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Compaktejector SCPi FS RP

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.

Published by

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Contents

1 Important Information

1.1 Note on Using this Document

J. Schmalz GmbH is generally referred to as Schmalz in these Operating instructions.

These Operating instructions contain 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 Operating instructions describe the product at the time of delivery by Schmalz.

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 life-threatening 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 Warnings in This Document

Warnings warn against hazards that may occur when handling the product. This document contains three levels of danger that you can recognize by the signal word.

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.

1.4 Symbol

This symbol indicates useful and important information.

✓ This symbol represents a prerequisite that must be met prior to an operational step.

▸ 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 Standards of Technology

The ejector is built in accordance with the latest standards of technology and is shipped safely, however, hazards can arise during use.

⚠ WARNING

Failure to follow the instructions in this manual can lead to life-threatening injuries!

- Read the operating instructions carefully and observe the contents.

2.2 Emissions

The ejector emits noise due to the operation of compressed air.

⚠ WARNING

Noise pollution due to the escape of compressed air

Hearing damage!

- Wear ear protectors.
- The ejector must only be operated with a silencer.

2.3 Intended Use

The ejector is designed to generate a vacuum for gripping and transporting objects when used in conjunction with suction cups. Operation is via a controller using external solenoid valves.

Neutral gases are approved as evacuation media. Neutral gases include air, nitrogen and inert gases (e.g. argon, xenon and neon).

The product is intended for industrial use.

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

2.4 Non-Intended Use

⚠ WARNING

Extraction of hazardous media, liquids or bulk material

Personal injury or damage to property!

- Do not extract harmful media such as dust, oil mists, vapors, aerosols etc.
- Do not extract aggressive gases or media such as acids, acid fumes, bases, biocides, disinfectants or detergents.
- Do not extract liquids or bulk materials, e.g. granulates.

Schmalz accepts no liability for damage resulting from non-intended use of the mini compact ejector.

In particular, the following are considered non-intended use:

- Use in potentially explosive atmospheres
- Use in medical applications
- Lifting people or animals

- Evacuation of objects that are in danger of imploding

2.5 Personnel Qualification

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

1. Only instruct qualified personnel to perform the tasks described in this manual.
2. The product may only be operated by persons who have undergone appropriate training.
3. Electrical work and installations may only be carried out by qualified electrical specialists.
4. Assembly and maintenance work may only be carried out by qualified personnel.

The following target groups are addressed in this manual:

- 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

2.6 Modifications to the Ejector

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

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

3 Product Description

3.1 Description of the Ejector

3.1.1 Suction of the Workpiece (Vacuum Generation)

The Venturi nozzle on the ejector is activated and deactivated using the Suction command.

In the NO (normally open) version, the Venturi nozzle is continuously sucking. As soon as compressed air is present at the ejector, the Venturi nozzle becomes active and the ejector generates a vacuum (suction). As soon as there is no compressed air at the ejector, the Venturi nozzle is deactivated.

An integrated sensor records the vacuum generated by the Venturi nozzle. The value is evaluated using electronics, displayed via the display and output via the IO-Link process data. The measured value serves as the basis for the various condition monitoring analysis functions in IO-Link mode.

The ejector has an integrated, pneumatically controlled, air saving function and automatically regulates the vacuum in Suction mode:

- The integrated, pneumatically controlled, air saving function switches off the Venturi nozzle as soon as the set vacuum limit value, deactivation value A, has been reached (factory setting).
- When objects with dense surfaces are picked up, the integrated non-return valve prevents the vacuum from dropping.
- If the system vacuum drops below the activation limit value E due to leaks, the Venturi nozzle is switched back on.
- Depending on the vacuum, the switching point SP1 is set once a workpiece is picked up safely. This enables the further handling process.
- The enable signal is only reset when rP1 is not reached *(> See ch. 3.1.3)*.

The air saving function is integrated in the ejector via a pneumatic controller. The limit values A and E cannot be changed.

The display and the LED status display show the current process states, for example the current vacuum level is displayed.

If small volumes are to be evacuated, the set deactivation value A might be exceeded considerably before the vacuum is switched off. This system behavior does not constitute an error.

3.1.2 Depositing the Workpiece (Blowing Off)

In Blow off mode, the vacuum circuit of the ejector is supplied with external compressed air at the corresponding compressed air connection. This ensures that the vacuum drops quickly, depositing the workpiece quickly as well.

NOTE

Compressed air at both compressed air connections at the same time

Damage to the ejector

- Do not apply compressed air to both compressed air connections at the same time!

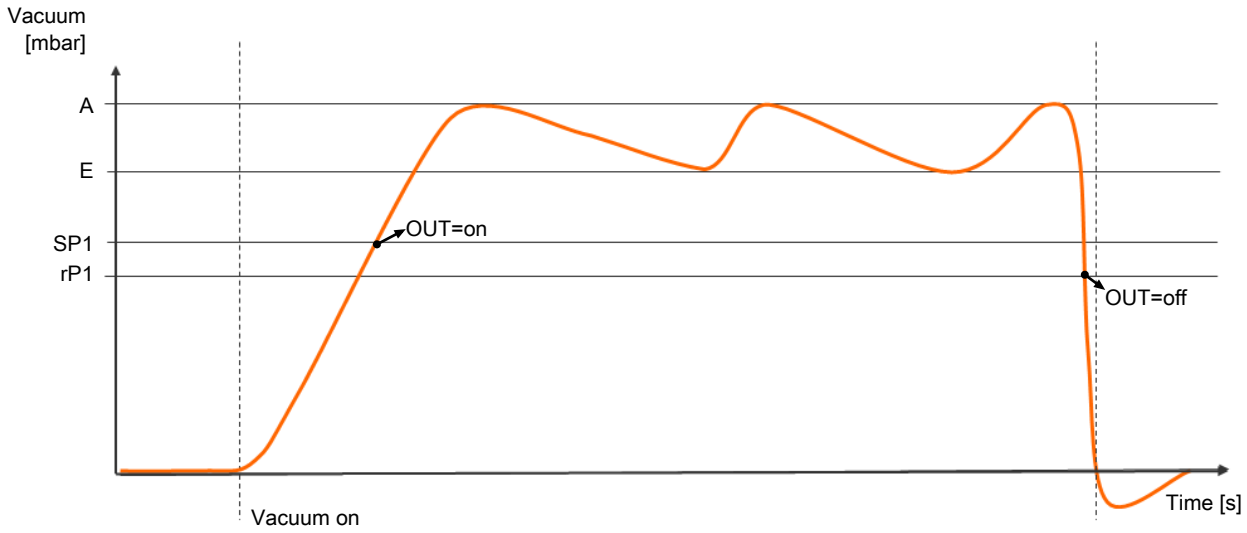
When blowing off, make sure that the compressed air supply for vacuum generation is switched off.

3.1.3 Pneumatic Air Saving Function

The ejector includes a pneumatically operated air saving function. When compressed air is applied to compressed air connection 1 *(> See ch. (See chap. Ejector structure))*, the ejector automatically controls the vacuum. When the set deactivation value A is reached, the ejector switches off the Venturi nozzle. If the system vacuum drops below the activation value E due to leaks, the Venturi nozzle is switched back on.

The following diagram shows the air saving function.

The output is set to "on" when switching point SP1 is reached. If the reset value rP1 is not reached, the output is set to "off."



3.2 Operating Modes

The vacuum switch can be operated in two operating modes. Users can choose between direct connection to discrete inputs (standard I/O = SIO mode) or connection through the communication line (IO-Link class A).

If the device is connected to the supply voltage, it is ready for operation. This is the normal operating mode, in which the vacuum switch is operated by the system controller. A differentiation is made between SIO mode and IO-Link mode.

