leakage too high” does not appear although there is high leakage in the system	Limit value L-x (permissible leakage per second) set too high	▸ Determine typical leakage values in a good handling cycle and set as limit value
	Limit values SPx and rPx for leakage measurement set too high	▸ Set limit values in such a way that there is a clear differentiation between the neutral and suction system states

11 List of Error Numbers

When a known error occurs, this is reported in the form of an error number. In SIO mode, the error messages are displayed periodically in the display with the measured value. On the display, an “E” for error precedes the error message, followed by the error number.

Additional descriptions of errors and system statuses are available via IO-Link and NFC (> See ch. 9.10.3 Status Signals, p. 36).

The system status is automatically refreshed on the NFC tag every 5 minutes at the latest. That means that an error may be displayed via NFC even though it has already disappeared. The following table shows all the error codes:

Display code	Fault	Possible cause	Measure
E01	Data error	Electronic errors – internal data management – EEPROM, operating voltage was disconnected too quickly after changing the parameters, saving process was not complete	▸ Reset to factory settings. Recording of a valid data set via IO-Link (with engineering tool)
E03	CAL error	Zero-point adjustment of the vacuum sensor outside ±3% FS cAL was canceled when the measurement value was too high or too low	▸ Vent pneumatic connection before cAL is carried out
E07	Under voltage US	Supply voltage is too low	▸ Check power supply unit and power load
E08	Communication canceled	IO-Link communication canceled without explicit “fallback” from master	▸ Check cabling for the master
E11	Overload / short circuit OUT1	Power load too high, short circuit	▸ Check cabling and power consumption for the connected consumers
E12	Overload / short circuit OUT2	Power load too high, short circuit	▸ Check cabling and power consumption for the connected consumers
E17	Over voltage US	Supply voltage is too high	▸ Check power supply
E19	Overheating	Ambient temperature too high, output continuous load too high	▸ Ensure ventilation/cooling, check the power consumption of the connected consumers
E20	Teach-in error	Teach-in was carried out with invalid measured value (FFF/-FF), teach-in of the leakage mode was carried out with existing pressure	▸ Measurement value must be in the valid measurement range
FFF	Measurement range exceeded	Overpressure in the system, e.g. when blowing off	—
-FF	Overpressure in vacuum circuit	Overpressure in the system, e.g. when blowing off	—

The error E01 remains in the display after being shown once. Delete the error by switching off the power supply. If this error occurs again after the power supply is switched back on, then the device must be replaced.

12 Cleaning the Product

1. For cleaning, do not use aggressive cleaning agents such as industrial alcohol, white spirit or thinners. Only use cleaning agents with a pH between 7 and 12.
2. Remove dirt on the exterior of the device with a soft cloth and soap suds at a maximum temperature of 60° C. Make sure that the silencer in the exhaust outlet is not soaked in soapy water.
3. Ensure that no moisture can reach the electrical connection or other electrical components.

13 Warranty

Schmalz guarantees this system pursuant to our General Terms and Conditions of Sale and Delivery. The same applies to spare parts, provided that these are original parts supplied by us.

A warranty claim can only be accepted by Schmalz if the product has been installed and used in accordance with its corresponding operating and assembly instructions. In the case of inappropriate handling or use of force, any warranty and liability claims shall be void.

Damage and defects resulting from inadequate maintenance and cleaning, improper use, repair or attempted repair by unauthorized persons, as well as damage and defects resulting from alterations or modifications to the product and from replaced parts or materials that do not conform to the original specification are excluded from the warranty.

Wearing parts are not covered by the warranty.

14 Decommissioning and Disposal

14.1 Disposing of the Product

The components may only be prepared for disposal by qualified specialists.

1. Dispose of the product properly after replacement or decommissioning.
2. Observe the country-specific guidelines and legal obligations for waste prevention and disposal.