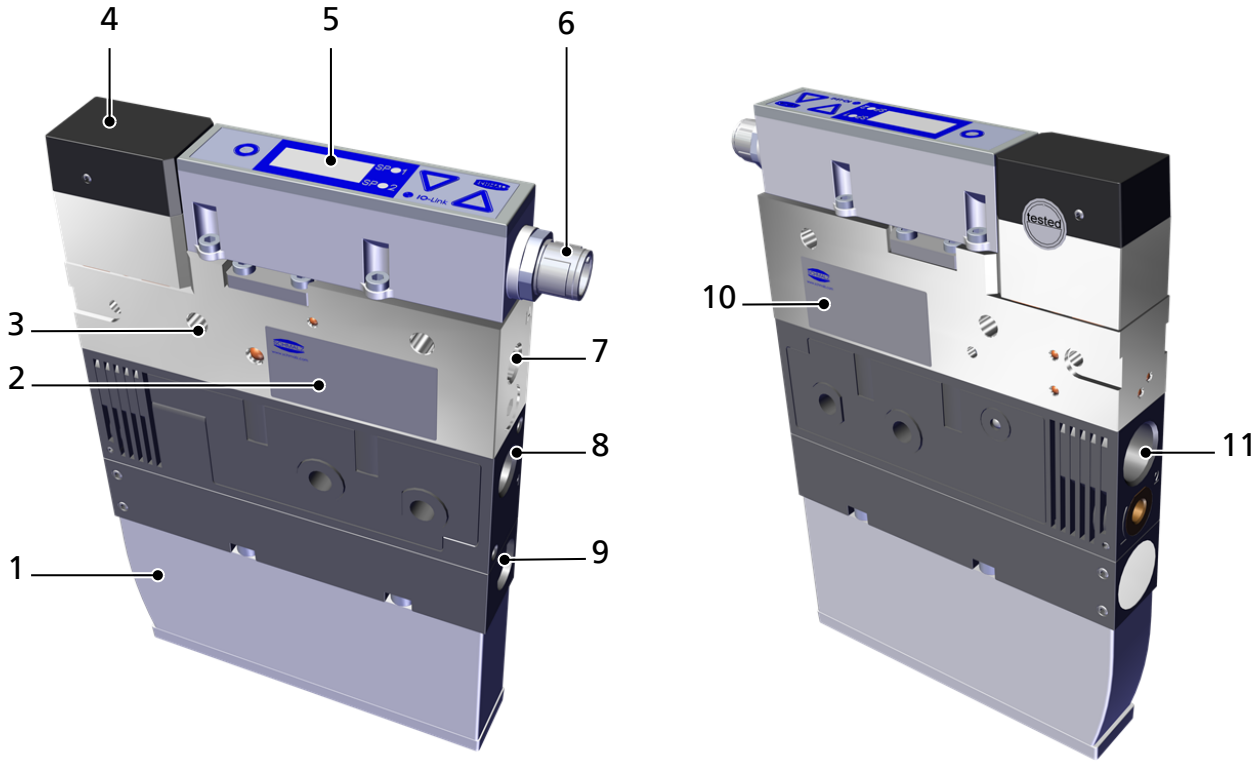
The vacuum switch is parameterized via the available menus or via IO-Link.

3.3 Ejector Designation

The breakdown of the item designation (e.g. SCPi 15 NO-FS RP-VD M12-5) is as follows:

Feature	Specifications
Type of ejector	SCPi
Nozzle size	1.5 mm
Control	Normally open (NO)
Type of external control	Externally controlled FS
Type of internal control	Pneumatically controlled RP
Type of display	Vacuum digital VD
Electrical connection	M12, 5-pin connector

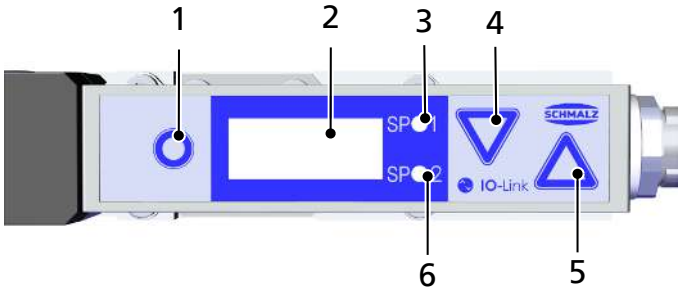
3.4 Ejector Structure



1	Silencer	2	Type plate 1
3	4x mounting holes	4	Position of pneumatic controller
5	Vacuum switch with control and display element	6	Electrical connection, M12, 5-pin
7	Compressed air connection 1A (blow off)	8	Compressed air connection 1 (suction)
9	Bypass for exhaust air	10	Type plate 2
11	Vacuum connection		

3.5 Display and Operating Element in Detail

The simple operation of the vacuum switch is ensured by 3 buttons, the 3-digit display, as well as 2 LEDs for status information.



1	Menu button	2	Display
3	LED switching point 1	4	Down button
5	Up button	6	LED switching point 2

Switching points are indicated using two orange LEDs. Depending on the selected operating mode, the LEDs of the switching points SP1 and SP2 indicate the level of the current system vacuum in relation to the set limit values.

Detailed information on the meaning of the LEDs in the respective operating modes can be found in the explanations of the operating modes *(> See ch. Functions of the Vacuum Switch)*.

4 Technical Data

4.1 Display Parameters

Parameter	Value	Unit	Comment
Display	3	Digit	Red 7-segment LED display
Resolution	±1	mbar	—
Accuracy	±3	% FS	T_{amb}= 25° C, based on FS (full-scale) final value
Linearity error	±1	%	—
Offset error	±2	mbar	After zero-point adjustment, without vacuum
Temperature influence	±3	%	5° C < T_{amb} < 50° C
Display refresh rate	5	1/s	Only affects the 7-segment display
Idle time before the menu is exited	1	min	The display mode is accessed automatically when no settings are made in a menu.

4.2 Electrical Parameters

Parameter	Symbol	Limit values			Unit	Note
		min.	typ.	max.		
Supply voltage	U_s	19.2	24	28.8	V_{DC}	PELV[1)]
Power consumption from U_S [2)]	I_S	—	40 [4)]	—	mA	U_S = 24.0 V
Voltage of signal output (PNP)	U_{OH}	U_S-2	—	U_s	V_{DC}	I_{OH} < 100 mA
Voltage of signal output (NPN)	U_{OL}	0	—	2	V_{DC}	I_{OL} < 100 mA
Current of signal output (PNP)	I_{OH}	—	—	100	mA	Short-circuit-proof [3)]
Current of signal output (NPN)	I_{OL}	—	—	-100	mA	Short-circuit-proof [3)]
Reaction time of signal outputs	t_O	1	—	200	ms	Adjustable

1) The power supply must correspond to the regulations in accordance with EN60204 (protected extra-low voltage). The signal outputs are protected against reverse polarity.

2) Plus the output currents

3) The signal output is protected against short circuits. However, it is not protected against overloading. Constant load currents of > 0.1 A can lead to impermissible heating and subsequent destruction of the vacuum switch.

4) Mean value

4.3 General Parameters

Parameter	Symbol	Limit value			Unit	Note
		min.	typ.	max.		
Working temperature	T_{amb}	5	—	50	°C	—
Storage temperature	T_{Sto}	-10	—	60	°C	—
Humidity	H_{rel}	10	—	90	% r.h.	Free from condensation
Degree of protection	—	—	—	IP65	—	—
Operating pressure	p	4	4.2	7	bar	—
Operating medium	Air or neutral gas, 5 µm filtered, with or without oil, class 3-3-3 compressed air quality in acc. with ISO 8573-1					

4.4 Mechanical Data

4.4.1 Performance Data

Version	SCPi-15	SCPi-20	SCPi-25
Nozzle size	1.5 mm	2.0 mm	2.5 mm
Max. vacuum[1] [%]	870		
Suction rate[1] [l/min]	75	135	185
Max. blow off capacity [1] [l/min]	300		
Air consumption [1] [l/min]	115	190	290
Air consumption for blow off[1] [l/min]	310		
Sound level[1], unobstructed suction [dBA]	75		
Sound level[1], suction [dBA]	72		
Weight [kg]	0.64		

All values at ambient conditions of T = 20° C and 1000 mbar ambient pressure

[1)] at 4.5 bar

4.4.2 Factory Settings

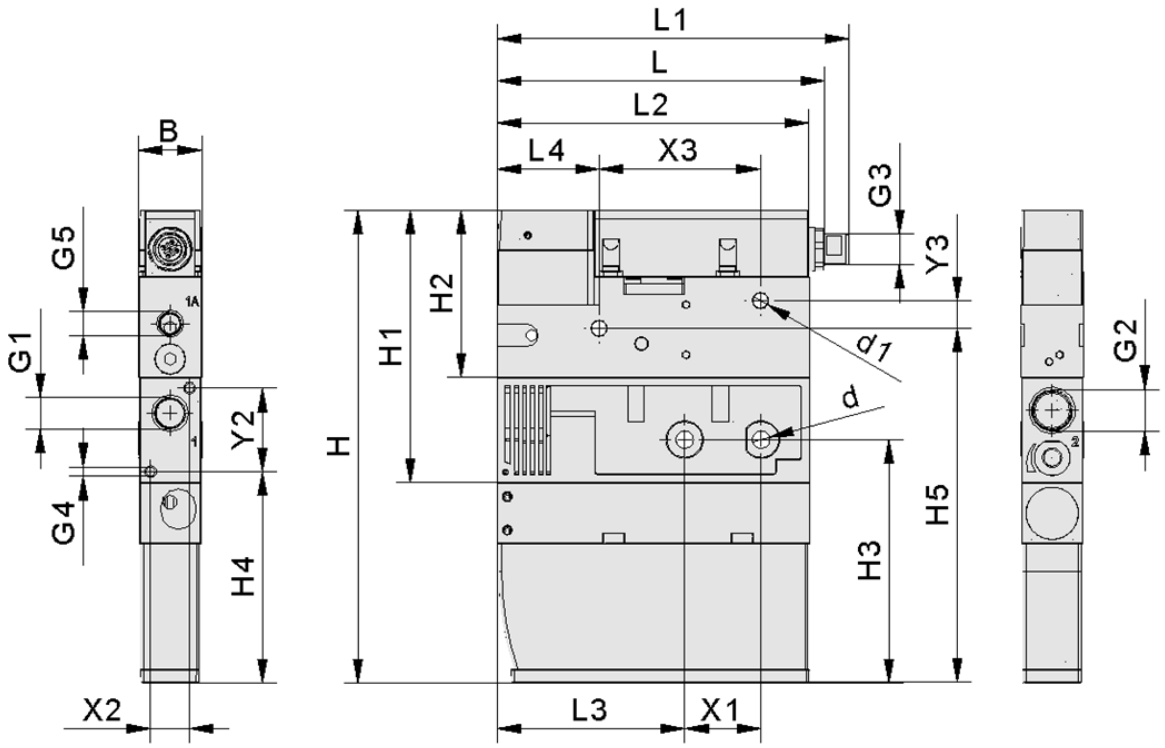
In the factory setting, switching point 1 is set in two-point mode (3), and switching point 2 is set in condition monitoring mode (128). The signals are in the NO state.

Part no.	Activation value E [mbar]	Switching point SP1 [mbar]	Reset point rp1 [mbar]	Switching point SP2 [mbar]	Reset point rp2 [mbar]	Leakage limit L2 [mbar/s]
10.02.02.05400	-520	-450	-440	-570	-500	100
10.02.02.05450						
10.02.02.04521						
10.02.02.05436	-630	-550	-540	-680	-610	100
10.02.02.05438						
10.02.02.05440						
10.02.02.06022		-500	-490			

Display code	Parameter	Value of the factory setting
HY 1	Window hysteresis 1	20 mbar
dS 1	Switch-on delay 1	0 ms
dr 1	Switch-off delay 1	0 ms
HY2	Window hysteresis 2	100 mbar
dS2	Switch-on delay 2	0 ms
dr2	Switch-off delay 2	0 ms
P-n	Signal type / transistor function	PNP switch = P-n
un i	Vacuum unit	Vacuum unit in mbar = -bA
Eco	ECO mode	Deactivated = oFF
d IS	Display alignment	Standard = Std
P in	PIN code	000

Factory settings

4.4.3 Dimensions

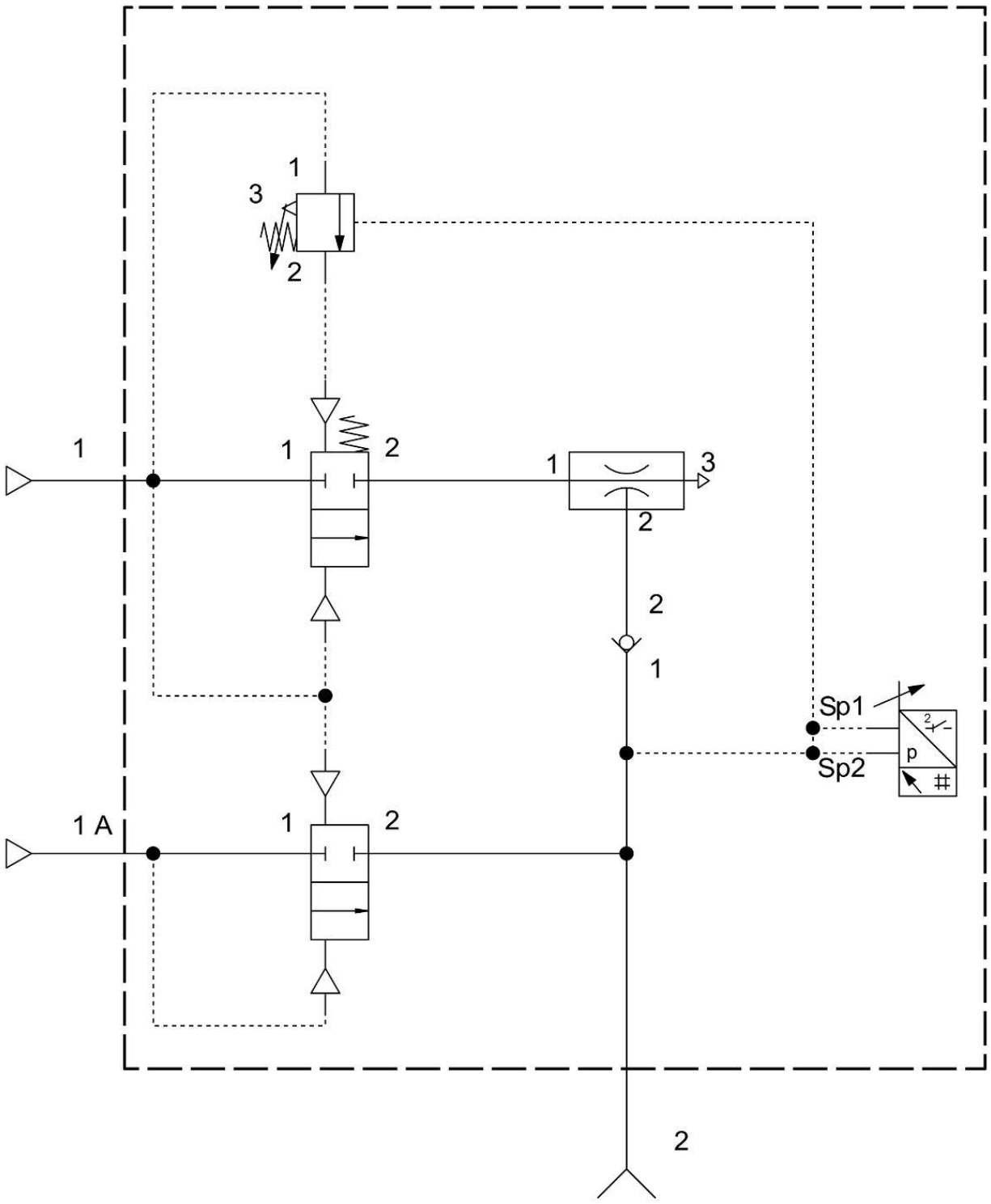


B	d	d1	G1	G2	G3	G4	G5	H	H1	H2	H3
22.8	6.6	5.5	G1/4" -IG	G3/8" -IG	M12x 1-AG	M4-IG	G1/8" -IG	170	98	460	87.5

H4	H5	L	L1	L2	L3	L4	X1	X2	X3	Y2	Y3
76	127.5	118	126.5	112	67.5	36.75	27.5	14	58	30	10

All specifications are in mm

4.4.4 Pneumatic Circuit Plan



5 General Description of Functions

5.1 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 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.

5.2 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 vacuum 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).

A detailed description of all the device parameters can be found in the data dictionary.

5.3 Operating and Menu Concepts

The unit is operated via three buttons on the foil keypad. The parameters are set via software menus. The current system status and the settings are shown on a display.

The operating structure is divided into three menus:

- The basic menu
- The menu for extended functions (EF)
- The info menu (INF)

Setting of the vacuum switch in the basic menu is sufficient for standard applications. An extended functions menu (EF) is available for applications with special requirements.

If settings are changed, undefined states of the system may occur for a short time (for approx. 50 ms).

The following information can be shown on the display:

- The current vacuum measurement value
- The selected menu item
- The setting values
- Error messages

In the basic operating menu state, the actual measurement value of the vacuum is displayed on the basis of the chosen display unit. All units are available in millibar, kilo pascal, inch-hg and PSi. The measured value is displayed as a positive compared to the ambient air pressure.

After setting a parameter via 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 E01 occurs.

The menus will automatically close if no button is pressed for 1 minute.

The display also returns to the basic status when an error status occurs so that the error number can be displayed. A menu can be called up and used again afterward.

If parameters are changed using the IO-Link, the menu will also close. The instruction dAt will then appear on the display for 2 seconds.

5.3.1 Navigating in the Menu

The basic menu can be reached from the basic status by pressing the **DOWN BUTTON**  or the **UP BUTTON**  . Scrolling through the menu is also possible using these buttons. When the desired menu item has been found, select it using the **MENU BUTTON**  . If there is a submenu ("EF" and "INF"), this can also be browsed in the same manner using the **DOWN** and **UP** buttons.

5.3.2 Enabling Vacuum Switches and Editing Parameters

Enabling Vacuum Switches

Using the Extended functions (EF) menu, the vacuum switch can be protected against unintentional access by means of a PIN code P In.

If you attempt to change a parameter value, the message "P.I.n" will appear in the display and changes to enter the 3-digit PIN code. It is also possible to exit the menu in the meantime.

How to enable the vacuum switch:

1. Press the  button
   ⇨ The display changes to input
2. Use the  or  buttons to enter the first digit of the PIN code

3. Confirm using the button
   ⇨ The display changes to the middle digit.
4. Enter the remaining digits in the same way.
5. To enable the device using the menu, press the button

⇨ When entering a valid PIN the message Unc appears.

⇨ The entry of an invalid PIN is rejected with the message Loc.

The lock is activated again automatically 1 minute after the selected menu or function is exited.

The PIN code 000 must be set for permanent deactivation of the lock.

Tips and Tricks for Parameter Setting

- By pressing the or button for approx. 3 seconds, the value to be changed is scrolled through quickly
- If you exit the changed value by briefly pressing , the value will not be applied.

Editing the parameters

If a menu item has been selected, the current value first appears in the display. With parameters that can be set, the adjustable digit or the whole value will flash. These values can be changed using the and buttons. When doing so, the possible settings are run through cyclically. For numerical valuesconsisting of 3 digits, the button is used to move to the next highest digit. At the end of the editing process, the button is pressed again after the last number. The new value then appears on the display without flashing.