14.2 Materials Used

Component	Material
Housing	PA12
Fluid connection	Stainless steel
Seals	Nitrile rubber (NBR)

15 Accessories

Type	Designation	Description	Part no.
Mounting kit	BEF-WIN 21x34.5x59 1.5	Metal bracket for simple switch attachment; incl. 1/8" nut	10.06.02.00061
Connection cable VSi...	ASK B-M8-4 5000 PUR GE	M8-4 female connector, cable end open	10.06.02.00031
Connection cable VSi...	ASK B-M12-4 5000 PUR GE	M12-4 female connector, cable end open	21.04.05.00263
Connection cable VSi...	ASK-S B-M8-4 5000 M12-4 PUR	M8-4 female connector with M12-4 plug	21.04.05.00264
Connection cable VSi...	ASK-S B-M12-4 5000 M12-4 PUR	M12-4 female connector with M12-4 plug	21.04.05.00265
Screw-in tool	MONT-VORR MON VS	Screw-in aid for quick assembly with cordless screwdriver	10.06.02.00615
Mounting bracket	BEF-WIN 21x22x61.5 1.5 VSi-D-M8	Mounting bracket for version with display	10.06.02.00664
Mounting bracket	BEF-WIN 21x22x39 1.5 VSi-M8	Mounting bracket for version without display	10.06.02.00666
Plastic holder for mounting	HTR-VSi clip	Plastic holder for mounting vacuum switches and pressure switches from the VSi / VS-V-SA series	10.06.02.00718

16 Declarations of Conformity

16.1 EU Declaration of Conformity

The manufacturer Schmalz confirms that the product Vacuum/pressure switch described in these operating instructions fulfills the following applicable EU directives:

2014/30/EU	Electromagnetic Compatibility
2011/65/EU	Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment

The following harmonized standards were applied:

EN ISO 12100	Safety of machinery — General principles for design — Risk assessment and risk reduction
EN 61000-6-1	Electromagnetic Compatibility - Immunity
EN 61000-6-4+A1	Electromagnetic compatibility - Part 6-4: Generic standards - Emission standard for industrial environments
EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

The EU Declaration of Conformity valid at the time of product delivery is delivered with product or made available online. The standards and directives cited here reflect the status at the time of publication of the operating and assembly instructions.

16.2 UKCA Conformity

The manufacturer Schmalz confirms that the product described in these operating instructions fulfills the following applicable UK regulations:

2016	Electromagnetic Compatibility Regulations
2012	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations

The following designated standards were applied:

EN ISO 12100	Safety of machinery — General principles for design — Risk assessment and risk reduction
EN 61000-6-1	Electromagnetic Compatibility - Immunity
EN 61000-6-4+A1	Electromagnetic compatibility - Part 6-4: Generic standards - Emission standard for industrial environments
EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

The Declaration of Conformity (UKCA) valid at the time of product delivery is delivered with the product or made available online. The standards and directives cited here reflect the status at the time of publication of the operating and assembly instructions.

IO-Link

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IO-Link Implementation

Vendor ID		234 (0x00EA)
Device ID	VSi V	100610 (0x018902)
	VSi P10	100611 (0x018903)
	VSi VP8	100613 (0x018905)
SIO-Mode		Yes
IO-Link Revision		1.1 (compatible with 1.0)
IO-Link Profile		Smart Sensor Profile with 2 Binary Data Channels, 1 Process Data Variable, Teach-In and Diagnosis
IO-Link Bitrate		38.4 kBit/sec (COM2)
Minimum Cycle Time		2.3 ms
Process Data Input		2 bytes
Process Data Output		None

Process Data

Process Data Input	Name	Bits	Data Type	Access	Special Values	Remark
PD In Byte 0	Vacuum in mbar, MSB	7…0	VSi V: 14-bit unsigned integer VSi P10: 14-bit unsigned integer VSi VP8: 14-bit signed integer	ro	VSi V: 10000 = Overflow, 16383 = Underflow (pressure) VSi P10: 10000 = Overflow, 16383 = Underflow (vacuum) VSi VP8: 8191 = Overflow P, -8192 = Overflow V	Most significant 8 bits of sensor measurement value (mbar)
PD In Byte 1	Vacuum in mbar, LSB	7…2				Least significant 6 bits of sensor measurement value (mbar)
	Switching Point 2	1	Boolean	ro		Logic state of switch point 2
	Switching Point 1	0	Boolean	ro		Logic state of switch point 1