If the new value is invalid, the display shows one of the following messages instead and the old value remains:

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

To cancel the editing process, buttons and can be simultaneously pressed at any time.

5.3.3 Displaying the Basic Settings (Slide Show)

By pressing the button in the basic operating state, the current parameter values of the vacuum switch listed here are automatically displayed one after the other on the display (slide show):

- The vacuum unit
- The communication mode
- The switching point
- The reset point
- The operating voltage

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

5.3.4 Basic Menu

All of the settings for standard vacuum switch applications can be configured and read from the basic menu.

1. Use ▲ or ▼ to select the desired adjustable parameter.
2. Confirm the selection of the parameter with the ◎ button.
3. Use the ▲ or ▼ buttons to set the value of the parameter.
4. To save and exit the menu, press and hold the ◎ button.

⇨ The displayed value flashes to confirm.

Display code	Parameter	Explanation
SP 1 or FH 1	Switching point 1 / upper window point 1	—
rP 1 or FL 1	Reset point 1 / lower window point 1	—
hY 1 or -L-	Hysteresis switching point 1 (window mode) or leakage limit 1 (CM mode)	—
SP2 or FH2	Switching point 2 / upper window point 2	—
rP2 or FL2	Reset point 2 / lower window point 2	—
hY2 or L-2	Hysteresis switching point 2 (window mode) or leakage limit 2 (CM mode)	—
tcH	Teach-in function	no / SP 1 / SP2
cAL	Calibrate zero offset	Calibrate integrated vacuum sensor, no / YES
EF	Additional functions	Menu: Additional functions
INF	Information	Menu: Information

Overview of the display codes in the basic menu

Calibrating the vacuum sensor

1. Select the parameter or display code cAL with the ▼ or ▲ buttons.
2. Confirm using the ◎ button.
3. Use the ▲ or ▼ buttons to select YES.
4. Press the ◎ button to confirm.

⇨ The vacuum sensor integrated in the ejector is now calibrated.

5.3.5 Extended Functions Menu (EF)

An "Extended functions" menu (EF) is available for applications with special requirements.

1. In the basic menu, press the ▽ or △ button to select the EF parameter and change to the parameter selection of the EF menu by pressing the ◎ button.
2. The parameters are set in accordance with the description in the Basic Menu section.

⇨ The first parameter Ou 1 appears on the display.

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

Overview of display codes in the Additional functions menu

5.3.6 Info menu (INF)

The "Info" (INF) menu is available for reading out system data such as counters, software version, part numbers and serial numbers.

1. In the basic menu, press the ▽ or △ button to select the INF parameter and change to the parameter selection of the menu by pressing the ◎ button.
2. The parameters are set in accordance with the description in the Basic Menu section.

⇨ The first parameter HI appears on the display.

Display code	Parameter	Explanation
HI	Max. vacuum value	Highest measured sensor value (since restart)
LO	Min. vacuum value	Lowest measured sensor value (since restart)
rHL	Reset vacuum value	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 3	Counter, switching ramp SP1 (erasable)
ct2	Counter 4	Counter, switching ramp SP2 (erasable)
rct	Reset erasable counters	Reset erasable counters (Ct1 and Ct2) using YES
Soc	Software function	Firmware revision
Art	Part number	Format of the part no., example: 10.02.02.05440
Snr	Serial number	Information about the production period

Overview of display codes in the "Info" menu

When specifying the counter valuesor numbers with more than 3 digits, the following special features must be observed.

The counters and serial numbers are 9-digit whole numbers. These are divided into 3 blocks of 3 numbers when indicated in the display. Each time a decimal point is displayed to indicate if it is the highest, middle or lowest block. The display starts with the 3 highest numbers and can be scrolled through using the ▽ or △ button.

Prompting for the counter values

After confirming the parameter counter 1 or counter 2 with the ◎ button, the three decimal places of the total counter value are displayed (the digits x10^6). This corresponds to the three-digit block with the highest perceived value.

Use the △ buttons to display the remaining decimal places of the total counter value in order. The decimal points show which three-digit block of the complete counter value is shown in the display.

The complete counter value is comprised of the three digit blocks together:

Displayed position	10^6	10^3	10^0
Displayed number block	0.48	61.8	593.

The current complete counter value in this example is 048 618 593.

Prompting for the part number

The part number of the ejector is printed on the label and also stored electronically.

After confirming the part number Art parameter with the button, the first two digits of the part number are displayed. The remaining digits of the part number are displayed with the button. The displayed decimal points are part of the part number.

The part number consists of 4 number blocks with a total of 11 digits.

Digit block	1	2	3	4
Displayed number block	10.	02.0	2.00	383

The part number in this example is 10.02.02.00383.

Prompting for the serial number

The serial number indicates the production period of the ejector.

After confirming the serial number parameter with the button, the first three decimal places of the serial number are displayed (the digits x10^6). This corresponds to the three-digit block with the highest perceived value.

The remaining decimal places of the serial number are displayed with the button. The decimal points show which three-digit block of the serial number is shown in the display.

The serial number consists of 3 number blocks with a total of 9 digits:

Displayed position	10^6	10^3	10^0
Displayed number block	0.48	61.8	593.

The serial number in this example is 048 618 593.

5.4 Error Display

If an error occurs, it appears on the display in the form of an error code (“E number”). The vacuum switch’s response to an error depends on the type of error.

You can find a list of possible errors and the corresponding codes in the Warnings and Errors section.

Any operation being performed in the menu will be interrupted if an error occurs.

The error code can also be opened as a parameter using IO-Link.

6 Transport and Storage

6.1 Checking the Delivery

The scope of delivery can be found in the order confirmation. The weights and dimensions are listed in the delivery notes.

1. Compare the entire delivery with the supplied delivery notes to make sure nothing is missing.
2. Damage caused by defective packaging or occurring in transit must be reported immediately to the carrier and J. Schmalz GmbH.

7 Installation

7.1 Installation Instructions

⚠ CAUTION

Improper installation or maintenance

Personal injury or damage to property

- During installation and maintenance, make sure that the product is disconnected and depressurized and that it cannot be switched on again without authorization.

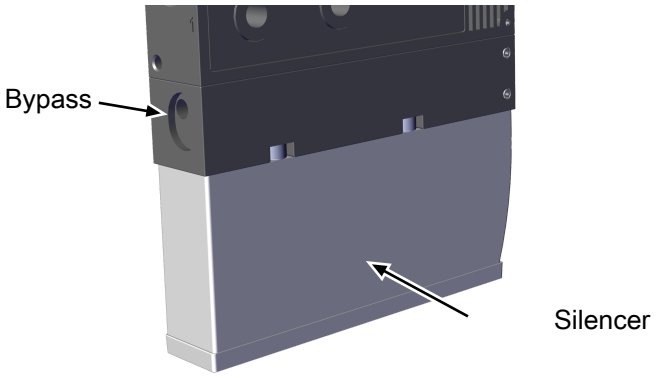
For safe installation, the following instructions must be observed:

- Use only the connectors, mounting holes and attachment materials that have been provided.
- Mounting and removal must be performed only when the device is unpressurized and disconnected from the mains.
- Pneumatic and electrical line connections must be securely connected and attached to the product.

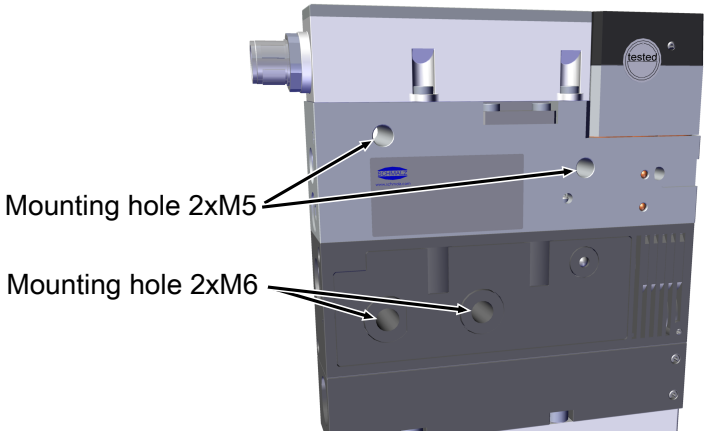
7.2 Installation

The ejector may be installed in any position.

When installing the ejector, make sure that the areas around the silencer and the bypass remain free, so that unimpeded discharge of the escaping air is ensured.



Four mounting holes for 2x M5 and 2x M6 screws are used to fix the ejector. The ejector is to be fixed with at least 2 screws, the maximum tightening torque is 6 Nm.



For start of operations, the ejector must be connected to the controller via the connection plug with a connection cable. The compressed air required to generate the vacuum and the blow off is connected via the corresponding compressed air connections. The compressed air supply must be supplied by the higher-level machine.

The vacuum circuit or gripping system is connected to the vacuum connection.

The installation process is described and explained in detail below.

7.3 Pneumatic Connection

⚠ CAUTION

Compressed air or vacuum in direct contact with the eye

Severe eye injury

- Wear eye protection
- Do not look into compressed air openings
- Do not look into the silencer air stream
- Do not look into vacuum openings, e.g. suction cups

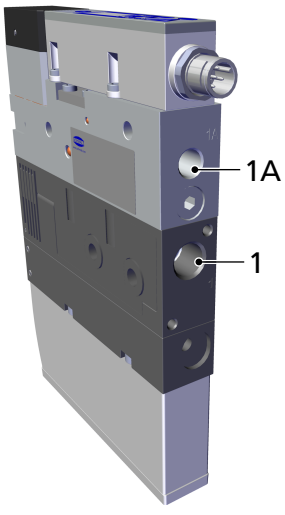
⚠ CAUTION

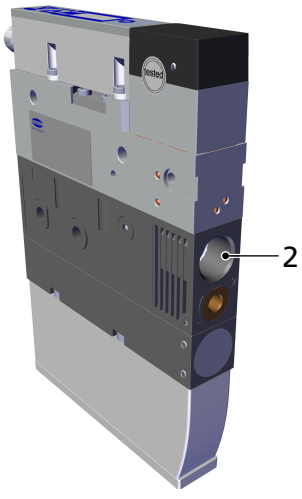
Noise pollution due to incorrect installation of the pressure and vacuum connections

Hearing damage

- Correct installation.
- Wear ear protectors.

7.3.1 Connecting the Compressed Air and Vacuum





1	Compressed air connection (suction)
1A	Compressed air connection (blow off)
2	Vacuum connection

The compressed air connection 1 on the ejector has the size G1/4"-IG.

- Connect compressed air hose. The max. tightening torque is 10 Nm.

The compressed air connection 1A on the ejector has the size G1/8"-IG.

- Connect compressed air hose. The max. tightening torque is 10 Nm.

The vacuum connection G3/8"-IG is marked with the number 2 on the ejector.

- Connect vacuum hose. The max. tightening torque is 10 Nm.

7.3.2 Instructions for the Pneumatic Connection

Use only screw unions with cylindrical G-threads for the compressed air and vacuum connection!

To ensure problem-free operation and a long service life of the ejector, only use adequately maintained compressed air and consider the following requirements:

- Use of air or neutral gas in accordance with EN 983, filtered 5 µm, oiled or unoiled.
- Dirt particles or foreign bodies in the ejector connections, hoses or pipelines can lead to partial or complete ejector malfunction.

1. Shorten the hoses and pipelines as much as possible.
2. Keep hose lines free of bends and crimps.
3. Only use a hose or pipe with the recommended internal diameter to connect the ejector, otherwise use the next largest diameter.
4. On the compressed air side, ensure that the internal diameter has the necessary specifications so that the ejector achieves its performance data.
5. On the vacuum side, ensure that the internal diameter has the necessary specifications to avoid high flow resistance. If the internal diameter is too small, the flow resistance and the evacuation times increase and the blow off times are extended.

The following table shows the recommended line cross-sections (internal diameter):

Performance class	Line cross-section (internal diameter) in mm[1)]	
	pressure side	Vacuum side
15	6	6
20	6	8
25	8	9

[1)] Based on a maximum hose length of 2 m.

- For longer hose lengths, the cross-sections must also be larger.

7.4 Electrical Connection

⚠ WARNING

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

Personal injury

- Avoid possible danger zone.
- Remain vigilant.

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.

NOTE

Power load too high

Destruction of the vacuum switch, as there is no protection against overloading!

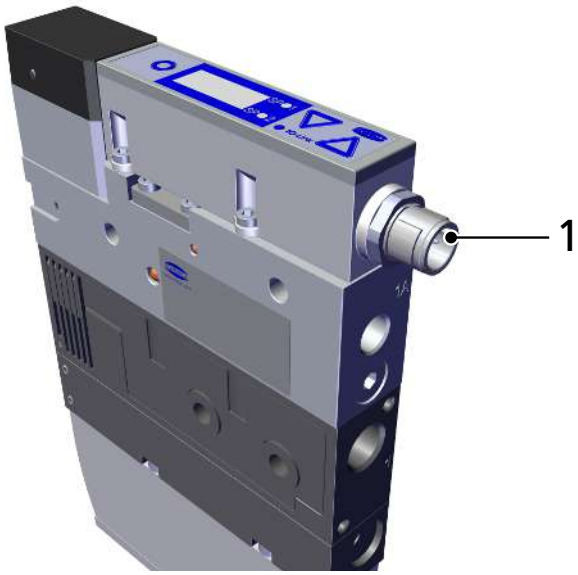
- Prevent constant load currents > 0.1 A.

The electrical connection is established using a 5-pin M12 connector that supplies the vacuum switch with voltage, and contains the two output signals.

The maximum line length for the supply voltage, the signal inputs and the signal output is:

- 30 m in SIO mode
- 20 m in IO-Link mode

Connect the ejector electrically using the plug connection 1 shown in the figure



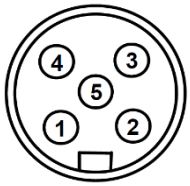
1	Electrical connection plug, M12, 5-pin

✓ Provide connection cable with 5-pin M12 plug, taking account of the selected operating mode (determined by the customer).

▸ Attach the connection cable to the ejector, maximum tightening torque = hand-tight.

7.4.1 Operating the Vacuum Switch in SIO Mode

PIN assignment, 5-pin M12 connector

M12 connector	Pin	Symbol	Function
	1	U_s	Supply voltage
	2	OUT2	Switching point 2, leakage monitoring (factory setting)
	3	Gnd_s	Ground
	4	OUT1	Switching point 1, parts control (factory setting)
	5	—	Not used

The electrical connection can be established in the following ways:

1. Direct connection to the controller

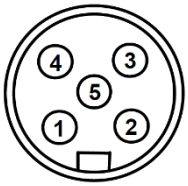
   Using the Schmalz connection cable, part no. 21.04.05.00080, with connector M12-5 with open end and 5 m length.

2. Connection via an I/O box

   Using the Schmalz connection cable, part no. 21.04.05.00158, with connector M12-5 on M12-5 and 1 m length.

7.4.2 Operating the Vacuum Switch in IO-Link Mode

PIN assignment, 5-pin M12 connector

M12 connector	Pin	Symbol	Function
	1	U_s	Power supply for sensor
	2	—	—
	3	Gnd	Ground
	4	C/Q	IO-Link communication
	5	—	—

Start of operations

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

When operating the switch in IO-Link mode (digital communication), the supply voltage, Gnd and the C/Q communication cable must be directly connected to the corresponding connections of an IO-Link master with IO-Link class A parts. 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.).

8 Functions of the Vacuum Switch

8.1 Overview of Functions

Description	Availability		Parameter	See section
	SIO	IO-Link		
Switching point setting	✓	✓	SP 1 / FH 1 rP 1 / FL 1 hy 1 / L- 1 SP2 / FH2 rP2 / FL2 hy2 / L-2	*(> See ch. 8.3.)*
Switching point mode and logic	✓	✓	Ou 1 / Ou2	*(> See ch. 8.3.1)*
Teach-in	✓	✓	tcH	*(> See ch. 8.4)*
Switch-on and switch-off delay	✓	✓	dS 1 / dr 1 dS2 / dr2	*(> See ch. 8.5.1)*
Transistor function	✓	✓	P-n	*(> See ch. 8.5.2)*
Display unit	✓	✓	un i	*(> See ch. 8.6.1)*
Display alignment	✓	✓	d iS	*(> See ch. 8.6.2)*
Eco mode	✓	✓	Eco	*(> See ch. 8.6.3)*
Menu PIN, access rights	✓	✓	P in	*(> See ch. 8.7.1)*
IO-Link device access locks	✗	✓	—	*(> See ch. 8.7.2)*
Part number	✓	✓	Art	*(> See ch. 5.3.6)*
Software version	✓	✓	Soc	*(> See ch. 5.3.6)*
Serial number	✓	✓	Snr	*(> See ch. 5.3.6)*
IO-Link identification data	✗	✓	—	*(> See ch. 8.8)*
User-specific identification	✗	✓	—	*(> See ch. 8.9)*
Voltage measurement	✓	✓	—	*(> See ch. 8.2)*
Minimum and maximum values	✓	✓	H i / LO	*(> See ch. 8.10.1)*
Counters	✓	✓	cc 1 / cc2 ct 1 / ct2	*(> See ch. 8.10.2)*
Warnings and errors	✓	✓	e.g. E02 FFF / -FF	*(> See ch. 10.2)*
System status	✗	✓	—	*(> See ch. 8.10.3)*
Condition monitoring (CM)	✗	✓	—	
Reset to factory settings	✓	✓	rES	*(> See ch. 8.11.1)*
Calibrate zero position	✓	✓	cAL	*(> See ch. 8.11.2)*
Reset maximum and minimum value	✓	✓	rHL	*(> See ch. 8.10.1)*
Reset counters	✓	✓	rct	*(> See ch. 8.10.2)*

8.2 Monitoring the Operating Voltage

The vacuum 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 *(> See ch. 10.2 and 10.3)* are triggered. In the undervoltage range, the switch delays all inputs by the user.

8.3 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.