ISDU Parameters

ISDU Index dec	ISDU Index hex	Subindex dec	Display Appearance	Parameter	Size	Value Range	Access	Default Value	Remark
Identification									
Device Management									
16	0x0010	0		Vendor Name	1...32 bytes		ro	J. Schmalz GmbH	Manufacturer designation
17	0x0011	0		Vendor Text	1...32 bytes		ro	www.schmalz.com	Internet address
18	0x0012	0		Product Name	1...32 bytes		ro	VSi / VSi-D	General product name
19	0x0013	0		Product ID	1...32 bytes		ro	VSi / VSi-D	Product variant name
20	0x0014	0		Product Text	1...32 bytes		ro	VSi V M12-4	Order-code
21	0x0015	0	Snr	Serial Number	9 bytes		ro	000000001	Serial number
22	0x0016	0		Hardware Revision	2 bytes		ro	00	Hardware revison
23	0x0017	0	SoC	Firmware Revision	4 bytes		ro	1.11	Firmware revision
240	0x00F0	0		Unique ID	20 bytes		ro		Unique device identification number
241	0x00F1	0		Device Features	11 bytes		ro		Type code of device features (see IODD)
250	0x00FA	0	Art	Article Number	14 bytes		ro	10.06.02.*	Order-number
251	0x00FB	0		Article Revision	2 bytes		ro	00	Article revision
252	0x00FC	0		Production Date	3 bytes		ro		Date code of production (month, year)
254	0x00FE	0		Detailed Product Text	1...64 bytes		ro	VSi V M12-4	Detailed type description of the device
Device Localization									
24	0x0018	0		Application Specific Tag	1...32 bytes		rw	***	User string to store location or tooling information
242	0x00F2	0		Equipment Identification	1…64 bytes		rw	***	User string to store identification name from schematic
246	0x00F6	0		Geolocation	1…64 bytes		rw	***	User string to store geolocation from handheld device
247	0x00F7	0		IODD Web Link	1…64 bytes		rw	***	User string to store web link to IODD file
248	0x00F8	0		NFC Web Link	1…64 bytes		rw	https://myproduct.schmalz.com/#/	Web link to NFC app (base URL for NFC tag)
249	0x00F9	0		Storage Location	1…32 bytes		rw	***	User string to store storage location
253	0x00FD	0		Installation Date	1…16 bytes		rw	***	User string to store date of installation
Parameter									
Device Settings									
Commands									
2	0x0002	0		System Command	1 byte	5, 65, 130, 165, 66, 167, 168, 169	wo		0x05 (dec 5): Force upload of parameter data into the master 0x41 (dec 65): Execute single-value teach for currently selected SPx 0x82 (dec 130): Restore device parameters to factory defaults 0xA5 (dec 165): Calibrate sensor 0xA7 (dec 167): Reset erasable counters ct1 and ct2 0xA8 (dec 168): Reset voltage HI/LO 0xA9 (dec 169): Reset sensor HI/LO
58	0x003A	0		Teach-In Channel	1 byte	1, 2	rw	1	Select switch point 1 or 2 for teaching
59	0x003B	0		Teach-In Status	1 byte		ro		Result of last teach-in command: 0x00 = Channel changed 0x07 = Teach-in failed 0x11 = Teach-in successful
Access Control									
12	0x000C	0		Device Access Locks	2 bytes	0 - 7	rw	0	Bit 0: Parameter access lock (lock ISDU-write access) Bit 1: Data storage lock Bit 2: Local parameterization lock (lock menu editing)
90	0x005A	0		Extended Device Access Locks	1 byte	0 - 3	rw	0	Bit 0: NFC write lock Bit 1: NFC disable
77	0x004D	0	Pin	Menu PIN code	2 bytes	0 - 999	rw	0	0 = Menu editing unlocked >0 = Menu editing locked with pin-code
91	0x005B	0		NFC PIN code	2 bytes	0 - 999	rw	0	Pass code for writing data from NFC app
Initial Settings									
73	0x0049	0	P-n	Signal Type	1 byte	0 - 1	rw	0	0 = PNP 1 = NPN
74	0x004A	0	uni	Display Unit	1 byte	0 - 3	rw	0	0 = mbar 1 = kPa 2 = inHg 3 = psi
76	0x004C	0	Eco	Eco-Mode	1 byte	0 - 2	rw	0	0 = off 1 = on (full eco mode with display switching off completely) 2 = Lo (medium eco mode with display dimmed to 50%)
79	0x004F	0	dIS	Display Rotation	1 byte	0 - 1	rw	0	0 = Standard 1 = Rotated
Process Settings									
Switch Point 1									
60	0x003C	1	SP1/FH1	Switch Point 1 - Upper Threshold	2 bytes	V: 999 >= SP1 > rP1 999 >= FH1 > FL1+Hy1 P: 9999 >= SP1 > rP1 9999 >= FH1 > FL1+Hy1 VP: 8000 >= SP1 > rP1 8000 >= FH1 >FL1+Hy1	rw	V: 750 P: 5500 VP: -750	Unit mbar
60	0x003C	2	rP1/FL1	Switch Point 1 - Lower Threshold	2 bytes	V: rP1/FL1 >= 0 P: rP1/FL1 >= 0 VP: rP1/FL1 >= -999	rw	V: 600 P: 5000 VP: -600	Unit mbar
61	0x003D	1	Ou1	Switch Point 1 - Logic	1 byte	0 - 1	rw	0	0 = NO 1 = NC
61	0x003D	2	Ou1	Switch Point 1 - Mode	1 byte	2, 3, 128, 129	rw	3	2 = Window Mode 3 = Two-Point Mode 128 = Condition Monitoring (not for VSi P10) 129 = Diagnostic Mode
61	0x003D	3	Hy1	Switch Point 1 - Window Hysteresis	2 bytes	0 <= Hy1 <= FH1-FL1 V: Hy1 < 999 P: Hy1 < 9999 VP: Hy1 < 8000	rw	V: 20 P: 100 VP: 20	Unit mbar
75	0x004B	1	dS1	Switch Point 1 - Switch-on delay	2 bytes	0 - 999	rw	0	Unit ms
75	0x004B	2	dr1	Switch Point 1 - Switch-off delay	2 bytes	0 - 999	rw	0	Unit ms

IO-Link

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			Switch Point 2						
62	0x003E	1	SP2/FH2	Switch Point 2 - Upper Threshold	2 bytes	V: 999 >= SP2 > rP2 999 >= FH2 > FL2+Hy2 P: 9999 >= SP2 > rP2 9999 >= FH2 > FL2+Hy2 VP: 8000 >= SP2 > rP2 8000 >= FH2 >FL2+Hy2	rw	V: 550 P: 5000 VP: 5500	Unit mbar
62	0x003E	2	rP2/FL2	Switch Point 2 - Lower Threshold	2 bytes	V: rP2/FL2 >= 0 P: rP2/FL2 >= 0 VP: rP2/FL2 >= -999	rw	V: 500 P: 4500 VP: 5000	Unit mbar
63	0x003F	1	Ou2	Switch Point 2 - Logic	1 byte	0 - 1	rw	0	0 = NO 1 = NC
63	0x003F	2	Ou2	Switch Point 2 - Mode	1 byte	2, 3, 128, 129	rw	3	2 = Window Mode 3 = Two-Point Mode 128 = Condition Monitoring (not for VSi P10) 129 = Diagnostic Mode
63	0x003F	3	Hy2	Switch Point 2 - Window Hysteresis	2 bytes	0 <= Hy2 <= FH2-FL2 V: Hy2 < 999 P: Hy2 < 9999 VP: Hy2 < 8000	rw	V: 20 P: 100 VP: 20	Unit mbar
80	0x0050	1	dS2	Switch Point 2 - Switch-on delay	2 bytes	0 - 999	rw	0	Unit ms
80	0x0050	2	dr2	Switch Point 2 - Switch-off delay	2 bytes	0 - 999	rw	0	Unit ms
			Condition Monitoring [CM]						
108	0x006C	0	-L-	Permissible Leakage Rate	2 bytes	0 - 999	rw	200	Unit mbar/sec
Observation									
			Monitoring						
			Process Data						
40	0x0028	0		Process Data In Copy	2 bytes		ro		Copy of currently active process data input
64	0x0040	1		Sensor Value	2 bytes		ro		Actual sensor value
64	0x0040	2		Sensor Value LO	2 bytes		ro		Lowest measured sensor value since power-up
64	0x0040	3		Sensor Value HI	2 bytes		ro		Highest measured sensor value since power-up
66	0x0042	1		Supply Voltage	2 bytes		ro		Supply voltage as measured by the device (unit: 0.1 Volt)
66	0x0042	2		Supply Voltage LO	2 bytes		ro		Lowest measured supply voltage since power-up
66	0x0042	3		Supply Voltage HI	2 bytes		ro		Highest measured supply voltage since power-up
			Communication Mode						
564	0x0234	0		Communication Mode	1 byte		ro		0x00 = SIO mode 0x10 = IO-Link revision 1.0 (set by master) 0x11 = IO-Link revision 1.1 (set by master)
			Counters						
140	0x008C	0	cc1	Counter cc1	4 bytes		ro		Switch-on counter for switch point 1 (non-erasable)
141	0x008D	0	cc2	Counter cc2	4 bytes		ro		Switch-on counter for switch point 2 (non-erasable)
143	0x008F	0	ct1	Counter ct1	4 bytes		ro		Switch-on counter for switch point 1 (erasable)
144	0x0090	0	ct2	Counter ct2	4 bytes		ro		Switch-on counter for switch point 2 (erasable)
Diagnosis									
			Device Status						
32	0x0020	0		Error Count	2 bytes		ro		Number of errors since last power-up
36	0x0024	0		IO-Link Device Status	1 byte		ro		0 = Device is operating properly 1 = Maintenance required 2 = Out of specification 3 = Functional check 4 = Failure
37	0x0025	1-15		Detailed Device Status	15 x 3 bytes		ro		Information about currently pending events Fixed-length array format according to IO-Link specification V1.1
130	0x0082	0		Active Error Code	1 byte		ro		0 = No error 1-99 = Error code displayed by the device
138	0x008A	1		Extended Device Status - Type	1 byte		ro		Type code of active device status (see below)
138	0x008A	2		Extended Device Status - ID	2 bytes		ro		ID code of active device status (see below)
139	0x008B	0		NFC Status	1 byte		ro		Result of recent NFC activity: 0x00: Data valid, write finished successfully 0x23: Write failed: Write access locked 0x30: Write failed: parameter(s) out of range 0x41: Write failed: parameter set inconsistent 0xA1: Write failed :invalid authorisation 0xA2: NFC not available 0xA3: Write failed: invalid data structure 0xA5: Write pending 0xA6: NFC internal error
			Condition Monitoring [CM]						
146	0x0092	0		Condition Monitoring	1 byte		ro		Bit 2: Leakage rate above limit -L- (not for VSi P10) Bit 5: Primary voltage US outside of optimal range
160	0x00A0	0		Actual Leakage Rate	2 bytes		ro		Leakage rate, unit mbar/sec (not for VSi P10)