8.3.1 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

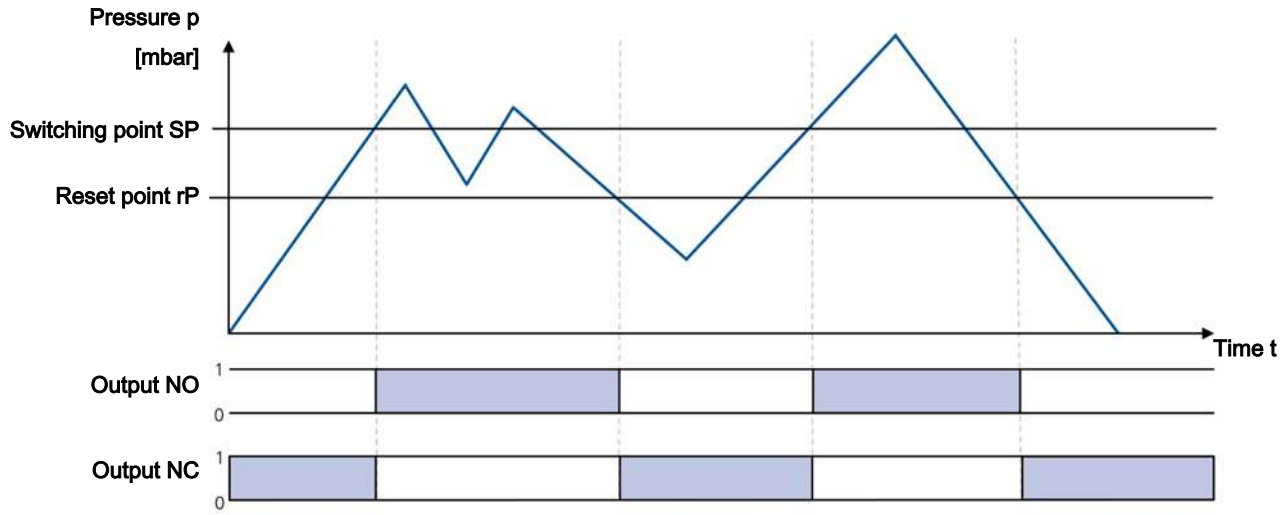
In this case, there is a differentiation between the switching point logic NO (normally open) and NC (normally closed). A change in the switching point logic from NO to NC causes a logical inversion of the electrical switching outputs, the switching point bits in the IO-link process data and the orange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

8.3.2 Two-Point Mode

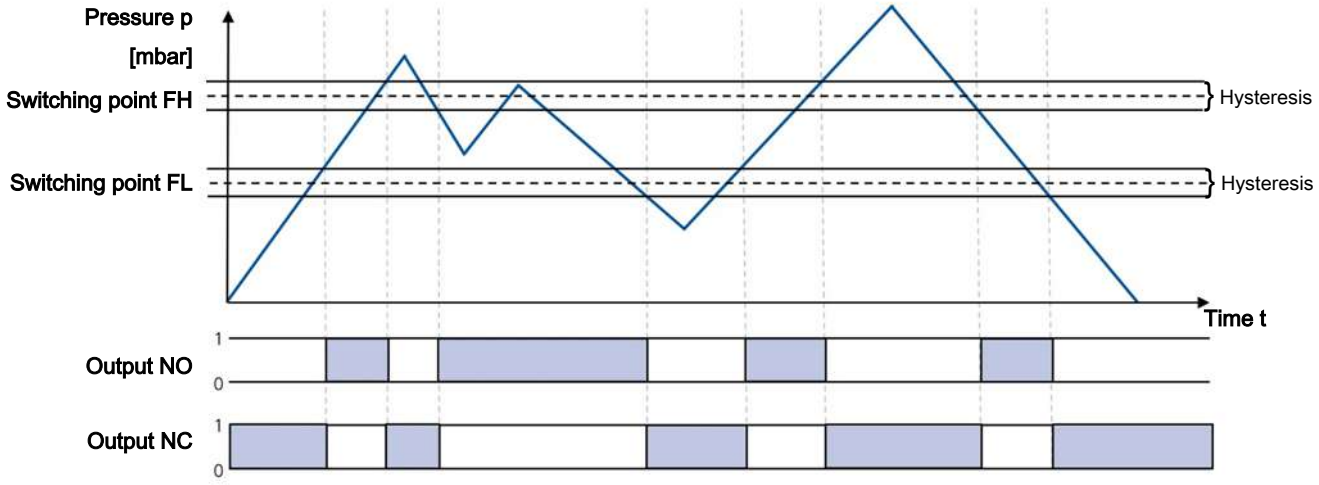
The two-point mode is a threshold switch with hysteresis.

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|.



8.3.3 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

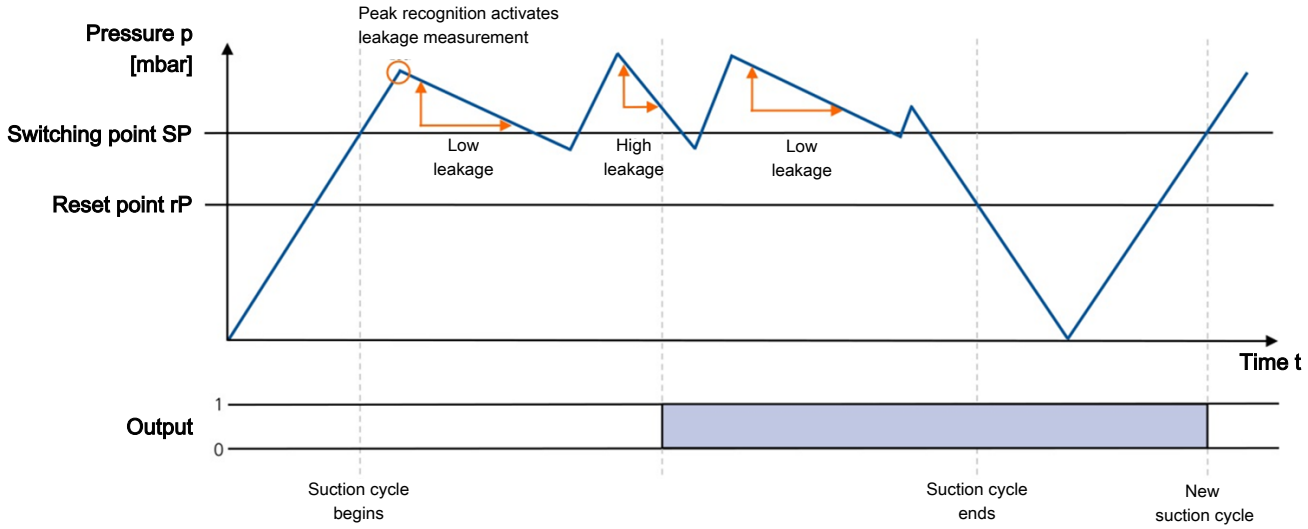


When switching from two-point mode to window mode, the current switching points SPx and rPx are interpreted as window points FHx and FLx. They are the same internal parameters (also see the data dictionary). If the resulting set of parameters are not valid in the new mode (e.g. hysteresis too big in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

8.3.4 Condition Monitoring Mode (Leakage Measurement)

The condition monitoring switching point mode is used to monitor the quality of a vacuum suction system. 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:



Another application for Condition monitoring mode occurs if the regulation threshold of the vacuum system is never achieved and the vacuum generator permanently sucks. In this case, if the end vacuum is 20 mbar lower than the start vacuum, the switching point will also be activated.

For a very tight vacuum system where the second case shown always occurs in normal operation and indicates no error, Condition monitoring mode is not suitable.

8.3.5 Diagnostics Mode

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

Diagnostics mode also includes the functions of Condition monitoring mode. That means the switching point is also activated when the leakage measurement results in a warning.

8.4 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 on one occasion and changes nothing on the selected switching point mode or 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 "tCH" in the basic menu.
- ▸ In the menu, the teach-in starts immediately when the button is pressed; if it is done via IO-link, the appropriate system command has to be written via ISDU 2 first.
- ⇨ The switch-on threshold SPX or FHx is set for teach-in in such a way that it is 20% below the actual required measurement value. The reset threshold for vacuum values is set at 50 mbar below the switch-on threshold. The associated hysteresis for window mode is set at 10 mbar for vacuum values.
- ⇨ After a successful teach-in process, an automatic display cycle of the newly set values appears in the display.

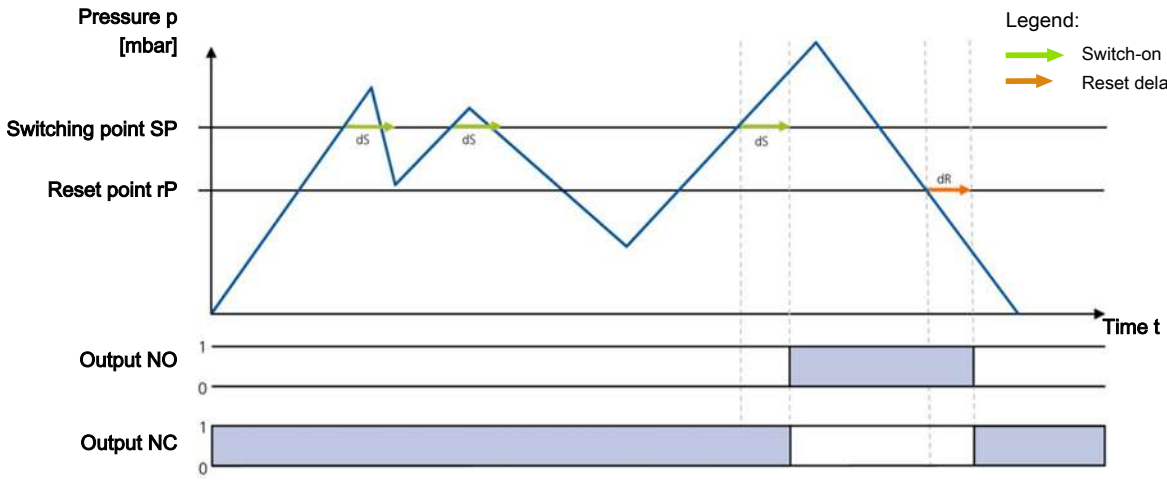
8.5 Additional Switching Point Settings

8.5.1 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:



8.5.2 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.

8.6 Display Screen

8.6.1 Vacuum Unit

The physical unit that is used to display the measured values as well as the limit valuesand hystereses on the display can be set via the EF menu under the menu item unit or via IO-Link:

Unit	Display code, setting parameters	Display unit
Bar	bAr	mbar
Pascal	PA	kPa
Inch Mercury	inHG	inHg
Pound-force per square inch	PSI	Psi

The selection of the vacuum unit affects only the display, it has no effect on the display of the values via IO-Link. These are always measured in mbar, see *(> See ch. data dictionary)*.

8.6.2 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.

8.6.3 ECO Mode

The ejector offers the option to switch off the display or to dim 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 (ECO mode "on"), the display is switched off 1 minute after the last 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.

8.7 Access Rights

8.7.1 PIN Code for Write Protection

A PIN code can be used to prevent the parameters from being changed using the operating menu.

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

The PIN code is entered in the EF menu under the menu item P In or via IO-Link.

The current settings are still displayed in a locked state.

The PIN is set to 000 on delivery, meaning access to the parameters is not locked. To activate the write protection, a PIN code between 001 and 999 must be entered via the menu or IO-Link.

If write protection is activated with a customer-specific PIN, the desired parameters are changed within one minute of the correct code being entered. If no changes are made within one minute, write protection is automatically reactivated. A PIN of 000 must be reset to permanently deactivate the lock.

Full access to the device is still possible via IO-Link even if a PIN is enabled. The current PIN can also be read out and changed/deleted (PIN = 000) via IO-Link.

8.7.2 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 via IO-Link, not via the ejector or the vacuum switch itself.

8.8 Device Identification

The IO-Link protocol provides a range of identification data for compliant devices that can be used to uniquely identify a device. This product contains even more advanced identification parameters.

The parameters are ASCII character strings that adapt their length to the relevant content.

The following parameters can be queried:

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

8.9 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.

8.10 System Monitoring and Diagnostics

8.10.1 Minimum and Maximum Values

The maximum and minimum 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 during operation using the appropriate system commands.

For the vacuum, it is possible to query the values using the INF menu via the parameters $H\ 1$ and Lo. The values are reset using the parameter rHL.

8.10.2 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.

8.10.3 Status Signals

The current status of the ejector, 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.

8.10.4 Leakage Measurement

If one of the switching points for the vacuum switch is set to Condition monitoring mode, the actual leakage measured can be read in millibars per second.

8.11 System Commands

8.11.1 Resetting to Factory Settings

All adjustable parameters for the vacuum switch are reset to factory settings using this function.

⚠ WARNING

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

Personal injury

- ▸ Avoid possible danger zone.
- ▸ Remain vigilant.

The function is executed in the EF menu under the parameter rES or via IO-Link:

1. Press the button.
   ⇨ When the menu is locked, enter the valid PIN code.
2. Use the or button to select the menu item EF.
3. Confirm using the button.
   ⇨ Ou I appears on the display.
4. Use the button to select the parameter rES.
5. Press the button.
   ⇨ YES appears on the display.
6. Press the button again.

⇨ The vacuum switch is reset to the factory settings.

⇨ The display flashes briefly and then returns to the display mode.

The Reset to factory settings function does not affect:

- Counter statuses
- The zero-point adjustment of the sensor
- The maximum and minimum values of the measurements

8.11.2 Calibrating the Vacuum Sensor

As the production conditions for the internally integrated vacuum sensor can vary, we recommend calibrating the sensor once it is installed in the ejector. 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 using IO-Link.

1. Press the button
   ⇨ The menu changes to input
2. Press the or button until cAL appears on the display
3. Confirm with the button
4. When YES appears, press the button to confirm.

⇨ The vacuum sensor is now calibrated.

A zero offset is only possible in the range of ± 3% around the theoretical zero position.

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

9 Operation

9.1 General Preparations

⚠ WARNING

Extraction of hazardous media, liquids or bulk material

Personal injury or damage to property!

- Do not extract harmful media such as dust, oil mists, vapors, aerosols etc.
- Do not extract aggressive gases or media such as acids, acid fumes, bases, biocides, disinfectants or detergents.
- Do not extract liquids or bulk materials, e.g. granulates.

Always carry out the following tasks before activating the system:

1. Before each start of operations, check that the safety features are in perfect condition.
2. Check the product for visible damage and deal with any problems immediately (or notify the supervisor).
3. Ensure that only authorized personnel are present in the working area of the machine or system and that no other personnel are put in danger by switching on the machine.

During automatic operation, there must be no people in the system danger area.

10 Troubleshooting

10.1 Help with Malfunctions

Error	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
Ejector does not respond	No compressed air supply	▸ Check the compressed air supply
Vacuum level is not reached or vacuum is built up too slowly	Press-in screen is contaminated	▸ Replace screen
	Silencer is soiled	▸ Replace silencer insert
	Leakage in hose line	▸ Eliminate leakage from hose connections
	Leakage at suction cup	▸ Eliminate leakage from suction cup
	Operating pressure too low	▸ Increase operating pressure, observe maximum limits
	Internal diameter of hose line too small	▸ Observe recommendations for hose diameter
Load cannot be held	Vacuum level is too low	▸ Increase the control range for the air saving function
	Suction cup too small	▸ Select a larger suction cup
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 "Error codes" table	▸ See "Error Codes" table in the following chapter
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 statuses
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

Error	Cause	Measure
	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 statuses

10.2 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.

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

The following table shows all of 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 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	—

Display code	Fault	Possible cause	Measure
-FF	Overpressure in vacuum circuit	Overpressure in the system, e.g. when blowing off	—

Error codes

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.

10.3 Warnings and Error Messages in IO-Link Mode

In IO-Link mode, status information is available in addition to the error messages displayed in SIO mode.

The following section from the data dictionary shows detailed information here.

Implemented IO-Link Events					
Event code			Event name	Event type	Remark
dec	hex				
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

Any condition monitoring events that occur during the suction cycle cause the system status light to immediately switch from green to yellow. The specific event that caused this switch can be seen in the "Condition monitoring" IO-Link parameter.

11 Maintenance

11.1 Safety

Maintenance work may only be carried out by qualified personnel.

- Create atmospheric pressure in the ejector's compressed air circuit before working on the system!

⚠ WARNING

Risk of injury due to incorrect maintenance or troubleshooting

- Check the proper functioning of the product, especially the safety features, after every maintenance or troubleshooting operation.

NOTE

Incorrect maintenance work

Damage to the ejector!

- Always switch off supply voltage before carrying out any maintenance work.
- Secure it so that it cannot be switched back on.
- The ejector must only be operated with a silencer and press-in screens.

11.2 Cleaning the Ejector

1. For cleaning, do not use aggressive cleaning agents such as industrial alcohol, white spirit or thinners. Only use cleaning agents with pH 7–12.
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 is not soaked in soapy water.
3. Ensure that no moisture can reach the electrical connection or other electrical components.

11.3 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 factory settings, e.g. via the operating menu.

⇨ 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 in the user menu on the device are automatically mirrored in the master.

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 the required parameters, execute ISDU write access to the System command parameter (index 2) with the ParamDownloadStore command (numerical value 5).

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

12 Warranty

This system is guaranteed in accordance with our general terms of trade and delivery. The same applies to spare parts, provided that these are original parts supplied by us.

We are not liable for any damage resulting from the use of non-original spare parts or accessories.

The exclusive use of original spare parts is a prerequisite for the proper functioning of the ejector and for the validity of the warranty.

Wearing parts are not covered by the warranty.

Opening the ejector will damage the “tested” labels. This voids the warranty.

13 Spare and Wearing Parts, Accessories

13.1 Spare and Wearing Parts

Maintenance work may only be carried out by qualified personnel.

⚠ WARNING

Risk of injury due to incorrect maintenance or troubleshooting

- Check the proper functioning of the product, especially the safety features, after every maintenance or troubleshooting operation.

The following list contains the primary spare and wearing parts.