Parameter ISDU 138 - Extended Device Status

Type	ID	Type Color	Type Text	Status Text
0x10	0x0000	Green	Everything OK	Everything OK
0x21	0x0002	Yellow	Warning lower	Leakage rate above limit
0x22	0x0007	Yellow	Warning upper	Primary supply voltage US outside of operating range
0x22	0x000A	Yellow	Warning upper	Sensor calibration failed
0x22	0x0017	Yellow	Warning upper	Teach-In failed
0x41	0x000C	Orange	Critical condition lower	Overload OUT1
0x41	0x000D	Orange	Critical condition lower	Overload OUT2
0x41	0x0015	Orange	Critical condition lower	Overtemperature
0x42	0x0010	Orange	Critical condition upper	Primary supply voltage US too low
0x42	0x0011	Orange	Critical condition upper	Primary supply voltage US too high
0x42	0x0016	Orange	Critical condition upper	IO-Link communication interruption
0x81	0x0000	Red	Defect lower	Internal parameter data invalid

Implemented IO-Link Events

Event code dec	Event code hex		Event name	Event type	Remark
4096	0x1000		General malfunction	Error	Error in internal data (E01)
16384	0x4000		Overtemperature	Error	Overtemperature in electronic circuit (E19)
20736	0x5100		General power supply fault	Error	Primary supply voltage US too low (E07)
20752	0x5110		Primary supply voltage over-run	Warning	Primary supply voltage US too high (E17)
30480	0x7710		Short circuit	Error	Overload or short circuit at one or more outputs (E11 and/or E12)
35872	0x8C20		Measurement range over-run	Error	Overflow of sensor value, invalid measurement
6144	0x1800		Calibration OK	Notification	Calibration offset 0 set successfully
6145	0x1801		Calibration failed	Notification	Sensor value too high or too low, offset not changed (E03)
6149	0x1805		Teach-In completed successfully	Notification	New values taught for SPx, rPx or FHx, FLx, hyx
6150	0x1806		Teach-In command failed	Notification	Sensor value over-run, SPx not changed (E20)
6153	0x1809		Leakage rate above limit	Warning	Condition Monitoring: leakage rate above limit
6156	0x180C		Primary supply voltage out of range	Warning	Condition Monitoring: primary supply voltage US outside operating range

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Handling systems

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