Part no.	Designation	Legend
10.02.02.03381	Silencer insert	W

Legend:

- **W**earing part = **W**

- When tightening the fastening screws on the silencer module, observe the maximum tightening torque of 0.4 Nm.

13.2 Accessories

Part no.	Designation	Note
21.04.05.00158	Connection cable	M12, 5-pin, to 5-pin M12 connector, 1 m
21.04.05.00080	Connection cable	M12, 5-pin, with open end, 5 m
21.04.05.00211	Connection cable	ASK B-M12-5 2000 S-M12-5
10.02.02.04149	HUT-SN-KL SCPS	Top-hat rail clamp comp. Section type: EN 50022
10.07.01.00241	VFI CN6/4 50	Vacuum filter with replaceable
10.07.01.00328	VFI 6/4 50	Vacuum filter with replaceable

14 Decommissioning and Recycling

14.1 Disposing of the Product

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	PA6-GF, PC-ABS, AL
Inner components	Aluminum alloy, anodized aluminum alloy, brass, galvanized steel, stainless-steel, PU, POM
Silencer insert	Porous PE
Screws	Galvanized steel
Sealing	Nitrile rubber (NBR)
Lubrication	Silicone-free
Piston	Stainless steel (1.4435 BN II)
Gasket	VMQ – 65 Shore (FDA 177.2600-21)

15 Attachment

See also

- SCPi_CE_30.30.01.01667-00.pdf [▶ 49]
- SCPi_Data Dictionary_01.pdf [▶ 50]

DE **EU-Konformitätserklärung**
EN **EC- Declaration of Conformity**
FR **CE-Déclaration de conformité**
ES **Certificado de conformidad CE**
IT **Dichiarazione di conformità CE**
NL **CE Conformiteitsverklaring**

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Produktbezeichnung / Product name / Designation du produit / Denominación del producto / Denominazione del prodotto / Beschrijving van de machine

SCPi FS RP

Ejektoren der Serie / Ejectors series / Ejecteurs de la série / Eyectores de la serie / Eiettori de la serie / Ejector Serie

Erfüllte einschlägige EU-Richtlinien / Applicable EC directives met / Directives CE applicables respectées / Directivas vigentes de la CE cumplidas / Direttive CE applicate ed osservate / Nagekomen betreffende EG-richtlijnen

2006/42/EG	Maschinenrichtlinie / Machinery Directive / Directive sur les machines / Directiva para máquinas / Direttiva macchine / Machinerichtlijn
2014/30/EU	Elektromagnetische Verträglichkeit / Electromagnetic Compatibility / Compatibilité électromagnétique / Compatibilidad electromagnética / Compatibilità elettromagnetica / Elektromagnetische compatibiliteit

Angewendete harmonisierte Normen / Harmonised standards applied / Normes d'harmonisation appliquées / Normas armonizadas aplicadas / Norme armonizzate adottate / Toegepaste geharmoniseerde normen

EN ISO 12100: 2011-03	Sicherheit von Maschinen - Allgemeine Gestaltungsleitsätze - Risikobeurteilung und Risikominderung / Safety of Machinery - General principles for design - Risk assessment and risk reduction / Sécurité des machines - Principes généraux de conception - Appréciation du risque et réduction du risque / Seguridad de máquinas - Principios generales de diseño - Evaluación del riesgo y reducción del riesgo / Sicurezza delle macchine - Principi generali di progettazione - Valutazione del rischio e riduzione del rischio / Veiligheid van machines - Algemene beginselen voor ontwerp - Risicobeoordeling en de risicoreductie
EN 61000-6-3: 2012-11	Elektromagnetische Verträglichkeit - Störaussendung / Electromagnetic Compatibility - Emission / Compatibilité électromagnétique – Norme sur l'émission / Compatibilidad electromagnética – Emisión de interferencias / Compatibilità elettromagnetica – Norma generica sull'emissione / Elektromagnetische compatibiliteit - emissie
EN 61000-6-2: 2006-03	Elektromagnetische Verträglichkeit - Störfestigkeit / Electromagnetic Compatibility - Immunity / Compatibilité électromagnétique – Immunité / Compatibilidad electromagnética – Resistencia a interferencias / Compatibilità elettromagnetica – Immunità / Elektromagnetische compatibiliteit - immuniteit

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Unterschrift, Angaben zum Unterzeichner / Signature, details of signatory / Signature, indications sur le soussigné / Firma y datos del firmante / Firma, dati concernenti il firmatario / Handtekening, omschrijving van de ondertekenaar

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IO-Link Implementation

Vendor ID	234 (0x00EA)
Device ID	100244 (0x018794)
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	ro	VSi V: 10000 = Overflow, 16383 = Underflow (pressure)	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

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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	SCP 25 NO FS RP	General product name
19	0x0013	0		Product ID	1...32 bytes		ro	SCP 25 NO FS RP	Product variant name
20	0x0014	0		Product Text	1...32 bytes		ro	SCP 25 NO FS RP	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	10.02.02.*	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	SCP 25 NO FS RP	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
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

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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		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)
77	0x004D	0	Pin	Menu PIN code	2 bytes	0 - 999	rw	0	0 = Menu editing unlocked >0 = Menu editing locked with pin-code

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

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Process Settings									
Switch Point 1									
60	0x003C	1	SP1/FH1	Switch Point 1 - Upper Threshold	2 bytes		rw		Unit mbar
60	0x003C	2	rP1/FL1	Switch Point 1 - Lower Threshold	2 bytes		rw		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		rw		Unit mbar
75	0x004B	1	dS1	Switch Point 1 - Switch-on delay	2 bytes	0 - 999	rw		Unit ms
75	0x004B	2	dr1	Switch Point 1 - Switch-off delay	2 bytes	0 - 999	rw		Unit ms
Switch Point 2									
62	0x003E	1	SP2/FH2	Switch Point 2 - Upper Threshold	2 bytes		rw		Unit mbar
62	0x003E	2	rP2/FL2	Switch Point 2 - Lower Threshold	2 bytes		rw		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		rw		Unit mbar
80	0x0050	1	dS2	Switch Point 2 - Switch-on delay	2 bytes	0 - 999	rw		Unit ms
80	0x0050	2	dr2	Switch Point 2 - Switch-off delay	2 bytes	0 - 999	rw		Unit ms
Condition Monitoring [CM]									
108	0x006C	0	-L-	Permissible Leakage Rate	2 bytes	0 - 999	rw		Unit mbar/sec

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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)
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)

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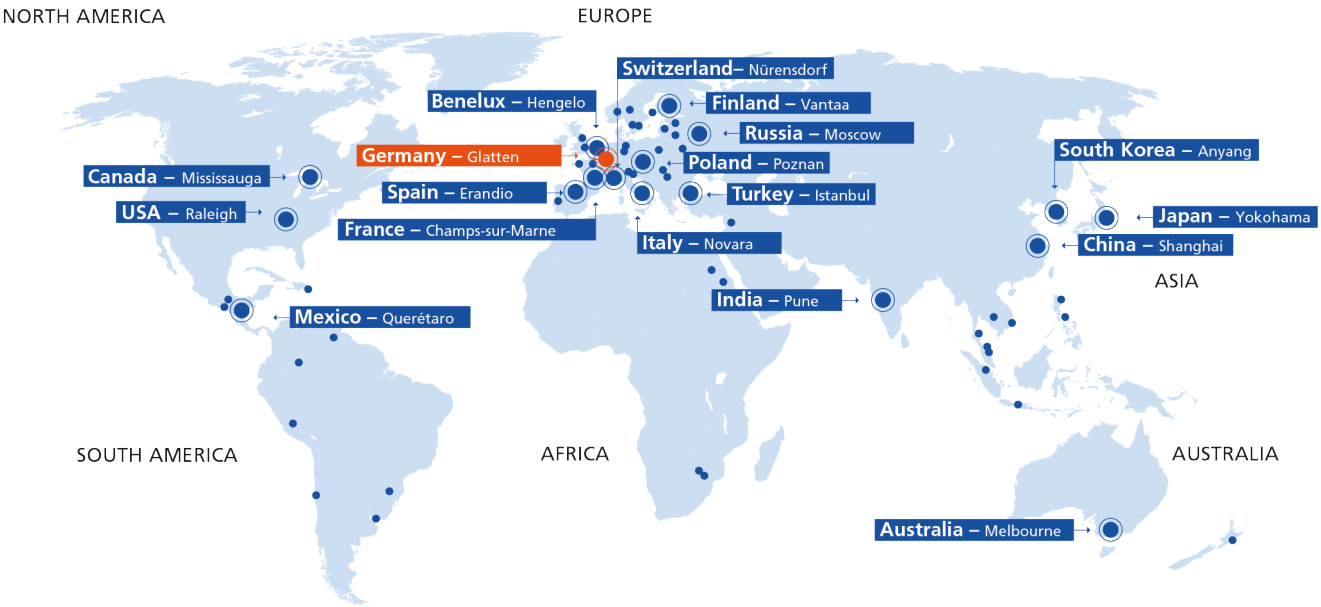
Parameter ISDU 138 - Extended Device Status

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

16 Notes

At your side worldwide



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